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

<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 5: System Development &amp; Demonstration (SDD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	596.594	77.529	62.426	63.878	-	63.878	63.923	65.150	66.418	67.718	Continuing	Continuing
0236: <i>SSN Comb Cont Sys Imprvmnt (ENG)</i>	596.594	58.717	62.426	63.878	-	63.878	63.923	65.150	66.418	67.718	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	18.812	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.812

**A. Mission Description and Budget Item Justification**

Project Unit 0236: This program develops Commercial-Off-The-Shelf (COTS) based software and hardware upgrades to integrate improved tactical and weapons control capabilities for multiple submarine Classes (SSN-688, SSGN, SEAWOLF, SSBN and VIRGINIA (Post Shakedown Availability)). The AN/BYG-1 is the combat control system common across submarine platforms which incorporates tactical control, payload control, and tactical Local Area Network (LAN) functions into a single development program. AN/BYG-1 allows the submarine to rapidly update the ship safety tactical picture, integrate the common tactical picture into the battlegroup, improve torpedo interfaces, and provide Tactical TOMAHAWK (TOMAHAWK Block IV) capability. The hardware upgrades accomplished via Technology Insertions (TI), are developed on a biennial basis to provide improved capability and address COTS obsolescence. Funding also accommodates the biennial integration of software accomplished via Advanced Processing Builds (APB) for incorporation of new algorithm improvements.

Tactical control integrates other sensor(ESM, sonar, radar, etc.)inputs to provide a common operational picture and improved situational awareness in conjunction with an increase in cyber resilience.

Weapons Control is winding down pending completion of TI-16 APB15. The Payload Control System (PCS) upgrade provides a modernized open architecture to support future payloads and integrate a common unmanned system controller and unmanned payloads.

Provides funding for the development of Payloads Launch System, Multi-tube Weapons System (MTWS), Information Assurance system, Onboard Team Trainer (OBTT), and Command, Control, Computer and Intelligence Maintenance Tool (C3IMT). FY18 added development of a Common Infrastructure Services (CIS) subsystem. This involves integration of Onboard Team Trainer - Master Controller (OBTT - MC) & Command, Control, Computer and Intelligence Maintenance Tool/ Inter-Subsystem Monitoring Tool (ISMT) efforts as well as other common services within Submarine Warfare Federated Tactical System (SWFTS). CIS will be an independent subsystem with its own software development and testing efforts, requiring additional funding to complete product delivery to platforms.

FY21 provides funding to continue development of APB 19 which will add two new system baselines in support of VA BLK IV Virginia Pay Module (VPM) and the COLUMBIA class (CLB). Cybersecurity efforts continue to grow due to increasing interconnection complexity, more IP based traffic in future baselines, and development

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of Cyber Safe Controls. As additional software applications are migrated to CIS, additional funding of this effort is required. Additional funding for integration efforts for submarine payloads including Contender, Maritime Strike Tomahawk (MST), Next Generation Countermeasure, Anti-Torpedo Torpedo Compact Rapid Attack Weapons program (ATT CRAW) is also included.

FY21 continues FY19 efforts on APB19 and commences TI-20 efforts.

FY21 funding integrates Submarine Launched Harpoon BLK 1C into Payload Control System. Additional efforts commencing in FY20 entail planning/prototyping support for classified payloads.

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
Previous President's Budget	80.324	62.426	63.749	-	63.749
Current President's Budget	77.529	62.426	63.878	-	63.878
Total Adjustments	-2.795	0.000	0.129	-	0.129
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.795	0.000			
• Program Adjustments	0.000	0.000	-0.640	-	-0.640
• Rate/Misc Adjustments	0.000	0.000	0.769	-	0.769

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

**Project:** 9999: *Congressional Adds*

Congressional Add: *Submarine Launched Unmanned Aerial System*

Congressional Add: *SBIR Technology Insertion*

Congressional Add: *Submarine Tactical Warfare System*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	<b>FY 2019</b>	<b>FY 2020</b>
	4.341	0.000
	9.647	0.000
	4.824	0.000
	18.812	0.000
	18.812	0.000

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<b><u>Change Summary Explanation</u></b> The overall FY21 funding was increased by \$0.129M due to a combination of realignment of funding from RD TEN to OMN to cover Submarine Warfare Tactical System (SWFTS) Cybersecurity Accreditation requirements and Navy Working Capital Fund (NWCF) rate adjustment increases.		

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Navy										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 1319 / 5					<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>				<b>Project (Number/Name)</b> 0236 / <i>SSN Comb Cont Sys Imprvmnt (ENG)</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
0236: <i>SSN Comb Cont Sys Imprvmnt (ENG)</i>	596.594	58.717	62.426	63.878	-	63.878	63.923	65.150	66.418	67.718	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

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Tactical control integrates other sensor(ESM, sonar, radar, etc.)inputs to provide a common operational picture and improved situational awareness in conjunction with an increase in cyber resilience.

Weapons Control is winding down pending completion of TI-16 APB15. The Payload Control System (PCS) upgrade provides a modernized open architecture to support future payloads and integrate a common unmanned system controller and unmanned payloads.

Provides funding for the development of Payloads Launch System, Multi-tube Weapons System (MTWS), Information Assurance system, Onboard Team Trainer (OBTT), and Command, Control, Computer and Intelligence Maintenance Tool (C3IMT). FY18 added development of a Common Infrastructure Services (CIS) subsystem. This involves integration of Onboard Team Trainer - Master Controller (OBTT - MC) & Command, Control, Computer and Intelligence Maintenance Tool/ Inter-Subsystem Monitoring Tool (ISMT) efforts as well as other common services within Submarine Warfare Federated Tactical System (SWFTS). CIS will be an independent subsystem with its own software development and testing efforts, requiring additional funding to complete product delivery to platforms.

FY21 provides funding to continue development of APB 19 which will add two new system baselines in support of VA BLK IV Virginia Pay Module (VPM) and the COLUMBIA class (CLB). Cybersecurity efforts continue to grow due to increasing interconnection complexity, more IP based traffic in future baselines, and development of Cyber Safe Controls. As additional software applications are migrated to CIS, additional funding of this effort is required. Additional funding for integration efforts for submarine payloads including Contender, Maritime Strike Tomahawk (MST), Next Generation Countermeasure, Anti-Torpedo Torpedo Compact Rapid Attack Weapons program (ATT CRAW) is also included.

FY21 continues FY19 efforts on APB19 and commences TI-20 efforts.

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FY21 funding integrates Submarine Launched Harpoon BLK 1C into Payload Control System.  
Additional efforts commencing in FY20 entail planning/prototyping support for classified payloads.

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

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p><b>Title:</b> Advanced Processing Builds</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> Continue development of VPM &amp; Columbia Class software baselines in APB19 and deliver APB17 (TI-18) baseline. Continue development of APB 19 into AN/BYG-1 (TI-18) baseline. Commence development of APB19 (TI-20) baseline. Commence development of APB21 efforts.</p> <p><b>FY 2021 Base Plans:</b> Continue development of APB 19 into AN/BYG-1 (TI-18) baseline. Continue development of APB19 (TI-20) baseline. Deliver APB19 into TI-20 baseline. Continue development of APB21 efforts. Continue development of VPM &amp; Columbia Class software baselines.</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase is due to ramp up of VPM &amp; Columbia Class software baseline developmental efforts.</p>	<p>20.282</p> <p align="center">-</p>	<p>23.590</p> <p align="center">-</p>	<p>25.804</p> <p align="center">-</p>	<p>0.000</p> <p align="center">-</p>	<p>25.804</p> <p align="center">-</p>
<p><b>Title:</b> AN/BYG-1 TI-22</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> N/A</p> <p><b>FY 2021 Base Plans:</b> Begin development, integration and test of AN/BYG-1 (TI-22) for SSN VA Class and COLUMBIA SSBN submarines to include Common Weapons Launcher (CWL) modernization development.</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b></p>	<p>0.000</p> <p align="center">-</p>	<p>0.000</p> <p align="center">-</p>	<p>3.538</p> <p align="center">-</p>	<p>0.000</p> <p align="center">-</p>	<p>3.538</p> <p align="center">-</p>

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<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
First year of development of this TI.					
<b>Title:</b> AN/BYG-1 TI-20  <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> Continue development, integration and test of AN/BYG-1 (TI-20) for SSN VA Class and COLUMBIA SSBN submarines to include Common Weapons Launcher modernization development.</p> <p><b>FY 2021 Base Plans:</b> Continue development, integration and test of AN/BYG-1 (TI-20) for SSN VA Class and COLUMBIA SSBN submarines to include Common Weapons Launcher modernization development.</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase is due to ramp up of development, integration and test of AN/BYG-1 (TI-20) for SSN VA Class and COLUMBIA SSBN submarines to include Common Weapons Launcher modernization development. This is the 3rd year of funding this TI.</p>	5.737	8.379	8.401	0.000	8.401
	-	-	-	-	-
<b>Title:</b> AN/BYG-1 TI-18  <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> Complete and deliver Phase I development, integration and test of the next generation AN/BYG-1 (TI-18) for SSN 688/SSGN/SSBN Class submarines</p> <p><b>FY 2021 Base Plans:</b> Complete and deliver Phase II development, integration and test of the next generation AN/BYG-1 (TI-18) for SSN 688/SSGN/SSBN Class submarines</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b></p>	6.208	4.749	0.000	0.000	0.000
	-	-	-	-	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>						
		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
Decrease is due to the ramping down of development, integration and testing of AN/BYG-1 (TI-18) for SSN 688/SSGN/SSBN Class submarines. Efforts set to complete in FY20.						
<b>Title:</b> Payload Control System Upgrade		4.004	0.000	0.000	0.000	0.000
		<b>Articles:</b>	-	-	-	-
<b>FY 2020 Plans:</b> N/A						
<b>FY 2021 Base Plans:</b> N/A						
<b>FY 2021 OCO Plans:</b> N/A						
<b>Title:</b> Testing		3.176	3.165	3.202	0.000	3.202
		<b>Articles:</b>	-	-	-	-
<b>FY 2020 Plans:</b> Begin DT/OT for AN/BYG-1 APB 19 on SSN 688/SEAWOLF/SSBN/SSGN/VA Class submarines.						
<b>FY 2021 Base Plans:</b> Continue DT/OT for AN/BYG-1 APB 19 on SSN 688/SEAWOLF/SSBN/SSGN/VA Class submarines.						
<b>FY 2021 OCO Plans:</b> N/A						
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase is due to inflation						
<b>Title:</b> Payload Integration		5.947	6.532	6.610	0.000	6.610
		<b>Articles:</b>	-	-	-	-
<b>FY 2020 Plans:</b> Continue software development efforts to support submarine payload integration of Mk 48 APB5+/APB6, Contender, Maritime Strike Tomahawk, and Anti-Torpedo Torpedo Compact Rapid Attack Weapons program. Begin integration of Harpoon BLK 1C into Payload Control System. Commence support of planning/prototyping for classified payloads.						
<b>FY 2021 Base Plans:</b>						

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<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
<p>Continue software development efforts to support submarine payload integration of Mk 48 APB5+/APB6, Contender, Maritime Strike Tomahawk, and Anti-Torpedo Torpedo Compact Rapid Attack Weapons program. Continue integration of Harpoon BLK 1C into Payload Control System. Commence support of planning/prototyping for classified payloads.</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase is due to ramp up of Submarine Launched Harpoon Platform Integration efforts.</p>					
<p><b>Title:</b> CyberSecurity</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> Commence development of CyberSecurity Toolkit and IA certification Testing on BYG-1 TI-20. Continue RMF accreditations for various systems.</p> <p><b>FY 2021 Base Plans:</b> Continue development of CyberSecurity Toolkit and IA certification Testing on BYG-1 TI-20. Continue RMF accreditations for various systems.</p> <p><b>FY 2021 OCO Plans:</b> N/A</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase due to inflation</p>	7.086 -	8.117 -	8.270 -	0.000 -	8.270 -
<p><b>Title:</b> Unmanned Aerial System (UAS)</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2020 Plans:</b> Continue Unmanned Aerial System development and integration efforts for 3 and 21 inch Submarine launched UAS.</p> <p><b>FY 2021 Base Plans:</b></p>	1.147 -	2.193 -	2.237 -	0.000 -	2.237 -

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<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
Continue Unmanned Aerial System development and integration efforts for 3 and 21 inch Submarine launched UAS. <b>FY 2021 OCO Plans:</b> N/A <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase is due to inflation.					
<b>Title:</b> Common Infrastructure Services (CIS)  <b>FY 2020 Plans:</b> Continue integration for Common Infrastructure Services to include Onboard Team Trainer - Master Controller & Command, Control, Computer and Intelligence Maintenance Tool/Inter-Subsystem Monitoring Tool (ISMT) efforts as well as other common services within SWFTS. <b>FY 2021 Base Plans:</b> Continue integration for Common Infrastructure Services to include Onboard Team Trainer - Master Controller & Command, Control, Computer and Intelligence Maintenance Tool/Inter-Subsystem Monitoring Tool (ISMT) efforts as well as other common services within SWFTS. <b>FY 2021 OCO Plans:</b> N/A <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase due to inflation.	5.130	5.701	5.816	0.000	5.816
<b>Articles:</b>	-	-	-	-	-
<b>Accomplishments/Planned Programs Subtotals</b>	58.717	62.426	63.878	0.000	63.878

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021 Base</u>	<u>FY 2021 OCO</u>	<u>FY 2021 Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• OPN/5420: SSN Combat Control Systems	133.651	143.678	173.770	-	173.770	160.469	158.631	147.472	151.561	Continuing	Continuing

**Remarks**  
OPN BA4 Ordinance Support & Equipment. BLI 5420 SSN Combat Control Systems

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**D. Acquisition Strategy**

This budget integrates APBs developed by the advanced development community.  
This program has been tailored in accordance with the new DoD5000 directive to incorporate annual MDA production reviews.  
Advanced Processing Builds (APB) products associated with AN/BYG-1 Release-To-Fleet 3Q 2019 and 3Q 2021.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy												Date: February 2020			
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/BYG-1 TECH INSERTION	C/CPIF	GENERAL DYNAMICS (GDAIS) : FAIR LAKES, VA	105.109	9.123	Oct 2018	9.628	Oct 2019	9.657	Oct 2020	-		9.657	Continuing	Continuing	Continuing
AN/BYG-1 TECH INSERTION	C/CPIF	PROGENY (PCS) : MANASSAS, VA	8.150	9.094	Oct 2018	9.599	Oct 2019	9.604	Oct 2020	-		9.604	Continuing	Continuing	Continuing
GOVERNMENT ENGINEERING	WR	NUWC : NEWPORT, RI	86.790	3.650	Oct 2018	3.853	Oct 2019	4.672	Oct 2020	-		4.672	Continuing	Continuing	Continuing
CYBERSECURITY	C/CPAF	PROGENY : MANASSAS, VA	42.927	7.086	Oct 2018	7.479	Oct 2019	7.503	Oct 2020	-		7.503	Continuing	Continuing	Continuing
UNMANNED AERIAL SYSTEM	WR	NUWC : NEWPORT, RI	1.506	0.675	Oct 2018	1.699	Oct 2019	1.733	Oct 2020	-		1.733	Continuing	Continuing	Continuing
UNMANNED AERIAL SYSEM	C/CPIF	PROGENY (PCS) : MANASSAS, VA	0.887	0.473	Oct 2018	0.481	Oct 2019	0.491	Oct 2020	-		0.491	Continuing	Continuing	Continuing
<b>Subtotal</b>			245.369	30.101		32.739		33.660		-		33.660	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
APB SOFTWARE INTEGRATION	C/CPIF	GENERAL DYNAMICS (GDAIS) : FAIRLAKES, VA	96.159	7.394	Oct 2018	7.606	Oct 2019	7.758	Oct 2020	-		7.758	Continuing	Continuing	Continuing
APB SOFTWARE INTEGRATION	WR	NUWC : NEWPORT, RI	63.599	4.860	Oct 2018	4.862	Oct 2019	4.959	Oct 2020	-		4.959	Continuing	Continuing	Continuing
APB SOFTWARE INTEGRATION	C/CPAF	LOCKHEED MARTIN (LM-MSS) : MANASSAS, VA	21.952	3.745	Oct 2018	3.749	Oct 2019	3.823	Oct 2020	-		3.823	Continuing	Continuing	Continuing
APB SOFTWARE INTEGRATION	C/CPFF	PROGENY (PCS) : MANASSAS, VA	9.783	4.799	Oct 2018	4.803	Oct 2019	4.899	Oct 2020	-		4.899	Continuing	Continuing	Continuing

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1319 / 5				PE 0604562N / Submarine Tactical Warfare System					0236 / SSN Comb Cont Sys Imprvmt (ENG)						
Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
SOFTWARE DEVELOPMENT	Various	VARIOUS : VARIOUS:Not Specified	56.487	2.053	Oct 2018	2.380	Oct 2019	2.427	Oct 2020	-		2.427	Continuing	Continuing	Continuing
HARPOON PLATFORM INTEGRATION	C/CPFF	PROGENY : MANASSAS, VA	0.000	0.000		0.500	Oct 2019	0.510	Oct 2020	-		0.510	0.000	1.010	-
<b>Subtotal</b>			247.980	22.851		23.900		24.376		-		24.376	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
DEVELOPMENT TEST & EVALUATION	WR	NUWC : NEWPORT, RI	39.030	0.987	Oct 2018	0.993	Oct 2019	1.012	Oct 2020	-		1.012	Continuing	Continuing	Continuing
TEST & EVALUATION	C/CPFI	GENERAL DYNAMICS : FAIRLAKES, VA	10.871	0.753	Oct 2018	0.758	Oct 2019	0.773	Oct 2020	-		0.773	Continuing	Continuing	Continuing
TEST & EVALUATION	C/CPFI	GENERAL DYNAMICS : PITTSFIELD, MA	4.975	0.753	Oct 2018	0.756	Oct 2019	0.761	Oct 2020	-		0.761	Continuing	Continuing	Continuing
TEST & EVALUATION	C/CPAF	PROGENY : MANASSAS, VA	2.796	0.492	Oct 2018	0.495	Oct 2019	0.504	Oct 2020	-		0.504	Continuing	Continuing	Continuing
OPERATIONAL TEST & EVALUATION	WR	COMOPTEVFOR : NORFOLK, VA	17.732	0.836	Oct 2018	0.839	Oct 2019	0.843	Oct 2020	-		0.843	Continuing	Continuing	Continuing
<b>Subtotal</b>			75.404	3.821		3.841		3.893		-		3.893	Continuing	Continuing	N/A
Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
PROGRAM MANAGEMENT SUPPORT	C/CPFF	VARIOUS : VARIOUS:Not Specified	27.841	1.944	Oct 2018	1.946	Oct 2019	1.949	Oct 2020	-		1.949	Continuing	Continuing	Continuing



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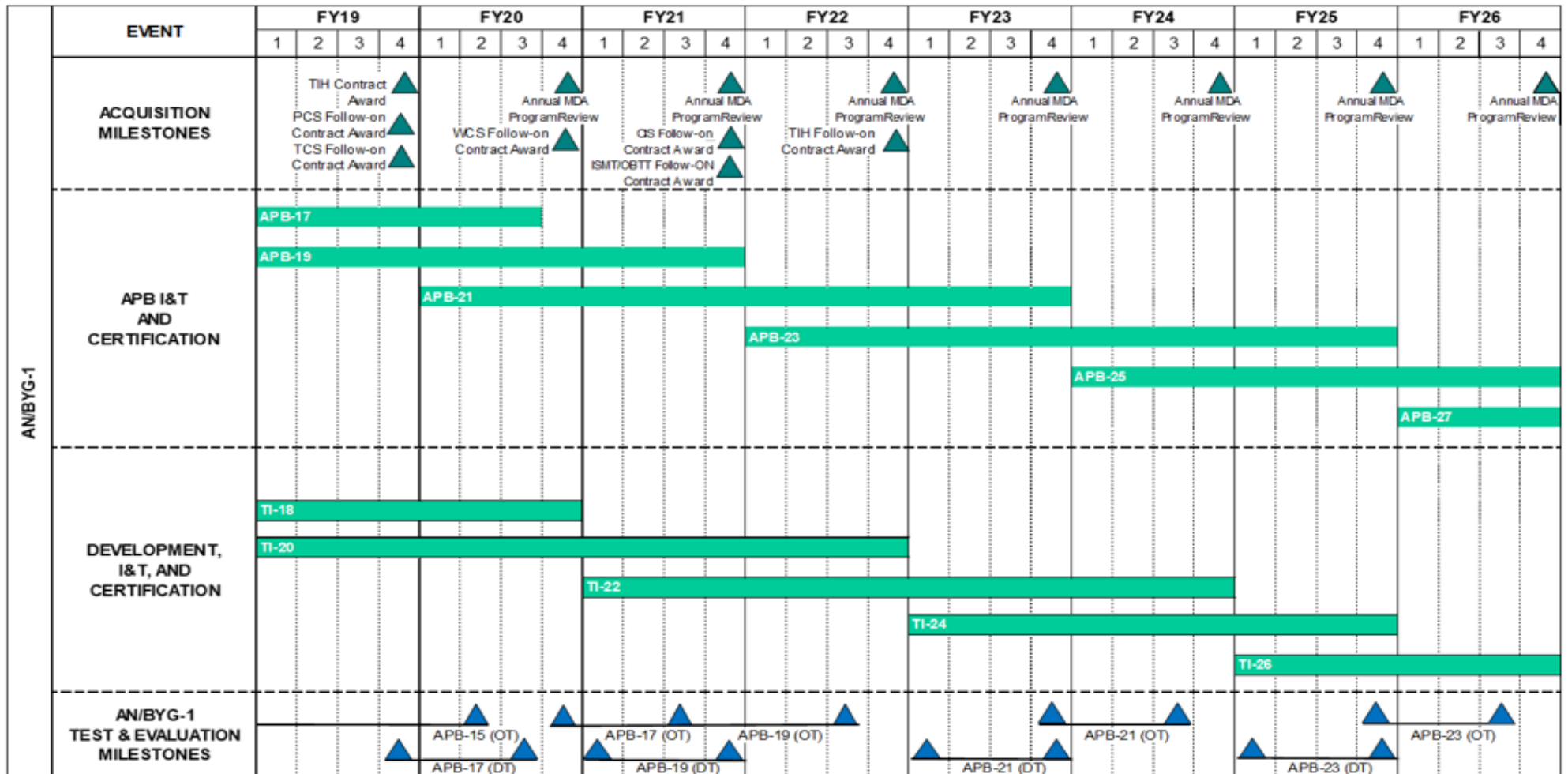
Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy

Date: February 2020

Appropriation/Budget Activity  
1319 / 5

R-1 Program Element (Number/Name)  
PE 0604562N / Submarine Tactical Warfare System

Project (Number/Name)  
0236 / SSN Comb Cont Sys Imprvmt (ENG)



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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2021 Navy		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 0236 / <i>SSN Comb Cont Sys Imprvmnt (ENG)</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Page 1</b>				
Acq Milestones: Annual MDA Program Review - FY19	4	2019	4	2019
Acq Milestones: Technical Insertion Hardware (TIH) TI20/TI22	4	2019	4	2019
Acq Milestones: Payload Control System (PCS)	4	2019	4	2019
Acq Milestones: Tactical Control System (TCS)	4	2019	4	2019
Acq Milestones: Annual MDA Program Review - FY20	4	2020	4	2020
Acq Milestones: Weapons Control System (WCS)	4	2020	4	2020
Acq Milestones: Annual MDA Program Review - FY21	4	2021	4	2021
Acq Milestones: Annual MDA Program Review - FY22	4	2022	4	2022
Acq Milestones: Annual MDA Program Review - FY23	4	2023	4	2023
Acq Milestones: Annual MDA Program Review - FY24	4	2024	4	2024
Acq Milestones: Annual MDA Program Review - FY25	4	2025	4	2025
APB I&T, Certification: APB-17: APB-17	1	2019	4	2019
APB I&T, Certification: APB-19: APB-19	1	2019	4	2021
APB I&T, Certification: APB-21: APB-21	1	2020	4	2023
APB I&T, Certification: APB-23: APB-23	1	2022	4	2025
APB I&T, Certification: APB-25: APB-25	1	2024	4	2025
Development, I&T Certification: TI-18: TI-18	1	2019	4	2020
Development, I&T Certification: TI-20: TI-20	1	2019	4	2022
Development, I&T Certification: TI-22: TI-22	1	2021	4	2024
Development, I&T Certification: T-24: TI-24	1	2023	4	2025
Development, I&T Certification: TI-26: TI-26	1	2025	4	2025

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

<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 0236 / <i>SSN Comb Cont Sys Imprvmt (ENG)</i>
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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
Test & Evaluation Milestones: AN/BYG-1: APB-15 OT	1	2019	2	2020
Test & Evaluation Milestones: AN/BYG-1: APB-17 DT	4	2019	3	2020
Test & Evaluation Milestones: AN/BYG-1: APB-17 OT	4	2020	3	2021
Test & Evaluation Milestones: AN/BYG-1: APB-19 DT	1	2021	4	2021
Test & Evaluation Milestones: AN/BYG-1: APB-19 OT	3	2021	3	2022
Test & Evaluation Milestones: AN/BYG-1: APB-21 DT	1	2023	4	2023
Test & Evaluation Milestones: AN/BYG-1: APB-21 OT	4	2023	3	2024
Test & Evaluation Milestones: AN/BYG-1: APB-23 DT	1	2025	4	2025
Test & Evaluation Milestones: AN/BYG-1: APB-23 OT	4	2025	4	2025

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Navy										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 1319 / 5					<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>				<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
9999: <i>Congressional Adds</i>	0.000	18.812	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.812
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

Project Unit 9999:

FY19 congressional adds provide funding to increase Submarine Launched Unmanned Aerial System (\$4.5M), SBIR Technology Insertion (\$10M) and Submarine Tactical Warfare System efforts (\$5M).

Provides funding to continue development of Submarine Launched Unmanned Aerial Systems (SLUAS), development and employment of T116 APB17 BYG-1 software with virtualization, containerized on expandable micro-blade servers (BYG-1 Virtual Twin) and the development and employment of all baselines of Common Weapon Launcher (CWL) software with virtualization on standard COTS hardware.

Funding provided for Submarine Warfare Federated Tactical System (SWFTS) T118 APB19 Cybersecurity Tool Kit (CSTK) rapid deployment of increased cyber resiliency tools and automation. Funding will allow for cybersecurity improvement to be developed and fielded to SSN and SSBN platforms sooner and improve overall cyber resilience through improved tools and automation improvements.

Funding provides for improvements and increase reliability within APB17 baseline, security improvements in BYG-1 data to support recent cyber changes and future payload interfaces. Also provides funding for increased capability within OBTT into APB17 baseline to allow additional operational training functionality and increase interface capability between user and machine.

- Selection of virtualization, and containerization technology
- Full virtualization of T116 APB17 BYG-1
- Containerization of T116 APB17 BYG-1 subsystems into applications.
- Full test program on BYG-1 Virtual Twin using ATRT
- Execute Common Weapon Launcher (CWL) Virtual Test Bed
- Full virtualization of T116APB17 BYG-1
- Full test program on CWL Test Bed
- Final Delivery to Government.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Navy		<b>Date:</b> February 2020	
<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>
<b>Congressional Add:</b> Submarine Launched Unmanned Aerial System		4.341	0.000
<b>FY 2019 Accomplishments:</b> Began development and procurement of two shipsets (24 units) of Blackwing to support Initial Operating Capability in FY20.			
Began development and procurement of five shipsets (60 units) of Hammerhead Spiral 1 Canisters to support Initial Operating Capability in FY20.			
Began development of Interface Control Document (ICD), manufacturability improvements (to lower unit costs), and design of expansion of internal space to house larger UAV.			
Began design and implementation of capability and interface requirements for submarine launch.			
<b>FY 2020 Plans:</b> Complete development and procurement of two shipsets (24 units) of Blackwing to support Initial Operating Capability in FY20.			
Complete development and procurement of five shipsets (60 units) of Hammerhead Spiral 1 Canisters to support Initial Operating Capability in FY20.			
Complete development of Interface Control Document (ICD), manufacturability improvements (to lower unit costs), and design of expansion of internal space to house larger UAV. Deliver Hammerhead ICD, Technical Data Package for Spiral 2 Hammerhead with reliability improvements and expansion of internal spaces.			
Complete design and implementation of capability and interface requirements for submarine launch. Complete certification and qualification of SLUAS at sea for LRIP.			
<b>Congressional Add:</b> SBIR Technology Insertion		9.647	0.000
<b>FY 2019 Accomplishments:</b> Develop SPEAR test tool. Begin building Test Bay as a service, associated security and demonstrate automated, remote testing capability via WAIF.			
Develop and employ all baselines of CWL software with virtualization on standard COTS hardware.			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Navy		<b>Date:</b> February 2020	
<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>
<p>Begin development and procurement of an SWFTS APB19 Cybersecurity Tool Kit (CSTK) Improvement to support Initial Operating Capability in FY20.</p> <p><b>FY 2020 Plans:</b> Complete development of a Systems Performance Evaluation Analysis Report (SPEAR) test tool. Complete building Test Bay as a service, associated security and demonstrate automated, remote testing capability via WAIF.</p> <p>Complete development of all baselines of CWL software with virtualization on standard COTS hardware.</p> <p>Complete development and procurement of SWFTS APB19 Cybersecurity Tool Kit Improvement to support Initial Operating Capability in FY20.</p> <p>Begin development and procurement of SWFTS APB21 Cybersecurity Tool Kit Improvement to support Initial Operating Capability in FY22.</p>			
<p><b>Congressional Add:</b> Submarine Tactical Warfare System</p> <p><b>FY 2019 Accomplishments:</b> Begin Phase 1 Command Applications and Platform (CAAP) implementation development and integration of Augmented Intelligence (AI) into BYG-1 to enhance ability to recognize and respond to changes in risk factors such as collision and counter detection.</p> <p>Begin and complete ISMT development and integration into APB-17 baseline. Begin ISMT development and integration of ISMT into APB-19 baseline.</p> <p><b>FY 2020 Plans:</b> Complete Phase 1 Command Applications and Platform (CAAP) implementation development and integration of Augmented Intelligence (AI) into BYG-1 to enhance ability to recognize and respond to changes in risk factors such as collision and counter detection.</p> <p>Complete development and integration of ISMT into APB-19 baseline.</p>		4.824	0.000
<b>Congressional Adds Subtotals</b>		18.812	0.000
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Navy		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>

**D. Acquisition Strategy**

Once developed, these modernization upgrades will be part of the TI/APB software baselines, utilizing the same Acquisition Strategy as the Tactical Warfare System. The program budget integrates APBs developed by the advanced development community. This program has been tailored in accordance with the new DoD5000 directive to incorporate annual MDA production reviews. Advanced Processing Builds (APB) products associated with AN/BYG-1 Release-To-Fleet 3Q 2019 and 3Q 2021.

Near term: Continued refinement of the AWESUM AUR with improvements in reliability, maturity of design, IA compliance and compatibility with the Common Communications solution being developed with PMS 425 and SEA 073.

Far term: Within Five years, leveraging the discovery from near term efforts and achieving actual feedback from fleet operations, the Program expects to submit a RFP to best produce the next generation of AUR development and system employment.

SLUAS Controller modernization upgrades will be incorporated into the TI/APB software baselines, utilizing the same Acquisition Strategy as the Tactical Warfare System for BYG-1.

This program has been tailored in accordance with the new DoD 5000 directive to incorporate annual MDA production reviews.

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

<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>
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<b>Product Development (\$ in Millions)</b>				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Hammerhead Shipsets	MIPR	DTIC/Prescient Edge : Various	0.000	3.250	May 2019	0.000		0.000		-		0.000	0.000	3.250	-
Blackwing Shipsets	MIPR	DIUx : Mountain View, CA	0.000	0.521	Apr 2019	0.000		0.000		-		0.000	0.000	0.521	-
Virtual Twin	Various	Various : Various	0.000	2.980	Jul 2019	0.000		0.000		-		0.000	0.000	2.980	-
Cybersecurity Toolkit	C/CPFF	Progeny : Manassas, VA	0.000	1.908	Apr 2019	0.000		0.000		-		0.000	0.000	1.908	-
Wide Area Integration Facility (WAIF) Node Circuit Setup	WR	NUWC : Newport, RI	0.000	0.250	Jun 2019	0.000		0.000		-		0.000	0.000	0.250	-
CWL Software - Virtualization	C/CPFF	Progeny : Manassas, VA	0.000	0.769	Jun 2019	0.000		0.000		-		0.000	0.000	0.769	-
Spear Test Tool Development	C/CPFF	Rite Solutions : Middletown, RI	0.000	0.650	Apr 2019	0.000		0.000		-		0.000	0.000	0.650	-
Integrated Systems Monitoring Tool (ISMT) Development	C/CPFF	Rite Solutions : Middletown, RI	0.000	0.364	Apr 2019	0.000		0.000		-		0.000	0.000	0.364	-
CAAP Development	C/CPFF	Assett : Manassas, VA	0.000	2.117	Jul 2019	0.000		0.000		-		0.000	0.000	2.117	-
<b>Subtotal</b>			0.000	12.809		0.000		0.000		-		0.000	0.000	12.809	N/A

<b>Support (\$ in Millions)</b>				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Virtual Twin	Various	Various : Various	0.000	0.500	Jul 2019	0.000		0.000		-		0.000	0.000	0.500	-
CWL Test Bed	TBD	Progeny : Manassas, VA	0.000	0.000	Jun 2019	0.000		0.000		-		0.000	0.000	0.000	-
SPEAR & Continuous Integration	Various	Rite Solutions : Middletown, RI	0.000	0.100	Apr 2019	0.000		0.000		-		0.000	0.000	0.100	-
Integrated Systems Monitoring Tool (ISMT)	C/CPFF	Rite Solutions : Middletown, RI	0.000	0.374	Apr 2019	0.000		0.000		-		0.000	0.000	0.374	-

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

<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>
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<b>Support (\$ in Millions)</b>				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Security Classification Guide	C/CPFF	Rite Solutions : Middletown, RI	0.000	0.090	Apr 2019	0.000		0.000		-		0.000	0.000	0.090	-
Phase 1 CAAP Implementation	C/CPFF	Assett : Manassas, VA	0.000	1.350	Jul 2019	0.000		0.000		-		0.000	0.000	1.350	-
SWFTS APB19 Cybersecurity Tool Kit	C/CPFF	Progeny : Manassas, VA	0.000	0.500	Apr 2019	0.000		0.000		-		0.000	0.000	0.500	-
<b>Subtotal</b>			0.000	2.914		0.000		0.000		-		0.000	0.000	2.914	N/A

<b>Test and Evaluation (\$ in Millions)</b>				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Phase 1 CAAP Implementation	C/CPFF	Assett : Manassas, VA	0.000	0.611	Jul 2019	0.000		0.000		-		0.000	0.000	0.611	-
SWFTS APB19 Cybersecurity Tool Kit	C/BA	Progeny : Manassas, VA	0.000	0.650	Apr 2019	0.000		0.000		-		0.000	0.000	0.650	-
<b>Subtotal</b>			0.000	1.261		0.000		0.000		-		0.000	0.000	1.261	N/A

<b>Management Services (\$ in Millions)</b>				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Virtual Twin	Various	Various : Various	0.000	0.250	Jul 2019	0.000		0.000		-		0.000	0.000	0.250	-
CWL Test Bed	TBD	Progeny : Manassas, VA	0.000	0.100	Jun 2019	0.000		0.000		-		0.000	0.000	0.100	-
SPEAR & Continuous Integration	Various	Rite Solutions : Middletown, RI	0.000	0.100	Apr 2019	0.000		0.000		-		0.000	0.000	0.100	-
Blackwing Shipsets	C/CPFF	AeroVironment : Simi Valley, CA	0.000	0.500	Apr 2019	0.000		0.000		-		0.000	0.000	0.500	-
Hammerhead Shipsets	MIPR	DTIC/Prescient Edge : Various	0.000	0.250	May 2019	0.000		0.000		-		0.000	0.000	0.250	-



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

<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>
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Proj 9999	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	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
<b>SBIR Technology</b>									CSTK I&T, Certification: CSTK APB19																			
									CSTK I&T, Certification: CSTK APB21																			
									Commons Weapons Launcher (CWL) Virtual Test Bed																			
									BYG-1 Virtual Twin																			
									SPEAR Continuous Integration																			
<b>Submarine Tactical Warfare System</b>									Command Applications And Platform (CAAP) Phase 1 - Start & Delivery																			
<b>Submarine Launched Unmanned Aerial System</b>									SLUAS Blackwing Shipset Procurement																			
									SLUAS Hammerhead Shipset Procurement																			
									SLUAS Hammerhead Canister Improvements																			
									SLUAS Evolutionary Development																			

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2021 Navy		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 1319 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604562N / <i>Submarine Tactical Warfare System</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 9999</b>				
SBIR Technology: CSTK I&T, Certification: CSTK APB19	2	2019	1	2021
SBIR Technology: CSTK I&T, Certification: CSTK APB21	1	2020	1	2023
SBIR Technology: Commons Weapons Launcher (CWL) Virtual Test Bed	3	2019	4	2021
SBIR Technology: BYG-1 Virtual Twin	3	2019	4	2022
SBIR Technology: IDT SPEAR Continuous Integration	3	2019	4	2020
Submarine Tactical Warfare System: Command Applications And Platform (CAAP) Phase 1 - Start & Delivery	2	2019	4	2020
Submarine Launched Unmanned Aerial System: SLUAS Blackwing Shipset Procurement	3	2019	3	2021
Submarine Launched Unmanned Aerial System: SLUAS Hammerhead Shipset Procurement	3	2019	3	2021
Submarine Launched Unmanned Aerial System: SLUAS Hammerhead Canister Improvements	3	2019	1	2022
Submarine Launched Unmanned Aerial System: SLUAS Defense Innovation (DIU) Evolutionary Development	3	2019	1	2022