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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy Date: March 2019

Appropriation/Budget Activity 1319: Research, Development, Test & Evaluation, Navy I BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0604227N I Harpoon Modifications							
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	5.197	2.302	-	2.302	0.600	0.000	0.000	0.000	0.000	8.099
1843: Harpoon Block II+	0.000	0.000	5.197	2.302	-	2.302	0.600	0.000	0.000	0.000	0.000	8.099

## A. Mission Description and Budget Item Justification

The Harpoon seeker upgrade program will modernize current seekers, designated 3700-3, to increase the targeting precision, reliability, and survivability. The program is the result of a successful Small Business Initiative, which will upgrade legacy 3700-3 to 3700-4+ seekers. The 3700-series seekers were designed to sequentially search, detect, acquire, and track a surface target in the designated Area of Uncertainty. The modified 3700-4+ seekers provide improvements in the sequential search radar probability of acquiring the intended target, and provide improved Electronic Protection which significantly increases the probability of engaging a valid surface target in a complex environment. These attributes of the 3700-4+ seekers will ultimately increase survivability and lethality of the Harpoon missile weapons system, and are intended to support the procurement of the Harpoon Block II+ missiles.

The Encapsulated (ENCAP) Harpoon Block IC (HIC) missiles provides Navy Los Angeles-class nuclear attack submarines (SSN) a sub-launched, all-weather, long-range Anti-Surface Warfare (ASuW) missile to attack enemy warships at stand-off ranges, to include Surface and Amphibious Action Groups. The ENCAP Reconstitution Program will refurbish and recertify 60 existing ENCAP HIC all-up rounds from deep storage to an "as-new" war-ready material condition (ENCAP Harpoons were placed in deep storage in 1996). The controlled storage conditions achieved by the missile capsule have preserved the material condition of the weapon system, allowing for relatively quick recertification and reissue. Due to the ease and speed of missile recertification's the ENCAP HIC Reconstitution Program will fill a critical, time sensitive ASuW capability gap and meet Speed to the Fleet requirements.

This program is funded under OPERATIONAL SYSTEMS DEVELOPMENT because it includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate funding in the current or subsequent fiscal year.

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
Previous President's Budget	0.000	5.426	4.557	-	4.557
Current President's Budget	0.000	5.197	2.302	-	2.302
Total Adjustments	0.000	-0.229	-2.255	-	-2.255
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-0.229			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	-2.255	-	-2.255

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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy				Date: March 2019	
Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
1319: Research, Development, Test & Evaluation, Navy / BA 7: Operational Systems Development		PE 0604227N / Harpoon Modifications			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
<u>Change Summary Explanation</u>					
The FY 2020 funding for Harpoon seeker was removed as the Navy has decided not to pursue this effort.					
The FY 2020 funding request provided \$2.3M to fund the Encapsulated (ENCAP) Harpoon Block IC Reconstitution Program.					
Technical: Not applicable.					
Schedule: Not applicable.					

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 7					R-1 Program Element (Number/Name) PE 0604227N / Harpoon Modifications				Project (Number/Name) 1843 / Harpoon Block II+			
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
1843: Harpoon Block II+	0.000	0.000	5.197	2.302	-	2.302	0.600	0.000	0.000	0.000	0.000	8.099
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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

The Harpoon Block II+ (HII+) retrofit kit procurement provides the Department of Navy (DoN) with an enhanced tactically navigation and targeting selectivity capabilities over the legacy Harpoon Block IC (HIC) inventory. Harpoon Block II+ is a Network Enabled, Air-Launched, Anti-ship Cruise missile with the ability to receive in-flight targeting updates, improving target selectivity and the engagement of moving maritime targets. Additionally, the system utilizes the Global Positioning System to provide in-flight updates coupled with an active radar seeker for accurate targeting. The program procurement budget keeps pace with evolving enemy threats by providing a network enabled, anti-ship cruise missile capability, which compliments the attributes of associated launch platforms. The survivability of the HII+ is increased over the HIC due to the upgrade retrofit kit, increasing the lethality of the weapon system. The DoN's planned procurement modifies legacy HIC with the retrofit kits, to include procurement of Captive Air Training Missiles (CATMs), increasing the Anti-Surface Warfare capabilities of Fleet Forces.

The Harpoon seeker upgrade program will modernize current seekers, designated 3700-3, to increase the targeting precision, reliability, and survivability. The program is the result of a successful Small Business Initiative, which will upgrade legacy 3700-7 to 3700-4+ seekers. The 3700-series seekers were designed to sequentially search, detect, acquire, and track a surface target in the designated Area of Uncertainty. The modified 3700-4+ seekers provide improvements in the sequential search radar probability of acquiring the intended target, and provide improved Electronic Protection which significantly increases the probability of engaging a valid surface target in a complex environment. These attributes of the 3700-4+ seekers will ultimately increase survivability and lethality of the Harpoon missile weapons system, and are intended to support the procurement of the Harpoon Block II+ missiles.

The Encapsulated (ENCAP) Harpoon Block IC (HIC) missiles provides Navy Los Angeles-class nuclear attack submarines (SSN) a sub-launched, all-weather, long-range Anti-Surface Warfare (ASuW) missile to attack enemy warships at stand-off ranges, to include Surface and Amphibious Action Groups. The ENCAP Reconstitution Program will refurbish and recertify 60 existing ENCAP HIC all-up rounds from deep storage to an "as-new" war-ready material condition (ENCAP Harpoons were placed in deep storage in 1996). The controlled storage conditions achieved by the missile capsule have preserved the material condition of the weapon system, allowing for relatively quick recertification and reissue. Due the ease and speed of missile recertifications the ENCAP HIC Reconstitution Program will fill a critical, time sensitive ASuW capability gap and meet Speed to the Fleet requirements.

This program is funded under OPERATIONAL SYSTEMS DEVELOPMENT because it includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate funding in the current or subsequent fiscal year.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
<b>Title:</b> Operational System Development	0.000	5.197	0.000	0.000	0.000
<b>Articles:</b>	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019		
Appropriation/Budget Activity 1319 / 7		R-1 Program Element (Number/Name) PE 0604227N / Harpoon Modifications		Project (Number/Name) 1843 / Harpoon Block II+		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<b>FY 2019 Plans:</b> New Start will begin in FY 2019 and provide funding for manufacturing, prototype and testing. FY 2019 plan is to develop a new manufacturing process to upgrade legacy 3700-3 seekers to 3700-4+ seekers. These efforts for the 3700-4+ seekers include factory acceptance tests, design verification tests, environmental tests and operational flight testing. The endstate is a production-ready seeker design.						
<b>FY 2020 Base Plans:</b> N/A						
<b>FY 2020 OCO Plans:</b> N/A						
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> The FY 2020 funding for Harpoon seeker was removed as the Navy has decided not to pursue this effort.						
<b>Title:</b> ENCAP Reconstitution Program		0.000	0.000	2.302	0.000	2.302
<b>Articles:</b>		-	-	-	-	-
<b>FY 2019 Plans:</b> N/A						
<b>FY 2020 Base Plans:</b> The ENCAP Reconstitution Program requires Navy to develop, test, validate, and certify submarine software changes; re-develop, test, and requalify submarine crew training systems, materials, and documentation; and transport, disassemble, inspect, repair, refurbish, modify, recertify, reassemble, re-inspect, and reissue ENCAP AUR capsules and Harpoon missile bodies (HMBs) between government storage sites and Contractor facilities.The ENCAP Reconstitution Program will require a collective, cooperative NAVAIR and NAVSEA effort to re-integrate ENCAP AURs and capability back into USN LA-class nuclear-powered attack submarines. Navy efforts within NAVSEA and NAVAIR may include: refurbishing, preparing, and test firing several Encapsulated Harpoon Certification and Training Vehicles (EHCVTs) at-sea from several LA-class SSNs; Shock and Implosion safety studies and analysis with supporting tests, reports, and engineering document; and Navy lab and contracted independent validation and verification (IV&V) efforts of developed and installed software algorithms in the BYG-1 submarine combat system and supporting submarine trainers.						
<b>FY 2020 OCO Plans:</b> N/A						
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b>						

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy									Date: March 2019		
Appropriation/Budget Activity 1319 / 7				R-1 Program Element (Number/Name) PE 0604227N / Harpoon Modifications			Project (Number/Name) 1843 / Harpoon Block II+				
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)						FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	
Fund Harpoon Reconstitution to SSNs											
Accomplishments/Planned Programs Subtotals						0.000	5.197	2.302	0.000	2.302	
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• 1507N/2326: Harpoon Mods	15.300	26.840	25.447	-	25.447	29.379	8.229	7.523	7.600	0.000	120.318
• 1810N/5227: Harpoon Support Equipment	0.000	0.000	1.100	-	1.100	0.100	0.100	0.100	0.100	0.000	1.500
Remarks											
D. Acquisition Strategy											
The new digital technology of the 3700-4+ seeker enables improved functionality, reliability, and survivability in a reduced footprint, and allows for the inclusion of a new interface which permits for future capability improvements for the Harpoon weapon system. The legacy Harpoon 3700-3 seekers will be upgraded using a unique process developed by L-3/Mustang to the 3700-4+ seeker. The upgrade will build upon achievements gained via SBIR N102-131 (Phases I and II) to develop the new seeker manufacturing process to convert old analog 3700-3 seekers to new 3700-4+ digital seekers. Developmental engineering and production assets will be procured by a sole source Cost-Plus Incentive Fee contract. Non-recurring engineering and production options will be priced separately.											
The Encapsulated Harpoon Block IC (ENCAP HIC) Reconstitution Program will refurbish and recertify 60 existing ENCAP HICs to an as-new war-ready material condition. Coordinated contracting efforts between NAVAIR and NAVSEA offices will reintegrate and supply ENCAP HICs. Vendor support for all associated activates will leverage existing vendor relationships, and exiting contracts when able. All required manufacturing processes, support facilities, and tooling currently exist and are in current use for this program.											
E. Performance Metrics											
The performance of the 3700-4+ seeker program will be managed through program reviews with the vendor, in conjunction with associated Government Support activities. The schedule of reviews will be established in FY 2020 with contract award.											
Encapsulated Harpoon Block 1C reconstitution efforts will be evaluated by incorporating required reporting into the existing Program Management Review schedule and process already established with the vendor for current R/A/UGM-84 work. Current formal program reviews will occur quarterly.											

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0604227N / Harpoon Modifications	<b>Project (Number/Name)</b> 1843 / Harpoon Block II+
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Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
Primary Hardware Development	SS/CPIF	Mustang/L3 : Plano, TX	0.000	0.000		4.968	Feb 2019	0.000		-		0.000	0.000	4.968	4.968
Missile Support- Encap	C/CPFF	BSC : Chantilly, VA	0.000	0.000		0.000		0.302	Dec 2019	-		0.302	0.200	0.502	0.502
<b>Subtotal</b>			0.000	0.000		4.968		0.302		-		0.302	0.200	5.470	N/A

**Remarks**  
BSC: Performing Independent Verification and Validation for Harpoon HIC ENCAP efforts for BYG-1 software modifications for required system safety reviews and requirements.

Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
Government Support	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.229	Nov 2018	0.000		-		0.000	0.000	0.229	-
<b>Subtotal</b>			0.000	0.000		0.229		0.000		-		0.000	0.000	0.229	N/A

**Remarks**  
FY 2020 Support costs consist of government in-house program management, technical management, and other support. These government support costs cover the efforts to develop, test, validate, and certify submarine software changes as well as requalify submarine crew training systems, materials, and documentation.

Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
T&E - Encap	WR	NUWC Naval Undersea Warfare Center : Newport, RI	0.000	0.000		0.000		1.600	Nov 2019	-		1.600	0.300	1.900	-
T&E - Encap	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.000		0.100	Nov 2019	-		0.100	0.050	0.150	-
T&E - Encap	WR	COMOPTEVFOR : Virginia	0.000	0.000		0.000		0.300	Nov 2019	-		0.300	0.050	0.350	-
<b>Subtotal</b>			0.000	0.000		0.000		2.000		-		2.000	0.400	2.400	N/A

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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis: PB 2020 Navy</b>													<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 1319 / 7						<b>R-1 Program Element (Number/Name)</b> PE 0604227N / <i>Harpoon Modifications</i>				<b>Project (Number/Name)</b> 1843 / <i>Harpoon Block II+</i>					
<b>Test and Evaluation (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>			
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Remarks</b> Test and Evaluation cost for the Harpoon HIC ENCAP reconstitution efforts include system safety analysis and reporting, verification testing of refurbished training systems, required sea trial activities with analysis and reporting, safety/shock/implosion analysis, and analysis reporting.															
			<b>Prior Years</b>	<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Project Cost Totals</b>			0.000	0.000		5.197		2.302		-		2.302	0.600	8.099	N/A
<b>Remarks</b>															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Navy	<b>Date:</b> March 2019
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<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0604227N / Harpoon Modifications	<b>Project (Number/Name)</b> 1843 / Harpoon Block II+
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Harpoon Modifications	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>Operational System Development</b>																												
System Development						Seeker Contract Award ●																						
System Development and Demonstration						Seeker Engineering Manufacturing and Development																						
<b>Test and Evaluation Activities</b>																												
Test and Evaluation									ENCAP Production Development and Test and Evaluation Component Level and System Integration																			
<b>Support</b>																												
Development Support																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Navy		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0604227N / <i>Harpoon Modifications</i>	<b>Project (Number/Name)</b> 1843 / <i>Harpoon Block II+</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Harpoon Modifications</i></b>				
Operational System Development: System Development: Seeker Contract Award	2	2019	2	2019
Operational System Development: System Development and Demonstration: Seeker Engineering Manufacturing and Development	1	2019	4	2019
Test and Evaluation Activities: Test and Evaluation: ENCAP Production Development and Test and Evaluation Component Level and System Integration	1	2020	1	2022