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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 / BA 5: System Development & Demonstration (SDD)					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)							
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	944.546	214.132	193.244	137.268	-	137.268	121.853	96.302	60.417	41.233	Continuing	Continuing
0167: 5in Rolling Airframe Missile	259.629	39.620	26.280	21.956	-	21.956	6.168	4.085	4.171	4.256	Continuing	Continuing
0173: NATO Sea Sparrow	672.179	129.038	87.400	78.873	-	78.873	89.293	81.011	47.958	36.977	Continuing	Continuing
0243: ALaMO	5.594	35.041	24.714	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	65.349
2070: OTH Missile	0.000	0.000	19.968	28.039	-	28.039	26.392	11.206	8.288	0.000	0.000	93.893
9081: Phalanx CIWS SEARAM	7.144	10.433	9.882	8.400	-	8.400	0.000	0.000	0.000	0.000	0.000	35.859
9999: Congressional Adds	0.000	0.000	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.000

## A. Mission Description and Budget Item Justification

This program element provides funding for the development of systems that fulfill a portion of the third phase of the Ship Self Defense: Engage Hard Kill. Development in this line will focus on hard kill capabilities in which missiles are used to intercept incoming Anti-Ship Cruise Missiles (ASCM), as well as a Surface-to Surface Strike weapon system. Missile and system improvements necessary to meet their requirements are being addressed via NATO SEASPARROW Missile System (NSSMS) (0173), Rolling Airframe Missile (RAM) (0167), Advanced Low Cost Munition Ordnance (ALaMO) (0243), Over-The-Horizon (OTH) missile (2070), and Phalanx Close-In Weapon System (CIWS) SeaRAM (9081). Missile improvements include improved kinematic performance plus advanced seeker and low elevation fusing/warhead capability improvements. CIWS System improvements include Technology Refresh for current and future fleet population. ALaMO (0243) qualifies a guided 57mm projectile with an active seeker for United States Navy (USN) use. ALaMO provides enhanced lethality against Fast In-shore Attack Craft (FIAC) when compared to existing 57mm ammunition.

B. Program Change Summary (\$ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	212.412	178.538	157.285	-	157.285
Current President's Budget	214.132	193.244	137.268	-	137.268
Total Adjustments	1.720	14.706	-20.017	-	-20.017
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-10.294			
• Congressional Rescissions	-	-			
• Congressional Adds	-	25.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-8.281	0.000			
• Program Adjustments	0.000	0.000	-19.842	-	-19.842

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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 5: System Development & Demonstration (SDD)			R-1 Program Element (Number/Name) PE 0604756N I Ship Self Def (Engage: Hard Kill)				
• Rate/Misc Adjustments			0.001	0.000	-0.175	-	-0.175
• Congressional Add Adjustments			10.000	-	-	-	-
Congressional Add Details (\$ in Millions, and Includes General Reductions)							
Project: 9999: Congressional Adds							
Congressional Add: Condition Based Maintenance							
Congressional Add: Next Generation Phalanx							
Congressional Add: Alamo Munition Systems							
Congressional Add Subtotals for Project: 9999							
Congressional Add Totals for all Projects							
Change Summary Explanation							
The FY2020 funding request was reduced by \$10.0M to account for the availability of prior year execution balances. CIWS Tech Refresh efforts for ELX and LCS/RCS were postponed reducing FY2020 by an additional \$9.842M.							

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0167 / 5in Rolling Airframe Missile			
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
0167: 5in Rolling Airframe Missile	259.629	39.620	26.280	21.956	-	21.956	6.168	4.085	4.171	4.256	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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

The RAM program is an international cooperative program with the government of the Federal Republic of Germany. The purpose of this program is to develop, test, and field a surface-to-air self-defense system utilizing a dual mode, passive radio frequency/infrared RAM. The baseline system RAM Block 0/1/1A provide defense capability against active and passive anti-ship missiles, very low altitude missiles, and maneuvering missiles through the utilization of passive radio frequency and infrared seekers and a maritime optimized fuse. The RAM Block 2 upgrade programs are a cooperative requirement of the U.S. and Federal Republic of Germany, as agreed to in an international Memorandum of Understanding (MOU), and allows RAM to counter emerging, highly maneuverable ASCM threats utilizing advanced seekers while maintaining all the proven capabilities of RAM Block 0/1/1A's accurate terminal guidance, proven lethality, and no shipboard post launch dependence. Funding supports formal Developmental and Operational Testing (DT/OT) scheduled through FY 2018, data analysis, operational/test driven studies, support of combat system performance analysis and identification of operationally relevant improvements. The RAM BLK 2A Fire Control Loop Improvement Project (FCLIP) will provide software only modifications to the missile and launcher to improve raid performance. The RAM BLK 2B Raid ECP will provide an upgraded seeker and Missile-to-Missile Link (MML) capability to counter emerging complex raid threats. Development and test of RAM BLK 2B Raid ECP will occur through FY 2022.

**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> Rolling Airframe Missile Block 2 Development and Test	39.557	26.168	21.844	0.000	21.844
<b>Articles:</b>	-	-	-	-	-
<b>FY 2019 Plans:</b> Finalize RAM BLK 2A FCLIP design, integration and test of the FCLIP combat system changes. Funds support conducting BLK 2A FCLIP development flight test (GTV-2) and final verification and qualification testing of the AUR design. Funding for RAM BLK 2B Raid ECP to support post-PDR design efforts culminating in a Critical Design Review (CDR) and initial Controlled Test Vehicle (CTV-1) flight test.					
<b>FY 2020 Base Plans:</b> Integrate new seeker and MML in AUR in preparation for flight testing. Execute GTV 1A and 1C developmental flight test in Q4 in addition execute GTV 2B development flight test in Q2 FY21. Conduct post flight analysis incorporating changes into new flight software build.					
<b>FY 2020 OCO Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Navy				<b>Date:</b> March 2019							
<b>Appropriation/Budget Activity</b> 1319 / 5		<b>R-1 Program Element (Number/Name)</b> PE 0604756N / Ship Self Def (Engage: Hard Kill)		<b>Project (Number/Name)</b> 0167 / 5in Rolling Airframe Missile							
<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>											
		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>					
N/A											
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Decrease due to reduction in RAM BLK 2B Raid ECP efforts											
<b>Title:</b> Rolling Airframe Missile Block 2 Travel		0.063	0.112	0.112	0.000	0.112					
<b>Articles:</b>		-	-	-	-	-					
<b>FY 2019 Plans:</b> Fund program office travel to support program/testing as required by program schedule and in accordance with travel reduction mandate.											
<b>FY 2020 Base Plans:</b> Fund program office travel to support program/testing as required by program schedule and in accordance with travel reduction mandate.											
<b>FY 2020 OCO Plans:</b> N/A											
<b>Accomplishments/Planned Programs Subtotals</b>		39.620	26.280	21.956	0.000	21.956					
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</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>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• WPN 2242: RAM	106.587	96.221	106.765	-	106.765	108.562	113.179	107.688	112.248	Continuing	Continuing
• OPN 5231: Ship Missile Support Equipment	7.656	16.158	7.464	-	7.464	10.072	7.195	6.835	6.973	Continuing	Continuing
<b>Remarks</b>											
<b>D. Acquisition Strategy</b> The RAM Program uses directed sole source contracts with Raytheon Missile Systems Company, Tucson, AZ.											
<b>E. Performance Metrics</b> Successfully complete DT/OT. Achieved Initial Operational Capability (IOC) decision and support a FRP decision.											

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0167 / 5in Rolling Airframe Missile					
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
Block 2 Upgrade	C/CPAF	Various : Various	154.650	0.000		0.000		0.000		-		0.000	0.000	154.650	-
Primary Hardware Dev/Blk 1	Various	Various : Various	10.081	0.000		0.000		0.000		-		0.000	0.000	10.081	-
FCLIP	WR	PHD : CA	0.193	0.000		0.000		0.000		-		0.000	0.000	0.193	-
FCLIP	SS/CPFF	AECOM : VA	0.506	0.211	Feb 2018	0.257	Dec 2018	0.244	Dec 2019	-		0.244	0.000	1.218	-
Raid ECP	SS/CPFF	Raytheon : Tucson/ Louisville	15.001	26.296	Oct 2017	18.574	Dec 2018	18.162	Dec 2019	-		18.162	0.000	78.033	-
FCLIP	SS/CPFF	Raytheon : Tucson/ Louisville	32.741	4.084	Jan 2018	5.049	Dec 2018	1.169	Dec 2019	-		1.169	0.000	43.043	-
Raid ECP	SS/CPFF	JHU/APL : MD	0.450	0.205	Feb 2018	0.050	Dec 2018	0.050	Dec 2019	-		0.050	0.000	0.755	-
FCLIP	WR	China Lake : CA	1.710	3.337	Jan 2018	0.480	Nov 2018	0.458	Nov 2019	-		0.458	0.000	5.985	-
Raid ECP	WR	China Lake : CA	0.245	1.393	Jan 2018	0.380	Nov 2018	0.380	Nov 2019	-		0.380	0.000	2.398	-
FCLIP	SS/CPFF	JHU/APL : MD	0.236	0.181	Feb 2018	0.100	Dec 2018	0.100	Dec 2019	-		0.100	0.000	0.617	-
Raid ECP	WR	PHD : CA	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Raid ECP	SS/CPFF	AECOM : VA	0.126	0.587	Feb 2018	0.378	Dec 2018	0.378	Dec 2019	-		0.378	0.000	1.469	-
FCLIP	WR	PT Mugu : CA	0.000	0.025	Apr 2018	0.000		0.000		-		0.000	0.000	0.025	-
FCLIP	WR	NSWC DD : VA	0.000	0.373	Apr 2018	0.143	May 2019	0.146	May 2020	-		0.146	0.000	0.662	-
Subtotal			215.989	36.692		25.411		21.087		-		21.087	0.000	299.179	N/A
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
Studies and Analysis	Various	Various : Various	1.210	0.200	May 2018	0.200	May 2019	0.200	May 2020	-		0.200	0.000	1.810	-
Subtotal			1.210	0.200		0.200		0.200		-		0.200	0.000	1.810	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0167 / 5in Rolling Airframe Missile					
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
Test Support	C/CPFF	Raytheon : Tucson	17.338	0.549	Nov 2017	0.300	Nov 2018	0.300	Nov 2019	-		0.300	0.000	18.487	-
Test Support	WR	China Lake/PHD : CA/CA	12.400	0.200	Oct 2017	0.157	Oct 2018	0.157	Oct 2019	-		0.157	Continuing	Continuing	Continuing
FOT&E	WR	China Lake : PHD, CA	4.701	0.000		0.000		0.000		-		0.000	0.000	4.701	-
Miscellaneous	Various	Various : Various	5.765	0.000		0.000		0.000		-		0.000	0.000	5.765	-
Test Support	SS/CPFF	JHU/APL : MD	0.467	0.150	Nov 2017	0.100	Nov 2018	0.100	Nov 2019	-		0.100	0.000	0.817	-
Integration	Various	Various : Various	0.000	1.719	Sep 2018	0.000		0.000		-		0.000	0.000	1.719	-
Subtotal			40.671	2.618		0.557		0.557		-		0.557	Continuing	Continuing	N/A
Management Services (\$ 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
Travel	Allot	Program Office : VA	1.612	0.110	Oct 2017	0.112	Oct 2018	0.112	Oct 2019	-		0.112	Continuing	Continuing	Continuing
Defense Acquisition Workforce Development Fund	Various	various : various	0.147	0.000		0.000		0.000		-		0.000	0.000	0.147	-
Subtotal			1.759	0.110		0.112		0.112		-		0.112	Continuing	Continuing	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			259.629	39.620		26.280		21.956		-		21.956	Continuing	Continuing	N/A
Remarks															

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy										Date: March 2019	
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)					Project (Number/Name) 0167 / 5in Rolling Airframe Missile	

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>Proj 0167</b>																												
RAM Block 2 Progam Milestones: FRP																												
ECPs/Improvement Studies: ECPs/ Improvement Studies																												
FCLIP Phase I: FCLIP Test Events																												
FCLIP Phase II: FCLIP Product Development/ Integration																												
Raid ECP: Raid ECP Product Development																												
Raid ECP: Raid ECP Test Events																												

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 0167 / <i>5in Rolling Airframe Missile</i>	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Proj 0167</i></b>				
RAM Block 2 Progam Milestones: FRP	1	2019	1	2019
ECPs/Improvement Studies: ECPs/Improvement Studies	1	2018	3	2021
FCLIP Phase I: FCLIP Test Events	1	2018	2	2019
FCLIP Phase II: FCLIP Product Development/Integration	1	2018	4	2020
Raid ECP: Raid ECP Product Development	1	2018	3	2021
Raid ECP: Raid ECP Test Events	2	2018	4	2022



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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0173 / NATO Sea Sparrow			
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
0173: NATO Sea Sparrow	672.179	129.038	87.400	78.873	-	78.873	89.293	81.011	47.958	36.977	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

## A. Mission Description and Budget Item Justification

This project encompasses nine (9) primary efforts to enhance ship self-defense:

1. Evolved SEASPARROW Missile (ESSM) Blk 1 is a cooperative effort among 10 NATO SEASPARROW Nations and the U.S. to provide crucial defense battlespace and fire power against the fast, low altitude, highly maneuverable Anti-Ship Cruise Missile (ASCM) threat. Modifications were made to both the MK 41 Vertical Launch System (VLS) to fire from a single cell with 4 ESSM (QuadPack) and the NATO SEASPARROW Surface Missile System (NSSMS), fielding ESSM Blk 1 onboard CVN 68, LHD 1, LHA 7, CG 47, and DDG 51 class ships. ESSM Blk 1 integration efforts continue to bring the capability to CVN 78 and DDG 1000. Testing scheduled for FY20 includes ESSM Blk 1 firings from the lead ship in support of DDG 1000 and CVN 78 class activation, AEGIS B/L 9C2 live fire testing, and Combat Systems Ship Qualification Trials live fire tests aboard CVN 78 and LHA 7.
2. NATO SEASPARROW Technical Direction Agent (TDA) - TDA support for the NSSMS Mk 57 Mods 12-15 which is integrated with the Ship Self Defense System (SSDS) Mk 2 to provide ship missile defense utilizing an open architected design on all CVN, LHA, and LHD class ships. A Launcher Min-Mod effort is scheduled for Mk 57 platforms making each upgraded ship ESSM Blk 1 and ESSM Blk 2 capable.
3. ESSM Blk 2 Risk Reduction/ESSM Blk 2 Engineering and Manufacturing Development (EMD):  
ESSM Blk 2 upgrade is a cooperative effort between U.S Navy and NATO SEASPARROW Consortium Nations. ESSM Blk 2 upgrade replaces the largely obsolete guidance section with a dual mode Active/Semi-Active X-Band seeker capable of defeating future threat capabilities within the existing envelope, including; smaller signatures, increased raid sizes, and adverse environments including countermeasures. Threat types include: advanced Anti-Ship Cruise Missiles (ASCMs), Anti-Ship Ballistic Missiles, surface and asymmetrical. The consortium nations provided the majority of their funding early in the program (FY15-17) with the US providing the bulk of its funding later in EMD (FY18-20). The remaining budget is required to complete ESSM Blk 2 EMD.
4. Improved Stalker (I-Stalker) provides incremental improvements to the currently fielded Stalker Long Range Electro-Optic Sensor System (SLREOSS) in response to a 2016 United States Fleet Forces Command (USFFC) Operational Needs Statement (ONS). SLREOSS was developed as a modular, portable, form/fit replacement for the NATO Sea Sparrow Missile System (NSSMS) MK 6 Low Light Level Television (LLTV) in response to the 2010 Naval Forces Central Command (NAVCENT) Counter Swarm Urgent Operational Need (UON) to combat Fast Attack Craft/Fast Inshore Attack Craft (FAC/FIAC). It is currently being fielded in either the NSSMS MK6 MOD 3 LLLTV Director Mount configuration or NSSMS MK6 MOD 4 LLLTV Independent Mount configuration depending on platform specifications. I-Stalker will provide required upgrades to the SLREOSS Independent Mount configuration with the enhanced capabilities provided by the Navy owned Situational Awareness System (SAwS) to deliver an integrated radar and electro-optic/Infrared control and display suite. I-Stalker includes two (2) NSSMS MK6 MOD 4 LLLTV Independent Mount systems and one (1) SAwS which are nomenclatured and installed as an AN/SAY-3.

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<p>5. Dual-Band Transceiver (DBT). The ESSM Blk 2 missile will utilize a DBT for in-flight data communications. This two-way datalink enables control and management of the missile during flight. This DBT leverages the new DDG 1000 / CVN 78 X-Band Transceiver to incorporate the functions to support S-Band Aegis data link (i.e. a Dual Band Transceiver). This resolves S-band obsolescence issues and provides a common transceiver across the ESSM inventory. DBT activities ended in FY18.</p> <p>6. Transition to Production (TTP). Transition to Production execution ensures the design (Hardware, Software, Test Equipment, Production Tooling, etc.), defined during the E&amp;MD Phase is successfully transitioned out of the engineering environment into a stable and capable production/manufacturing environment. During the early phase of Block 1 production the program experienced a series of 'process control failures' and 'production stoppages' leading to a "Blue Team" assessment and findings. One of the key underlying conditions identified as contributing to the discrepancies above was "incomplete transition to production activities and inadequate systems engineering." The Block 2 TTP phase of program execution exists to address the shortfalls identified in the "Blue Team" report and to ensure the requisite resources are in place to support the program as design activities end and Low Rate Initial Production(LRIP) begins to deliver missiles at a rate commensurate with the requirements of LRIP and Full Rate Production (FRP).</p> <p>7. Blk 2 Follow-on Test &amp; Evaluation (FOT&amp;E). The ESSM Blk 2 Milestone Decisionm Authority mandated that ESSM Blk 2 conduct FOT&amp;E on SSDS platform and fully support DDG flight III operational testing. Blk 2 EMD and TTP shared consortium development efforts end in FY20. This is for US Sole Combat Systems integration testing including but not limited to: Aegis Baseline 10 integration, Ship Self-Defense System (SSDS) integration, and other potential (future Frigate) platform integration testing as required. This includes support with appropriate ESSM Block 2 Missile Simulator Unit (MSU) with Raytheon Missile System operator support.</p> <p>8. Blk 2 Obsolescence and Redesign. Explore missile launcher and MK 9 Tracker-Illuminator System (TIS) redesign in order to respond to obsolescence issues affecting ESSM systems on all CVN, LHA, and LHD class ships.</p> <p>9. MK 73 Transmitter Replacement Initiative enables the MK 73 Transmitter to continue supporting self-defense mission requirements and pace emerging threats. The MK 73 Transmitter Replacement Initiative eliminates obsolescence issues and increases power output to provide improved tracking performance and higher ESSM probability of guidance on target. The MK 73 Transmitter replacement is required to field ESSM on CVNs 79, 80, and 81 with options available for future use on CVN 78 LHD 3, and LHD 5. The Transmitter replacement is required as the MK 73 Transmitter is unprocurable in its current design (MK 73 MOD 3).</p>		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		
Title: Evolved Sea Sparrow Missile (ESSM) Blk 1 Testing	FY 2018	FY 2019
Articles:	5.000	7.414
	-	-
FY 2019 Plans:		
Conduct CVN 78 Waterfront Integration Tests on SDTS and lead ship and participate in CSSQT with BLK1. Continue supporting Aegis ACB16 live fire testing. Continue operational flight tests for DDG 1000 and CVN 78 combat systems on SDTS and lead ship. Participate in the planning and execution of ZUMWALT CSSQT.		

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Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)		Project (Number/Name) 0173 / NATO Sea Sparrow		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
The program is expected to support Waterfront Integration Test (WIT) events on DDG 1000 and CVN 78, as well as 20 firings from DDG 1000, 20 firings from CVN 78, 6 additional CSSQTS, and development of the AEGIS and CVN test beds.  <b>FY 2020 Base Plans:</b> Continue supporting Aegis ACB 16 live fire testing with Block 1 missiles. Support DDG 1001 CSSQT live fire. Continue to support CVN 78 and DDG 1000 live fire events and CSSQT. Conduct live fire supporting CSSQTs on LHD 7. Start Waterfront Integration Testing on SDTS, testing Ship Self-Defense System (SSDS) Fire Control Improvement Process (FCLIP) phase 2, and conduct live fire events.  <b>FY 2020 OCO Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Funding increase to support Aegis ACB, DDG 1001 CSSQT live fire, and continued CVN 78 and DDG 1000 live fire events.						
<b>Title:</b> NATO Sea Sparrow Combat System Integraton Technical Direction Agent (TDA)  <b>Articles:</b>  <b>FY 2019 Plans:</b> The TDA will utilize their in-house integrated combat system analysis tools to conduct forward looking analyses and provide performance assessment of the MK 9 Tracker Illuminator System (TIS) and the Mk 29 Guided Missile Launching System (GMLS). Additionally, In FY19, further efforts are expected in the area of engineering support and risk mitigation planning associated with ESSM BLK 2 integration and SSDS ACB 20. TDA will provide continued support for launcher Min-Mod. Specifically, the TDA will complete design of new loading equipment, finalize the technical data package, and manufacture a developmental unit to facilitate qualification testing.  <b>FY 2020 Base Plans:</b> TDA will continue to conduct forward looking analyses, provide performance assessments, and provide engineering support and risk mitigation planning. TDA expertise will be leveraged to define requirements for a replacement radar system, and to evaluate options for a complete replacement and upgrade of the Mk 29 launcher. NSPO has submitted a POM 21 issue for both of these initiatives.  <b>FY 2020 OCO Plans:</b>		0.313 -	0.323 -	0.330 -	0.000 -	0.330 -

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019		
Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)		Project (Number/Name) 0173 / NATO Sea Sparrow		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A						
FY 2019 to FY 2020 Increase/Decrease Statement: Funding increase in FY 2020 due to escalation from FY 2019.						
Title: Evolved Sea Sparrow Missile (ESSM) Blk 2 EMD		105.310	57.614	23.460	0.000	23.460
Articles:		-	-	-	-	-
FY 2019 Plans: Continue maturing the ESSM Block 2 design during the EMD phase of the program focusing on S/W and H/W development. Complete GTV-2 and follow-on CFT (if needed), execute Milestone C review, and complete Developmental Test (DT) Tactical S/W build. Conduct DT flight testing. Prepare for Operational Flight Test to include build-up of Operational Test (OT) flight-test rounds, prepare for Functional Configuration Audit.						
FY 2020 Base Plans: Conduct Initial Operational Test & Evaluation (IOT&E) deployment aboard a DDG-51 Class Guided Missile Destroyer:						
Waterfront Integration Test (WIT), Pre-deployment crew training, shipment of test rounds to Naval Weapons Station Seal Beach, California, Point Mugu Sea Range support, target preparation and expenditure, Telemetry data collection and analysis, photographic data collection, and post flight reconstruction and reporting.						
Conduct Modeling and Simulation runs for record in support of system performance characterization and operational evaluation.						
FY 2020 OCO Plans: N/A						
FY 2019 to FY 2020 Increase/Decrease Statement: Decreased amount represents the remaining US amount required to fulfill their 40% of the total EMD cost obligation per the ESSM BLK2 EMD Memorandum of Understanding (MOU).						
Title: I-Stalker		2.399	3.626	0.000	0.000	0.000
Articles:		-	-	-	-	-
FY 2019 Plans: - Complete final I-Stalker design						

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019		
Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)		Project (Number/Name) 0173 / NATO Sea Sparrow		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<div>- Complete hardware fabrication of EDM</div> <div>- Complete software updates and execute performance/qualification testing.</div> <div>- Perform transition to production.</div> <div>FY 2020 Base Plans: N/A</div> <div>FY 2020 OCO Plans: N/A</div> <div>FY 2019 to FY 2020 Increase/Decrease Statement: I-Stalker RDT&amp;E effort ends in FY2019.</div>						
<div>Title: Dual Band Transceiver (DBT)</div> <div>Articles:</div> <div>FY 2019 Plans: N/A</div> <div>FY 2020 Base Plans: N/A</div> <div>FY 2020 OCO Plans: N/A</div> <div>FY 2019 to FY 2020 Increase/Decrease Statement: N/A</div>		1.799 -	0.000 -	0.000 -	0.000 -	0.000 -
<div>Title: BLK 2 Follow-on Test &amp; Evaluation (FOT&amp;E)</div> <div>Articles:</div> <div>FY 2019 Plans: N/A</div> <div>FY 2020 Base Plans: The ESSM Blk 2 Milestone Decision Authority mandated that ESSM Blk 2 conduct FOT&amp;E on SSDS platform and fully support DDG flight III operational testing. This is for US Sole Combat Systems integration testing including but not limited to: Aegis Baseline 10 integration, Ship Self-Defense System (SSDS) integration, and</div>		0.000 -	0.000 -	15.530 -	0.000 -	15.530 -

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019		
Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)		Project (Number/Name) 0173 / NATO Sea Sparrow		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
other potential (future Frigate) platform integration testing as required. This includes development of appropriate ESSM Block 2 missile simulators with Raytheon Missile System operator support.  <b>FY 2020 OCO Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Begin transitioning from EMD to Follow-On Test & Evaluation (FOT&E) and combat systems integration efforts outside of those tested during the EMD phase.						
<b>Title:</b> Transition to Production (TTP)  <b>Articles:</b>		14.217 -	16.923 -	18.840 -	0.000 -	18.840 -
<b>FY 2019 Plans:</b> TTP will be preparing for the LRIP activities associated with Test Equipment (TE) procurement, installation, prove-in, and integration for Circuit Card Assembly (CCA), Sub Assembly, and Section level missile hardware. ESSM BLK2 is a Consortium funded Program; this is the United States' obligation to fulfilling transition to Full Rate Production (FRP) under the Memorandums of Understanding.  <b>FY 2020 Base Plans:</b> Preparation for production will continue into FY 2020. Equipment procured in 2019 to support LRIP will be installed, proved-in, and integrated at RMS facilities. Upgrades to support FRP, including TE required for All Up Round testing and further capacity upgrades to section level production lines will occur. Additionally, lead-in activities will begin to support the execution of the FRP PRR. ESSM BLK2 is a Consortium funded Program; this fulfills the United States' obligation to transition to FRP under the Memorandums of Understanding.  <b>FY 2020 OCO Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Increase represents the remaining US amount required to fulfill Blk 2 TTP shared consortium development efforts.						
<b>Title:</b> BLK 2 Obsolescence and Redesign  <b>Articles:</b>		0.000 -	0.000 -	7.000 -	0.000 -	7.000 -
<b>FY 2019 Plans:</b>						

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019		
Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)	Project (Number/Name) 0173 / NATO Sea Sparrow		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A					
FY 2020 Base Plans: Explore missile launcher and MK 9 Tracker-Illuminator System (TIS) redesign in order to respond to obsolescence issues affecting ESSM systems on all CVN, LHA, and LHD class ships.					
FY 2020 OCO Plans: N/A					
FY 2019 to FY 2020 Increase/Decrease Statement: Increase to begin exploring missile launcher and MK 9 Tracker-Illuminator System (TIS) redesign.					
Title: MK 73 Tracker-Illuminator System Continuous Wave Tracker Illuminator Replacement Initiative	0.000	1.500	5.550	0.000	5.550
Articles:	-	-	-	-	-
FY 2019 Plans: Begin research and development efforts to initiate the non-recurring engineering (NRE) for the MK 73 Transmitter replacement. NRE efforts include identification of a prime contractor, modifying the interface to ensure seamless integration with existing MK 9 TIS elements, and beginning certification/qualification efforts for shipboard integration.					
FY 2020 Base Plans: Complete environmental qualification, complete MK 73 Transmitter replacement integration with MK 9 TIS and MK 57 NSSMS, and finalize MK 2 SSDS integration. Complete efforts to prepare, then install the MK 73 Transmitter replacement shipboard, and perform installation and checkout with the integrated MK 9 TIS.					
FY 2020 OCO Plans: N/A					
FY 2019 to FY 2020 Increase/Decrease Statement: Funding Increase from FY19 to FY20 due to completing efforts for preparation and installation of the MK 73 transmitter replacement. Additionally, completing efforts for installation and checkout with MK 9 TIS.					
Accomplishments/Planned Programs Subtotals	129.038	87.400	78.873	0.000	78.873

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy									Date: March 2019		
Appropriation/Budget Activity 1319 / 5				R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0173 / NATO Sea Sparrow			
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
• WPN 2307: ESSM	73.513	98.384	128.059	-	128.059	223.305	308.770	547.985	559.056	Continuing	Continuing
• OPN 5231: Ship Missile Defense	45.099	38.518	32.692	-	32.692	35.098	32.706	25.085	25.519	Continuing	Continuing
• OMN 1D4D: NATO Seasparrow	29.853	37.931	23.428	-	23.428	23.952	24.527	21.141	21.570	0.000	182.402
Remarks											
OPN for Stalker is included in above LI 5231 - Ship Missile Defense line as follows: FY18: \$6.268M, FY19: \$10.435M, FY20: \$8.9M, FY21: \$4.5M, FY22: \$4.5M.											
OMN funding is for ESSM Blk 1, NSSMS, & RIM-7											
**ESSM Blk 2 OMN funding not received, pending MOU signature**											
D. Acquisition Strategy											
ESSM Blk 2 EMD is a directed sole source contract to Raytheon Missile Systems Company.											
I-Stalker: NSWC Crane to initiate and complete final design of hardware/software for integration of SAwS w/Stalker in preparation for sole source procurement (OPN) of Stalker Kits from the current design agent (Ball Aerospace) and SAwS Kits from NSWC Crane to meet CVN and LHD/LHA fleet deployment schedules.											
E. Performance Metrics											
Successfully conduct Developmental Testing/Operational Testing. Two ESSM Blk 2 Controlled Test Vehicle flight tests were successfully conducted in June 2017 onboard the Self Defense Test Ship at the Point Mugu Sea Range. Successful GTV-1 in June 2018. GTV-2 completed Oct. 2018. GTV-3 scheduled to occur by Q3 FY19. The ESSM Blk 2 Milestone C decision is scheduled for Q2 FY 2019 with Initial Operational Capability for AEGIS platforms scheduled for 2020 and SSDS platforms in 2023. ESSM Blk 2 Low Rate Initial Production deliveries are expected to begin in 2020 with Full Rate Production rounds delivering to the Fleet in 2023.											
I-Stalker: Initiate and complete final design, successful performance/qualification testing and delivery of EDM.											



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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0173 / NATO Sea Sparrow					
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
ESSM Systems Engineering/Firing Spt	WR	Corona : CA	10.397	0.705	Oct 2017	0.705	Nov 2018	0.890	Dec 2019	-		0.890	0.000	12.697	-
NATO OC System Engineering	C/FFPLOE	Raytheon : RI	1.955	0.000		0.000		0.000		-		0.000	0.000	1.955	-
NATO OC - Software	C/FFPLOE	Raytheon : RI	8.054	0.000		0.000		0.000		-		0.000	0.000	8.054	-
Stalker System Engineering	WR	NSWC Crane : IN	4.782	0.000		0.000		0.000		-		0.000	0.000	4.782	-
Stalker Hardware Engineering	WR	NSWC Crane : IN	14.350	0.000		0.000		0.000		-		0.000	0.000	14.350	-
Stalker Software Engineering	WR	NSWC Crane : IN	2.725	0.000		0.000		0.000		-		0.000	0.000	2.725	-
ESSM Primary Hardware Development	C/CPAF	Raytheon : Tuscon	193.941	0.000		0.000		0.000		-		0.000	0.000	193.941	-
ESSM Ancillary Hardware	Various	Various : Various	71.324	0.000		0.000		0.000		-		0.000	0.000	71.324	-
ESSM Blk 2 EMD	C/CPIF	Raytheon : Tuscon	160.854	92.571	Oct 2017	44.417	Nov 2018	22.630	Nov 2019	-		22.630	0.000	320.472	-
I-Stalker Systems Engineering	WR	NSWC Crane : Crane, IN	0.000	1.288	Mar 2018	1.617	Dec 2018	0.000		-		0.000	0.000	2.905	-
TTP	SS/FFP	Raytheon : Tuscon	0.000	14.217	May 2018	16.923	Dec 2018	18.840	Dec 2019	-		18.840	0.000	49.980	
ESSM Blk 2 Risk reduction	SS/FFPLOE	Raytheon : Tuscon	44.150	0.000		0.000		0.000		-		0.000	0.000	44.150	-
NATO OC Systems Engineering SPT	WR	NSWC PHD : CA	0.700	0.000		0.000		0.000		-		0.000	0.000	0.700	-
Dual Band Tranceiver	SS/FFP	Raytheon : Tuscon	4.956	1.199	Oct 2017	0.000		0.000		-		0.000	0.000	6.155	-
MK 73 Tracker-Illuminator System Continuous Wave Tracker Illuminator Replacement Initiative	SS/FFP	TBD : TBD	0.000	0.000		1.500	Jun 2019	5.556	Nov 2019	-		5.556	0.000	7.056	-
BLK 2 Obsolescence and Redesign	SS/FFP	Raytheon : Tuscon	0.000	0.000		0.000		7.000	Jan 2020	-		7.000	0.000	7.000	-
Subtotal			518.188	109.980		65.162		54.916		-		54.916	0.000	748.246	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0173 / NATO Sea Sparrow					
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
NATO System TDA	SS/FP	APL : MD	2.789	0.313	Nov 2017	0.323	Jan 2019	0.330	Jan 2020	-		0.330	Continuing	Continuing	Continuing
NATO OC	SS/FFP	APL : MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Stalker -ISEA/TDA/RM&A	SS/FFP	various : various	0.750	0.000		0.000		0.000		-		0.000	0.000	0.750	-
ILS/Engineering Support	Various	Various : Various	15.543	0.000		0.000		0.000		-		0.000	0.000	15.543	-
ESSM Blk 2 EMD	WR	APL : MD	11.951	4.218	Oct 2017	4.285	Oct 2018	0.828	Dec 2019	-		0.828	0.000	21.282	-
ESSM Blk 2 EMD	WR	NAWC CL : CA	15.204	5.914	Nov 2017	6.197	Nov 2018	0.000		-		0.000	0.000	27.315	-
ESSM Blk 2 EMD	Various	Various : Various	6.259	2.607	Nov 2017	2.715	Nov 2018	0.000		-		0.000	0.000	11.581	-
I-Stalker Platform Integration	WR	Norfolk Naval Shipyard (NNSY) : Norfolk, VA	0.000	0.100	Jun 2018	0.300	Dec 2018	0.000		-		0.000	0.000	0.400	-
I-Stalker Platform Integration	C/BA	NSWC Dahlgren : Dahlgren, VA	0.000	0.232	Mar 2018	0.300	Dec 2018	0.000		-		0.000	0.000	0.532	-
I-Stalker Platform Integration	C/BA	NSWC Crane : Crane, IN	0.000	0.415	Mar 2018	0.709	Nov 2018	0.000		-		0.000	0.000	1.124	-
I-Stalker Platform Integration	WR	PSNSY : Puget Sound, WA	0.000	0.100	Mar 2018	0.400	Dec 2018	0.000		-		0.000	0.000	0.500	-
NATO OC Support	WR	Dahlgren : VA	2.174	0.000		0.000		0.000		-		0.000	0.000	2.174	-
Dual Band Transceiver	WR	APL : MD	0.600	0.200	Dec 2017	0.000		0.000		-		0.000	0.000	0.800	-
Dual Band Tranceiver	WR	NAWC CL : CA	1.200	0.400	Dec 2017	0.000		0.000		-		0.000	0.000	1.600	-
Subtotal			56.470	14.499		15.229		1.158		-		1.158	Continuing	Continuing	N/A
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
ESSM Developmental Test & Evaluation	WR	NAWC CL : CA	22.047	0.204	Oct 2017	0.851	Oct 2018	0.320	Dec 2019	-		0.320	Continuing	Continuing	Continuing
ESSM OPEVAL/TECHEVAL/Test Firings	WR	Corona, IHD, Dahlgren, SNSWC, PHD) : various	18.403	0.285	Nov 2017	1.500	Nov 2018	2.041	Nov 2019	-		2.041	0.000	22.229	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0173 / NATO Sea Sparrow					
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
ESSM Developmental Test & Evaluation	SS/FFP	APL : MD	5.882	0.100	Oct 2017	0.500	Oct 2018	3.500	Oct 2019	-		3.500	Continuing	Continuing	Continuing
ESSM Test & Evaluation	C/CPAF	Raytheon : Tuscon	19.917	3.118	Nov 2017	1.000	Nov 2018	9.188	Nov 2019	-		9.188	Continuing	Continuing	Continuing
ESSM Test & Evaluation	WR	Dahlgren/PHD : VA/ CA	2.714	0.372	Nov 2017	1.098	Nov 2018	3.298	Oct 2019	-		3.298	0.000	7.482	-
Developmental Test & Evaluation	WR	Dahlgren : VA	0.418	0.000		0.000		1.980	Nov 2019	-		1.980	0.000	2.398	-
I-Stalker Development Test and Evaluation	WR	NSWC Crane : IN	0.000	0.264	Mar 2018	0.300	Nov 2018	0.000		-		0.000	0.000	0.564	-
Subtotal			69.381	4.343		5.249		20.327		-		20.327	Continuing	Continuing	N/A
Management Services (\$ 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
ESSM-Support and Performing Activity	Allot	PHD/NAWC CL/ APL : CA/MD	14.995	0.116	Oct 2017	1.660	Oct 2018	2.272	Oct 2019	-		2.272	Continuing	Continuing	Continuing
ESSM-Travel	Allot	Program Office : VA	3.427	0.100	Oct 2017	0.100	Oct 2018	0.200	Oct 2019	-		0.200	Continuing	Continuing	Continuing
ESSM-Misc	Various	various : various	2.149	0.000		0.000		0.000		-		0.000	0.000	2.149	2.065
NATO Travel/Misc	Various	Program Office : various	2.111	0.000		0.000		0.000		-		0.000	0.000	2.111	-
Engineering Support	Various	Various : Various	5.458	0.000		0.000		0.000		-		0.000	0.000	5.458	-
Need Item Text	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Subtotal			28.140	0.216		1.760		2.472		-		2.472	Continuing	Continuing	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			672.179	129.038		87.400		78.873		-		78.873	Continuing	Continuing	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy							Date: March 2019			
Appropriation/Budget Activity 1319 / 5				R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)			Project (Number/Name) 0173 / NATO Sea Sparrow			
	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract	
Remarks Various used for multiple vendors and location under threshold.										

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Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Navy

Date: March 2019

## Appropriation/Budget Activity

1319 / 5

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

PE 0604756N / Ship Self Def (Engage: Hard Kill)

## Project (Number/Name)

0173 / NATO Sea Sparrow

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>Proj 0173</b>																												
ESSM BLOCK 2: Engineering and Manufacturing Development																												
ESSM BLOCK 2: Production MOU Negotiation/Signature																												
ESSM BLOCK 2: In Service Support MOU Negotiation/Signature																												
ESSM BLOCK 2: Transition to Production																												
ESSM BLOCK 2: Production Decision LRIP (Milestone C)																												
ESSM BLOCK 2: LRIP 1 Award																												
ESSM BLOCK 2: LRIP 2 Award																												
ESSM BLOCK 2: LRIP 3 Award Option																												
OBJECTIVE CONFIGURATION: CDR																												
I-STALKER Transition to Production: Transition to Production																												
I-STALKER Final Design, Engineering, & Manufacturing Development: Final Design, Engineering, & Manufacturing Development																												
I-STALKER Development Testing: Development Testing																												
I-STALKER EDM Delivery: EDM Delivery																												

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 0173 / <i>NATO Sea Sparrow</i>	

**Schedule Details**

<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
<b><i>Proj 0173</i></b>				
ESSM BLOCK 2: Engineering and Manufacturing Development	1	2018	4	2020
ESSM BLOCK 2: Production MOU Negotiation/Signature	1	2018	4	2018
ESSM BLOCK 2: In Service Support MOU Negotiation/Signature	1	2018	2	2019
ESSM BLOCK 2: Transition to Production	3	2018	4	2020
ESSM BLOCK 2: Production Decision LRIP (Milestone C)	2	2019	4	2020
ESSM BLOCK 2: LRIP 1 Award	3	2019	4	2021
ESSM BLOCK 2: LRIP 2 Award	3	2019	4	2021
ESSM BLOCK 2: LRIP 3 Award Option	3	2019	4	2021
OBJECTIVE CONFIGURATION: CDR	1	2018	1	2018
I-STALKER Transition to Production: Transition to Production	3	2019	4	2019
I-STALKER Final Design, Engineering, & Manufacturing Development: Final Design, Engineering, & Manufacturing Development	1	2018	4	2019
I-STALKER Development Testing: Development Testing	1	2019	4	2019
I-STALKER EDM Delivery: EDM Delivery	1	2019	1	2019

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019							
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 0243 / ALaMO								
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					
0243: ALaMO	5.594	35.041	24.714	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	65.349					
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-							
A. Mission Description and Budget Item Justification																	
The 57mm MK 332 HE-4G Projectile significantly increases MK 110 Gun Mount lethality and effectiveness against Fast Attack Craft and Fast In-Shore Attack Craft (FAC/FIAC). The 57mm ALaMO concluded development as part of a classified program and transitioned to qualification for Navy use in FY 2017. ALaMO will transition to production at the conclusion of the program.																	
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)								FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total					
Title: Systems Engineering and Testing								35.041	24.714	0.000	0.000	0.000					
								Articles: -	-	-	-	-					
FY 2019 Plans: Procure balance of hardware for DT assets. Conduct remaining performance verification test. Conduct hazard classification and insensitive munitions qualification. Conduct remaining safety and suitability environmental qualification tests. Build DT test assets Conduct land based and shipboard DT events. Conduct Weapons System Explosives Safety Review Board reviews for qualification closure. Conduct Weapons System Explosives Safety Review Board reviews for DT events.  FY 2020 Base Plans: N/A  FY 2020 OCO Plans: N/A  FY 2019 to FY 2020 Increase/Decrease Statement: There is no RDT&N funding planned for FY2020 as the program is transitioning to production. Funding for ALaMO beyond FY2019 will be PANMC via the Intermediate Caliber Ammunition Budget Line Item.																	
								Accomplishments/Planned Programs Subtotals					35.041	24.714	0.000	0.000	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Navy										<b>Date:</b> March 2019	
<b>Appropriation/Budget Activity</b> 1319 / 5				<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>				<b>Project (Number/Name)</b> 0243 / <i>ALaMO</i>			
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
			<u>FY 2020</u>	<u>FY 2020</u>	<u>FY 2020</u>					<u>Cost To</u>	
<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>Base</u>	<u>OCO</u>	<u>Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Complete</u>	<u>Total Cost</u>
• PANMC/0266: <i>INTERMEDIATE CALIBER GUN AMMO HE-4G</i>	0.000	19.494	19.494	-	19.494	20.306	28.151	21.126	29.289	0.000	137.860
<b>Remarks</b> Profile only reflects procurement of CART 57MM ALaMO (HE-4G).											
<b>D. Acquisition Strategy</b> MK 332 HE-4G will be completed qualifications and transition into LRIP FY2019.											
<b>E. Performance Metrics</b> Quarterly Program Reviews and semi-annual Product Certification Panel Reviews.											



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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)					Project (Number/Name) 0243 / ALaMO				
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
Produce Design Verification hardware, DT Hardware	MIPR	DOTC : PICATINNY ARSENAL, NJ	5.000	31.408	Jan 2018	20.097	Jan 2019	0.000		-		0.000	0.000	56.505	49.300
Subtotal			5.000	31.408		20.097		0.000		-		0.000	0.000	56.505	N/A
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 Engineering Services	WR	NSWC, DD : Dahlgren, VA	0.493	3.227	Oct 2017	2.965	Nov 2018	0.000		-		0.000	0.000	6.685	-
Government Engineering Services	WR	NSWC, IHEODTD : Indian Head, MD	0.101	0.406	Oct 2017	1.652	Nov 2018	0.000		-		0.000	0.000	2.159	-
Subtotal			0.594	3.633		4.617		0.000		-		0.000	0.000	8.844	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			5.594	35.041		24.714		0.000		-		0.000	0.000	65.349	N/A
Remarks															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Navy																<b>Date:</b> March 2019			
<b>Appropriation/Budget Activity</b> 1319 / 5								<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>								<b>Project (Number/Name)</b> 0243 / ALaMO			

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>Proj 0243</b>																												
Build Design Verification Test Hardware																												
Performance Verification Tests																												
Environmental Qualification Tests																												
Hazard Classification/Insensitive Munitions																												
Build DT Hardware																												
Land Based DT																												
Shipboard DT																												

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 0243 / ALaMO	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Proj 0243</i></b>				
Build Design Verification Test Hardware	1	2018	2	2019
Performance Verification Tests	4	2018	3	2019
Environmental Qualification Tests	2	2019	4	2019
Hazard Classification/Insensitive Munitions	3	2019	4	2019
Build DT Hardware	2	2019	4	2019
Land Based DT	4	2019	2	2020
Shipboard DT	3	2020	4	2020

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 2070 / OTH Missile			
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
2070: OTH Missile	0.000	0.000	19.968	28.039	-	28.039	26.392	11.206	8.288	0.000	0.000	93.893
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
A. Mission Description and Budget Item Justification												
Over-The-Horizon (OTH) Missile funds competitive acquisition, testing, and fielding of a modern, technologically mature Over-the-Horizon Weapon System (OTH-WS) surface to surface missile capability to be installed onto commissioned and in-production Littoral Combat Ship /Frigate(LCS/FFG(X)) beginning in FY 2021.												
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)								FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: OTH-WS Test and Evaluation and Systems Engineering								0.000	19.968	28.039	0.000	28.039
								Articles: -	-	-	-	-
FY 2019 Plans: -Execute and initiate Over-the-Horizon Weapon System (OTH-WS) ship engineering activities, to include installation planning and design configuration on both Independence and Freedom LCS platforms. -Receive approval on OTH-WS required acquisition milestone documentation in accordance with DoD 5000.2. -Develop OTH-WS artifacts to support combat/system certifications required prior to system installation aboard LCS class ships. -Perform OTH-WS test and evaluation activities to include procurement of test assets, conduct of scenario working groups and development of firing scripts. -Initiate Test Planning Activities (Development and Operational testing (DT-OT), Environments, Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC), Qualifications, etc.). -Execute OTH-WS logistics requirements to include, the development of maintenance plans, inventory management conceptualization, movement of equipment and asset movement coordination, identification and coordination of ordnance storage facilities, development of maintenance cards, and development of ordnance handling and loading procedures. -Provide overarching OTH-WS subject matter expertise to assist the program office with carrying out the surface to surface												

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019			
Appropriation/Budget Activity 1319 / 5		R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)	Project (Number/Name) 2070 / OTH Missile			
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
missile mission. -Begin OTH-WS Weapon System Explosives Safety Review Board (WSESRB) coordination and planning efforts (Software Systems Safety Technical Review Panel (SSSTRP), Fuse and Initiation System Technical Review Panel (FISTRP), Hazard of Electromagnetic Radiation to Ordnance (HERO), and Insensitive Munitions (IM)). -Begin the Element Certification Planning, Production Engineering efforts Ship Change Document (SCD), Interface control Document (ICD) preparation, production processes and factory acceptance familiarization, cyber planning, ship interfaces/combat system familiarization). -Start Fleet training planning (Facility, Naval Training System Plan (NTSP) development). -Fund the initial Original Equipment Manufacturer (OEM) Design Agent Support.  <b>FY 2020 Base Plans:</b> -Continue Over-the-Horizon Weapon System (OTH-WS) ship engineering activities to include installation planning and design configuration on both LCS and FFG(X) platforms. -Procure test articles (missiles, targets, components) required to support the OTH-WS Test and Evaluation Master Plan (TEMP). -Safety Testing - In FY20 the OTH-WS program will execute Electro-Magnetic Environmental Effects (E3) testing to include Electro-Magnetic Interference (EMI), Electro-magnetic Compatibility (EMC), and Electro-Magnetic Vulnerability (EMV). Additionally, Insensitive Munitions (IM) testing will be executed in accordance with the OTH-WS test plan. IM testing includes fast/slow energetics cook offs, bullet / fragment impact testing, sympathetic reaction testing, and missile drop tests. -Qualification Testing - In FY20 the OTH-WS test program will execute required environmental testing to include shock / vibration testing, low / high /cycling temperature testing, humidly testing, rain / salt / fog / sand & dust testing. -Performance testing - In FY20 the OTH-WS test program will execute required performance testing to include Seeker Discrimination Testing, restrained firing, warhead lethality testing, and survivability (Radar Cross Section (RCS), measurement testing, flight termination testing etc.) testing. -Coordinate and perform all OTH-WS logistics activities in accordance with maintenance / inventory management plans, coordinate movement of OTH-WS equipment and track asset movements to/from shipyards and ordnance storage facilities, and coordinate the handling and loading of OTH-WS equipment at the waterfront and other locations as applicable.						

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Navy				<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 1319 / 5		<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>		<b>Project (Number/Name)</b> 2070 / OTH Missile		
<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>						
		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
-Provide OTH-WS missile and fire control subject matter expertise to support the program office with program execution. - Implement organic Navy OTH-WS training capability in accordance with the Naval Training System Plan (NTSP).  <b>FY 2020 OCO Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> The increase in FY20 RDT&E funds is to support critical OTH-WS test execution activities related to safety, system qualifications, and performance testing.						
<b>Accomplishments/Planned Programs Subtotals</b>		0.000	19.968	28.039	0.000	28.039
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
<b>Line Item</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	
• RDTEN/0603599/3086: <i>Frigate / OTH Missile System</i>	11.594	1.232	0.000	-	0.000	16.059
• OPN /5231: <i>Ship Missile Support Equipment/OTH Missile</i>	0.000	2.874	1.800	-	1.800	25.287
• WPN 2292: <i>LCS OTH Missile</i>	0.000	18.156	38.137	-	38.137	222.675
• OPN /1604: <i>LCS IN-SERVICE MOD LN004</i>	9.348	0.000	0.000	-	0.000	9.348
<b>Remarks</b>						
<b>D. Acquisition Strategy</b>						
The OTH-WS is an Acquisition Category (ACAT) II level weapon system production and sustainment program to provide the current Littoral Combat Ship (LCS) variants and Frigate (FFG(X)) ships with an Over-the-Horizon Surface-To-Surface Missile (SSM) capability. The Navy awarded a competitive contract on May 31, 2018.						
<b>E. Performance Metrics</b>						
Performance metrics include awarding the Low Rate Initial Production (LRIP) 2 contract option for the OTH-WS, achieving a successful System Performance Verification Testing and initial Qualification Testing and Integrating training courses and materials into LCS schoolhouses. Additionally, the program office will continue installation planning and design configuration on required ship platforms (LCS/FFG), supporting combat/system certifications required prior to system installation, test						

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)	Project (Number/Name) 2070 / OTH Missile
<p>planning activities to include; SSSTRP, FISTRP, Quick Reaction Assessment (QRA) and Operational Testing (OT), and the development and integration of logistics support requirements for the OTH-WS.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 2070 / OTH Missile					
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
OTH All Up Round (AUR) Technical Design Agent	WR	NAWC/WD : China Lake, CA	0.000	0.000		1.366	Oct 2018	2.259	Oct 2019	-		2.259	0.000	3.625	-
OTH Simulation and Analysis	WR	NSWC/COR : Corona, CA	0.000	0.000		0.290	Oct 2018	0.290	Oct 2019	-		0.290	0.000	0.580	-
OTH Weapon System Design Agent	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.525	Oct 2018	0.800	Oct 2019	-		0.800	0.000	1.325	-
OTH Test & Evaluation / ILS	WR	NSWC/PHD : Port Hueneme, CA	0.000	0.000		0.750	Oct 2018	1.832	Oct 2019	-		1.832	0.000	2.582	-
OTH Weapon System Safety	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.220	Oct 2018	0.500	Oct 2019	-		0.500	0.000	0.720	-
Weapons Systems Engineering Planning	SS/CPFF	JHU/APL : Laurel, MD	0.000	0.000		0.462	Dec 2018	0.600	Dec 2019	-		0.600	0.000	1.062	-
OEM Engineering Support	C/CPFF	Raytheon : Tucson, AZ	0.000	0.000		3.200	Nov 2018	1.000	Nov 2019	-		1.000	0.000	4.200	-
Test & Evaluation Assets	C/FFP	Raytheon : Tucson, AZ	0.000	0.000		12.000	Nov 2018	15.638	Nov 2019	-		15.638	0.000	27.638	-
Range & Target	Various	Various : Various	0.000	0.000		0.000		4.100	Oct 2019	-		4.100	0.000	4.100	-
Subtotal			0.000	0.000		18.813		27.019		-		27.019	0.000	45.832	N/A
Management Services (\$ 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
OTH Contractor Acquisiton Mgt Suppt	C/CPIF	CACI : Arlington, VA	0.000	0.000		0.320	Dec 2018	0.320	Dec 2019	-		0.320	0.000	0.640	-
OTH Program Management Support	C/CPIF	Strategic Insight : Arlington, VA	0.000	0.000		0.100	Dec 2018	0.100	Dec 2019	-		0.100	0.000	0.200	-
OTH Program Management Support	WR	PEO IWS : Arlington, VA	0.000	0.000		0.100	Oct 2018	0.100	Oct 2019	-		0.100	0.000	0.200	-
OTH Contractor Engineering Support	C/CPIF	Alion/ECS/GDIT : Arlington, VA	0.000	0.000		0.635	Dec 2018	0.500	Dec 2019	-		0.500	0.000	1.135	-



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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 / 5						<b>R-1 Program Element (Number/Name)</b> PE 0604756N / Ship Self Def (Engage: Hard Kill)				<b>Project (Number/Name)</b> 2070 / OTH Missile				

  

Management Services (\$ 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
<b>Subtotal</b>			0.000	0.000		1.155		1.020		-		1.020	0.000	2.175	N/A

  

	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>	0.000	0.000	19.968	28.039	-	28.039	0.000	48.007	N/A

  

**Remarks**

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

**Date:** March 2019

**Appropriation/Budget Activity**  
1319 / 5

**R-1 Program Element (Number/Name)**  
PE 0604756N / *Ship Self Def (Engage: Hard Kill)*

**Project (Number/Name)**  
2070 / *OTH Missile*



## ***Over The Horizon-Weapon System***

Fiscal Year	FY18	FY19	FY20	FY21	FY22	FY23	FY24
Program Acquisition	▲ Contract Award / LRIP 1	▲ Option 1 / LRIP 2	▲ Option 2 / LRIP 3	▲ Option 3 / FRP	▲ Option 4 / FRP	▲ Option 5 / FRP	
Major Reviews		▲ Prod Readiness Rev  ▲ Milestone C		▲ Full Rate Prod Dec			
Planning & Test Events	▲ Test Planning /	TEMP ▲ Weapon Sys Explosive	Quick Reaction ▲ Safety Rev Board ▲ System Qualification	Assessment ▲	Operational Test	▲	

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 2070 / <i>OTH Missile</i>	

**Schedule Details**

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Proj 2070</i></b>				
Test Planning Activities (TEMP, Environments, EMC/EMI, Qualifications)	1	2018	4	2019
Maintenance Planning (ISEA, ILSP development, ILA support)	1	2018	4	2018
Contract Award / LRIP 1	3	2018	3	2018
Contract Option 1 Award / LRIP 2	1	2019	1	2019
Major Review - Production Readiness Review	1	2019	1	2019
Major Review - Milestone C Decision	1	2019	1	2019
Weapon System Explosives Safety Review Board Planning & Execution (SSSTRP, FISTRP, HERO, IM)	2	2019	3	2020
System Qualification	2	2019	3	2020
Contract Option 2 Award / LRIP 3	1	2020	1	2020
Quick Reaction Assessment	3	2020	4	2021
Full Rate Production (FRP) Decision	1	2021	1	2021
Contract Option 3 Award / FRP	1	2021	1	2021
Operational Testing	4	2021	3	2023
Contract Option 4 Award / FRP	1	2022	1	2022
Contract Option 5 Award / FRP	1	2023	1	2023

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 9081 / Phalanx CIWS SEARAM			
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
9081: Phalanx CIWS SEARAM	7.144	10.433	9.882	8.400	-	8.400	0.000	0.000	0.000	0.000	0.000	35.859
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
A. Mission Description and Budget Item Justification												
The MK 15 Close-In Weapons System (CIWS) is a fast reaction, rapid fire, computer controlled radar system utilizing either a 20mm gun (Phalanx) or a SeaRAM weapon system (SeaRAM) to meet its primary mission of providing Anti-Ship Missile (ASM) defense. CIWS fleet population exceeds 220 systems onboard nearly every USN surface combatant. In addition, CIWS continues to be installed on new construction surface ships with life expectancies of 25+ years. Basic system architecture is 20+ years old, hasn't had a significant R&D development effort since the 1990's, and is in need of Technology Refresh in order to avoid hardware obsolescence, maintain/improve reliability, increase capability, and provide affordable spare parts to achieve acceptable Operational Availability for the next 20+ years. Technology Refresh development started in FY 2018 and will be fielded during CIWS overhauls and will consist of three efforts: Electric Gun Drive System (EGDS), Electronics Enclosure Modernization (ELX), and Local Control Station and Remote Control Station (LCS/RCS) Redesign. EGDS will replace the current pneumatic gun drive system that is difficult and costly to maintain with an all-electric drive system. EGDS will reduce maintenance/troubleshooting requirements, reduce support costs, and provide capability increases such as variable firing rates and reduced ammunition expenditures. ELX replaces costly and obsolete 1970's technology circuit card assemblies, servo controllers and electronic drawer backplanes with COTS digital devices, integrated controllers, and efficient power converters. ELX also will provide a reduction in weight of approx 960 lbs and simplified maintainability. LCS/RCS Redesign eliminates expensive obsolete components, decreases maintenance requirements and complexity, increases commonality between the LCS and RCS via open architecture, and simplifies the user operation by reducing Human Machine Interface requirements.												
In August 2018, CIWS Tech Refresh efforts for ELX and LCS/RCS were postponed outside FYDP; direction was provided to complete EGDS FY18-20. CIWS Tech Refresh efforts cancelled FY21-FY24.												
SeaRAM CIWS is deployed onboard Rota DDG's in order to provide additional capability to meet emerging threats. Efforts include development, qualification, and testing of software and hardware modifications in order to support fielding on these AEGIS class ships.												
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)								FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: CIWS Tech Refresh								10.428	9.872	8.390	0.000	8.390
								Articles: -	-	-	-	-
FY 2019 Plans: Complete Electric Gun PDR and CDR. Acquire and test prototype hardware. Begin development of mission control computer Electric Gun software.												
FY 2020 Base Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Navy				<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 1319 / 5		<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>		<b>Project (Number/Name)</b> 9081 / <i>Phalanx CIWS SEARAM</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>						
		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
Complete development of mission computer and electric gun software. Complete integration and testing of Proof of manufacture hardware. Conduct test readiness review and complete qualification. Complete ECP.  <b>FY 2020 OCO Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> The decrease from FY2019 to FY2020 is due to electric gun development efforts ramping down for qualification and completion of the ECP in FY20.						
<b>Title:</b> CIWS Travel  <div align="right"><b>Articles:</b></div>		0.005	0.010	0.010	0.000	0.010
<b>FY 2019 Plans:</b> Fund program office travel to support program/testing as required by program schedule and in accordance with travel reduction mandate.  <b>FY 2020 Base Plans:</b> Fund program office travel to support program/testing as required by program schedule and in accordance with travel reduction mandate.  <b>FY 2020 OCO Plans:</b> N/A		-	-	-	-	-
<b>Accomplishments/Planned Programs Subtotals</b>		10.433	9.882	8.400	0.000	8.400
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>Remarks</b>						
<b>D. Acquisition Strategy</b>						
The MK 15 Close-In Weapons System (CIWS) is a fast reaction, rapid fire, computer controlled radar system utilizing either a 20mm gun (Phalanx) or a SeaRAM weapon system (SeaRAM) to meet its primary mission of providing Anti-Ship Missile (ASM) defense. Funding provides support for efforts related to Technology Refresh (for current fleet population) as well as efforts related to the integration/installation of SeaRAM CIWS in DDG 64, 71, 75, and 78. This work will be completed via sole source contracts to the CIWS Design Agent (Raytheon Missile Systems). Tech Refresh improvements will be fielded as Engineering Change Proposals (ECPs) and will be installed during CIWS overhauls or pierside.						

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)	Project (Number/Name) 9081 / Phalanx CIWS SEARAM
<b>E. Performance Metrics</b> Successfully complete trade studies and initial requirements definition for Technology Refresh and efforts related to successful integration/installation of SeaRAM CIWS in DDG class ships.		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 9081 / Phalanx CIWS SEARAM					
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
CIWS Tech Refresh	SS/CPFF	Raytheon Missile Systems : Tucson, AZ	4.435	9.400	Jul 2018	9.232	Dec 2018	7.620	Dec 2019	-		7.620	0.000	30.687	4.435
SeaRAM CIWS on DDG Class	SS/CPFF	Raytheon Missile Systems: : Various	2.309	0.000		0.000		0.000		-		0.000	0.000	2.309	-
CIWS Tech Refresh	Various	Various : Various	0.400	0.000	Jul 2018	0.000	Jan 2019	0.000		-		0.000	0.000	0.400	-
CIWS Tech Refresh	WR	NAWC CL : CA	0.000	0.085	Apr 2018	0.075	Jan 2019	0.180	Dec 2019	-		0.180	0.000	0.340	-
CIWS Tech Refresh	WR	NSWC DD : VA	0.000	0.050	Apr 2018	0.040	Jan 2019	0.040	Dec 2019	-		0.040	0.000	0.130	-
CIWS Tech Refresh	WR	NSWC IHD : MD	0.000	0.450	Apr 2018	0.250	Jan 2019	0.250	Dec 2019	-		0.250	0.000	0.950	-
CIWS Tech Refresh	C/BA	APL : MD	0.000	0.125	Jun 2018	0.025	Jan 2019	0.000		-		0.000	0.000	0.150	-
CIWS Tech Refresh	WR	TECH REP : CA	0.000	0.085	Sep 2018	0.100	Jan 2019	0.150	Dec 2019	-		0.150	0.000	0.335	-
CIWS Tech Refresh	SS/CPFF	TSC : VA	0.000	0.000		0.150	Dec 2018	0.150	Dec 2019	-		0.150	0.000	0.300	-
CIWS Tech Refresh	WR	NSWC CCD : Not Specified	0.000	0.012	Oct 2018	0.000		0.000		-		0.000	0.000	0.012	-
CIWS Tech Refresh	SS/CPFF	ALION : VA	0.000	0.221	Jul 2018	0.000		0.000		-		0.000	0.000	0.221	-
Subtotal			7.144	10.428		9.872		8.390		-		8.390	0.000	35.834	N/A
Remarks															
CIWS Tech Refresh modernization activities are focused on redesign of key subsystems, some of which date to the 1970s with obsolete and largely unsupportable electronics systems. Replacing these subsystems with modular "refreshed" components will reduce total ownership costs and maintenance requirements for the overall sustainment of the Phalanx system.															
Management Services (\$ 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
Travel	Allot	Program Office: : VA	0.000	0.005	Oct 2017	0.010	Dec 2018	0.010	Dec 2019	-		0.010	0.000	0.025	-
Subtotal			0.000	0.005		0.010		0.010		-		0.010	0.000	0.025	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy											Date: March 2019				
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)					Project (Number/Name) 9081 / Phalanx CIWS SEARAM					
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			7.144	10.433		9.882		8.400		-		8.400	0.000	35.859	N/A

Remarks



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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy																Date: March 2019			
Appropriation/Budget Activity 1319 / 5								R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)								Project (Number/Name) 9081 / Phalanx CIWS SEARAM			

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 9081 / <i>Phalanx CIWS SEARAM</i>	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Proj 9081</i></b>				
Tech Refresh: CIWS Research, Development, and Test for Tech Refresh	1	2018	4	2020

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 9999 / Congressional Adds			
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
9999: Congressional Adds	0.000	0.000	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
A. Mission Description and Budget Item Justification												
Three Congressional adds are funded. C468 for Condition Based Maintenance to support forecasting and scheduling of maintenance; C469 for Next Generation PHALANX for MK 15 CIWS; and C470 ALaMO Munition System: The 57mm MK 332 HE-4G Projectile significantly increases MK 110 Gun Mount lethality and effectiveness against Fast Attack Craft and Fast In-Shore Attack Craft (FAC/FIAC). The 57mm ALaMO concluded development as part of a classified program and transitioned to qualification for Navy use in FY 2017. ALaMO will transition to production at the conclusion of the program.												
B. Accomplishments/Planned Programs (\$ in Millions)								FY 2018	FY 2019			
Congressional Add: Condition Based Maintenance								0.000	8.000			
FY 2018 Accomplishments: N/A												
FY 2019 Plans: Project C468: Condition Based Maintenance program, originally developed for the LCS program, leverages work already done for LCS and AEGIS. It aides in forecasting and scheduling planned maintenance. Increase support for combat systems Condition Based Maintenance (CBM+) in the Evolved Sea Sparrow Missile System (ESSM), thereby enhancing three ship classes simultaneously - CVN, LHA and LHD.												
Congressional Add: Next Generation Phalanx								0.000	7.000			
FY 2018 Accomplishments: NA												
FY 2019 Plans: Project C469: The Navy currently does not have any mount design efforts planned for FY19. The program office is working with the prime contractor to define which efforts might align with the Navy's plans for the MK 15 Close-In Weapons System (CIWS).												
Congressional Add: Alamo Munition Systems								0.000	10.000			
FY 2018 Accomplishments: N/A												
FY 2019 Plans: Project C470 -Complete transition to production activities. -Procure hardware for Counter Unmanned Aerial Systems (CUAS) evaluation. -Conduct gun fired CUAS demonstration.												
Congressional Adds Subtotals								0.000	25.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)	Project (Number/Name) 9999 / Congressional Adds
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>Remarks</b>		
<b>D. Acquisition Strategy</b> C470 ALaMO Munition System: MK 332 HE-4G will have completed qualifications and transition into LRIP FY2019.		
<b>E. Performance Metrics</b> C470 ALaMO Munition System: Quarterly Reviews and semi-annual Product Certification Panel Reviews.		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 5						R-1 Program Element (Number/Name) PE 0604756N / Ship Self Def (Engage: Hard Kill)				Project (Number/Name) 9999 / Congressional Adds					
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
C470- Produce test hardware and production transition	MIPR	DOTC : Picatinny Arsenal, NJ	0.000	0.000		8.000	Mar 2019	0.000		-		0.000	0.000	8.000	-
Subtotal			0.000	0.000		8.000		0.000		-		0.000	0.000	8.000	N/A
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
C470-Government Engineering Support Services	WR	NSWC DD : NSWC Dahlgren, VA	0.000	0.000		2.000	Mar 2019	0.000		-		0.000	0.000	2.000	-
C468- Condition Based Maintenance	C/FFP	Mlkros Systems : NA	0.000	0.000		8.000	Jun 2019	0.000		-		0.000	0.000	8.000	-
C469-CIWS Improvements	SS/CPFF	Raytheon : Various	0.000	0.000		7.000	Mar 2019	0.000		-		0.000	0.000	7.000	-
Subtotal			0.000	0.000		17.000		0.000		-		0.000	0.000	17.000	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			0.000	0.000		25.000		0.000		-		0.000	0.000	25.000	N/A
Remarks															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Navy																<b>Date:</b> March 2019			
<b>Appropriation/Budget Activity</b> 1319 / 5								<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>								<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>			

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>Proj 9999</b>																												
C470 ALaMO Munition Systems: Transition to Production Activities																												
C470 ALaMO Munition Systems: Build Counter UAS Test Hardware																												
C470 ALaMO Munition Systems: Conduct Counter UAS Gun Testing																												
C470 ALaMO Munition Systems: Evaluate Counter UAS Effectivty																												
C470 ALaMO Munition Systems: C468 Condition Based Maintenance: Condition Based Maintenance																												

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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 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0604756N / <i>Ship Self Def (Engage: Hard Kill)</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Proj 9999</i></b>				
C470 ALaMO Munition Systems: Transition to Production Activities	2	2019	4	2019
C470 ALaMO Munition Systems: Build Counter UAS Test Hardware	3	2019	4	2019
C470 ALaMO Munition Systems: Conduct Counter UAS Gun Testing	1	2020	2	2020
C470 ALaMO Munition Systems: Evaluate Counter UAS Effectivty	2	2020	3	2020
C470 ALaMO Munition Systems: C468 Condition Based Maintenance: Condition Based Maintenance	3	2019	4	2019