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

<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 7: Operational Systems Development</i>	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>
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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	3,214.265	100.011	252.395	320.134	-	320.134	199.250	123.075	52.155	53.196	Continuing	Continuing
0545: <i>TOMAHAWK</i>	3,214.265	100.011	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3,314.276
4032: <i>A2AD</i>	0.000	0.000	4.835	4.144	-	4.144	0.000	0.000	0.000	0.000	0.000	8.979
4033: <i>M-Code</i>	0.000	0.000	21.760	28.912	-	28.912	14.569	3.964	12.800	3.672	Continuing	Continuing
4034: <i>Maritime Strike</i>	0.000	0.000	185.380	227.854	-	227.854	125.138	71.925	0.000	0.000	0.000	610.297
4035: <i>JMEWS</i>	0.000	0.000	17.031	41.226	-	41.226	45.543	37.021	21.487	31.298	Continuing	Continuing
4036: <i>TTWCS TMPC PPPI</i>	0.000	0.000	23.389	17.998	-	17.998	14.000	10.165	17.868	18.226	Continuing	Continuing

**Program MDAP/MAIS Code:**  
**Project MDAP/MAIS Code(s):** 289

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

The Block V is a modernized TACTOM missile which includes the Navigation / Communications (NAV/COMMs) upgrade. NAV/COMMs is a title replacement for Anti-Access, Area Denial (A2AD). Funds support development of the Tomahawk Weapons System (TWS) encompassing Tactical Tomahawk upgrades including baseline improvements into the Block V missile All-Up Round (AUR), Tactical Tomahawk Weapons Controls System (TTWCS), Theater Mission Planning Center (TMPC) upgrades and other missile system improvements to maintain pace with threats. The TWS provides a long range cruise missile attack capability against fixed and mobile targets. Tomahawk is capable of being deployed from both submarines and surface ships and significantly increases the total capability of joint forces.

JUSTIFICATION FOR BUDGET ACTIVITY: 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 (FRP) and anticipate funding in the current or subsequent fiscal year.

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<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	133.617	282.395	223.615	-	223.615
Current President's Budget	100.011	252.395	320.134	-	320.134
Total Adjustments	-33.606	-30.000	96.519	-	96.519
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-30.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.861	0.000			
• Program Adjustments	0.000	0.000	96.645	-	96.645
• Rate/Misc Adjustments	0.000	0.000	-0.126	-	-0.126
• Congressional Directed Reductions Adjustments	-31.745	-	-	-	-

**Change Summary Explanation**

Technical: Not applicable

Schedule:

PU 0545: Tomahawk schedule changes are associated with enhanced detail required to independently display program cost, schedule, and performance within the R-4 exhibit.

Moved M-Code EMD Phase I to PU 4033

A2AD Award Lot-1 was moved from 2Q FY 2018 of PU 0545 to 1Q FY2019 of PU 4032

PU 4032: A2AD schedule changes are due to the dependence of recertification line prove-in missiles which are now delayed as a result of changes in the recertification and modernization schedule.

A2AD Award Lot-1 was added and moved from 2Q FY 2018 of PU 0545 to 1Q FY2019 of PU 4032, causing Award Lots 2, 3, 4, 5 and 6 to shift accordingly.

Moved A2AD Modification Blk IV Fleet Release from 3Q FY2021 to 4Q FY2020

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<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy I BA 7: Operational Systems Development</i>	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	
<p>Moved A2AD OTRR from 4Q FY2020 to 3Q FY2020 in accordance with A2AD Acquisition Strategy Acquisition Plan.</p> <p>Added A2AD Functional Ground Test 3Q FY2019</p> <p>Changed A2AD Operational Test (OT) from 4Q FY2020 to 3Q FY2020</p> <p>PU 4033: M-Code schedule changes are associated with enhanced details required to independently display program cost, schedule, and performance within the R-4 exhibit.</p> <p>Moved MS B from 1Q FY2019 to 3Q FY2019</p> <p>Moved MS C from 1Q FY2021 to 1Q FY2023</p> <p>Moved M-Code Fleet Release from 4Q FY2023 to 1Q FY2025</p> <p>Added M-Code PDR to 2Q FY2020</p> <p>Moved M-Code CDR from 3Q FY2019 TO 4Q FY2020</p> <p>Moved M-Code DT from 1Q FY2019 to 4Q FY2020 to 3Q FY2020 through 1Q FY2023</p> <p>Moved M-Code OT from 1Q FY2021 to 2Q FY2023 to 2Q FY2023 to 3Q FY2025</p> <p>Added M-Code EMD Award Phase I from 2Q FY2018 to 3Q FY2019</p> <p>Moved M-Code EMD Award Phase II from 2Q FY2019 to 1Q FY2021</p> <p>Changed naming convention of LRIP to Lots. M-Code Lot-1 was shifted from 1Q FY2021 to 1Q FY2023. M-Code Lot-2 shifted from 1Q FY2022 to 1Q FY2024. Lot-3 was deleted.</p> <p>PU 4034: Maritime Strike schedule changes are due to the dependence of recertification line prove in missiles which are now delayed as a result of changes in the recertification and modernization schedule.</p>		

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<p>Moved Maritime Strike IOC from 4Q FY2021 to 4Q FY2022</p> <p>Moved Maritime Strike Simulation Capability from 1Q FY2020 to 3Q FY2020</p> <p>Moved Maritime Strike Ready for Ground Launches from 3Q FY2020 to 2Q FY2021</p> <p>Moved Maritime Strike Modeling and Simulation from 1Q FY2019 to 3Q FY2021 to 1Q FY2019 to 4Q FY2021</p> <p>Moved Maritime TTWCS Dev from 1Q FY2019 to 2Q FY2021 to 1Q FY2019 to 3Q FY2021</p> <p>Moved Maritime Strike Ready for QRA from 2Q FY2021 to 2Q FY2022</p> <p>Moved Maritime QRA from 2Q FY2021 to 2Q FY2022 through 3Q FY2022</p> <p>Moved Maritime Strike Initial Fielding from 4Q FY 2021 to 4Q FY 2022</p> <p>Added Maritime Production Contract Award LRIP 1 from 1Q FY2020</p> <p>Added Maritime Production Contract Award LRIP 2 from 1Q FY2021</p> <p>Added Maritime Production Contract Award LRIP 3 from 1Q FY2022</p> <p>Added Maritime Production Contract Award from 1Q FY2023</p> <p>PU 4035: JMEWS schedule changes are associated with enhanced details required to independently display program cost, schedule, and performance within the R-4 exhibit.</p> <p>Moved MS B from 2Q FY2019 to 4Q FY2019</p> <p>Moved MS C from 1Q FY2023 1Q FY2024</p> <p>Moved JMEWS Fuze Risk Reduction from 1Q FY2019 to 3Q FY2019 to 3Q FY2018 to 4Q FY2019</p>		

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<p>Moved JMEWS PDR from 1Q FY2020 to 3Q FY2020</p> <p>Moved JMEWS CDR from 4Q FY2020 to 2Q FY2021</p> <p>Moved JMEWS DT from 4Q FY2020 to 1Q FY2023 to 2Q FY2021 to 4Q FY2023</p> <p>Moved JMEWS OT from 2Q FY2023 to 4Q FY2023 to 1Q FY2024 to 4Q FY2024</p> <p>Moved JMEWS Long-Lead Energetics Award from 1Q FY2022 to 1Q FY2024</p> <p>Moved JMEWS Production Contract Award from 1Q FY2023 to 4Q FY2025</p> <p>PU 4036: TTWCS TMPC PPPI schedule changes are associated with enhanced details required to independently display program cost, schedule, and performance within the R-4 exhibit.</p> <p>Moved TMPC 7.0 IOC from 4Q FY2021 to 4Q FY2022</p> <p>Moved TMPC 7.0 PAT &amp; DT/OT from 1Q FY2020 to 4Q FY2021 to 1Q FY2021 to 4Q FY2022</p> <p>Moved TMPC 8.0 Requirements Definition from 2Q FY2019 to 4Q FY2019 to 4Q 2019 to 4Q FY2020</p> <p>Moved TMPC 8.0 PAT &amp; DT/OT from 3Q FY2022 to 1Q FY2024 to 2Q FY2024 to 4Q FY2025</p>		

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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 / 7					<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr				<b>Project (Number/Name)</b> 0545 / TOMAHAWK			
<b>COST (\$ in Millions)</b>	<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>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
0545: TOMAHAWK	3,214.265	100.011	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3,314.276
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
<b>Project MDAP/MAIS Code:</b> 289												

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

The Tomahawk Weapons System (TWS) provides a long range cruise missile attack capability against fixed and mobile/moving targets and can be launched from both surface ships submarines. TWS employs state of the art technology to preserve the efficiency of this proven weapon system, and includes all missile development, mission planning, weapons control system development, and submarine integration development. Tomahawk missiles consist of the following variants: (1) Block III, consisting of the RGM/UGM-109C Land Attack Conventional version and the RGM/UGM-109D Land Attack Submunition Dispenser variant; (2) Block IV, RGM/UGM-109E Tactical Tomahawk; (3) Block V, RGM/UGM-109E Modernized Tactical Tomahawk with a NAV/COMMs upgrade. All Block IV missiles that go through recertification will be converted into Block V missiles, and FY 2020 procured new production missiles will be delivered in a Block V configuration.

The essential upgrades of the Block V Tomahawk missile are more robust navigation and two-way satellite communication (SATCOM). Block V provides a dual-band SATCOM data link to enable the missile to receive In-flight Mission Modification Messages, to transfer Health and Status messages and to broadcast Battle Damage Indication messages. A Block V also includes development of continuing advances in GPS navigation (M-Code), Maritime Strike, and warhead design (JMEWS).

Tactical Tomahawk baseline improvements include the following:

- (1) NAV/COMMs, also known as Anti-Access/Area Denial (A2AD), upgrade the navigation software, replace the existing Satellite Data Link Terminal (SDLT) radio with a dual-band SATCOM Integrated Single Box Solution (ISBS) radio and accompanying antennas. The NAV/COMMs upgrade allow for planned missions using Terrain Contour Matching (TERCOM)/Digital Scene Matching Area Correlation (DSMAC) updates without GPS and continues communication to pass Health and Status messages and allow missile redirection inflight. NAV/COMM program includes upgrades to the All-Up Round (AUR) missile, Tactical Tomahawk Weapons Control System (TTWCS) and Theater Mission Planning Center (TMPC).
- (2) MARITIME STRIKE TOMAHAWK provides the capability to hit moving maritime targets through mid-course guidance via a third party or seeker mode, to a terminal seeker area of uncertainty. Maritime Strike Tomahawk program includes upgrades to the AUR missile, TTWCS, and TMPC.
- (3) M-CODE (ACAT IV) is the next generation, modernized Global Positioning System (GPS) signal-in-space broadcast for enhanced Position, Navigation, and Timing (PNT) capability. The mission of the Tomahawk Weapon System (TWS) M-Code Integrated Product Team (IPT) is to deliver the necessary modifications to the Tomahawk Block IV missile and associated upgrades to the Tactical Tomahawk Weapons Control System (TTWCS) and Theater Mission Planning Center (TMPC) to enable the TWS to utilize the M-Code capability. Enhancements include improved GPS signal integrity. M-Code program includes upgrades to the AUR missile, TTWCS, and TMPC.

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(4) JMEWS (ACAT III) is a new warhead for the Block V Tomahawk Cruise Missile. JMEWS will greatly expand the land target set that the Tomahawk missile is capable of defeating, by combining the blast and fragmentation capabilities of the current warhead with a new penetration capability and improved mission planning. JMEWS will also be compliant with Insensitive Munitions requirements which improve safety during transportation and storage on land and aboard ships and submarines. JMEWS program includes upgrades to the AUR missile, TTWCS, and TMPC.

The Theater Mission Planning Center (TMPC) consists of Commercial and Government Off-The-Shelf (COTS/GOTS) software and COTS hardware. TMPC is the mission planning segment of the Tomahawk Weapon System (TWS) that provides subsystems for the precision targeting, route planning, mission distribution, and strike management of Tomahawk cruise missile missions from sites located ashore and afloat. TMPC optimizes all aspects of the Tomahawk missile mission to successfully engage a target.

TMPC provides mission planning at the theater and operational levels and is designed for high rate mission planning production responsive to national strategic, operational, and tactical requirements. TMPC develops and distributes missions; provides command information services for all variants of the Tomahawk missile; provides strike planning, execution, coordination, control and reporting, and provides Maritime Component Commanders (MCC) the capability to plan or modify conventional TWS missions. TMPC is employed in major joint combat operations and Overseas Contingency Operations. TMPC has evolved into 4 scalable configurations deployed at 189 sites: Cruise Missile Support Activities (CMSAs) (3), Tomahawk Strike Mission Planning Cells (TSMPCs) (3), Carrier Strike Groups (CSGs) (19 - 10 CVN), and Firing Units (FRUs) (145 - 88 Surface / 57 Subsurface). Additionally, TMPC is installed in Labs (6) and Training Classrooms (13) that contain various combinations of the four configurations. TMPC software development activities support new capabilities for the Tomahawk Weapon System while also decreasing mission planning time, increasing the quality and accuracy of each mission and reducing complexity. TMPC was previously referred to as Tomahawk Command and Control System (TC2S).

The Tactical Tomahawk Weapons Control System (TTWCS) provides launch capability for surface and submarine platforms. Development of the TTWCS provides a common architecture to launch the TACTOM and all variants in inventory. Development of upgrades to the TTWCS is required to meet the Department of Defense Information Technology Standards Registry, to meet FORCENet compliance and be Internet Protocol Version 6 ready in order to remain interoperable within the Joint Service Architecture and to retain weapons system viability and usability for our Sailors.

**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> Tactical Tomahawk All-Up-Round (AUR) and Tactical Tomahawk Weapons Control System (TTWCS)	88.796	0.000	0.000	0.000	0.000
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> Continue Anti-Access/Area Denial (A2AD) navigation and communication integration into Block IV weapons system. Continue fleet experimentation and requirements coordination as well as Concept of Operations (CONOPS)/ Concept of Employment development. Continuation of the design and integration of the seeker suite into the Tactical Tomahawk (TACTOM) to be incorporated during recertification. Continuation of the cooperatively funded United States Navy/United Kingdom Joint Multi-Effects Warhead System (JMEWS) / Joint					

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<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>
<p>Capability Technology Demonstration (JCTD) and the commencement of fuze technology maturation and risk-reduction. Include significant research and analysis of the worldwide target set capability gaps to include Hard and Deeply Buried Targets and conventional Global Strike targets. In addition, NAWCAD also provides engine power data/analysis in order to determine reserve power available to power potential upgrades to the Tomahawk AUR, such as JMEWS. Continue development of activities associated with Military Global Positioning System User Equipment (MGUE) Insertion. In addition, the Maritime Strike Tomahawk modernization effort provides the capability to hit moving maritime targets through mid-course guidance via a third party or seeker mode, to a terminal seeker area of uncertainty in an A2AD environment.</p> <p><b>FY 2019 Plans:</b> N/A</p> <p><b>FY 2020 Base Plans:</b> N/A</p> <p><b>FY 2020 OCO Plans:</b> N/A</p>					
<p><b>Title:</b> Theater Mission Planning Center (TMPC)</p> <p align="right"><b>Articles:</b></p> <p><b>Description:</b> Development and incorporation of new capabilities into the Theater Mission Planning Center (TMPC) necessary for the employment of the Tomahawk Weapon System (TWS).</p> <p><b>FY 2019 Plans:</b> N/A</p> <p><b>FY 2020 Base Plans:</b> N/A</p> <p><b>FY 2020 OCO Plans:</b> N/A</p>	11.215	0.000	0.000	0.000	0.000
	-	-	-	-	-
<b>Accomplishments/Planned Programs Subtotals</b>	100.011	0.000	0.000	0.000	0.000



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**C. Other Program Funding Summary (\$ in Millions)**

Line Item	FY 2018	FY 2019	FY 2020	FY 2020	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Cost To	
			Base	OCO	Total					Complete	Total Cost
• WPN/2101: <i>Tomahawk</i>	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• OPN/5253: <i>Tomahawk Support Equipment</i>	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN/9020: <i>Initial and Vendor Direct Spares</i>	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN/6120: <i>Spares and Repair Parts</i>	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

**Remarks**

**D. Acquisition Strategy**

TACTOM Weapon System (ACAT I) achieved IOC in May 2004. The current acquisition strategy is to maintain production through 2021. The current operational life of a fielded TACTOM BLK IV missile is 15 years. Starting in FY 2019 these missiles will start reaching their Maintenance Due Date (MDD). The TACTOM Recertification Program (ACAT II) will overhaul each end-of-life missile enabling the missile to be operational for an additional 15 years of service. During missile recertification the NAV/COMM upgrade will be added to the missile, transitioning to a Block V missile. New production that occurs in FY 2020 and beyond will be in a baseline Block V configuration.

Maritime Strike Tomahawk (MST) will enable surface warfare engagement capability from U.S. Navy Guided Missile Cruiser (CG), Guided Missile Destroyer (DDG), and Nuclear Powered Fast Attack Submarine (SSN) platforms. MST was designated a DoDI 5000.02 Rapid Deployment Capability (RDC) by the Assistant Secretary of the Navy (Research, Development, and Acquisition) (ASN (RDA)) in Oct 2016. Initial Operational Capability (IOC) will occur in FY 2022 following a Quick Reaction Assessment (QRA) and characterization of operational performance. This strategy affords the program flexibility in achieving a threshold capability in a timely manner. Following IOC, further procurements will comply with DoDI 5000.02 as a program of record. The MST program includes upgrades to the AUR missile, TTWCS and TMPC.

The M-Code (ACAT IV) acquisition strategy includes the development, integration, test, qualification and production of a new GPS receiver which will satisfy Public Law 111-383, sec 913 compliance. M-Code capability enables the missile to maintain GPS integrity in an enhanced spoofing environment. M-Code Milestone B will occur in FY 2019, Milestone C is planned for FY 2023, and the capability will Fleet Release in FY 2025. The M-Code program includes upgrades to the AUR missile, TTWCS and TMPC.

Joint Multiple Effects Warhead System (JMEWS) (ACAT III) acquisition strategy includes the development, integration, test, qualification and production of a new warhead that will greatly expand the land target set that the Tomahawk missile is capable of defeating, by combining the blast and fragmentation capabilities of the current warhead with a new penetration capability and improved mission planning. JMEWS will also be compliant with Insensitive Munitions requirements which improve

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safety during transportation and storage on land and aboard ships and submarines. JMEWS Milestone B will occur in FY 20129, Milestone C is planned for FY 2024, and the capability will Fleet Release in FY 2025. JMEWS program includes upgrades to the AUR missile, TTWCS, and TMPC.

TMPC and TTWCS require periodic hardware and software updates to maintain compliance with IA standards and maintain system relevance against emerging threats. TMPC and TTWCS segments will rely on a blend of industry and government expertise through the remaining life of the program.

**E. Performance Metrics**

The Navy seeks to improve the Tomahawk cruise missile attack capability against land and maritime targets through research and development.

Examples in the area of the All-Up-Round include development of candidate warheads and sensors that will enhance weapon ability to cover all assigned target types, provide a quick reaction response capability for the weapon system, and improved guidance, navigation, control, mission computer two-way satellite communications, and a high anti-jam GPS receiver all in line with state of the art technology.

In the area of the weapons control system, research and development is performed to ensure viability and usability of the system into the future, providing necessary upgrades to meet the Department of Defense Information Technology standards registry to comply with FORCEnet requirements and be Internet Protocol Version 6 ready to remain interoperable within Joint Service Architecture, in order to provide battle-group tactical flexibility and responsiveness needed to enable full wartime capability.

In the area of the TMPC, research and development is performed in order to provide scalable configurations to deploy where and as needed to provide necessary command and control, conduct development necessary to function with national and tactical imagery architectures, support new TWS capabilities, decrease mission planning time, and increase the quality and accuracy of each mission for the TWS.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 7				R-1 Program Element (Number/Name) PE 0204229N / Tomahawk Mssn Planning Ctr				Project (Number/Name) 0545 / TOMAHAWK							
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
Systems Engineering - A2AD Improvements Prime Integrator (NAV/COMMS)	SS/CPFF	Raytheon : Tucson, AZ	25.425	11.615	Feb 2018	0.000		0.000		-		0.000	0.000	37.040	Continuing
Systems Engineering - TTWCS A2AD Improvements (NAV/COMMS)	WR	NSWC : Dahlgren, VA	3.265	1.436	Feb 2018	0.000		0.000		-		0.000	0.000	4.701	Continuing
Systems Engineering - Hardware Development-A2AD Improvements (NAV/COMMS)	MIPR	NRO : Chantilly, VA	33.914	5.970	Nov 2017	0.000		0.000		-		0.000	0.000	39.884	Continuing
Systems Engineering-TTWCS Software Support Activity(NAV/COMMS)	SS/CPFF	LMVF : Valley Forge, PA	2.778	2.219	Feb 2018	0.000		0.000		-		0.000	0.000	4.997	Continuing
M-Code - TTWCS	WR	NSWC : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code - AUR	C/CPFF	Raytheon : Tucson, AZ	0.000	2.100	Feb 2018	0.000		0.000		-		0.000	0.000	2.100	Continuing
M-Code- AUR	SS/FFP	Raytheon SAS : El Segundo, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code	WR	NSWC-IH : Indian Head, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code	WR	NUWC-RI : Newport, RI	0.000	0.086	Nov 2017	0.000		0.000		-		0.000	0.000	0.086	Continuing
M-Code	WR	NAWC-AD : Pax River, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code - TMPC	SS/CPFF	Tapestry : St. Louis, MO	0.000	0.250	Dec 2017	0.000		0.000		-		0.000	0.000	0.250	Continuing
M-Code - TMPC	SS/CPFF	Vencore : San Jose, CA	0.000	0.136	Dec 2017	0.000		0.000		-		0.000	0.000	0.136	Continuing
Maritime Strike - TMPC	SS/CPFF	Vencore : San Jose, CA	0.530	2.103	Dec 2017	0.000		0.000		-		0.000	0.000	2.633	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 7				R-1 Program Element (Number/Name) PE 0204229N / Tomahawk Mssn Planning Ctr				Project (Number/Name) 0545 / TOMAHAWK							
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
Maritime Strike - TMPC	SS/CPFF	Tapestry : St. Louis, MO	0.622	0.600	Dec 2017	0.000		0.000		-		0.000	0.000	1.222	Continuing
Maritime Strike - TMPC	SS/CPFF	BAE Systems : San Diego, CA	0.435	0.462	Dec 2017	0.000		0.000		-		0.000	0.000	0.897	Continuing
Maritime Strike - TMPC	SS/CPFF	Leidos : California, MD	0.999	0.823	Dec 2017	0.000		0.000		-		0.000	0.000	1.822	Continuing
Maritime Strike - TMPC	SS/CPFF	UARC APL : Laurel, MD	0.375	0.000		0.000		0.000		-		0.000	0.000	0.375	Continuing
Maritime Strike - TMPC	WR	NAWC-AD : Pax River, MD	0.126	0.606	Nov 2017	0.000		0.000		-		0.000	0.000	0.732	Continuing
Maritime Strike - TMPC	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike - AUR	C/CPFF	Raytheon : Tucson, AZ	9.400	50.242	Dec 2017	0.000		0.000		-		0.000	0.000	59.642	Continuing
Maritime Strike	SS/CPFF	UARC APL : Laurel, MD	0.000	0.088	Dec 2017	0.000		0.000		-		0.000	0.000	0.088	Continuing
Maritime Strike - TTWCS	WR	NSWC-DD : Dahlgren, VA	0.977	3.115	Nov 2017	0.000		0.000		-		0.000	0.000	4.092	Continuing
JMEWS - TMPC	SS/CPFF	Tapestry : St. Louis, MO	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike - TTWCS	SS/CPFF	LMVF : Valley Forge, PA	1.132	2.219	Dec 2017	0.000		0.000		-		0.000	0.000	3.351	Continuing
JMEWS - TMPC	SS/CPFF	BAE Systems : San Diego, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike - AUR	WR	NAWC-WD : China Lake, CA	0.521	0.000	Nov 2017	0.000		0.000		-		0.000	0.000	0.521	Continuing
JMEWS - TMPC	SS/CPFF	Leidos : California, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike - BRAT Dev	MIPR	AFRL : Dayton, OH	0.230	0.000		0.000		0.000		-		0.000	0.000	0.230	Continuing
JMEWS - TMPC	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 7				PE 0204229N / Tomahawk Mssn Planning Ctr				0545 / TOMAHAWK							
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
JMEWS	WR	NAWC-WD : China Lake, CA	0.000	1.508	Nov 2017	0.000		0.000		-		0.000	0.000	1.508	Continuing
Prior Year Prod Dev cost no longer funded in the FYDP	Various	Various : Various	2,660.256	0.000		0.000		0.000		-		0.000	0.000	2,660.256	-
<b>Subtotal</b>			2,740.985	85.578		0.000		0.000		-		0.000	0.000	2,826.563	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
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	SS/CPFF	Vencore : San Jose, CA	2.213	0.900	Feb 2018	0.000		0.000		-		0.000	0.000	3.113	Continuing
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	SS/CPFF	Boeing : St. Louis, MO	2.820	0.000		0.000		0.000		-		0.000	0.000	2.820	Continuing
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	SS/CPFF	BAE Systems : San Diego, CA	2.850	0.000		0.000		0.000		-		0.000	0.000	2.850	Continuing
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	SS/CPFF	Leidos : California, MD	5.001	1.482	Feb 2018	0.000		0.000		-		0.000	0.000	6.483	Continuing
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	SS/CPFF	UARC APL : Laurel, MD	2.623	0.000		0.000		0.000		-		0.000	0.000	2.623	Continuing
TLAM MP Analysis - Mission Planning	SS/CPFF	UARC APL : Laurel, MD	1.466	1.067	Feb 2018	0.000		0.000		-		0.000	0.000	2.533	Continuing
Imagery Format Analysis - Mission Planning	SS/CPFF	Leidos : California, MD	6.000	1.618	Feb 2018	0.000		0.000		-		0.000	0.000	7.618	Continuing
A2AD Improvements (NAV/COMMS) - Mission Planning upgrade	WR	NAWC-AD : Pax River, MD	1.024	1.220	Feb 2018	0.000		0.000		-		0.000	0.000	2.244	Continuing

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Development Support - TTWCS AUR	WR	NSWC : Dahlgren, VA	4.067	0.000		0.000		0.000		-		0.000	0.000	4.067	Continuing
Development Support - CSS AUR	SS/CPFF	Leidos : California, MD	1.539	0.000		0.000		0.000		-		0.000	0.000	1.539	Continuing
Development Support - Advanced Concepts AUR	WR	NAWC-WD : China Lake, CA	82.067	0.559	Nov 2017	0.000		0.000		-		0.000	0.000	82.626	Continuing
Development Support - AUR Fleet Representative	SS/CPFF	UARC APL : Laurel, MD	0.497	0.330	Nov 2017	0.000		0.000		-		0.000	0.000	0.827	Continuing
Development Support - Advanced Concepts AUR	WR	NAWC-AD : Pax River, MD	0.753	0.105	Nov 2017	0.000		0.000		-		0.000	0.000	0.858	Continuing
Development Support - Advanced Concepts AUR	WR	NSWC : Dahlgren, VA	0.396	0.425	Nov 2017	0.000		0.000		-		0.000	0.000	0.821	Continuing
Development Spt - CSS AUR	C/BA	Precise : Lexington Park, MD	0.180	0.230	Dec 2017	0.000		0.000		-		0.000	0.000	0.410	Continuing
Development Spt - M-Code	C/BA	UARC APL : Laurel, MD	0.000	0.439	Dec 2017	0.000		0.000		-		0.000	0.000	0.439	Continuing
M-Code AUR	WR	NUWC-NPT : Newport, RI	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code AUR	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code AUR	WR	NSWC-IH : Indian Head, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code TWS	C/BA	Precise : Lexington Park, MD	0.000	0.056	Apr 2018	0.000		0.000		-		0.000	0.000	0.056	Continuing
M-Code TTWCS	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
M-Code TTWCS	C/BA	UARC APL : Laurel, MD	0.000	0.100	May 2018	0.000		0.000		-		0.000	0.000	0.100	Continuing
M-Code TTWCS	SS/CPFF	LMVF : Valley Forge, PA	0.000	0.515	Mar 2018	0.000		0.000		-		0.000	0.000	0.515	Continuing
M-Code TTWCS	SS/CPFF	LMBM : Baltimore, MD	0.000	0.065	May 2018	0.000		0.000		-		0.000	0.000	0.065	Continuing

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code TTWCS	WR	NUWC-NPT : Newport, RI	0.000	0.086	Nov 2017	0.000		0.000		-		0.000	0.000	0.086	Continuing
Development Spt - Maritime Strike	WR	NUWC-NPT : Newport, RI	0.188	0.380	Nov 2017	0.000		0.000		-		0.000	0.000	0.568	Continuing
Development Spt - Maritime Strike	WR	NAWC-WD : China Lake, CA	0.000	1.742	Nov 2017	0.000		0.000		-		0.000	0.000	1.742	Continuing
Development Spt - Maritime Strike	SS/CPFF	NSWC-DD : Dahlgren, VA	0.500	0.717	Nov 2017	0.000		0.000		-		0.000	0.000	1.217	Continuing
Development Spt - Maritime Strike	WR	NAWC-AD : Pax River, MD	0.865	1.385	Nov 2017	0.000		0.000		-		0.000	0.000	2.250	Continuing
Prior Year Support cost no longer funded in FYDP	Various	Various : Various	274.418	0.000		0.000		0.000		-		0.000	0.000	274.418	Continuing
Development Spt - JMEWS	WR	NAWC-AD : Pax River, MD	0.000	0.068	Apr 2018	0.000		0.000		-		0.000	0.000	0.068	-
Development Spt - JMEWS (CSS)	C/BA	Engility : Lexington Park, MD	0.000	0.100	Apr 2018	0.000		0.000		-		0.000	0.000	0.100	-
<b>Subtotal</b>			389.467	13.589		0.000		0.000		-		0.000	0.000	403.056	N/A

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Maritime Strike	C/CPFF	Raytheon : Tucson, AZ	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike	WR	NAWC-AD : China Lake, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike	WR	NAWC-WD : Pax River, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Maritime Strike	WR	NSWC : Dahlgren, VA	0.000	0.485	Dec 2017	0.000		0.000		-		0.000	0.000	0.485	Continuing
TTWCS	WR	NSWC-DD : Dahlgren	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code	WR	NAWC-AD : Patuxent River, MD	0.000	0.359	Nov 2017	0.000		0.000		-		0.000	0.000	0.359	Continuing
A2AD Improvements (NAV/COMMS)	SS/CPFF	NSWC-IHD : Indian Head, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
A2AD Improvements (NAV/COMMS)	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Prior Year T&E cost no longer funded in FYDP	Various	Various : Various	83.412	0.000		0.000		0.000		-		0.000	0.000	83.412	Continuing
<b>Subtotal</b>			83.412	0.844		0.000		0.000		-		0.000	0.000	84.256	N/A

<b>Management Services (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	Continuing
Prior Year Mgmt cost no longer funded in FYDP	Various	Various : Various	0.401	0.000		0.000		0.000		-		0.000	0.000	0.401	Continuing
<b>Subtotal</b>			0.401	0.000		0.000		0.000		-		0.000	0.000	0.401	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>	3,214.265	100.011	0.000	0.000	-	0.000	0.000	3,314.276	N/A

**Remarks**



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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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Tomahawk Mission Planning Center	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>Acquisition Milestones</b>																												
Milestones	JMEWS ASR ▲																											
<b>Systems Development</b>																												
Critical Design Reviews	M-Code TWS SRR ■																											
Software Development	A2AD NAV																											
	A2AD ECPs/Integration																											
	Maritime TTWCS Dev																											
	Maritime TMPC Dev																											
	Maritime SW Design																											
	Maritime NAVSIL Update																											
Acquisition Reviews	A2AD CDR ■																											

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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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Tomahawk Mission Planning Center - Page 2	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>Systems Development (cont)</b>																																
Hardware Development	TT P3I																															
	Maritime AUR Seeker Integration																															
	Maritime Suite Selected ■																															
	JMEWS FUZE RISK REDUCTION																															
<b>Reviews</b>																																
<b>Test and Evaluation</b>																																
	TTWCS V5.6 DT/OT																															
	Maritime HWIL/LAB/IT&E																															
	Maritime Initial Integration Testing																															
	A2AD Parking Lot Test ▲				TMPC 6.0																											

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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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<b>Tomahawk Mission Planning Center - Page 3</b>	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>Production Milestones</b>																												
Contract Awards																												
<b>TACTOM Modernization Deliveries</b>																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details: PB 2020 Navy</b>		<b>Date: March 2019</b>
<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 0545 / TOMAHAWK

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Tomahawk Mission Planning Center</b>				
Acquisition Milestones: Milestones: JMEWS Acquisition Strategy Review	1	2018	1	2018
Systems Development: Critical Design Reviews: M-CodeTWS SRR	1	2018	1	2018
Systems Development: Software Development: A2AD Navigation	1	2018	4	2018
Systems Development: Software Development: A2AD ECPs/Integration	1	2018	4	2018
Systems Development: Software Development: Maritime Strike- TTWCS Development	1	2018	4	2018
Systems Development: Software Development: Maritime Strike- TMPC Development	1	2018	4	2018
Systems Development: Software Development: Maritime Strike Software Design	1	2018	4	2018
Systems Development: Software Development: Maritime Strike NAVSIL Update	1	2018	4	2018
Systems Development: Acquisition Reviews: A2AD - CDR	1	2018	1	2018
<b>Tomahawk Mission Planning Center - Page 2</b>				
Systems Development (cont): Hardware Development: TT Preplanned Product Improvement (P3I)	1	2018	4	2018
Systems Development (cont): Hardware Development: Maritime Strike - AUR Seeker Integration	1	2018	4	2018
Systems Development (cont): Hardware Development: Maritime Strike Suite Selected	3	2018	3	2018
Systems Development (cont): Hardware Development: JMEWS FUZE RISK REDUCTION	1	2018	4	2018
Test and Evaluation: TTWCS V5.6 Modernized Missile DT/OT	1	2018	4	2018
Test and Evaluation: Maritime Strike - HWIL/LAB/Integration Testing	1	2018	4	2018
Test and Evaluation: Maritime Strike Initial Integration Testing	4	2018	4	2018
Test and Evaluation: TMPC 6.0	3	2018	4	2018
Test and Evaluation: A2AD Parking Lot Test	2	2018	2	2018

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**Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 0545 / TOMAHAWK
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Tomahawk Mission Planning Center - Page 3</i></b>				
TACTOM Modernization Deliveries: TACTOM Modernization Deliveries	4	2020	4	2024

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Navy **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4032 / A2AD
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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
4032: A2AD	0.000	0.000	4.835	4.144	-	4.144	0.000	0.000	0.000	0.000	0.000	8.979
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**Project MDAP/MAIS Code:** 289

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

This project funds Anti-Access / Area Denial (A2AD) engineering change proposal (ECP) upgrades to the navigation and communication of the Tactical Tomahawk (TACTOM). TACTOM navigation modernization will enable launch via a fine alignment solution and navigation using TERCOM/DSMAC/Vertical Update Point in a GPS denied/degraded environment. TACTOM communications development replaces 5Khz DAMA with Advanced Communication Architecture (ACA) leveraging National Technical Means (NTM), replacing the Satellite Data Link Terminal (SDLT) with an Integrated Single Box Solution (ISBS) that combines Dual Transmit and Receive Capability in a single box, replacing existing UHF antenna and adding a second band antenna.

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

	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<b>Title:</b> Anti-Access/Area Denial	0.000	4.835	4.144	0.000	4.144
<b>Articles:</b>	-	-	-	-	-
<b>FY 2019 Plans:</b>					
FY 2019 plans include A2AD(NAV/COMMS) identification of the kit bill of materials, logistics, fabrication, assembly, integration, test, and documentation of prototype kits for the Functional Ground Test (FGT), flight test, and associated procedures. Includes the completion of the FGT and technical assessments of data collected. Continue program management and engineering support for navigation and communication system upgrades completion of the Engineering Change Proposal (ECP). Continue technical engineering support to the Integrated Single Box Solution (ISBS) radio developer and Advanced Communication Architecture (ACA) Network Service Provider. Complete the AUR System Verification Review (SVR) and Operational Test Readiness Review (OTRR).					
<b>FY 2020 Base Plans:</b>					
FY 2020 plans include A2AD(NAV/COMMS) the continuation of technical engineering support for the Integrated Single Box Solution (ISBS) radio developer and Advanced Communication Architecture (ACA) Network Service Provider. Complete the AUR Operational Test Readiness Review (OTRR), Operational Test (OT) and Fleet Release.					
<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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4032 / A2AD

<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><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> Decrease of \$0.691 million from FY 2019 to FY 2020 associated with the transition from primarily product development activities to test.					
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	4.835	4.144	0.000	4.144

**C. Other Program Funding Summary (\$ in Millions)**

<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 2101: <i>Tomahawk</i>	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• OPN 5253: <i>Tomahawk Support Equipment</i>	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN 9020: <i>Initial and Vendor Direct Spares</i>	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN 6120: <i>Spares and Repair Parts</i>	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

**Remarks**

**D. Acquisition Strategy**

Tactical Tomahawk communications and navigation development is funded via the National Reconnaissance Office (NRO) and Raytheon Missile Systems to include the development of either multiple or multi-band antennas, for the integrated single box solution radio. These changes will be incorporated during missile recertification scheduled to begin in FY 2020.

**E. Performance Metrics**

The Navy seeks to improve the Tomahawk cruise missile attack capability against land and maritime targets through research and development.

Examples in the area of the All-Up-Round include development of improved navigation, control, and mission computer two-way satellite communications, all in line with state of the art technology.

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4032 / A2AD
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<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
A2AD Improvements Prime Integrator (NAV/COMMS)	SS/CPFF	Raytheon : Tucson, AZ	0.000	0.000		0.750	Nov 2018	0.000		-		0.000	0.000	0.750	-
Hardware Development-A2AD Improvements (NAV/COMMS)	MIPR	NRO : Chantilly, VA	0.000	0.000		2.100	Nov 2018	1.507	Dec 2019	-		1.507	0.000	3.607	-
<b>Subtotal</b>			0.000	0.000		2.850		1.507		-		1.507	0.000	4.357	N/A

**Remarks**  
FY 2020 A2AD Product Development funding required to complete hardware development to include the development of either multiple or multi-band antennas for the integrated single box solution radio.

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
A2AD Development Support	WR	NAWC-AD : Pax River, MD	0.000	0.000		0.170	Nov 2018	1.558	Nov 2019	-		1.558	0.000	1.728	-
A2AD Development Support	WR	NAWC-WD : China Lake, CA	0.000	0.000		0.665	Dec 2018	0.332	Dec 2019	-		0.332	0.000	0.997	-
<b>Subtotal</b>			0.000	0.000		0.835		1.890		-		1.890	0.000	2.725	N/A

**Remarks**  
Increase in Development Support funding in FY 2020 required for support to scheduled test events and test reviews.

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
A2AD Test & Evaluation	WR	NAWC-WD : China Lake, CA	0.000	0.000		0.625	Nov 2018	0.747	Nov 2019	-		0.747	0.000	1.372	-



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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis: PB 2020 Navy</b>											<b>Date: March 2019</b>				
<b>Appropriation/Budget Activity</b> 1319 / 7						<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>					<b>Project (Number/Name)</b> 4032 / A2AD				

<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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
A2AD Test & Evaluation	SS/CPFF	Raytheon : Tucson, AZ	0.000	0.000		0.525	Dec 2018	0.000		-		0.000	0.000	0.525	-	
<b>Subtotal</b>			0.000	0.000		1.150		0.747		-		0.747	0.000	1.897	N/A	

**Remarks**  
FY 2020 A2AD Test and Evaluation funding required for flight test and associated procedures.

<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	4.835	4.144	-	4.144	0.000	8.979	N/A

**Remarks**

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

Date: March 2019

Appropriation/Budget Activity  
1319 / 7

R-1 Program Element (Number/Name)  
PE 0204229N / Tomahawk Mssn Planning  
Ctr

Project (Number/Name)  
4032 / A2AD

A2AD	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>Acquisition Milestones</b>																																				
Milestones											A2AD Recert Cut-In ▲																									
<b>Systems Development</b>																																				
Software Development					A2AD ECPs/Integration																															
Hardware Development																																				
<b>Reviews</b>																																				
Critical Design Review																																				
Acquisition Reviews											A2AD OTRR ■																									
<b>Test and Evaluation</b>																																				
							A2AD Functional Ground Test ■				A2AD OT ■																									
<b>Production Milestones</b>																																				
Contract Awards					A2AD Kit Award Lot-1 ▲				A2AD Kit Award Lot-2 ▲				A2AD Kit Award Lot-3 ▲				A2AD Kit Award Lot-4 ▲				A2AD Kit Award Lot-5 ▲				A2AD Kit Award Lot-6 ▲											
<b>Deliverables</b>																																				
									A2AD (NAV/COMMS) Production Deliveries																											

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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 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4032 / A2AD

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>A2AD</b>				
Acquisition Milestones: Milestones: A2AD Recert Cut-In	3	2020	3	2020
Acquisition Milestones: Milestones: A2AD Modernization Blk IV Fleet Release	4	2020	4	2020
Systems Development: Software Development: A2AD Navigation/Communications ECPs/Integration	1	2019	2	2021
Reviews: Acquisition Reviews: A2AD - OTRR	3	2020	3	2020
Test and Evaluation: A2AD Functional Ground Test	3	2019	3	2019
Test and Evaluation: A2AD Operational Test	3	2020	3	2020
Production Milestones: Contract Awards: A2AD Kit Award Lot-1	1	2019	1	2019
Production Milestones: Contract Awards: A2AD Kit Award Lot-2	1	2020	1	2020
Production Milestones: Contract Awards: A2AD Kit Award Lot-3	1	2021	1	2021
Production Milestones: Contract Awards: A2AD Kit Award Lot-4	1	2022	1	2022
Production Milestones: Contract Awards: A2AD Kit Award Lot-5	1	2023	1	2023
Production Milestones: Contract Awards: A2AD Kit Award Lot-6	1	2024	1	2024
Deliverables: A2AD (NAV/COMMS) Production Deliveries	1	2020	4	2024

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Navy **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4033 / M-Code
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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
4033: M-Code	0.000	0.000	21.760	28.912	-	28.912	14.569	3.964	12.800	3.672	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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

The M-Code ACAT IVT program upgrades the Tactical Tomahawk to the next generation Global Positioning System (GPS) satellite constellation required to maintain GPS-provided position, navigation, and timing (PNT) for the missiles and is estimated to be available for operations in FY 2024. The M-code mandate and Public Law restrict the purchase of only M-code-capable GPS User Equipment (MGUE) after FY 2017 unless a waiver is granted by the Secretary of Defense.

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

	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<b>Title:</b> M-Code	0.000	21.760	28.912	0.000	28.912
<b>Articles:</b>	-	-	-	-	-
<b>FY 2019 Plans:</b> Military-Code (M-Code) planned activities include completing Milestone B to enter the Engineering Manufacturing and Development (EMD) phase. EMD efforts include design, development, and integration of the Application Specific Integrated Circuit (ASIC) chip.					
<b>FY 2020 Base Plans:</b> M-Code planned activities include continuation of EMD efforts, completion of Preliminary Design Review (PDR), and Critical Design Review (CDR). EMD efforts include of hardware and software development, design, development, integrate, and test the integrated ASIC chip into the upgraded Tactical Tomahawk (TACTOM) Anti-Jam Receiver (AGR5).					
<b>FY 2020 OCO Plans:</b> N/A					
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> The increase from FY2019 to FY2020 of \$7.152M is due to EMD efforts required for the addition of hardware and software development to mature the design to meet PDR and CDR.					
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	21.760	28.912	0.000	28.912

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4033 / <i>M-Code</i>

**C. Other Program Funding Summary (\$ in Millions)**

Line Item	FY 2018	FY 2019	FY 2020	FY 2020	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Cost To	
			Base	OCO	Total					Complete	Total Cost
• WPN 2101: <i>Tomahawk</i>	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• OPN 5253: <i>Tomahawk Support Equipment</i>	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN 9020: <i>Initial and Vendor Direct Spares</i>	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN 6120: <i>Spares and Repair Parts</i>	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

**Remarks**

**D. Acquisition Strategy**

The M-Code (ACAT IV) acquisition strategy includes the development, integration, test, qualification and production of a new GPS receiver which will satisfy Public Law 111-383, sec 913 compliance. M-Code capability enables the missile to maintain GPS integrity in an enhanced spoofing environment. M-Code Milestone B will occur in FY 2019, Milestone C is planned for FY 2023, and the capability will Fleet Release in FY 2025. The M-Code program includes upgrades to the All-Up Round (AUR) missile, Tactical Tomahawk Weapons Control System (TTWCS) and Theater Mission Planning Center (TMPC).

**E. Performance Metrics**

The Navy seeks to improve the Tomahawk cruise missile attack capability against land and maritime targets through research and development.

Examples in the area of the All-Up-Round include development of a high anti-jam GPS receiver in line with state of the art technology.

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4033 / M-Code
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<b>Product Development (\$ 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>
M-Code-AUR	C/CPFF	Raytheon : Tuscon, AZ	0.000	0.000		6.478	Dec 2018	22.086	Dec 2019	-		22.086	Continuing	Continuing	Continuing
M-Code - AUR	SS/FFP	Raytheon : Raytheon, AZ/SAS:	0.000	0.000		9.345	Dec 2018	0.000		-		0.000	Continuing	Continuing	Continuing
M-Code - TTWCS	SS/CPFF	LMVF : Valley Forge, PA	0.000	0.000		0.239	Nov 2018	0.500	Dec 2019	-		0.500	Continuing	Continuing	Continuing
M-Code - TTWCS	SS/CPFF	LMBM : Baltimore, MD	0.000	0.000		0.371	Nov 2018	0.500	Dec 2019	-		0.500	Continuing	Continuing	Continuing
M-Code - TTWCS	SS/CPFF	BAE Systems : San Diego, CA	0.000	0.000		0.065	Apr 2019	0.065	Dec 2019	-		0.065	0.000	0.130	-
<b>Subtotal</b>			0.000	0.000		16.498		23.151		-		23.151	Continuing	Continuing	N/A

**Remarks**  
 FY 2020 M-Code product development funding required to commence the Engineering and Manufacturing Development phase while continuing design & certification of the Application Specific Integrated Circuit (ASIC) chip; fabrication, integration, testing and evaluation (IT&E) of the ASIC chip into the upgraded Anti-jam GPS Receiver (AGR-5); beginning stages of IT&E of the AGR-5 into subsystem components and the AUR missile.

<b>Support (\$ 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>
M-Code Development Support	WR	NAWC-WD : China Lake, CA	0.000	0.000		0.146	Dec 2018	0.275	Nov 2019	-		0.275	Continuing	Continuing	Continuing
M-Code Development Support	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.552	Nov 2018	1.360	Nov 2019	-		1.360	0.000	1.912	-
M-Code Development Support	WR	NUWC-NPT : Newport, RI	0.000	0.000		0.500	Nov 2018	0.500	Nov 2019	-		0.500	0.000	1.000	-
M-Code Development Support	WR	NSWC-IH : Indian Head, MD	0.000	0.000		0.644	Nov 2018	0.650	Nov 2019	-		0.650	Continuing	Continuing	Continuing
M-Code Development Support	SS/CPFF	UARC APL : Laurel, MD	0.000	0.000		1.727	Nov 2018	0.960	Nov 2019	-		0.960	Continuing	Continuing	Continuing

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4033 / M-Code
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code/TTWCS Development Spt	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.990	Nov 2018	0.520	Dec 2019	-		0.520	Continuing	Continuing	Continuing
M-Code/TTWCS VLS Development Spt	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.300	Dec 2019	-		0.300	0.000	0.300	-
M-Code Development Support	SS/CPFF	Various : Various	0.000	0.000		0.075	Dec 2018	0.000		-		0.000	0.000	0.075	-
<b>Subtotal</b>			0.000	0.000		4.634		4.565		-		4.565	Continuing	Continuing	N/A

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code Test & Evaluation	WR	NAWC-AD : Patuxent River	0.000	0.000		0.000		0.656	Nov 2019	-		0.656	Continuing	Continuing	Continuing
M-Code/TTWCS Test & Evaluation	WR	NUWC-NPT : Newport, RI	0.000	0.000		0.000		0.290	Nov 2019	-		0.290	0.000	0.290	-
M-Code Test & Evaluation	WR	NSWCIH : Indian Head, MD	0.000	0.000		0.553	Nov 2018	0.000		-		0.000	0.000	0.553	-
<b>Subtotal</b>			0.000	0.000		0.553		0.946		-		0.946	Continuing	Continuing	N/A

**Remarks**  
 FY 2020 M-Code Test and Evaluation will encompass modeling and simulation of the AGR-5 in navigation simulators designed to simulate real-world M-Code, Y-Code, and jamming environments. Test vectors will be designed, developed, and finalized to guide the M&S testing events

<b>Management Services (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
M-Code	WR	NAWC-AD : Patuxent River	0.000	0.000		0.075	Nov 2018	0.250	Nov 2019	-		0.250	Continuing	Continuing	Continuing
<b>Subtotal</b>			0.000	0.000		0.075		0.250		-		0.250	Continuing	Continuing	N/A

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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis: PB 2020 Navy</b>							<b>Date: March 2019</b>				
<b>Appropriation/Budget Activity</b> 1319 / 7			<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>				<b>Project (Number/Name)</b> 4033 / <i>M-Code</i>				
	<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	21.760		28.912	-	28.912	Continuing	Continuing	N/A	

**Remarks**



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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4033 / <i>M-Code</i>
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M-CODE	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>Acquisition Milestones</b>																												
Milestones							MS B ▲																					
<b>Systems Development</b>																												
Critical Design Reviews											M-Code PDR ■		M-Code CDR ■															
Software Development																												
Acquisition Reviews																												
Test and Evaluation																												
<b>Production Milestones</b>																												
Contract Awards																												
Deliveries																												

**UNCLASSIFIED**

<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 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4033 / <i>M-Code</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>M-CODE</b>				
Acquisition Milestones: Milestones: Milestone B	3	2019	3	2019
Acquisition Milestones: Milestones: Milestone C	1	2023	1	2023
Systems Development: Critical Design Reviews: M-Code PDR	2	2020	2	2020
Systems Development: Critical Design Reviews: M-Code CDR	4	2020	4	2020
Systems Development: Test and Evaluation: M-Code Development Test Build One & Development Test Build Two	3	2020	1	2023
Systems Development: Test and Evaluation: M-Code Operational Test	2	2023	4	2024
Production Milestones: Contract Awards: M-Code EMD Award Phase I	3	2019	3	2019
Production Milestones: Contract Awards: M-Code EMD Award Phase II	1	2021	1	2021
Production Milestones: Deliveries: M-Code Lot-1	1	2023	1	2023
Production Milestones: Deliveries: M-Code Lot-2	1	2024	1	2024

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Navy **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4034 / Maritime Strike
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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
4034: <i>Maritime Strike</i>	0.000	0.000	185.380	227.854	-	227.854	125.138	71.925	0.000	0.000	0.000	610.297
Quantity of RDT&E Articles		-	18	-	-	-	-	-	-	-		

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

Maritime Strike Tomahawk modernization effort provides the capability to hit moving maritime targets through mid-course guidance via a third party or seeker mode, to a terminal seeker area of uncertainty.

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

	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<b>Title:</b> Maritime Strike Tomahawk	0.000	185.380	227.854	0.000	227.854
<b>Articles:</b>	-	18	-	-	-
<b>FY 2019 Plans:</b>					
Continuation of activities in support of Maritime Strike Tomahawk (MST). Effort includes development of system requirements, specifications, and interfaces; integration of seeker suites, culminating in a mature hardware design with software algorithm preliminary design architecture. Continue Tactical Tomahawk Weapons Control System (TTWCS), Theater Mission Planning Center (TMPC), and missile software development; captive carriage flights and sensor capture events, and lab and component-level testing. Award contract for integration and test. Commence integration and testing of mature hardware design with software functionality qualification of hardware and software, missile Operationally Embedded Software (OES) software development, laboratory development of Modeling and Simulation capabilities in the lab for missile performance and algorithm maturity, and simulation updates. In addition, procure (18) Engineering Development Models (EDMs) for the purpose of parallel testing and reducing risk while allowing for procurement of hardware components required to build kits for full system end to end testing in FY 2020.					
<b>FY 2020 Base Plans:</b>					
Continuation of activities in support of Maritime Strike Tomahawk (MST). Effort includes integration of seeker suites and mature software algorithm code. Software functionality qualification; establish validation and verification procedures through data collection. Missile OES software development continues, laboratory development of Modeling and Simulation capabilities in the lab for missile performance and algorithm maturity; simulation updates. Develop interfaces through SPAWAR to support data quality infrastructure.					
Build-up of Trailblazer Engineering Development Model for Functional Ground test and design verification test parameters. Hardware qualification of system and subsystems/components. Early developmental captive					

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4034 / <i>Maritime Strike</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>
<p>flight tests and simulations to refine software algorithm performance. Establish Hardware-in-the-Loop (HWIL) capability and associated test and support equipment. Refine Modeling and Simulation capability through software performance enhancements. Continue TTWCS and missile software development. Continue development of logistics, training, and installation products. Develop and conduct transition to production requirements, telemeter products, develop kitting requirements and containers. Begin development of procedures for induction to recertification line, acceptance test procedures, and automated test equipment. Commence end to end system testing.</p> <p><b>FY 2020 OCO Plans:</b> N/A</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 to FY 2020 increase is due to the acceleration of seeker integration and software design and coding efforts in FY 2020. These efforts include ground launches, flight test readiness review, earlier ground launches, earlier hardware qualification of system and subsystems / components, earlier Flight Software Build 1, and earlier System of System Testing (Modeling and Simulation) supporting ground launch and sensor test runs that refine sensor software algorithm performance. These accelerated activities support an Initial Operational Capability (IOC) of 4Q FY 2022.</p>					
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	185.380	227.854	0.000	227.854

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020 Base</u>	<u>FY 2020 OCO</u>	<u>FY 2020 Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• WPN 2101: <i>Tomahawk</i>	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• OPN 5253: <i>Tomahawk Support Equipment</i>	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN 9120: <i>Initial and Vendor Direct Spares</i>	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN 6120: <i>Spares and Repair Parts</i>	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

**Remarks**

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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 0204229N / Tomahawk Mssn Planning Ctr	Project (Number/Name) 4034 / Maritime Strike

**D. Acquisition Strategy**

Maritime Strike Tomahawk (MST) will enable surface warfare engagement capability from U.S. Navy Guided Missile Cruiser (CG), Guided Missile Destroyer (DDG), and Nuclear Powered Fast Attack Submarine (SSN) platforms. MST was designated a DoDI 5000.02 Rapid Deployment Capability (RDC) by the Assistant Secretary of the Navy (Research, Development, and Acquisition) (ASN (RDA)) in Oct 2016. Initial Operational Capability (IOC) will occur in FY 2022 following a Quick Reaction Assessment (QRA) and characterization of operational performance. This strategy affords the program flexibility in achieving a threshold capability in a timely manner. Following IOC, further procurements will comply with DoDI 5000.02 as a program of record. The MST program includes upgrades to the All-Up Round (AUR) missile, Tactical Tomahawk Weapons Control System (TTWCS) and Theater Mission Planning Center (TMPC).

**E. Performance Metrics**

The Navy seeks to improve the Tomahawk cruise missile attack capability against maritime targets through research and development.

Examples in the area of the All-Up-Round include development of a seeker that will enhance weapon ability to cover all assigned target types in line with state of the art technology.

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4034 / Maritime Strike
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<b>Product Development (\$ 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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
Maritime Strike - AUR	SS/CPPIF	Raytheon : Tucson, AZ	0.000	0.000		124.175	Dec 2018	183.688	Dec 2019	-		183.688	0.000	307.863	-
Maritime Strike - AUR	WR	NAWCWD : China Lake, CA	0.000	0.000		20.330	Nov 2018	9.500	Nov 2019	-		9.500	0.000	29.830	-
Maritime Strike- TTWCS	SS/CPFF	LMVF : Valley Forge, PA	0.000	0.000		9.090	Dec 2018	0.750	Dec 2019	-		0.750	0.000	9.840	-
Maritime Strike- TTWCS	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		6.250	Nov 2018	6.250	Nov 2019	-		6.250	0.000	12.500	-
Maritime Strike- TTWCS	WR	NUWC-DN : Newport, RI	0.000	0.000		1.060	Nov 2018	0.750	Nov 2019	-		0.750	0.000	1.810	-
<b>Subtotal</b>			0.000	0.000		160.905		200.938		-		200.938	0.000	361.843	N/A

**Remarks**

FY 2020 Maritime Strike funding includes the integration of seeker suites and mature software algorithm code. The procurement of developmental low rate production assets. Develop and conduct transition to production requirements, telemeter products, develop kitting requirements and containers. Begin development of procedures for induction to recertification line, acceptance test procedures, and automated test equipment.

<b>Support (\$ 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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
Maritime Strike Development Support	WR	NAWC-WD : China Lake	0.000	0.000		3.400	Nov 2018	3.461	Nov 2019	-		3.461	0.000	6.861	-
Maritime Strike Development Support	SS/CPFF	UARC APL : Laurel, MD	0.000	0.000		0.521	Dec 2018	0.530	Dec 2019	-		0.530	0.000	1.051	-
Maritime Strike Development Support	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.500	Nov 2018	0.835	Nov 2019	-		0.835	0.000	1.335	-
Maritime Strike Development Support	WR	NAWC-AD : Pax River, MD	0.000	0.000		1.910	Nov 2018	2.500	Nov 2019	-		2.500	0.000	4.410	-
Maritime Strike Development Support	WR	NSWC-PHD : Port Hueneme, CA	0.000	0.000		1.580	Nov 2018	1.608	Nov 2019	-		1.608	0.000	3.188	-

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4034 / Maritime Strike
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<b>Support (\$ 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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
Maritime Strike Development Support	C/CPFF	SSC : San Diego, CA	0.000	0.000		3.920	Dec 2018	0.750	Dec 2019	-		0.750	0.000	4.670	-
Maritime Strike Development Support	WR	SPAWAR : San Diego, CA	0.000	0.000		2.980	Dec 2018	3.000	Dec 2019	-		3.000	0.000	5.980	-
Maritime Strike Development Support	C/FFP	TBD : Dahlgren, VA	0.000	0.000		2.105	Dec 2018	2.143	Dec 2019	-		2.143	0.000	4.248	-
Maritime Strike Development Support	C/CPFF	TBD : Newport, RI	0.000	0.000		0.383	Dec 2018	0.385	Dec 2019	-		0.385	0.000	0.768	-
Maritime Strike Development Support	Various	Various : Various	0.000	0.000		2.952	Dec 2018	3.005	Dec 2019	-		3.005	0.000	5.957	-
<b>Subtotal</b>			0.000	0.000		20.251		18.217		-		18.217	0.000	38.468	N/A

**Remarks**  
Decrease from FY19 to FY20 due to reduction in Contractor Support Services

<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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
Maritime Strike Test and Evaluation	WR	NAWC-WD : China Lake	0.000	0.000		3.133	Nov 2018	6.449	Nov 2019	-		6.449	0.000	9.582	-
Maritime Strike Test and Evaluation	WR	NAWC-AD : Pax River	0.000	0.000		0.841	Nov 2018	1.500	Nov 2019	-		1.500	0.000	2.341	-
Maritime Strike Test and Evaluation	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.250	Nov 2018	0.750	Nov 2019	-		0.750	0.000	1.000	-
<b>Subtotal</b>			0.000	0.000		4.224		8.699		-		8.699	0.000	12.923	N/A

**Remarks**  
FY 2020 Test and Evaluation Maritime Strike funding required to develop Operationally Embedded Software (OES) development Build-up of Trailblazer Engineering Development Model for Functional Ground test and design verification test parameters. Hardware qualification of the seeker suite. Early developmental captive flight tests and simulations to refine software algorithm performance. Establish HWIL capability and associated test and support equipment. Continue TTWCS and missile software development.

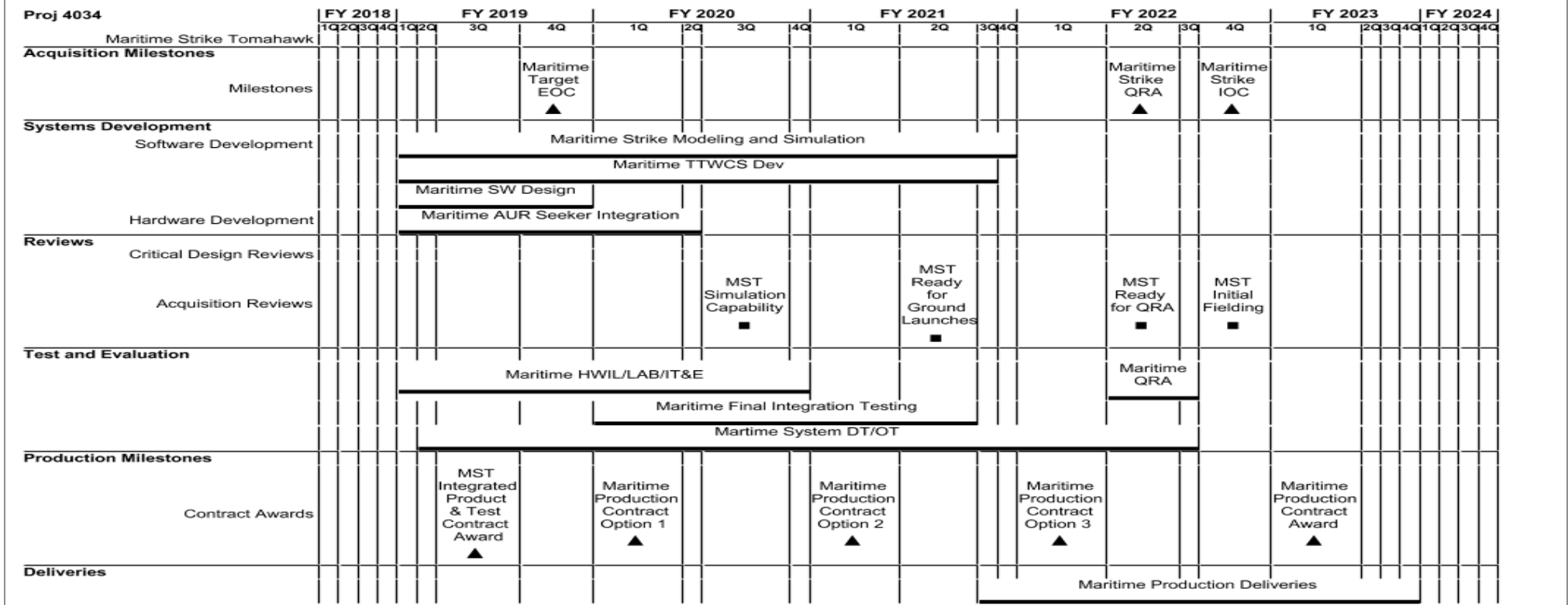




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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4034 / Maritime Strike
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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 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4034 / <i>Maritime Strike</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 4034</b>				
Acquisition Milestones: Milestones: Maritime Target Capability Early Operational Capability	4	2019	4	2019
Acquisition Milestones: Milestones: Maritime Strike Initial Operational Capability	4	2022	4	2022
Acquisition Milestones: Milestones: Maritime Strike QRA	2	2022	2	2022
Systems Development: Software Development: Maritime Strike Modeling and Simulation	1	2019	4	2021
Systems Development: Software Development: Maritime Strike- TTWCS Development	1	2019	3	2021
Systems Development: Software Development: Maritime Strike Software Design	1	2019	4	2019
Systems Development: Hardware Development: Maritime Strike - AUR Seeker Integration	1	2019	2	2020
Reviews: Acquisition Reviews: Maritime Strike Simulation Capability	3	2020	3	2020
Reviews: Acquisition Reviews: Maritime Strike Ready for Ground Launches	2	2021	2	2021
Reviews: Acquisition Reviews: Maritime Strike Ready for QRA	2	2022	2	2022
Reviews: Acquisition Reviews: Maritime Strike Initial Fielding	4	2022	4	2022
Test and Evaluation: Maritime Strike - HWIL/LAB/Integration Testing	1	2019	4	2020
Test and Evaluation: Maritime Strike QRA	2	2022	3	2022
Test and Evaluation: Maritime Strike Final Integration Testing	1	2020	2	2021
Test and Evaluation: Maritime Strike Testing	2	2019	3	2022
Production Milestones: Contract Awards: MST Integrated Product & Test Contract Award	3	2019	3	2019
Production Milestones: Contract Awards: Maritime Strike Production Contract Award LRIP-1	1	2020	1	2020

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2020 Navy **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4034 / <i>Maritime Strike</i>
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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
Production Milestones: Contract Awards: Maritime Strike Production Contract Award LRIP-2	1	2021	1	2021
Production Milestones: Contract Awards: Maritime Strike Production Contract Award LRIP-3	1	2022	1	2022
Production Milestones: Contract Awards: Maritime Strike Production Contract Award	1	2023	1	2023
Deliveries: Maritime Strike Production Deliveries	3	2021	4	2023

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Navy **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4035 / JMEWS
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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
4035: JMEWS	0.000	0.000	17.031	41.226	-	41.226	45.543	37.021	21.487	31.298	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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

The Joint Multiple-Effects Warhead System (JMEWS) ACAT III program enables the Tactical Tomahawk to utilize multiple lethal effects to address Hard and Deeply Buried Targets (HDBT) while increasing the Tomahawk Weapon System (TWS) capabilities against Integrated Air Defense Systems (IADS) and Weapons of Mass Destruction (WMD).

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

	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
<b>Title:</b> JMEWS	0.000	17.031	41.226	0.000	41.226
<b>Articles:</b>	-	-	-	-	-
<b>FY 2019 Plans:</b> JMEWS planned activities include completion of the fuze risk reduction efforts, and completing Milestone B to enter the Engineering and Manufacturing Development phase. Fuze risk reduction will culminate in sled testing. Initial Engineering and Manufacturing Design (EMD) efforts include continuation of hardware and software development, performing fuze and warhead integration, performing subscale testing required to improve lethality modeling capabilities, and system engineering reviews. Update Tomahawk Test and Evaluation Master Plan.					
<b>FY 2020 Base Plans:</b> JMEWS planned activities include the Engineering and Manufacturing Development phase. Initial Engineering and Manufacturing Design (EMD) efforts include continuation of hardware and software development, performing fuze and warhead integration, performing subscale testing required to improve lethality modeling capabilities, system engineering reviews and several Safety Review Boards.					
<b>FY 2020 OCO Plans:</b> N/A					
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 to FY 2020 increase due to transition of the program into the Engineering Manufacturing and Development Phase.					
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	17.031	41.226	0.000	41.226

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</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 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4035 / JMEWS
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**C. Other Program Funding Summary (\$ in Millions)**

Line Item	FY 2018	FY 2019	FY 2020	FY 2020	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Cost To	
			Base	OCO	Total					Complete	Total Cost
• WPN 2101: <i>Tomahawk</i>	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• OPN 5253: <i>Tomahawk Support Equipment</i>	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN 9020: <i>Initial and Vendor Direct Spares</i>	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN 6120: <i>Spares and Repair Parts</i>	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

**Remarks**

**D. Acquisition Strategy**

Joint Multiple Effects Warhead System (JMEWS) (ACAT III) acquisition strategy includes the development, integration, test, qualification and production of a new warhead that will greatly expand the land target set that the Tomahawk missile is capable of defeating, by combining the blast and fragmentation capabilities of the current warhead with a new penetration capability and improved mission planning. JMEWS will also be compliant with Insensitive Munitions requirements which improve safety during transportation and storage on land and aboard ships and submarines. JMEWS Milestone B will occur in FY 20129, Milestone C is planned for FY 2024, and the capability will Fleet Release in FY2025. JMEWS program includes upgrades to the All-Up Round (AUR) missile, Tactical Tomahawk Weapons Control System (TTWCS) and Theater Mission Planning Center (TMPC).

**E. Performance Metrics**

The Navy seeks to improve the Tomahawk cruise missile attack capability against land targets through research and development.

Examples in the area of the All-Up-Round include development of candidate warheads that will enhance weapon ability to cover all assigned target types in line with state of the art technology.

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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis: PB 2020 Navy</b>											<b>Date: March 2019</b>				
<b>Appropriation/Budget Activity</b> 1319 / 7						<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr					<b>Project (Number/Name)</b> 4035 / JMEWS				

<b>Product Development (\$ 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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
JMEWS	SS/CPFF	Raytheon : Tucson, AZ	0.000	0.000		1.680	Dec 2018	27.914	Jul 2020	-		27.914	Continuing	Continuing	Continuing
JMEWS	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.587	Nov 2018	0.000		-		0.000	Continuing	Continuing	Continuing
JMEWS	WR	NAWC-WD : China Lake, CA	0.000	0.000		8.876	Nov 2018	0.000		-		0.000	Continuing	Continuing	Continuing
JMEWS/TTWCS	SS/CPFF	LMVF : Valley Forge, PA	0.000	0.000		0.000		0.550	Dec 2019	-		0.550	0.000	0.550	-
JMEWS/TTWCS	SS/CPFF	BAE Systems : San Diego, CA	0.000	0.000		0.000		0.065	Dec 2019	-		0.065	0.000	0.065	-
JMEWS/TTWCS	SS/CPFF	LMBM : Baltimore, MD	0.000	0.000		0.000		0.685	Dec 2019	-		0.685	0.000	0.685	-
<b>Subtotal</b>			0.000	0.000		11.143		29.214		-		29.214	Continuing	Continuing	N/A

**Remarks**  
 FY 2020 JMEWS product development efforts include hardware and software development, performing fuze and warhead integration, performing subscale testing required to improve lethality modeling capabilities, system engineering reviews and several Safety Review Boards.

<b>Support (\$ 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 To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</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>			
JMEWS Development Support	SS/CPFF	UARC-APL : Laurel, MD	0.000	0.000		0.105	Nov 2018	0.337	Dec 2019	-		0.337	Continuing	Continuing	Continuing
JMEWS Development Support	WR	NSWC-IH : Indian Head, MD	0.000	0.000		0.256	Nov 2018	0.274	Nov 2019	-		0.274	Continuing	Continuing	Continuing
JMEWS Development Support	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.376	Nov 2018	0.900	Nov 2019	-		0.900	Continuing	Continuing	Continuing
JMEWS Development Support	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.000		1.500	Nov 2019	-		1.500	0.000	1.500	-
JMEWS Development Support	WR	NAWC-WD : China Lake, CA	0.000	0.000		0.149	Nov 2018	4.197	Nov 2019	-		4.197	0.000	4.346	-

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4035 / JMEWS
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
JMEWS/TTWCS Dev Support	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.735	Dec 2019	-		0.735	0.000	0.735	-
JMEWS/TTWCS VLS Dev Support	SS/CPFF	NSWC-DD : Dahlgren, VA	0.000	0.000		0.112	Dec 2018	0.960	Dec 2019	-		0.960	0.000	1.072	-
JMEWS Development Support	Various	Various : Various	0.000	0.000		0.160	Dec 2018	0.163	Dec 2019	-		0.163	Continuing	Continuing	Continuing
<b>Subtotal</b>			0.000	0.000		1.158		9.066		-		9.066	Continuing	Continuing	N/A

**Remarks**  
FY 2020 JMEWS Development Support funds government oversight efforts of the transition to the Engineering and Manufacturing Development phase, including conduct of scheduled technical reviews.

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
JMEWS T&E	WR	NAWC-WD : China Lake, CA	0.000	0.000		4.730	Nov 2018	1.705	Nov 2019	-		1.705	0.000	6.435	-
JMEWS T&E	WR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		0.656	Nov 2019	-		0.656	0.000	0.656	-
JMEWS/TTWCS T&E	WR	NUWC-NPT : Newport, RI	0.000	0.000		0.000		0.335	Nov 2019	-		0.335	0.000	0.335	-
<b>Subtotal</b>			0.000	0.000		4.730		2.696		-		2.696	0.000	7.426	N/A

**Remarks**  
FY 2020 JMEWS testing will include performing subscale testing required to improve lethality modeling capabilities, system engineering reviews and several Safety Review Boards.





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**Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4035 / JMEWS
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JMEWS	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>Acquisition Milestones</b>																														
Milestones								MS B ▲																		MS C ▲				
<b>Systems Development</b>																														
Software Development									JMEWS TTWCS SW Dev																					
Hardware Development	JMEWS FUZE RISK REDUCTION																													
									JMEWS Warhead,Fuze,Target Design Integration																					
<b>Reviews</b>																														
Critical Design Reviews																														
Acquisition Reviews									JMEWS PDR ▲					JMEWS CDR ▲																
<b>Test and Evaluation</b>																														
																	JMEWS DT				JMEWS OT									
<b>Production Milestones</b>																														
Contract Awards								JMEWS EMD Contract Award ▲																		JMEWS Long-Lead Energetics Award ▲				
Deliveries																														

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<b>Exhibit R-4A, RDT&amp;E Schedule Details: PB 2020 Navy</b>		<b>Date: March 2019</b>
<b>Appropriation/Budget Activity</b> 1319 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4035 / JMEWS

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>JMEWS</b>				
Acquisition Milestones: Milestones: Milestone B	4	2019	4	2019
Acquisition Milestones: Milestones: Milestone C	1	2024	1	2024
Systems Development: Software Development: JMEWS TTWCS SW Dev	1	2020	4	2024
Systems Development: Hardware Development: JMEWS FUZE RISK REDUCTION	3	2018	4	2019
Systems Development: Hardware Development: JMEWS Warhead,Fuze,Target Design Integration	4	2019	1	2024
Reviews: Acquisition Reviews: JMEWS PDR	3	2020	3	2020
Reviews: Acquisition Reviews: JMEWS CDR	2	2021	2	2021
Test and Evaluation: JMEWS DT	2	2021	4	2023
Test and Evaluation: JMEWS OT	1	2024	4	2024
Production Milestones: Contract Awards: JMEWS EMD Contract Award	4	2019	4	2019
Production Milestones: Contract Awards: JMEWS Long-Lead Energetics Award	1	2024	1	2024

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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 / 7					<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>				<b>Project (Number/Name)</b> 4036 / <i>TTWCS TMPC PPPI</i>			
<b>COST (\$ in Millions)</b>	<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>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
4036: <i>TTWCS TMPC PPPI</i>	0.000	0.000	23.389	17.998	-	17.998	14.000	10.165	17.868	18.226	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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

The Theater Mission Planning Center (TMPC) consists of Commercial and Government Off-The-Shelf (COTS/GOTS) software and COTS hardware. TMPC is the mission planning segment of the Tomahawk Weapon System (TWS) that provides subsystems for the precision targeting, route planning, mission distribution, and strike management of Tomahawk cruise missile missions from sites located ashore and afloat. TMPC optimizes all aspects of the Tomahawk missile mission to successfully engage a target.

TMPC provides mission planning at the theater and operational levels and is designed for high rate mission planning production responsive to national strategic, operational, and tactical requirements. TMPC develops and distributes missions; provides command information services for all variants of the Tomahawk missile; provides strike planning, execution, coordination, control and reporting, and provides Maritime Component Commanders (MCC) the capability to plan or modify conventional TWS missions. TMPC is employed in major joint combat operations and Overseas Contingency Operations. TMPC has evolved into 4 scalable configurations deployed at 189 sites: Cruise Missile Support Activities (CMSAs) (3), Tomahawk Strike Mission Planning Cells (TSMPCs) (3), Carrier Strike Groups (CSGs) (19 - 10 CVN), and Firing Units (FRUs) (145 - 88 Surface / 57 Subsurface). Additionally, TMPC is installed in Labs (6) and Training Classrooms (13) that contain various combinations of the four configurations. TMPC software development activities support new capabilities for the Tomahawk Weapon System while also decreasing mission planning time, increasing the quality and accuracy of each mission and reducing complexity. TMPC was previously referred to as Tomahawk Command and Control System (TC2S).

The Tactical Tomahawk Weapons Control System (TTWCS) provides launch capability for surface and submarine platforms. Development of the TTWCS provides a common architecture to launch the TACTOM and all variants in inventory. Development of upgrades to the TTWCS is required to meet the Department of Defense Information Technology Standards Registry, to meet FORCEnet compliance and be Internet Protocol Version 6 ready in order to remain interoperable within the Joint Service Architecture and to retain weapons system viability and usability for our Sailors. Additionally, TTWCS provides launch capability for both types of modernization efforts, A2AD (Nav/Comms) and Maritime, through an incremental approach to software and hardware upgrades. These efforts provide battle-group tactical flexibility and responsiveness while maximizing TWS wartime capability.

Pre-Planned Product Improvement (P3I) funding is required to create an integrated future strategy across the Tomahawk Weapon System. This includes identifying potential capability upgrades, advanced technologies, and new requirements resulting from target and lethality assessments, engine performance analysis, data-fusion studies, campaign planning, mission analysis, fleet experimentation and kill chain analysis. Perform nonrecurring engineering activities, systems and software development, integration and testing of capability upgrades to address emergent threats, Urgent Operational Needs (UONS), fleet gaps, and the Tomahawk Operational Readiness Document (ORD).

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4036 / <i>TTWCS TMPC PPPI</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>
<p><b>Title:</b> Theater Mission Planning Center (TMPC)</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2019 Plans:</b> Continue TWS navigation and accuracy and weapons delivery Circular Error Probable (CEP) studies and assessments necessary to ensure the TWS is properly employed; continued evaluation of TMPC design process to ensure Tomahawk missile performance characteristics are adequately modeled in TMPC; and continue evaluation of imagery formats resulting from nationally mandated architectural and format changes. Conduct A2AD navigation and communications system product acceptance testing (PAT) at the TWS level required to support the TWS Modernization program. Conduct software development and start system integration and testing of Maritime Strike Tomahawk capability. Conduct requirements definition for the TWS GPS M-Code upgrade necessary to enhance TWS GPS navigation and guidance. Conduct requirements definition and preliminary design to support TWS Joint Multiple Effects Warhead System (JMEWS) transition, demonstration and test efforts.</p> <p><b>FY 2020 Base Plans:</b> Continue evaluation of TMPC design process to ensure Tomahawk missile performance characteristics are adequately modeled in TMPC. Complete A2AD navigation and communications system testing at the TWS level required to support the TWS Modernization program. Continue coding of Maritime Strike Tomahawk capability. Complete requirements definition and preliminary design to support TWS Joint Multiple Effects Warhead System (JMEWS) transition, demonstration and test efforts.</p> <p><b>FY 2020 OCO Plans:</b> N/A</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 to FY 2020 decrease of 4.3 million is the result of completing the majority of software development and systems integration and testing of the Maritime Strike Tomahawk capability in FY 2019 prior to commencing Product Acceptance Testing (PAT) in FY 2020.</p>	0.000	20.664	16.407	0.000	16.407
	-	-	-	-	-
<p><b>Title:</b> Tactical Tomahawk Weapons Control System (TTWCS)</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2019 Plans:</b> Continue TTWCS software development efforts necessary to enable Tomahawk navigation and communications modernization. Conduct integration and functional testing for TTWCS v5.6 which includes A2AD navigation and</p>	0.000	2.725	1.591	0.000	1.591
	-	-	-	-	-

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4036 / TTWCS TMPC PPPI

<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>
<p>modernization improvements. Correct and verify software deficiencies found in segment testing and develop final software "fix-it" build for system level test events. Continue TTWCS ship test, ship certifications and prepare for operational test events. Perform nonrecurring engineering activities, systems and software development, integration and testing of capability upgrades to address emergent threats, Urgent Operational Needs (UONS), fleet gaps, and the Tomahawk Operational Readiness Document (ORD).</p> <p><b>FY 2020 Base Plans:</b> Continue TTWCS software development efforts necessary to enable Tomahawk navigation and communications modernization. Conduct integration and functional testing for TTWCS v5.6 which includes A2AD navigation and modernization improvements. Correct and verify software deficiencies found in segment testing and develop final software "fix-it" build for system level test events. Continue TTWCS ship test, ship certifications and prepare for operational test events. Perform nonrecurring engineering activities, systems and software development, integration and testing of capability upgrades to address emergent threats, Urgent Operational Needs (UONS), fleet gaps, and the Tomahawk Operational Readiness Document (ORD).</p> <p><b>FY 2020 OCO Plans:</b> N/A</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 to FY 2020 decrease of \$1.134 million due to due to reduced requirement to conduct studies to modernize Tomahawk as a result of funded Tomahawk development efforts in previous budget cycles.</p>					
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	23.389	17.998	0.000	17.998

<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>
• OPN 5253: Tomahawk Support Equipment	73.184	86.045	78.593	-	78.593	95.438	108.493	86.741	85.304	Continuing	Continuing
• OPN 9020: Initial and Vendor Direct Spares	0.311	0.365	0.095	-	0.095	0.180	0.199	0.219	0.223	Continuing	Continuing
• WPN 2101: Tomahawk	187.354	98.570	386.730	-	386.730	373.963	220.141	317.815	280.825	1,438.643	16,756.166
• WPN 6120: Spares and Repair Parts	13.518	25.096	23.801	-	23.801	19.575	18.707	22.499	22.949	Continuing	Continuing

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4036 / <i>TTWCS TMPC PPPI</i>

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u> <u>Base</u>	<u>FY 2020</u> <u>OCO</u>	<u>FY 2020</u> <u>Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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**Remarks**

**D. Acquisition Strategy**

TMPC and TTWCS require periodic hardware and software updates to maintain compliance with Information Assurance (IA) standards and maintain system relevance against emerging threats. TMPC and TTWCS segments will rely on a blend of industry and government expertise through the remaining life of the program.

**E. Performance Metrics**

In the area of the weapons control system, research and development is performed to ensure viability and usability of the system into the future, providing necessary upgrades to meet the Department of Defense Information Technology standards registry to comply with FORCEnet requirements and be Internet Protocol Version 6 ready to remain interoperable within Joint Service Architecture, in order to provide battle-group tactical flexibility and responsiveness needed to enable full wartime capability.

In the area of the TMPC, research and development is performed in order to provide scalable configurations to deploy where and as needed to provide necessary command and control, conduct development necessary to function with national and tactical imagery architectures, support new TWS capabilities, decrease mission planning time, and increase the quality and accuracy of each mission for the TWS.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy												Date: March 2019			
Appropriation/Budget Activity 1319 / 7				R-1 Program Element (Number/Name) PE 0204229N / Tomahawk Mssn Planning Ctr				Project (Number/Name) 4036 / TTWCS TMPC PPPI							
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
TMPC 7.0	SS/CPFF	Perspecta : San Jose, CA	0.000	0.000		5.675	Dec 2018	0.228	Dec 2019	-		0.228	Continuing	Continuing	Continuing
TMPC 7.0	SS/CPFF	Tapestry : St. Louis, MO	0.000	0.000		1.407	Dec 2018	0.095	Dec 2019	-		0.095	Continuing	Continuing	Continuing
TMPC 7.0	SS/CPFF	BAE Systems : San Diego, CA	0.000	0.000		1.331	Dec 2018	0.095	Dec 2019	-		0.095	Continuing	Continuing	Continuing
TMPC 7.0	SS/CPFF	Leidos : California, MD	0.000	0.000		5.703	Dec 2018	4.736	Dec 2019	-		4.736	Continuing	Continuing	Continuing
TMPC 7.0	SS/CPFF	UARC APL : Laurel, MD	0.000	0.000		0.111	Nov 2018	0.105	Nov 2019	-		0.105	Continuing	Continuing	Continuing
TMPC 7.0	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		2.323	Nov 2018	1.291	Dec 2019	-		1.291	Continuing	Continuing	Continuing
TMPC 8.0	SS/CPFF	Perspecta : San Jose, CA	0.000	0.000		0.362	Dec 2018	1.137	Dec 2019	-		1.137	Continuing	Continuing	Continuing
TMPC 8.0	SS/CPFF	Tapestry : St. Louis, MO	0.000	0.000		0.328	Nov 2018	2.029	Nov 2019	-		2.029	Continuing	Continuing	Continuing
TMPC 8.0	SS/CPFF	BAE Systems : San Diego, CA	0.000	0.000		0.328	Nov 2018	0.791	Nov 2019	-		0.791	Continuing	Continuing	Continuing
TMPC 8.0	SS/CPFF	Leidos : California, MD	0.000	0.000		0.618	Nov 2018	2.965	Nov 2019	-		2.965	Continuing	Continuing	Continuing
TMPC 8.0	SS/CPFF	UARC APL : Laurel, MD	0.000	0.000		0.084	Nov 2018	0.890	Nov 2019	-		0.890	Continuing	Continuing	Continuing
TMPC 8.0	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.277	Nov 2018	0.949	Nov 2019	-		0.949	Continuing	Continuing	Continuing
Systems Engineering - TTWCS A2AD Improvements (NAV/COMMS)	WR	NSWC : Dahlgren, VA	0.000	0.000		1.180	Dec 2018	0.641	Dec 2019	-		0.641	Continuing	Continuing	Continuing
Systems Engineering-TTWCS Software Support Activity(NAV/COMMS)	SS/CPFF	LMVF : Valley Forge, PA	0.000	0.000		0.785	Dec 2018	0.516	Dec 2019	-		0.516	Continuing	Continuing	Continuing
<b>Subtotal</b>			0.000	0.000		20.512		16.468		-		16.468	Continuing	Continuing	N/A

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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 0204229N / Tomahawk Mssn Planning Ctr	<b>Project (Number/Name)</b> 4036 / TTWCS TMPC PPPI
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<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			

**Remarks**  
 TMPC 7.0 - Implements functionality to support Maritime Strike Tomahawk. Aligns with PU 4034.  
 TMPC 8.0 - Software development and integration in FY20 implement functionality to support GPS M-Code and JMEWS. Aligns with PU 4033 and 4035.

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
TMPC 6.0	SS/CPFF	Perspecta : San Jose, CA	0.000	0.000		0.988	Dec 2018	0.508	Dec 2019	-		0.508	0.000	1.496	1.496
TMPC 6.0	SS/CPFF	Leidos : California, MD	0.000	0.000		1.129	Nov 2018	0.588	Nov 2019	-		0.588	0.000	1.717	1.717
PPPI Development Support	WR	NAWC-WD : China Lake, CA	0.000	0.000		0.760	Nov 2018	0.434	Nov 2019	-		0.434	Continuing	Continuing	Continuing
<b>Subtotal</b>			0.000	0.000		2.877		1.530		-		1.530	Continuing	Continuing	N/A

**Remarks**  
 Pre-Planned Product Improvement efforts (PPPI) required to perform nonrecurring engineering activities, systems and software development, integration and testing of capability upgrades to address emergent threats, UONS, fleet gaps, and the Tomahawk ORD.  
 TMPC 6.0 - Missile Modernization; Timeline Improvements; Communications Upgrades; deploys to all sites, IOC 4th Qtr FY20. Aligns with PU: 4032.

	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	23.389	17.998	-	17.998	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 / 7

**R-1 Program Element (Number/Name)**  
PE 0204229N / Tomahawk Mssn Planning  
Ctr

**Project (Number/Name)**  
4036 / TTWCS TMPC PPPI

TMPC, TTWCS, P3I	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>Acquisition Milestones</b>																																				
Milestones																																				
<b>Systems Development</b>																																				
Software Development					TMPC 7.0 SW Dev & Integration								TMPC 8.0 SW Dev & Integration																							
									TMPC 8.0 Requirements Definition																											
Hardware Development					TACTOM Preplanned Product Improvement (P3I)																															
<b>Reviews</b>																																				
Critical Design Reviews																																				
Acquisition Reviews																																				
Test and Evaluation					TTWCS V5.6 DT/OT												TMPC 6.0 PAT & DT/OT								TMPC 7.0 PAT & DT/OT								TMPC 8.0 PAT & DT/OT			

2020PB - 0204229N - 4036

**UNCLASSIFIED**

<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 0204229N / <i>Tomahawk Mssn Planning Ctr</i>	<b>Project (Number/Name)</b> 4036 / <i>TTWCS TMPC PPPI</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>TMPC, TTWCS, P3I</b>				
Acquisition Milestones: Milestones: TMPC 6.0 IOC	4	2020	4	2020
Acquisition Milestones: Milestones: TMPC 7.0 IOC	4	2022	4	2022
Systems Development: Software Development: TMPC 7.0 SW Dev & Integration	1	2019	4	2021
Systems Development: Software Development: TMPC 8.0 SW Dev & Integration	1	2022	1	2024
Systems Development: Software Development: TMPC 8.0 Requirements Definition	4	2019	4	2020
Systems Development: Hardware Development: TACTOM Preplanned Product Improvement (P3I)	1	2019	4	2024
Reviews: Test and Evaluation: TTWCS V5.6 Modernized Missile DT/OT	1	2019	4	2020
Reviews: Test and Evaluation: TMPC 6.0 Product Acceptance Testing (PAT) & DT/OT	1	2019	4	2020
Reviews: Test and Evaluation: TMPC 7.0 Product Acceptance Testing (PAT) & DT/OT	1	2021	4	2022
Reviews: Test and Evaluation: TMPC 8.0 Product Acceptance Testing (PAT) & DT/OT	2	2024	4	2024