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

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0204202N / DDG-1000
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,564.126	137.004	111.435	208.448	-	208.448	90.883	30.343	12.076	4.309	Continuing	Continuing
2464: <i>DD(X) Sys Design, Dev & Integration</i>	1,564.126	137.004	111.435	208.448	-	208.448	90.883	30.343	12.076	4.309	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 197

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by \$11.517 million to account for the availability of prior year execution balances.

This Program Element (PE) provides funds for development of the DDG 1000 Class of U.S. Navy surface combatants. The mission of the DDG 1000 class is to provide credible independent forward presence/deterrence and operate as an integral part of Naval, Joint or Combined Maritime Forces. DDG 1000 will establish and maintain surface and sub-surface superiority, provide local air defense, and incorporate signature reduction to operate in all threat environments. DDG 1000 will have seamless Joint Interoperability to integrate all source information for battlespace awareness and weapons direction.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	140.264	111.435	107.912	-	107.912
Current President's Budget	137.004	111.435	208.448	-	208.448
Total Adjustments	-3.260	0.000	100.536	-	100.536
• Congressional General Reductions	-	-	-	-	-
• Congressional Directed Reductions	-	-	-	-	-
• Congressional Rescissions	-	-	-	-	-
• Congressional Adds	-	-	-	-	-
• Congressional Directed Transfers	-	-	-	-	-
• Reprogrammings	-	-	-	-	-
• SBIR/STTR Transfer	-3.260	0.000	-	-	-
• Program Adjustments	0.000	0.000	99.187	-	99.187
• Rate/Misc Adjustments	0.000	0.000	1.349	-	1.349

Change Summary Explanation

FY19: -\$3.260M due to SBIR/STTR Transfer.

FY21: +100.536 due to +\$110.704M of additional funds for component shock certification, TEMP events, development of sustainment and modernization solutions to address class technical and obsolescence issues, SM-6 integration, overall combat system operability test (OCSOT), and next generation surface search radar (NGSSR).; and -\$10.168M due to the availability of prior year execution balances.

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

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0204202N / DDG-1000	Project (Number/Name) 2464 / DD(X) Sys Design, Dev & Integration
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2464: DD(X) Sys Design, Dev & Integration	1,564.126	137.004	111.435	208.448	-	208.448	90.883	30.343	12.076	4.309	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 197

A. Mission Description and Budget Item Justification

This project encompasses DDG 1000 development efforts required to deliver the Flight I DDG 1000 Class Ships. Major efforts include software requirements analysis, architectural and design code and unit testing, integration, qualification testing, and Independent Verification and Validation (IV&V) for Software Releases; execution of Integrated Power Systems (IPS) and ship control system testing and integration; Live Fire Test and Evaluation (LFT&E), Developmental Testing (DT), and Integrated Testing (IT) in support of the Test and Evaluation Master Plan (TEMP) and development of Tactical Tomahawk Weapon Control System (TTWCS) software. Funding for previous years is included in PE 0604300N and under 0204202N Project Unit 4009, Advanced Gun System (AGS), on DD(X).

Surface Strike

After a comprehensive review of Zumwalt class requirements, Navy decided in November 2017 to refocus the primary mission of the Zumwalt Class Destroyers from Land Attack to Offensive Surface Strike. The funding requested in FY 2021 President's Budget request will facilitate this change in mission and add lethal, offensive fires against targets afloat and ashore. These changes include integration of SM-6 capability, Maritime Strike Tomahawk Integration, and organic cryptologic collection equipment (SPECTRAL). In order to maintain the required radar signature, an upgrade in off-board platform communications to the Network Tactical Common Data Link (NTCDL) is also required, paired with the SPECTRAL system.

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

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product / Software Development	60.154	63.915	145.648	0.000	145.648
Articles:	-	-	-	-	-
Description: Product Development/Software Development					
FY 2020 Plans:					
Continue development of the Surface Strike with Program Design Review, Software (S/W) development, testing, and roll-out, preparing for Land Based Testing for SM-6. Preparing to support Preliminary Design Review (PDR)/Critical Design Review (CDRT) Test Readiness Review (TRR), commencing installation of the SM-6 demonstration configuration equipment, and initiating system-engineering activities for Maritime Strike Tomahawk (MST) are major milestones for ship integration for Maritime Strike Tomahawk (MST) are major milestones for ship integration. Development of a low Radar Cross Section (RCS) antenna for use with SPECTRAL to include requirements definition, CDR, PDR and preparation for testing and installation of the					

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

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>sensor for SPECTRAL. Array placement and integration efforts and procurement of initial Low Rate Initial Production (LRIP) unit for Navy Tactical Common Data Link (NTCDL) and Maritime Targeting Cell -Afloat (MTC-A) with a Phase 1 Integrated Program Review (IPR), a Request for Proposal (RFP) Release, a major test event and a software delivery.</p> <p>FY 2021 Base Plans: Continue development of the Surface Strike by certifying the SM-6 demonstration scenario, conduct of the SM-6 Mission Readiness Review (MRR) culminating in an SM-6 BLK IA proof of concept demonstration ("fire and forget" guided test vehicle) without in-flight missile support, i.e. uplinks, downlinks, and organic radar, onboard DDG 1000 in late 3rd quarter/early 4th quarter of FY21. The systems engineering process results in the Maritime Strike Tomahawk (MST) Delta System Requirements Review (SRR) scheduled in the 4th quarter of FY21. Development of a low Radar Cross Section (RCS) antenna for use with SPECTRAL to include CDR and preparation for testing and installation of the sensor for SPECTRAL. First ship install of Navy Tactical Common Data Link as well as procurement ship sets 2 and 3 of (NTCDL) and Maritime Targeting Cell - Afloat (MTC-A) with preparations for major test events aboard a DDG 1000 class ship, and a software delivery. Product development for class technical issues to include Electro-Optical / InfraRed (EO/IR) Sensors and shaft encoder.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: An increase from FY2020 to FY2021 is due to the incremental software upgrades for TTWCS that will include new communication messages and crypto keys, MST firing solution and engagement management, missile management, MST post launch, maritime track management, and training support and proof of concept demonstration will occur in FY21.</p> <p>In addition the program is developing sustainment and modernization solutions to address class technical and obsolescence issues such as EO/IR cameras, shaft encoder, propulsion motor drive controller upgrade, engineering control sytem, and cybersecurity.</p>					
<p>Title: Test and Evaluation</p> <p align="right">Articles:</p> <p>Description: Test and Evaluation Master Plan (TEMP) Execution</p> <p>FY 2020 Plans:</p>	76.850 -	47.520 -	62.800 -	0.000 -	62.800 -

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continued execution of Self Defense Test SHip (SDTS) Anti-Air Warfare events, execution of Lead ship TEMP events for Anti-Air Warfare (AAW) , Anti-Surface Warfare (ASuW), and Equipment Shock Qualification. Continued planning for Lead Ship TEMP events (AAW, ASuW, Strike Warfare, IUSW (ASW and Torpedo Defense)), execution of lead ship Combat System Ship Qualification Trials (CSSQT) events, equipment shock qualification, and planning for capability improvement, and testing IAW the CNO directed mission change to Offensive Surface Strike.					
<i>FY 2021 Base Plans:</i> Execution of Lead Ship TEMP events (AAW, ASuW, Magnetics Signature, Radar Cross Section (RCS), Integrated Undersea Warfare (IUSW) (ASW and Torpedo Defense, Strike Warfare), execution of lead ship TSST events, planning for capability improvement, and testing IAW the CNO directed mission change to Surface Strike.					
<i>FY 2021 OCO Plans:</i> N/A					
<i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> An increase to the program from FY20 to FY21 is for execution of TEMP events, component shock qualification (propulsion), capability improvement testing in accordance with the CNO directed ship mission change, and software development integration, as a result of delays in shipboard system activation, and unplanned equipment component changeouts (VLS System).					
Accomplishments/Planned Programs Subtotals	137.004	111.435	208.448	0.000	208.448

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OMN / 3B1K: <i>Specialized Skill Training</i>	3.025	3.050	12.129	-	12.129	3.192	3.247	3.311	3.378	0.000	740.997
• OPN / 0947: DDG 1000 <i>Class Support Equipment</i>	57.700	8.530	42.279	-	42.279	124.957	141.665	180.334	41.044	0.000	629.913
• OMN/15BUO: Life <i>Cycle Engineering (IWS)</i>	65.273	47.560	100.170	-	100.170	93.958	123.288	95.765	115.884	0.000	678.154
• OMN/15BR1: DDG 1000 Life <i>Cycle Engineering and Sustainment</i>	12.012	11.818	49.959	-	49.959	40.237	51.639	53.636	50.357	0.000	314.466
• SCN/2119: DDG 1000	270.965	155.944	78.205	-	78.205	25.297	29.285	0.000	0.000	0.000	13,275.637

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

<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u> <u>Base</u>	<u>FY 2021</u> <u>OCO</u>	<u>FY 2021</u> <u>Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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Remarks

D. Acquisition Strategy

In October 2010 a revised acquisition strategy had been determined that supports the DDG-1000/DDG-51 restart shipyard allocation workload Memorandum of Agreements (MOAs). Execution of the MOAs shifted primary construction of all three DDG-1000 class ships to Bath Iron Works (BIW). Award of the DDG 1001/1002 to BIW occurred in September 2011.

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

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0204202N / DDG-1000	Project (Number/Name) 2464 / DD(X) Sys Design, Dev & Integration
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Ship Integration Development Software	SS/CPAF	Raytheon : Tewksbury MA	960.391	30.387	Dec 2018	0.000		11.300	Dec 2020	-		11.300	0.000	1,002.078	-
Ship Integration Development (Prod Dev), TTWCS /ASIST	SS/CPFF	Various : Various	94.857	13.467	Dec 2018	0.000		0.000		-		0.000	0.000	108.324	-
Surface Strike	Various	Various : Various	0.000	8.300	Jan 2019	33.970	Dec 2019	52.233	Dec 2020	-		52.233	Continuing	Continuing	Continuing
Maritime Targeting Cell - Afloat	Various	Various : Various	0.000	8.000	Jan 2019	29.945	Jan 2020	59.499	Jan 2021	-		59.499	Continuing	Continuing	Continuing
Alternative Weapon System Analysis	Various	Various : Various	1.312	0.000		0.000		0.000		-		0.000	0.000	1.312	-
Cybersecurity	Various	Various : Various	0.000	0.000		0.000		6.500	Dec 2020	-		6.500	0.000	6.500	-
Product Development for Technical Issues	Various	Various : Various	0.000	0.000		0.000		16.116	Dec 2020	-		16.116	0.000	16.116	-
Subtotal			1,056.560	60.154		63.915		145.648		-		145.648	Continuing	Continuing	N/A

Remarks
Industry Day for surface strike and MTC-A was conducted in August 2018. This effort is in preparation of RFP release for development efforts beginning in FY19.

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
SDTS (ITB1-120) / PRA TB	SS/CPFF	Raytheon : Portsmouth, RI	127.299	11.300	Dec 2018	8.438	Dec 2019	7.965	Dec 2020	-		7.965	4.800	159.802	-
T&E Engineering	C/CPFF	CSC : Washington, DC	3.400	0.200	Dec 2018	0.200	Dec 2019	0.200	Dec 2020	-		0.200	0.200	4.200	-
SDTS/PRA/Integrated Test	Various	Various : Various	49.142	2.116	Nov 2018	4.018	Nov 2019	8.377	Nov 2020	-		8.377	5.411	69.064	-
Advanced Program	C/CPFF	NSMA : Arlington, VA	16.579	2.400	Nov 2018	3.853	Feb 2020	2.986	Mar 2021	-		2.986	2.400	28.218	-
Maritime Targeting Cell - Afloat	TBD	TBD : TBD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Eng/M&S/Cert Agents	WR	NSWC : Dahlgren, VA	8.327	0.244	Nov 2018	0.412	Nov 2019	1.456	Nov 2020	-		1.456	0.200	10.639	-

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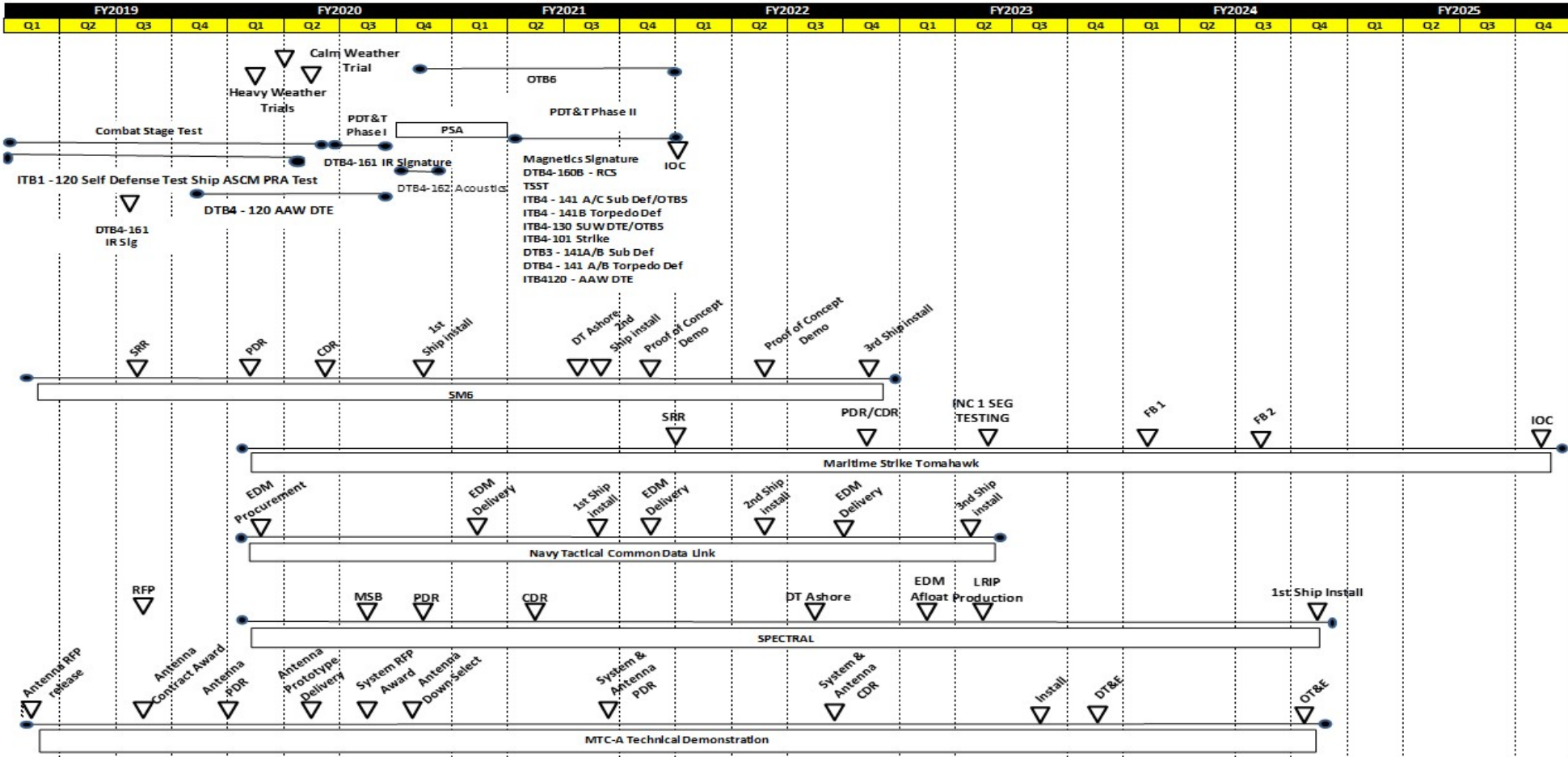
Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

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Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Integrated Test	WR	NSWC : Bethesda, MD	16.947	2.450	Nov 2018	2.169	Nov 2019	0.000		-		0.000	1.825	23.391	-
HM&E Systems	WR	NSWC : Philadelphia, PA	0.850	0.000		0.000		0.000		-		0.000	0.125	0.975	-
SDTS/PRA/Test Bed/ ESSM Engagement	Various	Various : Various	11.264	0.000		0.000		0.000		-		0.000	0.000	11.264	-
Threat Assesment/IR	C/CPIF	NRL : Washington, DC	1.400	1.320	Dec 2018	0.525	Dec 2019	0.550	Dec 2020	-		0.550	1.800	5.595	-
SDTS	WR	SCSC : Wallops, Is, VA	5.903	0.000		0.000		0.000		-		0.000	0.000	5.903	-
LFT&E	C/CPIF	ROI : Mullica Hills, NJ	7.950	0.000		0.000		0.000		-		0.000	0.000	7.950	-
ITB3/ITB4/OPEVAL	Various	Various : Various	16.092	12.983	Nov 2018	10.536	Nov 2019	6.919	Nov 2020	-		6.919	14.800	61.330	-
Integration and Testing	Various	Various : Various	11.953	0.599	Dec 2018	0.000		0.000		-		0.000	0.024	12.576	-
T&E Engineering	WR	COTF : Norfolk, VA.	12.447	2.110	Dec 2018	0.704	Dec 2019	2.700	Dec 2020	-		2.700	2.634	20.595	-
Int Test/Undersea Warfare	WR	Various : Various	0.747	0.000		0.000		0.000		-		0.000	0.000	0.747	-
TTWCS	C/CPIF	NAVAIR : Not Specified	2.100	1.805	Mar 2019	1.805	Apr 2020	2.597	Mar 2021	-		2.597	3.600	11.907	-
Sonobouys	TBD	NAVAIR : Not Specified	0.000	0.300	Dec 2018	0.000		0.000		-		0.000	0.650	0.950	-
LRLAP Test Article Procurement ITB3/ITB4 (EMD)	C/CPIF	BAE : Minneapolis, MN	54.064	0.000		0.000		0.000		-		0.000	0.000	54.064	-
LFT&E Engineering	C/CPIF	ROI : Mullica Hills, NJ	35.252	0.600	Dec 2018	0.400	Dec 2019	0.400	Dec 2020	-		0.400	0.600	37.252	-
ESSM/SM2 Procurement	C/CPIF	Raytheon : Tucson, AZ	39.538	0.000		0.000		0.000		-		0.000	0.000	39.538	-
MOE Test Bed	WR	NUWC : Various	3.229	8.515	Nov 2018	4.646	Nov 2019	7.411	Nov 2020	-		7.411	1.657	25.458	-
Component Shock Qualification	WR	Various : Various	5.693	21.000	Nov 2018	1.307	Oct 2019	16.000	Oct 2020	-		16.000	21.000	65.000	-
SDTS and Integrated Test	Various	PEO IWS : Washington, DC	67.505	7.408	Nov 2018	5.565	Nov 2019	1.226	Nov 2020	-		1.226	9.298	91.002	-

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy	Date: February 2020	
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0204202N / DDG-1000	Project (Number/Name) 2464 / DD(X) Sys Design, Dev & Integration



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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0204202N / DDG-1000	Project (Number/Name) 2464 / DD(X) Sys Design, Dev & Integration

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 2464				
Conduct ITB1 - SDTS	1	2019	2	2020
Combat Stage Test	1	2019	2	2020
Post Delivery Test & Trials Phase I	2	2020	3	2020
PSA	4	2020	1	2021
Post Delivery Test & Trials Phase II	2	2021	4	2021
IOC	4	2021	4	2021
OTB6	4	2020	4	2021
Heavy Weather Trials 1	1	2020	1	2020
Heavy Weather Trials 2	2	2020	2	2020
Calm Weather Trials 1	1	2020	2	2020
TSST	4	2021	4	2021
DTB4-161 IR Signature	3	2019	3	2019
DTB4-162 Acoustics	4	2019	4	2019
DTB4-120 AAW	3	2020	4	2020
DTB3-141A/B Sub Def, DTB4-141 A/B Torpedo Def, DTB4-130 SUW	2	2021	3	2021
Magnetics, ITB4-120 AAW DTE/OTB5, ITB4-141 A/C Sub Def/OTB5, ITB4-141B Torpedo Def, ITB4-130 SUW DTE/OTB5, ITB4-101 Strike, OTB5 AAW and ASW	2	2021	4	2021
SM6	1	2019	4	2022
Maritime Strike Tomahawk	1	2020	4	2025
Navy Tactical Common Data Link	1	2020	2	2023
SPECTRAL	1	2020	4	2024
MTC-A Technical Demonstration	1	2019	4	2024