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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 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,388.183	36.864	16.934	32.178	-	32.178	82.206	96.503	40.871	77.067	Continuing	Continuing
3096: <i>Littoral Combat Ship</i>	1,328.889	16.458	8.781	30.781	-	30.781	80.654	95.148	39.938	76.116	Continuing	Continuing
4506: <i>LCS Training</i>	49.643	10.759	1.153	1.397	-	1.397	1.552	1.355	0.933	0.951	Continuing	Continuing
9999: <i>Congressional Adds</i>	9.651	9.647	7.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.298

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 374

A. Mission Description and Budget Item Justification

The Littoral Combat Ship (LCS) Program Element (PE) provides funds for detailed design, development, construction, issue resolution, certification, integration, and testing of the Littoral Combat Ship (LCS). LCS operates with focused-mission packages that deploy manned and unmanned vehicles to execute a variety of missions, including Anti-Submarine Warfare (ASW), Surface Warfare (SUW) and Mine Countermeasures (MCM). LCS also possesses inherent capabilities, regardless of the Mission package installed, including intelligence/surveillance/reconnaissance (ISR), LCS SUW will also include Maritime Interdiction/interception Operations (MIO), Anti-Terrorism/Force Protection (AT/FP), air warfare self-defense, joint littoral mobility and logistic support for movement of personnel and supplies. This relatively small, shallow-draft, high-speed surface combatant complements the U.S. Navy's Surface Fleet by operating in environments where it is impossible or undesirable to employ larger, deeper-draft, multi-mission ships. LCS can deploy independently to overseas littoral regions or remain on station for extended periods of time either with a battle group or through a forward-basing arrangement. LCS will operate with Carrier Strike Groups, Surface Action Groups, or independently as dictated by the mission and environment. Additionally, LCS can operate cooperatively with the U.S. Coast Guard and Allies.

Beginning in FY 2021, this PE also provides funds for the design, development, engineering, implementation, and testing of the combat system modifications for Lethality and Survivability (L&S) for both LCS variants (Independence and Freedom). The L&S upgrades include the development of a common Combat Management System (CMS) and integration and testing of government furnished systems including the Gun Weapon System (GWS), Electronic Warfare (EW) system and Decoy Launching System (DLS) for both LCS Class Variant ships.

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B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	37.997	9.934	34.581	-	34.581
Current President's Budget	36.864	16.934	32.178	-	32.178
Total Adjustments	-1.133	7.000	-2.403	-	-2.403
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	7.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.133	0.000			
• Program Adjustments	0.000	0.000	-0.625	-	-0.625
• Rate/Misc Adjustments	0.000	0.000	-1.778	-	-1.778

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

Project: 9999: *Congressional Adds*

Congressional Add: *LCS Training Courseware*

Congressional Add: *Integrated fire control land-based test asset*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2019	FY 2020
	9.647	0.000
	0.000	7.000
Congressional Add Subtotals for Project: 9999	9.647	7.000
Congressional Add Totals for all Projects	9.647	7.000

Change Summary Explanation

FY19: *-\$1.133M SBIR transfer*

FY20: *+\$7.000M Congressional Add Integrated Fire Control Land Based Test Asset*

FY21: *-\$1.999M due to availability of prior year execution balances; +\$0.221M rate adjustments; -\$0.625M for other program adjustments.*

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3096: <i>Littoral Combat Ship</i>	1,328.889	16.458	8.781	30.781	-	30.781	80.654	95.148	39.938	76.116	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 374

Note

The FY 2021 funding request has been reduced by \$0.899M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The RDT&E portion of the LCS Program comprises design and development efforts required to field the LCS Class Ships, including integration with the Mission Packages (MCM, ASW and SUW) activities both pre- and post-delivery. It includes the design and development effort required to support the introduction and deployment of a Flight 0+ baseline (LCS 3/4 and Follow) with incorporation of lessons learned from the design and construction of USS FREEDOM (LCS 1) and USS INDEPENDENCE (LCS 2). Additionally, it includes design, development, issue resolution, certification and testing efforts required to support the design baseline for the six year block buy in FY10-15. This baseline will include lessons learned from the LCS 1 through LCS 4.

The LCS design and development phases include platform design and development, experimentation, ship system design and integration, hull platform testing, development of Technical Data Packages (TDPs), total ship system engineering and integration, combat systems and warfare systems certification, and planning and conduct of system testing. These efforts include procurement of combat and warfare system elements and/or simulators to support production representative testing in support of design, development, and certification efforts and ordnance in support of testing.

The RDT&E portion of LCS funding also comprises formal Developmental and Operational Assessment testing of the LCS Ships and Mission Packages. Test and Evaluation (T&E) will concentrate on verifying integration and interoperability of employed technologies and systems in the LCS seaframe designs and modular mission packages to achieve the mission capabilities and performance requirements as defined in the LCS program's Flight 0 and Flight 0+ Capabilities Development Documents (CDD). T&E functions will include the evaluation of Critical Technical Parameters (CTP), Measures of Effectiveness (MOE), Measures of Suitability (MOS), and Key Performance Parameters (KPP) for the core seaframe and the focused missions.

Beginning in FY 2021, this budget provides funds for the design, development, engineering, implementation, and testing of the combat system modifications for Lethality and Survivability (L&S) for both LCS variants (Independence and Freedom). The L&S upgrades include the development of a common Combat Management System (CMS) and integration and testing of government furnished systems including the Gun Weapon System (GWS), Electronic Warfare (EW) system, and Decoy Launching System (DLS) for both LCS Class Variants (Independence and Freedom)ships.

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

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: LCS System-of-Systems Development, Engineering & Experimentation	14.030	6.697	5.902	0.000	5.902
Articles:	-	-	-	-	-

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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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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>Description: Provides for LCS program systems engineering in support of Flight 0, Flight 0+, the FY10 Block Buy baseline design, and future procurement baseline design, development, certification, and production (including ship system design and integration); combat system and C4I design, integration, and test; aviation (manned and unmanned) integration; Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) mission package (MP) integration; logistics product development; and various systems engineering activities required to perform risk analyses of new design and production technology concepts.</p> <p>FY 2020 Plans: Provide systems engineering support for SUW DT on the INDEPENDENCE Variant. Provide systems engineering support for ASW DT, TECHEVAL and IOT&E Mission Package on the FREEDOM Variant.</p> <p>FY 2021 Base Plans: Provide systems engineering support for MCM DT, MCM TECHEVAL, ASW DT ,and ASW IOT&E on INDEPENDENCE Variant.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Decrease in funding attributable to decrease in scope of efforts.</p>					
<p>Title: LCS Test & Evaluation</p> <p align="right">Articles:</p> <p>Description: Execute formal LCS Developmental Testing and Operational Testing (DT/OT), including Live Fire Test & Evaluation (LFT&E), and procurement of T&E Ordnance. Execute DT and C4I integration and testing; aviation integration (manned and unmanned), Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) Mission Package (MP) integration.</p> <p>FY 2020 Plans: Conduct SUW DT on the INDEPENDENCE Variant. Conduct ASW DT Phase II, TECHEVAL, and IOT&E on the FREEDOM Variant. Begin planning MCM DT, TECHEVAL, and IOT&E on the INDEPENDENCE Variant.</p> <p>FY 2021 Base Plans: Conduct MCM DT, MCM TECHEVAL, ASW DT ,and ASW IOT&E on INDEPENDENCE Variant.</p> <p>FY 2021 OCO Plans:</p>	2.428	2.084	1.524	0.000	1.524
	-	-	-	-	-

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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
N/A					
<i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> Decrease in funding attributable to decrease in scope of efforts.					
<i>Title:</i> LCS Lethality and Survivability	0.000	0.000	23.355	0.000	23.355
<i>Articles:</i>	-	-	-	-	-
<i>Description:</i> Provides engineering support to develop a common combat management system, leveraging COMBATSS-21 and a common source library, for installation on both LCS variants (Independence and Freedom). The Combat Systems baseline will be compatible with Program of Record (PoR) combat systems replacing Contractor Furnished Equipment (CFE) and integrate Over the Horizon (OTH) missile system. Funding includes logistic product development, Engineering Change Proposals (ECPs), ship structural analysis, development of an integrated test plan and cyber analysis to accomplish Risk Management Framework authorization.					
<i>FY 2020 Plans:</i> N/A					
<i>FY 2021 Base Plans:</i> Design and develop a common combat system for installation on both LCS variants (Independence and Freedom). The new baseline will interface with Program of Record Government Furnished Equipment(GFE) systems that will replace Contractor Furnished Equipment (CFE).					
<i>FY 2021 OCO Plans:</i> N/A					
<i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> Beginning in FY21, funding for LCS Lethality and Survivability provides engineering support to develop a common combat management system for both LCS variants compatible with Program of Record (PoR) combat systems replacing Contractor Furnished Equipment (CFE) and to integrate Over the Horizon (OTH) missile system.					
Accomplishments/Planned Programs Subtotals	16.458	8.781	30.781	0.000	30.781

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

Line Item	FY 2019	FY 2020	FY 2021			FY 2022	FY 2023	FY 2024	FY 2025	Cost To	
			Base	OCO	Total					Complete	Total Cost
• SCN/2127: <i>LCS Ship</i>	1,674.422	14.000	0.000	-	0.000	15.000	31.860	19.530	0.000	0.000	16,797.603
• 1604: <i>LCS In-Service Modernization</i>	0.000	0.000	0.000	31.388	31.388	63.185	66.907	87.729	85.567	Continuing	Continuing

Remarks

BLI 1604 supports Lethality and Survivability efforts on the LCS Ships

D. Acquisition Strategy

The LCS program takes an evolutionary approach to acquisition that emphasizes competition as a key to achieving affordability. Initially, two industry teams competed against each other with two distinctly different LCS designs. The decision produced two flights with a vessel from each design: Flight 0 (LCS 1 and LCS 2); and Flight 0+ (LCS 3 and out). The Flight 0+ baseline incorporates lessons learned from the design, construction, and testing of the Flight 0 ships. The Navy conducted a limited competition amongst the existing LCS industry teams or team participants for the award of a contract for the construction of a block buy of up to ten (10) LCS Flight 0+ Class ships, with an objective of competitively awarding a single contract to a single industry team.

By Acquisition Decision Memorandum of December 23, 2010, the USD (AT&L) authorized execution of an alternative acquisition strategy for the FY 2010 through FY 2015 procurement of 20 seaframes through two ten-ship block buy contracts. On December 29, 2010, the Navy awarded two contracts for block buys of up to ten ships, beginning with the award to each contractor of one FY 2010 ship and associated non-recurring engineering, the development of the Technical Data Package (TDP), core class services, and associated data. This was followed by the contractual funding of one ship to each contractor in FY 2011 and two ships each funded in FY 2012 through FY 2014.

On October 17, 2014 USD(AT&L) approved the Navy's plan to procure three ships in FY 2015 and three ships in FY 2016 by modifying the current block buy contracts. The modification to each of the block buy contracts completed the previously approved 20 ship block buy procurement and added options for two FY 2016 ships for a total of 26 LCS ships. The Navy's Acquisition strategy supported the procurement of three LCS ships in FY17, FY18, and FY19.

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

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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost 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			
L&S Product Development	SS/CPIF	LM : Moorestown, NJ	0.000	0.000		0.000		14.907	Jan 2021	-		14.907	Continuing	Continuing	Continuing
Product Development Summary	Various	Various : Various	479.868	0.000		0.000		0.000		-		0.000	0.000	479.868	-
Subtotal			479.868	0.000		0.000		14.907		-		14.907	Continuing	Continuing	N/A

Support (\$ 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			
Government Engineering Support	WR	NSWC/DD : Dahlgren, VA	72.273	2.460	Nov 2018	1.056	Nov 2019	1.374	Nov 2020	-		1.374	0.000	77.163	-
Government Engineering Support	WR	NSWC/PC : Panama City, FL	27.987	0.000		0.000		0.000		-		0.000	0.000	27.987	-
Government Engineering Support	WR	NUWC/N : Newport, RI	10.192	0.110	Nov 2018	0.122	Nov 2019	0.000		-		0.000	0.000	10.424	-
Government Engineering Support	WR	NAWC/AD : Pax River, MD	25.062	0.000		0.000		0.000		-		0.000	0.000	25.062	-
Government Engineering Support	WR	NSWC/CR : Crane, IN	17.722	0.000		0.000		0.000		-		0.000	0.000	17.722	-
Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	75.032	1.918	Nov 2018	1.105	Nov 2019	1.437	Nov 2020	-		1.437	0.000	79.492	-
Government Engineering Support	Various	Government Activities : Various	54.775	1.682	Nov 2018	1.180	Nov 2019	0.000		-		0.000	0.000	57.637	-
Contractor Engineering Support	C/CPAF	Alion/CSC : Arlington, VA	49.802	0.000		0.000		0.000		-		0.000	0.000	49.802	-
L&S Contractor Engineering Support	C/CPAF	Various : Various	24.678	1.641	Mar 2019	1.070	Mar 2020	0.798	Nov 2020	-		0.798	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.000		2.783	Oct 2020	-		2.783	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NAWC/AD : Saint Inigoes, MD	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/CR : Crane, IN	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy												Date: February 2020			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 4				PE 0603581N / Littoral Combat Ship				3096 / Littoral Combat Ship							
Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
L&S Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	Government Activities : Various	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC/CD : Bethesda, MD	14.705	2.131	Feb 2019	1.044	Nov 2019	1.373	Nov 2020	-		1.373	0.000	19.253	-
L&S Government Engineering Support	WR	NSWC/CD : Bethesda, MD	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
Government Engineering Support	WR	PEO IWS : Various	5.375	2.945	Dec 2018	1.072	Mar 2020	0.000		-		0.000	0.000	9.392	-
L&S Government Engineering Support	WR	PEO IWS : Various	0.000	0.000		0.000		1.777	Oct 2020	-		1.777	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/PHD : Port Hueneme, CA	0.000	0.000		0.000		0.490	Oct 2020	-		0.490	Continuing	Continuing	Continuing
Contractor Engineering Support	WR	General Dynamics Bath Iron Works : Bath, ME	0.933	0.000		0.000		0.000		-		0.000	0.000	0.933	-
Condition Based Maintenance	WR	NSWC/PHD : Port Hueneme, CA	5.180	0.000		0.000		0.000		-		0.000	0.000	5.180	-
Government Engineering Support	WR	NSWC/PHD : Port Hueneme, CA	0.917	1.143	Nov 2018	0.048	Nov 2019	1.718	Nov 2020	-		1.718	0.000	3.826	-
Frigate Government Engineering Support	WR	NSWC/CD : Carderock, MD	1.179	0.000		0.000		0.000		-		0.000	0.000	1.179	-
Frigate Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	0.468	0.000		0.000		0.000		-		0.000	0.000	0.468	-
Frigate Contractor Engineering Support	C/CPAF	Alion : Arlington, VA	0.973	0.000		0.000		0.000		-		0.000	0.000	0.973	-
Frigate Contractor Engineering Support	C/CPAF	Booz Allen Hamilton : McLean, VA	0.345	0.000		0.000		0.000		-		0.000	0.000	0.345	-
Subtotal			387.598	14.030		6.697		13.950		-		13.950	Continuing	Continuing	N/A

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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			
Test & Evaluation	C/CPAF	Alion/CSC : Arlington, VA	31.844	0.000		0.000		0.000		-		0.000	0.000	31.844	-
Test & Evaluation	WR	NSWC/PHD : Port Hueneme, CA	57.972	0.179	Nov 2018	0.079	Nov 2019	0.000		-		0.000	0.000	58.230	-
Test & Evaluation	WR	NSWC/PD : Philadelphia, PA	67.169	0.000		0.000		0.000		-		0.000	0.000	67.169	-
Test & Evaluation	WR	NSWC/PC : Panama City, FL	16.473	0.000		0.000		0.000		-		0.000	0.000	16.473	-
Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	14.893	0.757	Nov 2018	0.335	Nov 2019	0.342	Nov 2020	-		0.342	0.000	16.327	-
Test & Evaluation	WR	NSWC/COR : Corona, CA	18.431	0.106	Nov 2018	0.401	Nov 2019	0.000		-		0.000	0.000	18.938	-
Test & Evaluation	WR	Government Activities : Various	71.566	0.216	Mar 2019	0.096	Mar 2020	0.341	Nov 2020	-		0.341	0.000	72.219	-
Test & Evaluation	C/CPAF	LM/GD/Austal : Various	81.066	0.000		0.173	Mar 2020	0.341	Nov 2020	-		0.341	0.000	81.580	-
Test & Evaluation	WR	PEO C4I : Charleston, SC	11.562	0.000		0.000		0.000		-		0.000	0.000	11.562	-
T&E Ordnance/ Ammunition	WR	PEO IWS : Various	22.544	0.000		0.000		0.000		-		0.000	0.000	22.544	-
L&S Test & Evaluation	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.000		0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
FSST Support	WR	NAVAIR : Patuxent River, MD	4.487	0.000		0.000		0.000		-		0.000	0.000	4.487	-
Range Support	WR	NAWC/WD : Pt. Mugu, CA	3.468	0.000		0.000		0.000		-		0.000	0.000	3.468	-
Test & Evaluation	WR	NSWC/CD : Bethesda, MD	22.614	1.170	Feb 2019	1.000	Nov 2019	0.000		-		0.000	0.000	24.784	-
FSST Support	C/BA	National Science Foundation : Arlington, VA	2.671	0.000		0.000		0.000		-		0.000	0.000	2.671	-
FSST Support	C/BA	NAVFAC Atlantic : Virginia Beach, VA	0.759	0.000		0.000		0.000		-		0.000	0.000	0.759	-

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

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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 3096																												
LCS FSAR: LCS Final Survivability Assessment Report																												
ADT: Air Defense Testing for Self Defense Test Ship																												
ADST in Support of PRA Testing: Air Defense Seaframe Testing - INDEPENDENCE Variant																												
DT SUW: Surface Warfare Developmental Test - Phase I - FREEDOM Variant																												
TECHEVAL SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Technical Evaluation - FREEDOM Variant																												
ADG Degaussing: Advanced Degaussing System - FREEDOM Variant																												
AIMS Testing: Assessment and Identification of Mine Susceptibility - FREEDOM Variant																												
AMISS Testing: Advanced Mine Simulation System - FREEDOM Variant																												
VTUAV Dynamic Interface Testing: Vertical Take-off and Landing Unmanned Aerial Vehicle Dynamic Interface Testing - FREEDOM Variant																												
IOT&E SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Initial Operational Test and Evaluation - FREEDOM Variant																												
SUW DT: Surface Warfare Developmental Testing - INDEPENDENCE Variant																												

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
ASW DT: Anti-Submarine Warfare Developmental Test - FREEDOM Variant																												
ASW TECHEVAL: Anti-Submarine Warfare Technical Evaluation - FREEDOM Variant																												
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - FREEDOM Variant																												
ASW DT: Anti-Submarine Warfare Developmental Test - INDEPENDENCE Variant																												
DT MCM: Mine Countermeasures Mission Package Developmental Testing - INDEPENDENCE Variant																												
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant																												
L&S IPR 1: LCS Lethality & Survivability In Progress Review																												
MCM TECHEVAL: Mine Countermeasures Mission Package Technical Evaluation - INDEPENDENCE Variant																												
MCM IOT&E: Mine Countermeasures Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant																												
L&S IPR 2: LCS Lethality & Survivability In Progress Review																												
MCM DT: Modular Mine Countermeasure Mission Package Developmental Testing - FREEDOM Variant																												

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025							
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
L&S IPR 3: LCS Lethality & Survivability In Progress Review																																
MCM IOT&E: Modular Mine Countermeasure Mission Package Initial Operational Test and Evaluation - FREEDOM Variant																																
L&S IOT&E: LCS Lethality & Survivability Initial Operational Test and Evaluation - Both Variants																																
L&S Phase 2 TECHEVAL: LCS Lethality & Survivability Combat System Integration Analysis for Phase 2 - Both Variants																																
L&S Combat System Certification: LCS Lethality & Survivability Combat System Certification																																
L&S Combat System Test Period: LCS Lethality & Survivability Combat System Test Period																																

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 3096				
LCS FSAR: LCS Final Survivability Assessment Report	1	2019	3	2019
ADT: Air Defense Testing for Self Defense Test Ship	1	2019	1	2019
ADST in Support of PRA Testing: Air Defense Seaframe Testing - INDEPENDENCE Variant	1	2019	3	2019
DT SUW: Surface Warfare Developmental Test - Phase I - FREEDOM Variant	1	2019	1	2019
TECHEVAL SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Technical Evaluation - FREEDOM Variant	1	2019	1	2019
ADG Degaussing: Advanced Degaussing System - FREEDOM Variant	1	2019	2	2019
AIMS Testing: Assessment and Identification of Mine Susceptibility - FREEDOM Variant	1	2019	3	2019
AMISS Testing: Advanced Mine Simulation System - FREEDOM Variant	1	2019	3	2019
VTUAV Dynamic Interface Testing: Vertical Take-off and Landing Unmanned Aerial Vehicle Dynamic Interface Testing - FREEDOM Variant	1	2019	2	2019
IOT&E SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Initial Operational Test and Evaluation - FREEDOM Variant	1	2019	3	2019
SUW DT: Surface Warfare Developmental Testing - INDEPENDENCE Variant	4	2019	1	2020
ASW DT: Anti-Submarine Warfare Developmental Test - FREEDOM Variant	1	2020	2	2020
ASW TECHEVAL: Anti-Submarine Warfare Technical Evaluation - FREEDOM Variant	2	2020	3	2020
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - FREEDOM Variant	3	2020	3	2020
ASW DT: Anti-Submarine Warfare Developmental Test - INDEPENDENCE Variant	1	2021	2	2021
DT MCM: Mine Countermeasures Mission Package Developmental Testing - INDEPENDENCE Variant	2	2021	3	2021

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 3096 / <i>Littoral Combat Ship</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant	4	2021	1	2022
L&S IPR 1: LCS Lethality & Survivability In Progress Review	4	2021	4	2021
MCM TECHEVAL: Mine Countermeasures Mission Package Technical Evaluation - INDEPENDENCE Variant	4	2021	1	2022
MCM IOT&E: Mine Countermeasures Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant	1	2022	2	2022
L&S IPR 2: LCS Lethality & Survivability In Progress Review	2	2022	2	2022
MCM DT: Modular Mine Countermeasure Mission Package Developmental Testing - FREEDOM Variant	3	2022	4	2022
L&S IPR 3: LCS Lethality & Survivability In Progress Review	4	2022	4	2022
MCM IOT&E: Modular Mine Countermeasure Mission Package Initial Operational Test and Evaluation - FREEDOM Variant	1	2023	1	2023
L&S IOT&E: LCS Lethality & Survivability Initial Operational Test and Evaluation - Both Variants	2	2023	4	2023
L&S Phase 2 TECHEVAL: LCS Lethality & Survivability Combat System Integration Analysis for Phase 2 - Both Variants	3	2023	3	2023
L&S Combat System Certification: LCS Lethality & Survivability Combat System Certification	1	2024	1	2024
L&S Combat System Test Period: LCS Lethality & Survivability Combat System Test Period	1	2024	3	2024

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

Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>				Project (Number/Name) 4506 / <i>LCS Training</i>			
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
4506: <i>LCS Training</i>	49.643	10.759	1.153	1.397	-	1.397	1.552	1.355	0.933	0.951	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 374

Note

The FY 2021 funding request was reduced by \$1.100 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

As a minimally-manned ship, the LCS uses a Train-to-Qualify (T2Q)/Train-to-Certify (T2C) training process in an off-ship/shore-based virtual ship trainer environment. These simulators and blended training solutions focus on tactical, equipment operations, and maintenance training. When completely developed and procured, the LCS shore-based training capability will satisfy individual, team, unit, and force training, with an objective of meeting Capability Development Document (CDD) T2Q/T2C Key Performance Parameter (KPP) requirements.

FY 2021 funding will development upgrades of the Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. Additionally, after fielding more of the systems and courseware, out-year funding will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures, as well as test and evaluate training devices to verify compliance with requirements.

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

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: LCS Total System Training Architecture	10.759	1.153	1.397	0.000	1.397
Articles:	-	-	-	-	-
FY 2020 Plans: FY20 funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. (Additionally, after fielding these systems and courseware, RDT&E funds will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures. RDT&E funds are also used to test and evaluate training devices to verify compliance with requirements.) This funding also provides NAWC TSD program management oversight while LCS deck operations (both variants) are completed, combat systems IVSE courseware and the combat systems part task trainer efforts are continued. (NAWC TSD will continue the development of the VTUAV visual display trainer, oversee performance of the development effort, while providing additional support efforts to the program). This funding also supports continued NAVFAC efforts preparing for additional small ship homeports required by the Strategic Laydown plan.					
FY 2021 Base Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 4506 / <i>LCS Training</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>FY21 funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. Additionally, after fielding these systems and courseware, RDT&E funds will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures. RDT&E funds are also used to test and evaluate training devices to verify compliance with requirements.) This funding also provides NAWC TSD program management oversight while LCS deck operations (both variants) are completed, combat systems IVSE courseware and the combat systems part task trainer efforts are continued. (NAWC TSD will continue the development of the VTUAV visual display trainer, oversee performance of the development effort, while providing additional support efforts to the program). This funding also supports continued NAVFAC efforts preparing for additional small ship homeports required by the Strategic Laydown plan.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: The additional funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the LCS training objectives.</p>					
Accomplishments/Planned Programs Subtotals	10.759	1.153	1.397	0.000	1.397

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021 Base</u>	<u>FY 2021 OCO</u>	<u>FY 2021 Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• OPN/5664: <i>Surface Training Equipment</i>	227.791	233.175	195.033	-	195.033	128.097	82.968	85.932	78.793	Continuing	Continuing

Remarks
PEO USC funding accounts for only a portion of the OPN 5664 line.

D. Acquisition Strategy
Per the combined LCS Navy Training System Plan (NTSP), the LCS core crew training concept will meet Train to Qualify (T2Q) and Train to Certify (T2C) requirements incrementally, with expected completion in FY21. In the interim, individual qualifications for LCS crew members will be accomplished through a combination of vendor training, existing Navy training, new LCS courses and trainers that are presently online, and Under Instruction (U/I) time aboard LCS ships, prior to reporting for duty. Shore-based training requirements cannot be fully met with the interim LCS training strategy. Full realization will be achieved with the completed standup of the San Diego and Mayport, LCS Training Facilities (LTF), which include the Integrated Tactical Trainers, Bridge, Readiness Control Officer (RCO), Combat Systems and

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 4506 / <i>LCS Training</i>
Mission Package Training System (MPTS) part-task trainers, the Common Mission Package Trainer (CMPT), Mission Bay Trainer and Virtual Reality Labs to support the Train to Qualify operations and maintenance pipeline courses.		

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 4506 / <i>LCS Training</i>
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Deck/Mission Bay Courseware	C/FFP	Cubic : Orlando, FL	1.878	0.000	Nov 2018	0.150	Nov 2019	0.225	Nov 2020	-		0.225	0.000	2.253	-
Combat Systems Courseware	C/FFP	Cubic : Orlando, FL	24.262	3.914	Nov 2018	0.150	Nov 2019	0.225	Nov 2020	-		0.225	7.800	36.351	-
Eng. Training Courseware	C/FFP	Cubic : Orlando, FL	1.092	0.000		0.000		0.000		-		0.000	0.000	1.092	-
Training Development - Support	WR	NAWC/TSD : Orlando, FL	11.125	0.587	Nov 2018	0.251	Oct 2019	0.344	Oct 2020	-		0.344	Continuing	Continuing	Continuing
VTUAV/MH60	C/FFP	TBD : TBD	0.000	0.000	Mar 2019	0.178	Nov 2019	0.186	Nov 2020	-		0.186	6.270	6.634	-
Combat System Part Task Trainer	C/FP	TBD : TBD	0.000	0.000	Mar 2019	0.000		0.000		-		0.000	0.000	0.000	-
Mission Bay Trainer	C/CPAF	Cubic : Orlando, FL	0.822	0.701	Aug 2019	0.000		0.000		-		0.000	0.000	1.523	-
Subtotal			39.179	5.202		0.729		0.980		-		0.980	Continuing	Continuing	N/A

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Human Systems Integration	WR	NSWC, DD : Dahlgren Virginia	0.704	0.230	Jun 2019	0.030	Nov 2019	0.065	Nov 2020	-		0.065	Continuing	Continuing	Continuing
Information Assurance	WR	NSWC, DN : Dam Neck, VA	3.114	1.300	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Training ISEA	WR	NSWC/PHD : Port Huenum, CA	1.241	0.293	Jun 2019	0.194	Nov 2019	0.120	Nov 2020	-		0.120	Continuing	Continuing	Continuing
Warfare Center SME/ NAVFAC	WR	VARIOUS : VARIOUS	0.237	2.560	Nov 2018	0.050	Nov 2019	0.108	Nov 2020	-		0.108	Continuing	Continuing	Continuing
Subtotal			5.296	4.383		0.274		0.293		-		0.293	Continuing	Continuing	N/A

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Support	C/CPAF	Various : Various	5.168	1.174	Mar 2019	0.150	Nov 2019	0.124	Nov 2020	-		0.124	Continuing	Continuing	Continuing

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 4506 / <i>LCS Training</i>
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Proj 4506	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	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
Surface Training Advanced Virtual Environment (STAVE)																												
DECK STAVE- Development	DECK STAVE Development																											
Combat System Courseware Development	Combat System Courseware Development																											
VTUAV/MH60 Development	Contract Award ▲ VTUAV/MH60 Development																											
Training Development																												
Training Development	Training Development - Support																											
Combat System Part Task Trainer																												
	Contract Award ▲ Combat Systems Part Task Trainer - Development																											

2021PB - 0603581N - 4506

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 4506 / <i>LCS Training</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 4506				
Surface Training Advanced Virtual Environment (STAVE): DECK STAVE-Development: DECK STAVE - Development	1	2019	2	2025
Surface Training Advanced Virtual Environment (STAVE): Combat System Courseware Development: Combat System Courseware Development	1	2019	1	2024
Surface Training Advanced Virtual Environment (STAVE): VTUAV/MH60 Development: VTUAV/MH60 Contract Award	2	2020	2	2020
Surface Training Advanced Virtual Environment (STAVE): VTUAV/MH60 Development: VTUAV/MH60 Development	2	2020	4	2022
Training Development: Training Development: Training Development - Support	1	2019	4	2025
Combat System Part Task Trainer: Combat Systems Part Task Trainer - Contract Award	2	2020	2	2020
Combat System Part Task Trainer: Combat Systems Part Task Trainer - Development	2	2020	2	2022

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

Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603581N / Littoral Combat Ship				Project (Number/Name) 9999 / Congressional Adds			
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
9999: Congressional Adds	9.651	9.647	7.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.298
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add funding will be used to develop Surface Training Advanced Virtual Environment (STAVE) courseware (previously titled Immersive Virtual Ship Environment (IVSE)), and associated simulators to achieve the training objectives. Funding will continue the courseware development efforts of the LCS STAVE Deck Operations (both variants FREEDOM / INDEPENDENCE), and LCS STAVE Combat Systems Trouble Shooting Courseware (both variants FREEDOM / INDEPENDENCE). FY20 Congressional Add funding to provide an LCS Integrated Fire Control Land Based Test Asset

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2019	FY 2020
Congressional Add: LCS Training Courseware	9.647	0.000
FY 2019 Accomplishments: Continue the Courseware development efforts of the LCS STAVE Deck Operations (both FREEDOM / INDEPENDENCE variants), and LCS STAVE Combat Systems Trouble Shooting Courseware (both FREEDOM / INDEPENDENCE variants).		
FY 2020 Plans: N/A		
Congressional Add: Integrated fire control land-based test asset	0.000	7.000
FY 2019 Accomplishments: N/A		
FY 2020 Plans: Congressional add to provide LCS integrated fire control land-based test asset.		
Congressional Adds Subtotals	9.647	7.000

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

N/A

Remarks

D. Acquisition Strategy

N/A

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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Proj 9999	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	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
LCS Surface Training Advanced Virtual Environment (STAVE)																												
LCS STAVE Congressional Add																												
LCS STAVE Deck Operations Development																												
LCS STAVE Combat Systems Trouble Shooting Courseware Development																												
Integrated Fire Control Land Based Test Asset																												

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603581N / <i>Littoral Combat Ship</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 9999				
LCS Surface Training Advanced Virtual Environment (STAVE): LCS STAVE Deck Operations Development: LCS STAVE Deck Operations Development	1	2019	4	2019
LCS Surface Training Advanced Virtual Environment (STAVE): LCS STAVE Combat Systems Trouble Shooting Courseware Development: LCS STAVE Combat Systems Trouble Shooting Courseware Development	1	2019	4	2019
LCS Surface Training Advanced Virtual Environment (STAVE): Integrated Fire Control Land Based Test Asset: Integrated Fire Control Land Based Test Asset	2	2020	4	2020