Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy											Date: April 2022	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0603178N *I (U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	89.198	102.493	146.840	-	146.840	125.501	122.643	123.302	128.796	Continuing	Continuing
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	67.517	102.493	146.840	-	146.840	125.501	122.643	123.302	128.796	Continuing	Continuing
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	21.681	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.681

Note

Large Unmanned Surface Vessel (LUSV) (Proj 3066) and Unmanned Surface Vehicle (USV) Enabling Capabilities (Proj 3067) were new starts in FY 2020. FY 2020 funding in Program Element (PE) 0603502N. LUSV and USV Enabling Capabilities realigned from PE 0603502N to PE 0603178N in FY 2021.

In FY 2022, the Navy realigned funding for USV Enabling Capabilities (Proj 3067) from PE 0603178N to new PE 0605513N. Concurrent with the shift to separate Program Elements, the Navy has rebalanced the FY 2022 RDTEN profile, shifting C4I non-recurring engineering and autonomy development funding that can be applied to both the LUSV and MUSV programs into the USV Enabling Capabilities PE 0605513N. For FY2023, the Navy realigned funding for development of the Unmanned Surface Vessel Integrated Combat System Development (USV ICS) to PE 0605513N, reflecting the Navy's vision of eventually fielding the USV ICS across all unmanned surface platforms. Hardware and platform-specific USV ICS requirements for LUSV and Overlord prototypes remain in LUSV PE 0603178N.

A. Mission Description and Budget Item Justification

This Program Element provides resources for the Large Unmanned Surface Vessel (LUSV), one of the two unmanned platforms in the Navy's Future Surface Combatant Force (FSCF). This Program Element also provides resources for the Overlord research and development prototype vessels. LUSVs will provide affordable, high endurance ships able to accommodate various payloads for unmanned missions and augment the Navy's manned surface force. LUSVs will be capable of semi-autonomous operation, with operators in-the-loop or on-the-loop. USV Command and Control (C2) will be maintained via an afloat element (i.e., embarked on a United States Navy (USN) combatant/other assigned afloat asset) or via an ashore element (C2 station ashore). While MUSV (PE 0605512N) and LUSV will logically share common Government Furnished Equipment (GFE) C2 systems to support fleet integration and operations and may share other autonomy and mechanical technologies (depending on acquisition approaches), they will be primarily differentiated by size and cost driven by payload capabilities, and capacities.

LUSV is a key enabler of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to forward deploy and team with individual manned combatants or augment battle groups. LUSV will complement the Navy's manned combatant force by delivering increased readiness, capability and needed capacity at lower procurement and sustainment costs and reduced risk to sailors. While unmanned surface vehicles are new additions to the fleet units, LUSV will combine robust and proven commercial vessel specifications with existing military payloads to rapidly and affordably expand the capacity and capability of the surface fleet.

The Large Unmanned Surface Vessel (LUSV) development is supported by research and development prototype vessels (Overlord prototype vessels already purchased) intended to demonstrate successful integration of government furnished Command, Control, Communications, Computers and Intelligence (C4I), combat systems, and the reliability of automated hull, mechanical, and electrical (HM&E) systems. The program leverages years of investment and full scale demonstration

efforts in autonomy, endurance, command and control, payloads and testing from the Defense Advanced research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV), Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter (FY 2017 to FY 2021), and Office of the Secretary of Defense Strategic Capabilities Office (OSD- SCO) Ghost Fleet Overlord Large USV experimentation effort (FY 2018 - FY 2021). The combination of fleet-ready C2 solutions developed by the Ghost Fleet Overlord program and man-in-the-loop or man-on-the-loop control will reduce the risk of fleet integration of unmanned surface vehicles and allow autonomy and payload technologies to develop in parallel with fielding vehicles with standardized interfaces.

LUSV is the baseline vessel defined in the Offensive Surface Fires Analysis of Alternatives (OSF AoA). The OSF AoA examined a wide range of material solutions to determine the most appropriate vessel to deliver additional capacity to the fleet.

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	91.747	144.846	0.000	-	0.000
Current President's Budget	89.198	102.493	146.840	-	146.840
Total Adjustments	-2.549	-42.353	146.840	-	146.840
• Congressional General Reductions	-	-0.353			
• Congressional Directed Reductions	-	-42.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.549	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
• Adjustments to Budget Year	-	-	146.840	-	146.840

Change Summary Explanation

Program Changes:
Technical: N/A
Schedule: N/A
Cost:
FY 2021: -$2.549M SBIR/STTR/FTT Assessment (SBIR)
FY 2022: -$42.0M direct Congressional Reduction; -$0.353M general Congressional reduction
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FY 2023 funding increase reflects the fact that the FY 2022 President’s Budget request did not include out-year funding.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	Project (Number/Name) 3066 / *Large Unmanned Surface Vessel (LUSV)*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	67.517	102.493	146.840	-	146.840	125.501	122.643	123.302	128.796	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Large Unmanned Surface Vessel (LUSV) (Project 3066) was a new start in FY 2020. FY 2020 funding in Program Element (PE) 0603502N. Project 3066 realigned from PE 0603502N starting in FY 2021. The Navy has rebalanced the FY 2022 RDTEN profile, shifting C4I non-recurring engineering and autonomy development funding that can be applied to both the LUSV and MUSV programs into the USV Enabling Capabilities Project 3067 (Program Element 0605513N). For FY23, the Navy realigned funding for development of the Unmanned Surface Vessel Integrated Combat System Development (USV ICS) to PE 0605513N, reflecting the Navy's vision of eventually fielding the USV ICS across all unmanned surface platforms. Hardware and platform-specific USV ICS requirements for LUSV and Overlord prototype vessels remain in LUSV PE 0603178N.

A. Mission Description and Budget Item Justification

The major change between FY 2022 and FY 2023 is the delay in planned Detail Design and Construction (DD&C) for the initial production LUSV to FY 2025. The Navy instituted a comprehensive system engineering framework and supporting land and sea based prototyping plan, which will be completed prior to commencing the formal program of record and LUSV production. In support of this, the Navy has developed a holistic USV work breakdown structure (WBS) framework to help coordinate developmental and systems engineering efforts applicable across the USV portfolio and efforts that are platform-specific. The WBS categories are divided into broad key enablers, including HM&E (1.0), C4I (2.0), USV ICS (3.0), Common Control System (CCS) (4.0), autonomy (5.0), and prototyping efforts (6.0).

The supporting land and sea based prototyping plan will use the four Overlord Prototype vessels (vessels procured in FY20 will be delivered in FY22) and various land based testing facilities to mature enabling technologies and qualify representative machinery. In support of the updated developmental and prototyping plan, the Navy is aligning Detail Design and Construction for the initial production LUSVs with the risk reduction and qualification plans described in the program System Engineering Framework (Work Breakdown Structure (WBS)). In addition, the outcome of the Offensive Surface Fires Analysis of Alternatives (OSF AoA) is supporting the refinement of program requirements leading to the validation of a Capability Development Document, acquisition strategy, and timing for procurement. The Navy's new plan does not include procurement of any additional prototype vessels.

The LUSV will be capable of weeks-long deployments and trans-oceanic transits and operate aggregated with Carrier Strike Groups (CSGs), Amphibious Ready Groups (ARGs), Surface Action Groups (SAGs), and individual manned combatants. The LUSV will be capable of autonomous navigation, transit planning, and COLREGS-compliant maneuvering and will be designed with automated propulsion, electrical generation, and support systems. LUSV missions will be conducted with operators in-the-loop (with continuous or near-continuous observation or control) or on-the-loop (autonomous operation that prompts operator action/intervention from sensory input or autonomous behaviors). LUSVs with integrated payload capability and prototypes employing non-organic payloads will not be capable of autonomous payload engagement or execution of a complete detect-to-engage sequence. The vessel will be incapable of payload activation, deactivation, or engagement without the deliberate action of a remote, off-hull human operator in the command and control loop. The program will integrate current Navy combat systems programs of record

that have been adapted to enable remote monitoring and operational control from an off-hull command and control point, and will not be equipped with components that would enable payload engagement from onboard the vessel. USV Command and Control (C2) will be maintained via an afloat element (i.e., embarked on a United States Navy (USN) combatant), or via the ashore element (C2 station ashore).

The LUSV program is continuing to execute a comprehensive land and sea-based prototyping strategy to develop and deliver incremental capability increases, demonstrate key autonomy and automation enablers, and improve reliability of representative machinery. The Overlord research and development prototype vessels support this strategy by demonstrating successful integration of government furnished Command, Control, Communications, Computers and Intelligence (C4I) (WBS 2.0), combat systems (WBS 3.0), and the reliability of automated hull, mechanical, and electrical (HM&E) systems (WBS 1.0), eventually leading to a LUSV with the Unmanned Surface Vessel Integrated Combat System (USV ICS) and organic payloads. Early prototype vessels are enabling the Navy to accrue operational hours to gather data on autonomy, automation, and systems reliability, increase confidence in the man-machine team, and develop and refine unmanned concepts of operation (CONOPs) and tactics, techniques, and procedures (TTPs). The overarching LUSV development strategy views the purchase, fielding, and testing of the prototype USVs through the procurement of production USVs as a single developmental effort.

The LUSV Performance Specification that will be released under the Detail Design and Construction (DD&C) solicitation will heavily leverage the results of the prototype USV developmental effort, land based testing plan, LUSV industry design studies, and continued engagement with industry. The government-furnished C4I suite, and the USV ICS hardware and software that will be incorporated into the LUSV will be developed under the Unmanned Surface Vehicle Enabling Capabilities (PE 0605513N) (WBS 2.0 and 3.0). Non-organic payloads (e.g. CTEM) are being developed separately under other prototyping efforts and will be further developed and/or integrated into LUSV under the Enabling Capabilities project. Key combat systems, payload technologies, and enablers will continue to be developed and matured, leading to at-sea demonstrations, including a remotely commanded demonstration in FY 2023.

The Navy is also executing a comprehensive reliability plan with the intent to discover and implement reliability enhancements into USV machinery plants (WBS 1.0) as well as provide a means to qualify LUSV-representative machinery plants prior to award of the initial production LUSVs. The effort leveraged industry engagement initially started under the LUSV Studies Contract effort, assisting the Navy to determine reliability enhancements, improvements, and other potential machinery plant architectures designed to achieve LUSV operational and reliability requirements. Additionally, the Navy is executing a parallel effort to qualify the main engines for the prototype MUSV (same as on 3 of 4 Overlord prototype USVs), which concludes in FY 2023. In FY 2021, the Navy worked with the American Bureau of Shipping (ABS) to develop USV machinery plant standards, which will provide potential vendors a path to prove reliability of proposed architectures and equipment for production LUSVs.

As part of the long term reliability plan in FY 2022, the Navy extended the LUSV Studies Contracts to include government oversight of a robust and comprehensive industry-led main machinery and electrical distribution qualification plan to provide. The plan provides the opportunity to qualify representative machinery from multiple manufacturers through the execution of testing at vendor sites, ultimately providing increased flexibility and options for vendors in the competitive LUSV DD&C contract. In parallel, the Navy is continuing to test ancillary equipment and develop solutions for government-furnished engineering operations autonomy modules and machinery control systems at the Land Based Test Site at Naval Surface Warfare Center, Philadelphia.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Product Development	40.484	87.246	128.821	0.000	128.821
Articles:	-	-	-	-	-

FY 2022 Plans:

Complete OSF AoA, select the Navy's preferred alternative, and develop/refine requirements currently contained in the LUSV Top Level Requirements. Continue machinery plant and total platform reliability improvement plans, building on initial industry collaboration in FY 2020 and FY 2021, initiating plans to establish a Land Based Test Site as Naval Surface Warfare Center, Philadelphia and industry led machinery qualification efforts at multiple vendor sites (WBS 1.0). Reliability efforts in FY 2022 will be incorporated into the Performance Specification and captured in the DD&C RFP solicitation and associated artifacts (WBS 1.0). Execute test and experimentation plans, led and executed by Commander, Surface Development Squadron ONE, for the prototype USVs in the inventory to continue to develop concepts of operation and unmanned/autonomous tactics, techniques, and procedures (WBS 6.0). Provide for the sustainment and maintenance of the prototype USVs in the inventory. Refine program requirements leading to validation of a Capability Development Document.

FY 2023 Base Plans:

Continue machinery plant (main machinery and electrical distribution) qualification and reliability improvement plans, building on the efforts started under the LUSV Studies Contract. Continue site preparation and initial buildout of a LUSV shaft line, electrical distribution system, and expanded software and machinery control system lab at the Land Based Test Site as Naval Surface Warfare Center, Philadelphia (WBS 1.0). Reliability efforts in FY 2023 will be incorporated into the Performance Specification and captured in the DD&C RFP solicitation and associated artifacts (WBS 1.0). Purchase prototype USV ICS hardware for testing and demonstration from prototype USVs (WBS 3.0). Purchase P1 Payload for prototyping use on both manned and unmanned fleet assets (WBS6.0). Execute test and experimentation plans, led and executed by Commander, Surface Development Squadron ONE, for the prototype USVs in the inventory to continue to develop concepts of operation and unmanned/autonomous tactics, techniques, and procedures (WBS 6.0). Provide for the sustainment and maintenance of the prototype USVs in the inventory. Refine program requirements from the output of the OSF AoA leading to validation of a Capability Development Document.

FY 2023 OCO Plans:

N/A

FY 2022 to FY 2023 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Increase from FY 2022 to FY 2023 accounts for transfer of development of future USV ICS to the USV Enabling Capabilities Program Element (0605513N) and addition of ICS hardware procurements in the LUSV PU 3066.					
Title: Support	24.898	13.074	15.809	0.000	15.809
Articles:	-	-	-	-	-
FY 2022 Plans: Continue support to technology development and maturation efforts and the continued refinement of requirements and acquisition documentation including a Capability Development Document, SEP, TEMP, LCSP, Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan, NTSP and PPP, and all other artifacts leading up to a planned Milestone review prior to the planned DD&C award for the first production LUSV. Support all land and sea based prototyping and testing (WBS 6.0), program reliability improvement efforts, collaborating with industry and government partners to gather existing reliability data on LUSV-representative machinery plants, and develop and execute plans for qualification testing (WBS 1.0). ***FY 2023 Base Plans:*** Continue support to technology development and maturation efforts (across all WBS categories) and the continued refinement of requirements and acquisition documentation including a Capability Development Document, SEP, TEMP, LCSP, Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan, NTSP and PPP, and all other artifacts leading up to a planned Milestone review prior to the planned DD&C award for the first production LUSV. Support all land and sea based prototyping and testing (WBS 6.0), program reliability improvement efforts, collaborating with industry and government partners to gather existing reliability data on LUSV-representative machinery plants, and develop and execute plans for qualification testing (WBS 1.0). Support demonstration of the Integrated Combat System from a surface combatant in FY 2023 (WBS 1.0 and 6.0) ***FY 2023 OCO Plans:*** N/A ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Increase from FY 2022 to FY 2023 accounts for additional support necessary for Overlord prototype operations.					
Title: Management Services	2.135	2.173	2.210	0.000	2.210

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Articles:	-	-	-	-	-
FY 2022 Plans: Continue efforts carrying over from FY 2021, developing governing LUSV program acquisition and requirements documentation and supporting program developmental plans. Provide management support and oversight for the construction of the two Overlord prototypes that were procured in FY 2020. ***FY 2023 Base Plans:*** Continue efforts carrying over from FY 2021, developing governing LUSV program acquisition and requirements documentation and supporting program developmental plans. Provide management support and oversight for the four prototype USVs. ***FY 2023 OCO Plans:*** N/A ***FY 2022 to FY 2023 Increase/Decrease Statement:*** No significant change.					
Accomplishments/Planned Programs Subtotals	67.517	102.493	146.840	0.000	146.840

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
• RDTEN/0603178N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	21.681	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.681
• RDTEN/0605512N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	53.402	60.028	104.000	-	104.000	93.809	98.894	97.757	99.229	Continuing	Continuing
• RDTEN/0605513N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	170.838	181.620	-	181.620	192.885	299.182	195.298	195.827	Continuing	Continuing
• SCN/5119: *Large Unmanned Surface Vessel*	0.000	0.000	0.000	-	0.000	0.000	315.000	522.532	722.710	0.000	1,560.242

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

D. Acquisition Strategy

In FY 2020, the Navy purchased two Overlord prototype USVs as a means to mitigate technical risk and continue to generate lessons learned through testing and experimentation, as well as to further refine CONOPs and TTPs to include manned/unmanned teaming. In FY 2020, the Navy also awarded multiple LUSV Studies Contracts for a LUSV with reservations in the design to integrate future payloads, which will inform the final Performance Specification. Additionally, in FY 2020, the Navy implemented a comprehensive reliability improvement program, which will allow continuous engagement with industry to improve reliability of representative machinery plants (main engines, generators, and ancillary equipment) as well as provide a path to qualify the MUSV (and prototype USV) main engine and representative LUSV engines and generators. This effort will continue throughout the FYDP with the goal to qualify machinery plants for incorporation into the LUSV design as well as provide a set of standards for offerors to use to prove reliability. In parallel, the Navy has established a Land Based Test Site at Naval Surface Warfare Center, Philadelphia, which will serve to test ancillary equipment as well as develop and prove government furnished engineering autonomy software and machinery control systems. In PB23, the Navy delayed procurement of initial production LUSVs to FY 2025 to align with risk reduction and qualification plans as described in the program System Engineering Framework (Work Breakdown Structure (WBS)).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prototype USV Experimentation, CONOPS Development, Reliabaility Demonstration, Capstone, Underway Payload & Capability Demonstrations	Various	TBD : TBD	0.000	30.484	Nov 2020	45.546	Nov 2021	40.422	Nov 2022	-		40.422	Continuing	Continuing	Continuing
Prototype USV Operations and Support, Crew, Fuel	TBD	TBD : TBD	0.000	0.000		15.000	Nov 2021	22.520	Nov 2022	-		22.520	Continuing	Continuing	Continuing
Prototype USV Integrated Combat System HW	TBD	TBD : TBD	0.000	0.000		0.000		32.000	Dec 2022	-		32.000	0.000	32.000	-
LUSV Comprehensive Reliability Plan/Machinery Plant Qualification	TBD	TBD : TBD	0.000	0.000		18.200	Nov 2021	17.545	Nov 2022	-		17.545	Continuing	Continuing	Continuing
LUSV Studies Contracts Engineering and Reliability Studies	C/FFP	Various : Various	0.000	10.000	Nov 2020	0.000		0.000		-		0.000	10.000	20.000	-
Prototype USV 3 & 4 Contract Requirements	TBD	TBD : TBD	0.000	0.000		8.500	Nov 2021	11.300	Nov 2022	-		11.300	Continuing	Continuing	Continuing
LUSV Requirements Development	Various	TBD : TBD	0.000	0.000		0.000		5.034	Nov 2022	-		5.034	0.000	5.034	-
		Subtotal	0.000	40.484		87.246		128.821		-		128.821	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SUPSHIP, WF Center Support	WR	Various : Various	0.000	24.898	Nov 2020	13.074	Nov 2021	15.809	Nov 2022	-		15.809	Continuing	Continuing	Continuing
		Subtotal	0.000	24.898		13.074		15.809		-		15.809	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

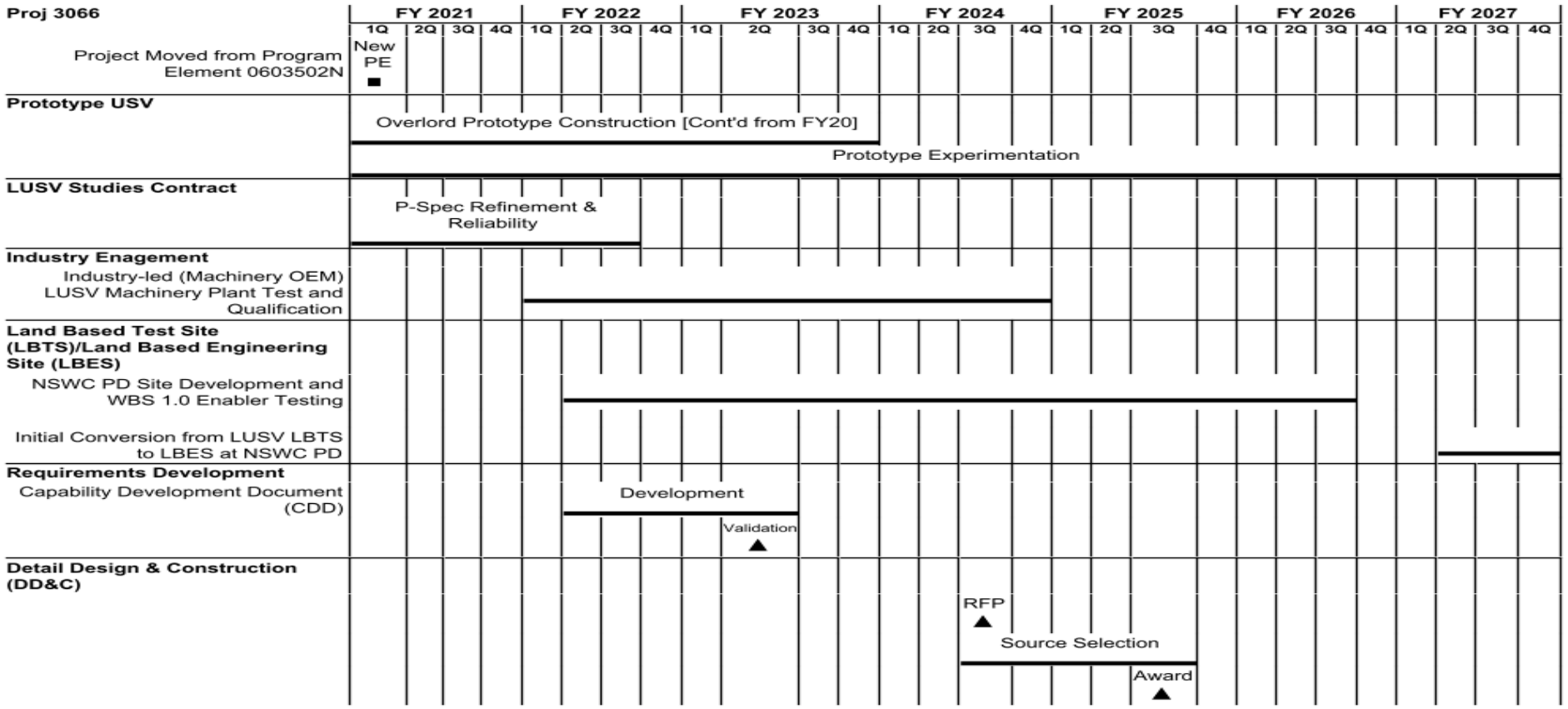
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	WR	NAVSEA : Washington, DC	0.000	0.300	Nov 2020	0.300	Nov 2021	0.300	Nov 2022	-		0.300	Continuing	Continuing	Continuing
Management Services	WR	Various : Various	0.000	1.835	Nov 2020	1.873	Nov 2021	1.910	Nov 2022	-		1.910	Continuing	Continuing	Continuing
		Subtotal	0.000	2.135		2.173		2.210		-		2.210	Continuing	Continuing	N/A

	Prior Years	FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	67.517		102.493		146.840		-		146.840	Continuing	Continuing	N/A

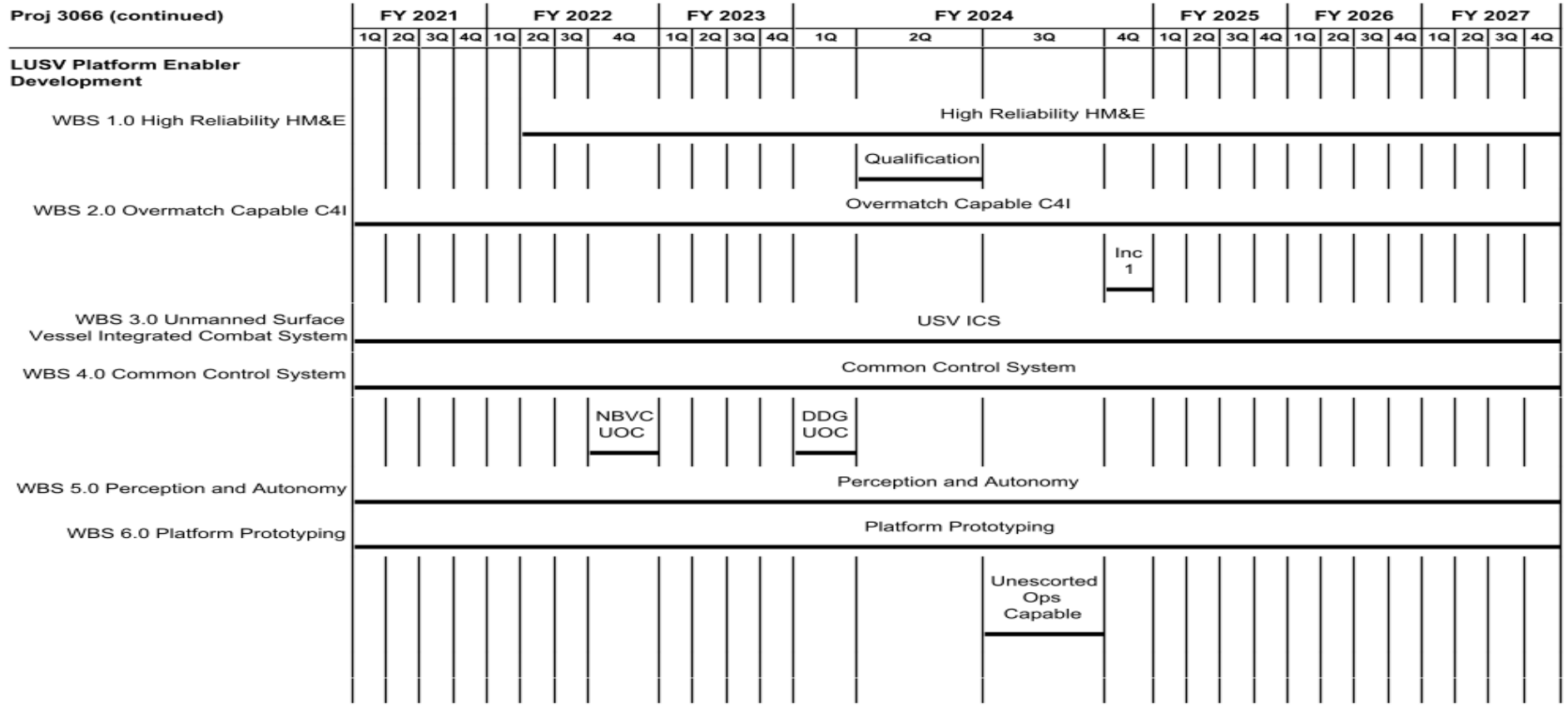
Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*



2023PB - 0603178N - 3066

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*



2023PB - 0603178N - 3066

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3066				
Project Moved from Program Element 0603502N: New PE	1	2021	1	2021
Prototype USV: Overlord Prototype Construction (options on WHS contract) [Continued from FY20]	1	2021	4	2023
Prototype USV: Prototype Experimentation	1	2021	4	2027
LUSV Studies Contract: Performance Specification Refinement and Reliability Studies	1	2021	3	2022
Industry Enagement: Industry-led (Machinery OEM) LUSV Machinery Plant Test and Qualification:	1	2022	4	2024
Land Based Test Site (LBTS)/Land Based Engineering Site (LBES): NSWC PD Site Development and WBS 1.0 Enabler Testing: NSWC PD Site Development and WBS 1.0 Enabler Testing	2	2022	3	2026
Land Based Test Site (LBTS)/Land Based Engineering Site (LBES): Initial Conversion from LUSV LBTS to LBES at NSWC PD: Initial Conversion from LUSV LBTS to LBES at NSWC PD	2	2027	4	2027
Requirements Development: Capability Development Document (CDD): CDD Development	2	2022	2	2023
Requirements Development: Capability Development Document (CDD): CDD Validation	2	2023	2	2023
Detail Design & Construction (DD&C): RFP	3	2024	3	2024
Detail Design & Construction (DD&C): Source Selection	3	2024	3	2025
Detail Design & Construction (DD&C): Award	3	2025	3	2025
Proj 3066 (continued)				
LUSV Platform Enabler Development: WBS 1.0 High Reliability HM&E: WBS 1.0 High Reliability HM&E	2	2022	4	2027

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
LUSV Platform Enabler Development: WBS 1.0 High Reliability HM&E: WBS 1.0 High Reliability HM&E: Qualification	2	2024	2	2024
LUSV Platform Enabler Development: WBS 2.0 Overmatch Capable C4I: WBS 2.0 Overmatch Capable C4I	1	2021	4	2027
LUSV Platform Enabler Development: WBS 2.0 Overmatch Capable C4I: WBS 2.0 Overmatch Capable C4I: Increment 1	4	2024	4	2024
LUSV Platform Enabler Development: WBS 3.0 Unmanned Surface Vessel Integrated Combat System: WBS 3.0 Unmanned Surface Vessel Integrated Combat System (USV ICS)	1	2021	4	2027
LUSV Platform Enabler Development: WBS 4.0 Common Control System: WBS 4.0 Common Control System	1	2021	4	2027
LUSV Platform Enabler Development: WBS 4.0 Common Control System: WBS 4.0 Common Control System: NBVC UOC	4	2022	4	2022
LUSV Platform Enabler Development: WBS 4.0 Common Control System: WBS 4.0 Common Control System: DDG UOC	1	2024	1	2024
LUSV Platform Enabler Development: WBS 5.0 Perception and Autonomy: WBS 5.0 Perception and Autonomy	1	2021	4	2027
LUSV Platform Enabler Development: WBS 6.0 Platform Prototyping: WBS 6.0 Platform Prototyping	1	2021	4	2027
LUSV Platform Enabler Development: WBS 6.0 Platform Prototyping: WBS 6.0 Platform Prototyping: Unescorted Ops Capable	3	2024	3	2024

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	Project (Number/Name) 3067 / *Unmanned Surface Vehicle Enabling Capabilities*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	21.681	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.681
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2020 funding in Program Element (PE) 0603502N. Project 3067 realigned from PE 0603502N to 0603178N in FY 2021, and from 0603178N to 0605513N in FY 2022 and future years.

A. Mission Description and Budget Item Justification

In order to accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS), the USV Enabling Capabilities project includes the development, test, and integration of USV technologies; the advancement of Defense Advanced Research Projects Agency (DARPA), Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO), Office of Naval Research (ONR) and Industry USV efforts for associated technologies, and the development and fabrication of payloads for Large Unmanned Surface Vessels (LUSVs) and Medium Unmanned Surface Vehicles (MUSVs). USV technology efforts in this project unit support the development and demonstration of autonomy, communications, USV Operations Centers, sensor and component integration for navigation compliance and reliability, data management, machinery qualification, non-combat payload feasibility, and enabling technologies for other USVs in the USV FoS, as applicable.

The Autonomy portion of this project funds efforts to standardize autonomy architecture and interfaces, develop and test low Technology Readiness Level (TRL) autonomy functions, develop and test common vessel control systems, software modeling and simulation, and employ a Secure Development and Operations (DevSecOps) software pipeline to facilitate integration and improve security. These autonomy efforts are executed under the Rapid Autonomy Integration Laboratory (RAIL) framework and include advanced development, prototyping, and demonstrations.

The Communications portion of this project funds efforts to develop, test, and demonstrate autonomous communication hardware and software. A key enabler to allow man-in-the-loop or man-on-the-loop control of the USVs and USV FoSs will be the development of an unmanned communications suite. Initial efforts have focused on the modification of existing Program of Record of PEO C4I systems. Further efforts are needed to engineer autonomous behaviors into the Navy's next generation of PEO C4I systems to meet USV operational needs. Additionally, this effort will include modification and testing of cryptographic equipment as needed to obtain the necessary approvals and certifications for use in unmanned, high-threat environments.

The USV Operations Center portion of this project will outfit and sustain land-based USV Operations Centers. These Operations Centers will allow the Fleet to control multiple USVs and multiple types of USVs simultaneously, conduct exercises, and continue CONOPS development.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

The sensor and component integration for navigation compliance and reliability portion of this project funds efforts to analyze the performance of commercial hardware/ software and integrate those sensors/components into USVs for improved performance. These funds also identify gaps in performance for future SBIRs, Department of Defense Science and Technology efforts, and industry feedback as well as establish standards of performance for future contracting actions.

The data management portion of this project will develop the data infrastructure needed to collect, store, and analyze data from the USVs in order to certify system performance, maintain and improve software, and identify sensors/components in need of further improvement.

Non-combat modular payloads employed by USVs will be developed under this Project Element. Payloads will be customized to meet Navy needs and demonstrate useful capability for the Fleet. Some examples include ISR payloads as well as persistent airborne systems that extend the C2 reach of host platforms.

In FY 2021, Technology development and maturation efforts build upon activities executed throughout FY 2020, with the goal of delivering a data management infrastructure capable of facilitating certification needs, reliability evaluations, and software development. Also in FY 2021, the Navy began the development of low Technology Readiness Level (TRL) autonomy functions, contracting actions needed for follow-on autonomy development, and experimentation with the Sea Hunter platform.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Product Development	6.751	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2022 Plans: FY 2022 Plans under PE 0605513N.					
FY 2023 Base Plans: FY 2023 Plans under PE 0605513N.					
FY 2023 OCO Plans: N/A					
Title: Support	13.017	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2022 Plans: FY 2022 Plans under PE 0605513N.					
FY 2023 Base Plans: FY 2023 Plans under PE 0605513N.					
FY 2023 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
N/A					
Title: Management Services	1.913	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2022 Plans: FY 2022 Plans under PE 0605513N.					
FY 2023 Base Plans: FY 2023 Plans under PE 0605513N.					
FY 2023 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	21.681	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
• RDTE/0605513N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	170.838	181.620	-	181.620	192.885	299.182	195.298	195.827	Continuing	Continuing
• RDTE/0603178N/3066: *Large Unmanned Surface Vessel (LUSV)*	67.517	144.846	146.840	-	146.840	125.501	122.643	123.302	128.796	Continuing	Continuing
• RDTE/0605512N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	53.402	60.028	104.000	-	104.000	93.809	98.894	97.757	99.229	Continuing	Continuing

Remarks

Project Unit 3067 USV Enabling Capabilities was transferred from PE 0603178N to PE 0605512N beginning in FY22.

D. Acquisition Strategy

USV Enabling Capabilities efforts will accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS). This will occur by leveraging efforts from the Department of Defense Research and Development Enterprise and industry for associated technologies and payloads and integrating them into USVs at the appropriate level of technical maturity. Coordination with UxS platforms will eliminate redundant efforts, encourage innovation and improve coordination of unmanned systems across multiple domains. Leveraging Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO)-developed standalone capabilities, the plan is to develop these capabilities for the initial prototype USVs and then transition those capabilities into a Program of Record USV through incremental development and integration across the funding portfolio. The Navy will accomplish efforts under USV Enabling Capabilities through existing

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

contract vehicles prepared for OSD SCO and Office of Naval Research (ONR) efforts, the USV FoS Indefinite Delivery Indefinite Quantity (IDIQ) Multiple Award Contract (MAC) which was awarded in FY 2020, the prime contract awarded for MUSV detail design and fabrication, the prime contract(s) awarded for LUSV Concept Studies, existing contracts for payload fabrication, and future contracts for further software development and maintenance.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Combat System (ICS) Integration Development	Various	TBD : TBD	0.000	0.042	Apr 2021	0.000		0.000		-		0.000	0.000	0.042	-
Elevated Sensors	C/CPIF	TBD : TBD	0.000	0.936	Apr 2021	0.000		0.000		-		0.000	0.000	0.936	-
Experimentation	WR	Various : Various	0.000	5.773	Oct 2020	0.000		0.000		-		0.000	0.000	5.773	-
		Subtotal	0.000	6.751		0.000		0.000		-		0.000	0.000	6.751	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomy	Various	Various : Various	0.000	4.755	Oct 2020	0.000		0.000		-		0.000	0.000	4.755	-
Rapid Autonomy Integration Laboratory (RAIL)	Various	Various : Various	0.000	1.300	Oct 2020	0.000		0.000		-		0.000	0.000	1.300	-
Command and Control (C2) Integration	Various	Various : Various	0.000	4.137	Oct 2020	0.000		0.000		-		0.000	0.000	4.137	-
Delta Req, RFP Dev, Evaluation	WR	Various : Various	0.000	2.500	Oct 2020	0.000		0.000		-		0.000	0.000	2.500	-
Perception	WR	Various : Various	0.000	0.325	Oct 2020	0.000		0.000		-		0.000	0.000	0.325	-
		Subtotal	0.000	13.017		0.000		0.000		-		0.000	0.000	13.017	N/A

Management Services ($ in Millions)

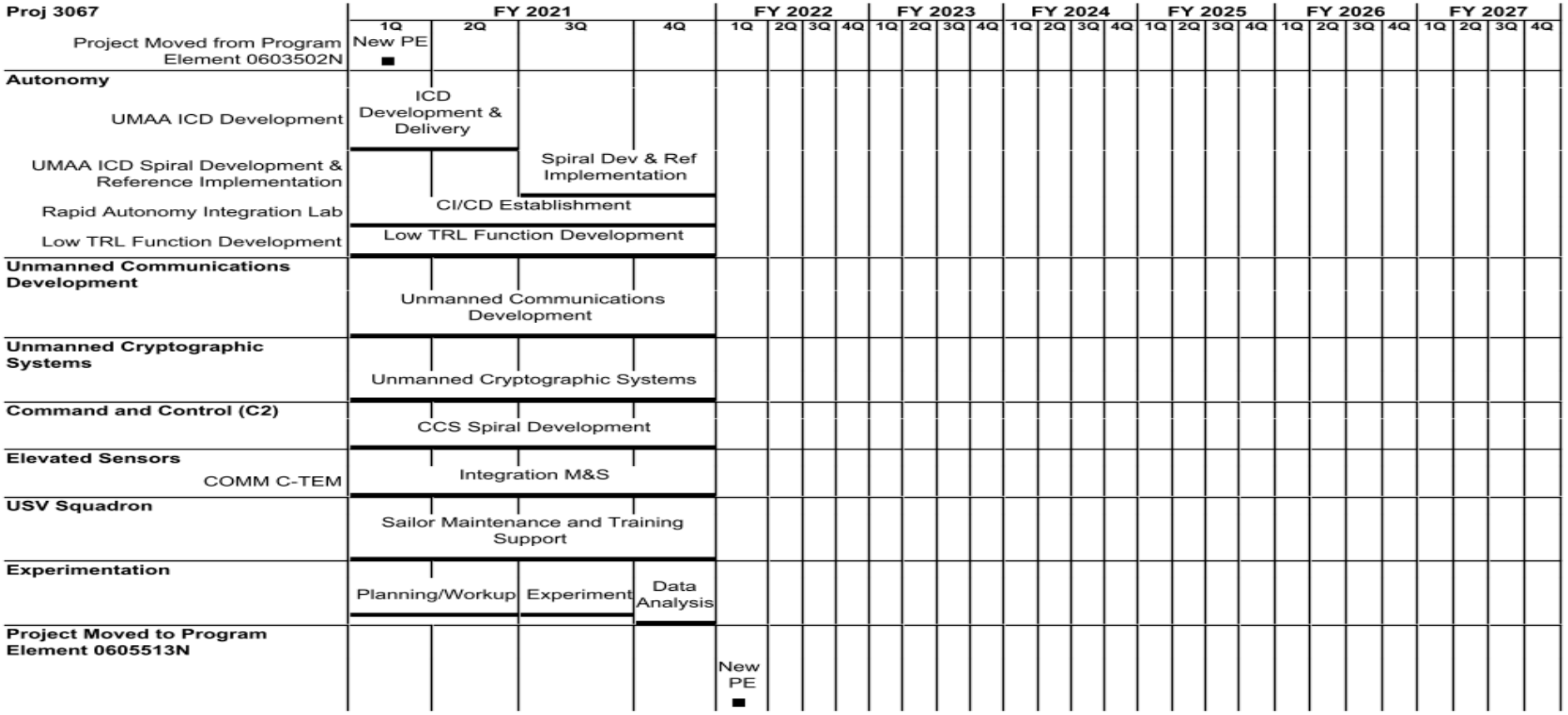
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	WR	NAVSEA : Washington, DC	0.000	1.913	Oct 2020	0.000		0.000		-		0.000	0.000	1.913	-
		Subtotal	0.000	1.913		0.000		0.000		-		0.000	0.000	1.913	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	Project (Number/Name) 3067 / *Unmanned Surface Vehicle Enabling Capabilities*	

	Prior Years	FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	21.681		0.000		0.000		-		0.000	0.000	21.681	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*



2023DON - 0603178N - 3067

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *(U)LARGE UNMANNED SURFACE VESSELS (LUSVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3067				
Project Moved from Program Element 0603502N: New PE	1	2021	1	2021
Autonomy: UMAA ICD Development: ICD Development and Delivery	1	2021	2	2021
Autonomy: UMAA ICD Spiral Development & Reference Implementation: Spiral Development and Reference Implementation	3	2021	4	2021
Autonomy: Rapid Autonomy Integration Lab: CI/CD Establishment	1	2021	4	2021
Autonomy: Low TRL Function Development: Low TRL Function Development	1	2021	4	2021
Unmanned Communications Development: Unmanned Communications Development	1	2021	4	2021
Unmanned Cryptographic Systems: Unmanned Cryptographic Systems	1	2021	4	2021
Command and Control (C2): CCS Spiral Development	1	2021	4	2021
Elevated Sensors: COMM C-TEM: Integration Modeling and Simulation	1	2021	4	2021
USV Squadron: Sailor Maintenance and Training Support	1	2021	4	2021
Experimentation: Planning/Workup	1	2021	2	2021
Experimentation: Experiment	3	2021	3	2021
Experimentation: Data Analysis	4	2021	4	2021
Project Moved to Program Element 0605513N: New PE	1	2022	1	2022