Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy											Date: May 2021	
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 MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	0.000	91.747	144.846	-	144.846	-	-	-	-	-	-
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	69.634	144.846	-	144.846	-	-	-	-	-	-
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	22.113	0.000	-	0.000	-	-	-	-	-	-

Note

FY 2020 and prior funding in Program Element (PE) 0603502N. Large Unmanned Surface Vessel (LUSV) (Project 3066) and Unmanned Surface Vehicle (USV) Enabling Capabilities (Project 3067) realigned from PE 0603502N 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. Funding for Integrated Combat System (ICS) development remains in the LUSV PE 0601378N.

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). LUSV is the material solution which will be defined in the Offensive Surface Fires Analysis of Alternatives (OSF AoA). The OSF AoA is looking at a wide range of material solutions including MUSV, LUSV and manned platforms.

The Large Unmanned Surface Vessel (LUSV) will be delivered and fielded initially as 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. 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 as 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. Fielding of LUSV will provide the Navy increased capability and necessary capacity at lower procurement and sustainment costs,

reduced risk to sailors and increased readiness by offloading missions from manned combatants. While unmanned surface vehicles are new additions to 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. Both programs benefit from 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 to FY 2021). The combination of fleet-ready C2 solutions developed by the Ghost Fleet Overlord program and initial 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.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	0.000	464.042	530.035	-	530.035
Current President's Budget	0.000	91.747	144.846	-	144.846
Total Adjustments	0.000	-372.295	-385.189	-	-385.189
• Congressional General Reductions	-	-1.953			
• Congressional Directed Reductions	-	-408.640			
• Congressional Rescissions	-	-			
• Congressional Adds	-	93.700			
• Congressional Directed Transfers	-	-55.402			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	-380.653	-	-380.653
• Rate/Misc Adjustments	0.000	0.000	-4.536	-	-4.536

Change Summary Explanation

Program Changes:
FY21: -$372.295M Total; -$1.953M congressional general reduction, -$408.640M congressional directed reductions for restoring acquisition accountability, $93.700M congressional adds for restoring acquisition accountability - program restructure, -$55.402M congressional directed transfers to MUSV new PE.
FY22: -$385.189M Total; -$380.653M other program adjustments: realignment of MUSV and USV Enabling Capabilities, re-phase and re-balance USV portfolio, -$4.536M other rate/misc. adjustments
Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy												Date: May 2021
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*				Project (Number/Name) 3066 / *Large Unmanned Surface Vessel (LUSV)*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	69.634	144.846	-	144.846	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2020 and prior 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). Funding for Integrated Combat System (ICS) development remains in the LUSV Project 3066 (PE 0603178N).

A. Mission Description and Budget Item Justification

The major change between FY 2021 and FY 2022 is that the Navy has reevaluated the LUSV program development and acquisition strategy, and has instituted a comprehensive land and sea based prototyping plan, which will be completed prior to commencing LUSV production. The 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 delaying Detail Design and Construction for the initial production LUSVs until the enabling technologies are sufficiently mature and representative machinery has been qualified. In addition, the outcome of the Offensive Surface Fires Analysis of Alternatives (OSF AoA) Navy will support the refinement of program requirements, acquisition strategy, and timing for procurement. The Navy's new plan does not include purchase of any additional prototype vessels. Finally, the Navy has developed a holistic USV funding work breakdown structure (WBS) 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), ICS (3.0), Common Control System (CCS) (4.0), autonomy (5.0), and prototyping efforts (6.0).

LUSVs will provide affordable, high endurance ships able to accommodate various payloads augmenting the Navy's manned surface force in supporting the Future Surface Combatant Force (FSCF) program and Distributed Maritime Operations (DMO) concept. In FY21, the Navy is executing OSF AoA that will explore options ranging from existing designs through conversion of commercial ships to achieve Navy and Department of Defense maritime strike requirements. While the project is titled "Large Unmanned Surface Vessel", this exhibit will describe the desired unmanned capabilities and requirements that the Navy is continuing to pursue pending outcome of the OSF AoA and for simplicity use "LUSV" as the selected platform but the technology development would be applicable to all of the material solutions that are being considered as part of the AoA. 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. If an autonomous variant from the OSF AoA is chosen by the Navy, 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

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

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). Pending outcome of the OSF AoA, 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 strategy supports research and development prototype vessels intended to demonstrate 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 Integrated Combat System (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, and continued engagement with industry. The government-furnished C4I suite that will be incorporated into the LUSV will be developed under the Unmanned Surface Vehicle Enabling Capabilities (Project 3067) (WBS 2.0). 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 from a surface combatant, in FY 2022. In FY 2020, the Navy also implemented 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 start of construction of the initial production LUSVs. The effort will leverage industry engagement under the FY 2020 - FY 2021 LUSV Studies Contract effort, which will be used to determine reliability enhancements, improvements, and other potential machinery plant architectures designed to achieve LUSV operational and reliability requirements. Additionally, the Navy executed a parallel effort to qualify the main engines for the prototype MUSV (same as on 3 of 4 prototype USVs), which will conclude in FY 2023. This effort assisted the Navy in developing plans, in concert with industry, that will carry forward to FY 2022 plans to qualify LUSV-representative machinery plants. In FY 2021, the Navy worked with the American Bureau of Shipping (ABS) to develop USV machinery plant standards, which will allow 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 will continue the comprehensive reliability plan, engaging with industry to execute a robust industry-led, with government oversight, qualification plan to provide several options and improving flexibility to potential vendors for the competitive LUSV DD&C award with potential applicability to other commercially-based ship classes such as the Light Amphibious Warship and the Next Generation Logistics Ship. The plan would seek to purchase representative machinery from multiple manufacturers and conduct qualification testing at a vendor site. In parallel, the Navy will determine the feasibility of and explore options to establish a government Land Based Engineering Site, to further develop and institute reliability enhancements to representative machinery architectures.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Product Development	0.000	42.600	129.246	0.000	129.246
Articles:	-	-	-	-	-
FY 2021 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
In FY 2021, the LUSV Contract Studies base CLIN efforts will be completed, delivering a Performance Specification which will continue to be refined, leveraging lessons learned from USV prototyping projects and collaboration with industry, government, and academia. The Navy will also execute efforts to integrate modular payloads on the two Ghost Fleet Overlord vessels procured by OSD in FY 2019 that will be transferring to the Navy in FY 2021. Technology development and maturation efforts in FY 2021 will build upon activities executed throughout FY 2020, with the goal to execute an at-sea capstone demonstration of the integrated combat system remotely from a surface combatant. Concurrently, the Navy is executing the Offensive Surface Fires Analysis of Alternatives (OSF AoA) to refine program requirements and lead to the selection of the appropriate material solution to meet Navy and Department of Defense maritime strike requirements. Lead the development, in conjunction with ABS, the development of USV machinery plant standards that will be included in all future solicitations and used as the basis for machinery plant qualification. Finally, the Navy will continue execution of a comprehensive reliability plan, which began in FY 2020, with the intent to qualify machinery plants for inclusion into the LUSV design. The plan will result in the qualification of the MUSV main engines by the middle of FY 2023 and the selection of LUSV-representative engines and generators in early FY 2022. This will be informed by the results of the OSF AoA, which will be qualified before Milestone B is obtained, with updated GFI provided to offerors under the Detail Design and Construction (DD&C) solicitation, which will be released following completion of a comprehensive land and sea based prototyping and testing plan. ***FY 2022 Base 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 (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). Continue developmental efforts started in FY 2020 and FY 2021 including development of the Integrated Combat System (ICS) (WBS 3.0). ICS work will focus on the development and delivery of the prototype hardware and software baselines that will be first tested and proven in prototype USVs, including a remote demonstration of the firing chain, commanded from a manned surface combatant in FY 2022 (WBS 3.0 and 6.0). 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					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
maintenance of the prototype USVs in the inventory. Refine program requirements leading to validation of a Capability Development Document. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase between FY 2021 as enacted to FY 2022 reflects the ramp up of land and sea based prototyping, testing ICS development, machinery qualification plans, and other risk reduction activities informing the production LUSVs. The FY 2022 budget also reflects a shift of funding for the development of government-furnished C4I system non-recurring engineering, autonomy software and laboratories, perception and sensing systems, and key enabling technologies (WBS 2.0, 4.0, and 5.0) from Project 3066 to Project 3067 in Program Element 0605513N to better align developmental efforts that can be applied to MUSV, LUSV, and future USVs.					
Title: Support ***Articles:*** ***FY 2021 Plans:*** Complete the LUSV Studies Contract effort started in FY 2020. Support development of the OSF AoA. Continue to support technology development and maturation efforts and the development of requirements and acquisition documentation. This includes initial scoping of program Milestone review artifacts including Capability Development Document, System Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan, Navy Training Systems Plan (NTSP), and Program Protection Plan (PPP). Support efforts leading to the purchase of Overlord prototypes that advance lessons learned from the Ghost Fleet Overlord project, which will serve as HM&E and combat systems/C4I test vessels and will be used to further refine TTPs and CONOPs. ***FY 2022 Base 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	0.000 -	24.898 -	13.427 -	0.000 -	13.427 -

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
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 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease from FY 2021 to FY 2022 due to completion of the LUSV Studies Contracts and OSF AoA.					
Title: Management Services ***Articles:*** ***FY 2021 Plans:*** Continue efforts started in FY 2020 which includes 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 2022 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 construction of the two Overlord prototypes that were procured in FY 2020. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase from FY 2021 to FY 2022 consistent with maintaining the existing level of support by government activities, adjusted for inflation.	0.000 -	2.136 -	2.173 -	0.000 -	2.173 -
Accomplishments/Planned Programs Subtotals	0.000	69.634	144.846	0.000	144.846

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0603502N/3066: *Large Unmanned Surface Vehicle (LUSV)*	258.620	0.000	0.000	-	0.000	-	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• SCN/5119: *Large Unmanned Surface Vessel.*	0.000	0.000	0.000	-	0.000	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

In FY 2020, the Navy purchased two 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. Also in FY 2020, the Navy awarded multiple LUSV Studies Contracts for a LUSV with reservations in the design to integrate future payloads, which will inform the final Performance Specification. Also 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. The Navy is delaying procurement of initial production LUSVs until FY 2027.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	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 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LUSV Integrated Combat System	Various	TBD : TBD	0.000	0.000		0.000		42.000	Oct 2021	-		42.000	-	-	-
Prototype USV Experimentation, CONOPS Development, Reliability Demonstration, Capstone	Various	TBD : TBD	0.000	0.000		32.600	Nov 2020	45.546	Nov 2021	-		45.546	-	-	-
Prototype USV Support	TBD	TBD : TBD	0.000	0.000		0.000		15.000	Nov 2021	-		15.000	-	-	-
LUSV Comprehensive Reliability Plan/Machinery Plant Qualification	TBD	TBD : TBD	0.000	0.000		0.000		18.200	Nov 2021	-		18.200	-	-	-
LUSV Studies Contract Engineering and Reliability Studies	C/FFP	Various : Various	0.000	0.000		10.000	Nov 2020	0.000		-		0.000	-	-	-
Prototype USV 3 & 4 Contract Requirements	TBD	TBD : TBD	0.000	0.000		0.000		8.500	Nov 2021	-		8.500	-	-	-
		Subtotal	0.000	0.000		42.600		129.246		-		129.246	-	-	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SUPSHIP, WF Center Support	WR	Various : Various	0.000	0.000		24.898	Nov 2020	13.427	Nov 2021	-		13.427	-	-	-
LUSV Source Selection	WR	Various : Various	0.000	0.000		0.000		0.000		-		0.000	-	-	-
		Subtotal	0.000	0.000		24.898		13.427		-		13.427	-	-	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**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 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	WR	NAVSEA : Washington, DC	0.000	0.000		0.300	Nov 2020	0.300	Nov 2021	-		0.300	-	-	-
Management Services	WR	Various : Various	0.000	0.000		1.836	Nov 2020	1.873	Nov 2021	-		1.873	-	-	-
		Subtotal	0.000	0.000		2.136		2.173		-		2.173	-	-	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		69.634		144.846		-		144.846	-	-	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

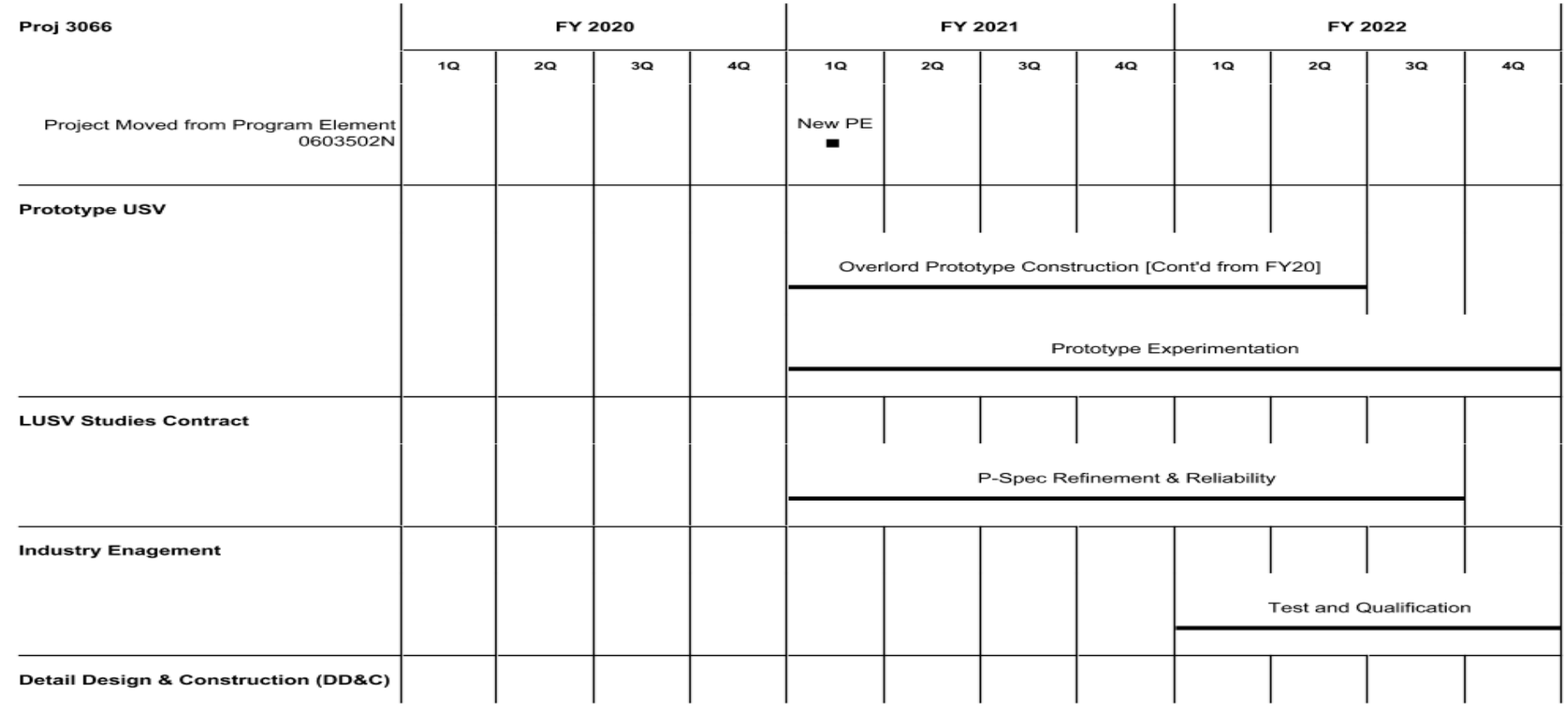

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

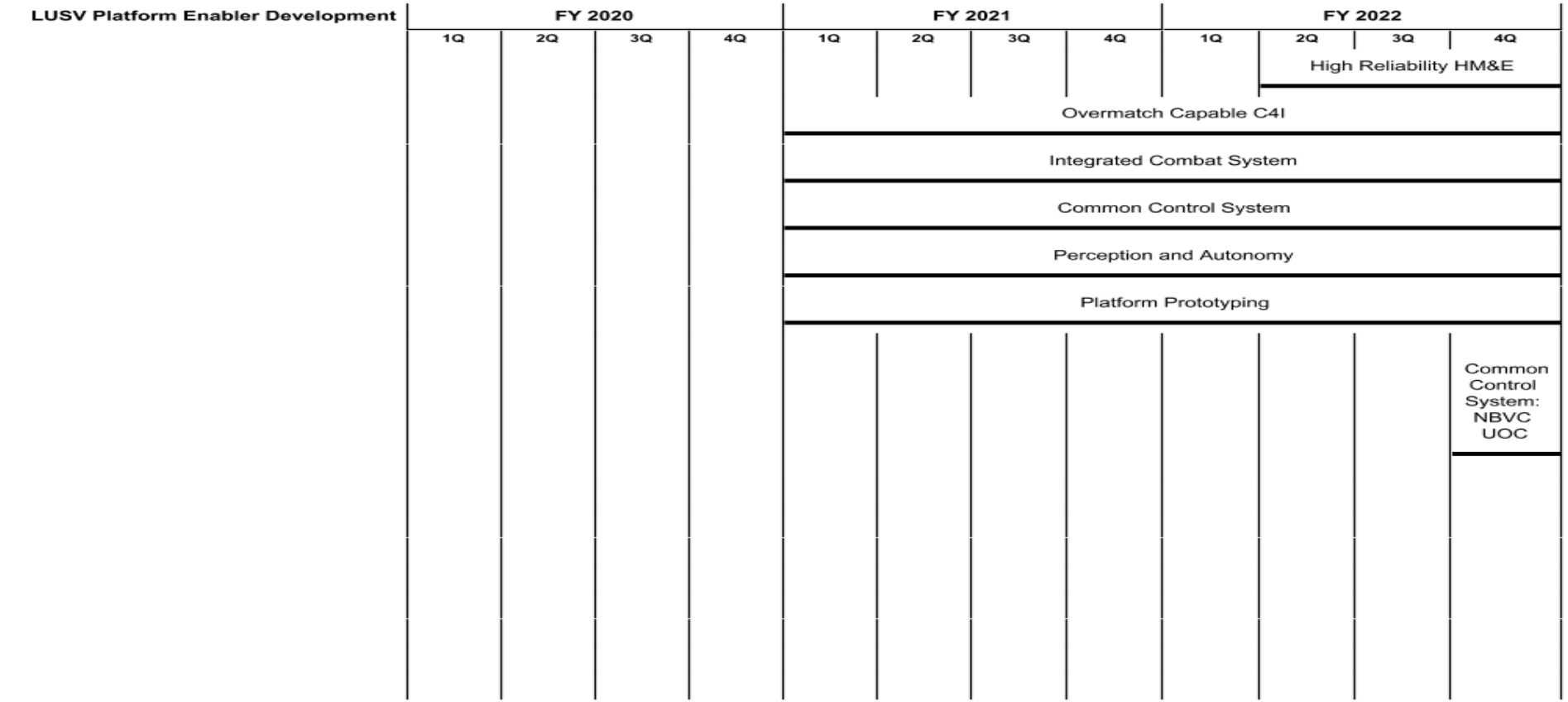

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned 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	2	2022
Prototype USV: Prototype Experimentation	1	2021	4	2022
LUSV Studies Contract: Performance Specification Refinement and Reliability Studies	1	2021	3	2022
Industry Enagement: Industry-led LUSV Machinery Plant Test and Qualification	1	2022	4	2022
LUSV Platform Enabler Development				
WBS 1.0 High Reliability HM&E	2	2022	4	2022
WBS 2.0 Overmatch Capable C4I	1	2021	4	2022
WBS 3.0 Integrated Combat System	1	2021	4	2022
WBS 4.0 Common Control System	1	2021	4	2022
WBS 5.0 Perception and Autonomy	1	2021	4	2022
WBS 6.0 Platform Prototyping	1	2021	4	2022
WBS 4.0 Common Control System: NBVC UOC	4	2022	4	2022

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy												Date: May 2021
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*				Project (Number/Name) 3067 / *Unmanned Surface Vehicle Enabling Capabilities*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	22.113	0.000	-	0.000	-	-	-	-	-	-
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.

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 Unmanned Surface Vessel 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 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Product Development	0.000	6.751	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: Continue efforts for the Future Surface Combatant Force (FSCF) strategy. Sea Hunter experimentation continued with approximately eleven on-water evolutions and Fleet interactions. Continued development of cryptographic units capable of authorized unmanned operation in high-threat environments. Begin development of low TRL autonomy functions in the areas of Mission Management and Engineering Operations. Create a data management infrastructure to collect and analyze vessel performance data. Commence demonstration of the Containerized Elevated Payload (C-TEP) prototype under Rapid Innovation fund (RIF) contract. Commence develop and finalization of the Containerized Tethered Elevated Mast (C-TEM) Request for Proposal (RFP) and source selection activities for FY 2022 contract award. Release C-TEM RFP to industry.					
FY 2022 Base Plans: FY 2022 Plans under PE 0605513N.					
FY 2022 OCO Plans: N/A					
FY 2021 to FY 2022 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Project realigned to PE 0605513N from 0603178N in FY 2022.					
Title: Support	0.000	13.449	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: Continue efforts concerning development and refinement of autonomy, common autonomy standards, interfaces, and planning for Unmanned Operations Centers (UOC). Continue the development of interface control specifications and architecture documentation, update Common Control System documentation, and support testing and design efforts. Complete any necessary plans, documents, and other artifacts to support installation and integration of the initial prototype elevated sensors. Continue to support efforts to develop the Unmanned Maritime Autonomy Architecture (UMAA) effort, starting spiral development efforts and implementation of the UMAA Interface Control Documents (ICDs). ***FY 2022 Base Plans:*** FY 2022 Plans under PE 0605513N. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Project realigned to PE 0605513N from 0603178N in FY 2022.					
Title: Management Services	0.000	1.913	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: Continue to provide oversight and management of product development and support efforts. Continue coordination with and across supporting activities (e.g., Program Executive Office (PEO) Integrated Warfare Continue coordination with and across supporting activities (e.g., PEO Integrated Warfare Systems (IWS), PEO C4I), warfare centers, labs, and industry partners to address requirements, manage funding and execute plans for the integration of MUSV payloads. Continue to develop and refine required acquisition documents and artifacts that support required capabilities managed under this project. ***FY 2022 Base Plans:*** FY 2022 Plans under PE 0605513N. ***FY 2022 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Project realigned to PE 0605513N from 0603178N in FY 2022.					
Accomplishments/Planned Programs Subtotals	0.000	22.113	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0603502N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	48.438	0.000	0.000	-	0.000	-	-	-	-	-	-

Remarks

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 Naval 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 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 contract vehicles prepared for SCO and 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 design and fabrication, the prime contract(s) awarded for LUSV Conceptual Studies, and existing contracts for payload fabrication.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	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 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Combat System (ICS) Integration Development	Various	TBD : TBD	0.000	0.000		0.042	Apr 2021	0.000		-		0.000	-	-	-
Elevated Sensors	C/CPIF	TBD : TBD	0.000	0.000		0.936	Apr 2021	0.000		-		0.000	-	-	-
Experimentation	WR	Various : Various	0.000	0.000		5.773	Oct 2020	0.000		-		0.000	-	-	-
		Subtotal	0.000	0.000		6.751		0.000		-		0.000	-	-	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomy	Various	Various : Various	0.000	0.000		4.987	Oct 2020	0.000		-		0.000	-	-	-
Rapid Autonomy Integration Laboratory (RAIL)	Various	Various : Various	0.000	0.000		1.300	Oct 2020	0.000		-		0.000	-	-	-
Command and Control (C2) Integration	Various	Various : Various	0.000	0.000		4.337	Oct 2020	0.000		-		0.000	-	-	-
Delta Req, RFP Dev, Evaluation	WR	Various : Various	0.000	0.000		2.500	Oct 2020	0.000		-		0.000	-	-	-
Perception	WR	Various : Various	0.000	0.000		0.325	Oct 2020	0.000		-		0.000	-	-	-
		Subtotal	0.000	0.000		13.449		0.000		-		0.000	-	-	N/A

Management Services ($ in Millions)

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

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
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	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		22.113		0.000		-		0.000	-	-	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

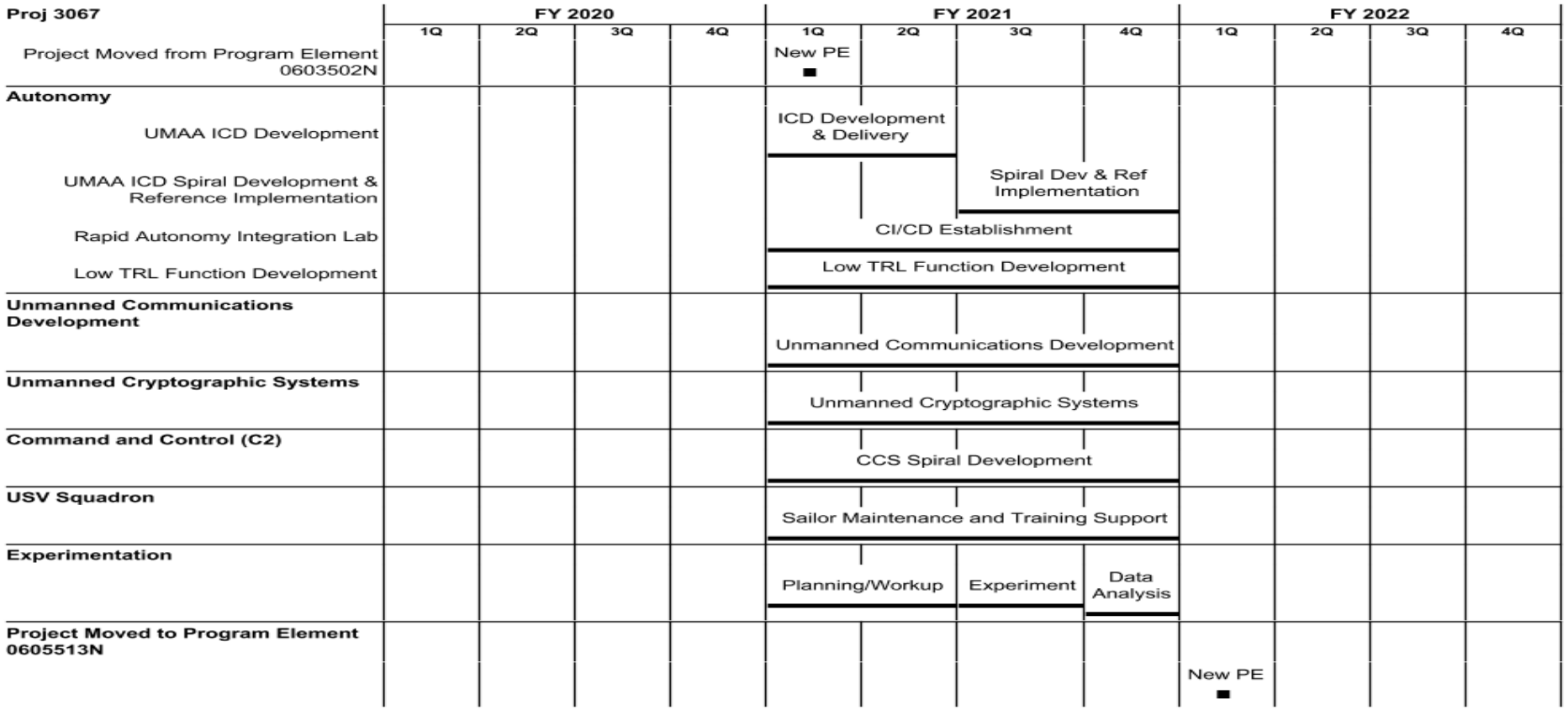

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *MEDIUM & LARGE UNMANNED SURFACE VESSELS (USVs)*	**Project (Number/Name)** 3067 / *Unmanned 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
Elevated Sensors: COMM C-TEM: RFP Release	4	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