Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
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 0604028N *I (U)Small and Medium Unmanned Undersea Vehicles*

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	16.717	32.527	-	32.527	53.991	20.506	30.748	13.044	Continuing	Continuing
3123: *SMCM UUV*	0.000	0.000	16.717	22.747	-	22.747	20.666	16.413	6.789	2.541	Continuing	Continuing
3785: *Razorback*	0.000	0.000	0.000	9.780	-	9.780	33.325	4.093	23.959	10.503	Continuing	Continuing

Note

FY 2018 and prior funding for Project 3123 in Program Element (PE) 0603502N. Project 3123 SMCM UUV realigned from PE 0603502N starting in FY 2019.

Razorback is not a new start program. FY 2019 and prior funding in PE 0604218N. Project 3785 Razorback realigned from PE 0604218N starting in FY 2020. SAFECAP is not a new start. FY 2019 and prior funding in PE 0603561N.

SAFECAP realigned from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning in FY 2020.

A. Mission Description and Budget Item Justification

Small and Medium Unmanned Undersea Vehicles (UUVs) are a segment of the Navy's UUV Family of Systems (FoS) defined as having a diameter between 3 inches and 10 inches for small UUVs and a diameter of 10 inches to 21 inches for medium UUVs. The UUVs can be launched by submarines, surface ships, or larger UUVs, and can be recovered by surface ships and submarines. This class of UUVs can have one or more types of sensors to perform multiple missions including Intelligence Preparation of the Operational Environment (IPOE), battlespace awareness, and mine warfare. In order to accelerate future capability and support steady growth of the Navy's UUV FoS, the Knifefish Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV) program develops advanced medium class UUVs to support clandestine mine detection capability against volume, bottom, and buried mines. Equipment includes vehicles and associated systems support equipment. In parallel, Block Upgrade design efforts aligned to Fleet needs, are ongoing to support insertion of incremental capability when the technology is ready. Planned Block Upgrade candidates being considered include increased detection range capability, communications upgrades, on-board sonar processing and target recognition, command and control improvements, increased operational depth, and other smaller tasks, as well as future payloads as required. Littoral Battlespace Sensing - Autonomous Undersea Vehicle Submarine Variant (LBS-AUV(S)), also known as Razorback, is a medium class UUV capable of persistent, autonomous, ocean sensing and data collection in support of Navy Intelligence Preparation of the Operational Environment (IPOE) mission. Razorback is deployed from host submarines in two variants: from the Dry Deck Shelter (DDS) or from the Torpedo Tube. The DDS deployed Razorback variant has been procured beginning in FY 2017 with Fleet operational deployments planned for FY 2020. Development of requirements and submarine integration efforts commenced in FY 2019 for the torpedo tube deployed variant, which will be competitively sourced to industry by FY 2021.

In order to deploy Razorback, or other small or medium class UUVs from a host submarine platform with sufficient endurance to perform a desired mission, high energy density sources such as lithium ion batteries are used. Consequently, safety is paramount and mitigation systems must be in place to prevent or stop a high energy casualty event. SAFECAP is being developed as an active mitigation strategy that includes a shock qualified capsule that aides in the launch and recovery of small and medium sized vehicles through the torpedo tube. It also contains a Battery Casualty Detection System that constantly monitors battery health and status, providing early

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
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 0604028N *I (U)Small and Medium Unmanned Undersea Vehicles*

warning signs of a battery short via an alarm. In the event of a casualty, the capsule and vehicle portion of SAFECAP are flooded via the fire hose connections and the event is extinguished.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	16.717	22.747	-	22.747
Current President's Budget	0.000	16.717	32.527	-	32.527
Total Adjustments	0.000	0.000	9.780	-	9.780
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	9.780	-	9.780

Change Summary Explanation

Program Changes: FY 2020 +$9,780K UUV Family of Systems (FoS) realignment
Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	Project (Number/Name) 3123 / *SMCM UUV*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3123: *SMCM UUV*	0.000	0.000	16.717	22.747	-	22.747	20.666	16.413	6.789	2.541	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2018 and prior funding in PE 0603502N. Project 3123 SMCM UUV realigned from PE 0603502N starting in FY 2019.

Operational Assesment (OA) was delayed from FY 2018 to FY 2019 in order to implement fixes/updates to system performance discovered during FY 2018 Developmental Testing (DT) prior to Milestone C (MS C). MS C shifts from 4Q FY 2018 to 2Q FY 2019. As a result, Initial Operational Capability (IOC) shifts into FY 2020, and Full Rate Production (FRP) Decision shifts to FY 2021.

A. Mission Description and Budget Item Justification

As part of the UUV Family of Systems (FoS) and in support of the Mine Countermeasures (MCM) Mission Package (MP), the Knifefish Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV) program develops advanced medium class UUVs to support clandestine mine detection capability against volume, bottom, and buried mines. Equipment includes vehicles and associated systems support equipment. In parallel, Block Upgrade design efforts aligned to Fleet needs are ongoing to support insertion of incremental capability when the technology is ready. Planned Block Upgrade candidates being considered include increased detection range capability, communications upgrades, on-board sonar processing and target recognition, command and control improvements, increased operational depth, and other smaller tasks, as well as potential future payloads as required.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Knifefish Development	0.000	9.072	17.820	0.000	17.820
Articles:	-	-	-	-	-
FY 2019 Plans: Complete fixes/updates from prior DT into the EDM and LRIP design and verify that system reliability and mine hunting performance have improved. Complete DT regression testing and Operational Assessment. Perform Launch and Recovery integration efforts for the LCS Independence variant. Complete Block 1 development efforts (3X sonar range improvement and reacquisition/identification maneuver that will significantly reduce false alarms). Maintain GFE support systems (Support Container, Launch & Recovery Device) through DT/OA. Release competitive production award Request for Proposal (RFP) to Industry.					
FY 2020 Base Plans: Continue engineering and acquisition efforts for competitive production award. Conduct LCS Freedom variant integration testing and begin LCS Freedom variant integration. Begin development for Block 2 (deeply buried					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
mine hunting, increased operating depth limit, mine case burial estimation, Net-Centric Sensor Analysis for Mine Warfare interoperability) capability and integrate into the Knifefish system. Begin prototype fuel cell integration and transition from ONR for a future Block Upgrade. Continued maintenance of GFE support systems for Block upgrade and LCS integration testing. Achieve Initial Operational Capability (IOC). ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increases due to Block upgrade and LCS integration efforts.					
Title: Knifefish Support ***Articles:*** ***FY 2019 Plans:*** Provide engineering support of fixes/updates to EDM systems, LCS L&R integration efforts, support the completion of Block 1 development efforts for 3X range extension and reduced false alarms. Provide acquisition support for MS C and to prepare RFP for competitive production award. ***FY 2020 Base Plans:*** Provide engineering support for Block 2 upgrade development, LCS integration, and prototype fuel cell efforts. Provide acquisition support of competitive procurement activities and IOC. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to completion of DT/OA in FY 2019.	0.000 -	4.403 -	3.165 -	0.000 -	3.165 -
Title: Knifefish Test and Evaluation ***Articles:*** ***FY 2019 Plans:*** Conduct second phase of DT from Vessel of Opportunity (VOO). Conduct and complete OA in support of MS C in 2Q FY 2019. Conduct Block 1 Upgrade testing. ***FY 2020 Base Plans:***	0.000 -	2.460 -	0.800 -	0.000 -	0.800 -

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Complete final integration testing from the LCS Independence variant and initial integration testing on the Freedom variant. Conduct Operational Testing (OT) from LCS, and other testing from VOO, as required. Conduct testing related to Block Upgrade efforts. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease in funding due to completion of DT/OA.					
Title: Knifefish Management Services ***Articles:***	0.000 -	0.782 -	0.962 -	0.000 -	0.962 -
FY 2019 Plans: Conduct acquisition and management of development, procurement, and program activities including final Block 1 and initial Block 2 and fuel cell efforts, MS C, LRIP award, and preparation of RFP for competitive production award. ***FY 2020 Base Plans:*** Conduct acquisition and management of development, test, and program activities supporting Block 2 and fuel cell efforts, and competitive procurement activities, and IOC. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Slight increase due to increased management of competitive production award and Block Upgrade efforts.					
Accomplishments/Planned Programs Subtotals	0.000	16.717	22.747	0.000	22.747

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• OPN/2622: *Minesweeping Replacement*	57.343	32.367	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
• OPN/1601: *LCS MCM Mission Modules*	45.146	98.901	197.129	-	197.129	222.831	222.523	233.151	243.503	1,213.078	2,655.367

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• RDTEN/0603502N/3123: *SMCM UUV*	21.799	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	178.219
• OPN/1611: *Small & Medium UUV*	0.000	0.000	40.547	-	40.547	38.817	24.310	8.564	35.170	Continuing	Continuing

Remarks

The above OPN funding lines (1601/1611) account for several programs, of which the Knifefish program is only a portion.

D. Acquisition Strategy

The Knifefish program, initiated in FY 2011 and competitively sourced to General Dynamics Mission Systems (GDMS), develops SMCM UUVs equipped with advanced Low Frequency Broadband (LFBB) sonar to provide volume, bottom, and buried mine detection capability, when operated from the Littoral Combat Ship (LCS) Mine Countermeasures Mission Package (MCM MP) or Vessel of Opportunity (VOO). An Engineering Development Model (EDM) system was fabricated and tested through Developmental Testing (DT). After incorporating fixes and upgrades discovered during DT and from Fleet operator inputs, an Operational Assessment (OA) will be conducted from a VOO in order to inform a Milestone C (MS C) decision and Low Rate Initial Production (LRIP) award of five Knifefish systems. Operational integration testing with the LCS will occur as test ships are available, but prior to Initial Operational Capability (IOC). Following LCS Integration Testing, a full and open competitive production contract will be awarded. The overall approach is to deliver systems through incrementally increasing capability via three Block Upgrades, balancing technology development maturity against a manageable level of risk to the program. New capability Block Upgrades will not transition to the production system until stable requirements are established, demonstrated, and verified for each respective Block. Knifefish is designated as an ACAT III program.

E. Performance Metrics

Successful MS C in 3Q FY 2019, competitive production award in 3Q FY 2020 and IOC in 4Q FY 2020.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Knifefish Development & Engineering Support	C/CPIF	General Dynamics AIS : McLeansville, NC	0.000	0.000		8.520	Dec 2018	2.694	Dec 2019	-		2.694	Continuing	Continuing	Continuing
Hardware/Software Development - Support Equipment	WR	NSWC, PC : PANAMA CITY, FL	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Knifefish Block 1 Development Contractor	C/CPIF	GDMS : McLeansville, NC	0.000	0.000		0.552	Nov 2018	13.326	Nov 2019	-		13.326	Continuing	Continuing	Continuing
Knifefish Block 1 Development	TBD	Various : Various	0.000	0.000		0.000		1.800	Jan 2020	-		1.800	0.000	1.800	-
		Subtotal	0.000	0.000		9.072		17.820		-		17.820	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support	WR	NSWC, PC : PANAMA CITY, FL	0.000	0.000		2.866	Dec 2018	1.450	Dec 2019	-		1.450	Continuing	Continuing	Continuing
Engineering Support	WR	NUWC, Newport : NEWPORT, RI	0.000	0.000		0.974	Dec 2018	0.850	Dec 2019	-		0.850	Continuing	Continuing	Continuing
Engineering Support	WR	Various : Various	0.000	0.000		0.563	Dec 2018	0.865	Dec 2019	-		0.865	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		4.403		3.165		-		3.165	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	Project (Number/Name) 3123 / *SMCM UUV*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government T&E Support	WR	Various : Various	0.000	0.000		0.145	Jan 2019	0.000		-		0.000	0.000	0.145	-
Test and Evaluation	WR	COMOPTEVFOR : NORFOLK, VA	0.000	0.000		0.115	Dec 2018	0.415	Dec 2019	-		0.415	0.000	0.530	-
Government T&E Support	WR	NSWC, PC : PANAMA CITY, FL	0.000	0.000		2.200	Nov 2018	0.385	Dec 2019	-		0.385	0.000	2.585	-
		Subtotal	0.000	0.000		2.460		0.800		-		0.800	0.000	3.260	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPFF	Various : WASHINGTON, DC	0.000	0.000		0.682	Feb 2019	0.887	Feb 2020	-		0.887	0.000	1.569	-
Travel	WR	NAVSEA : WNY, DC	0.000	0.000		0.100	Dec 2018	0.075	Dec 2019	-		0.075	0.000	0.175	-
		Subtotal	0.000	0.000		0.782		0.962		-		0.962	0.000	1.744	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		16.717		22.747		-		22.747	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

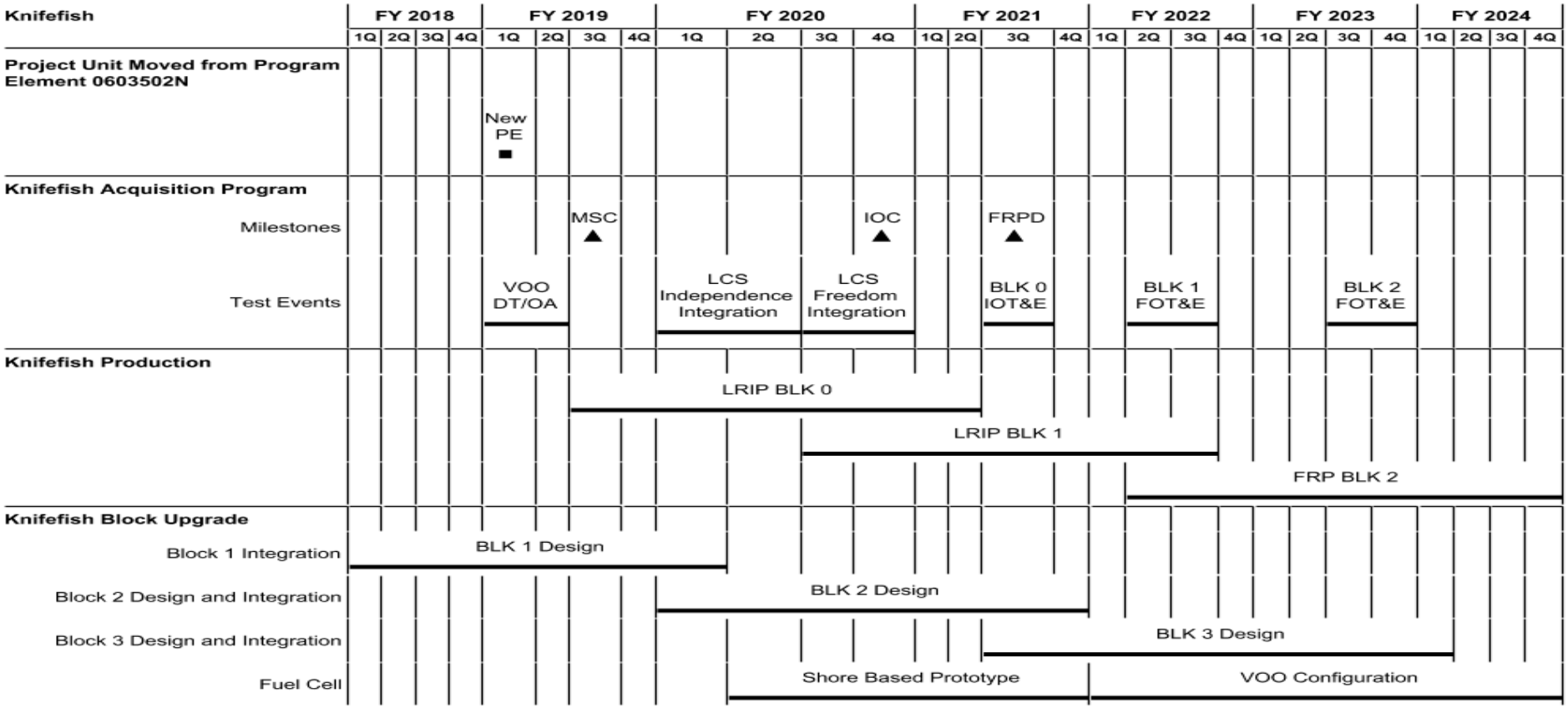

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Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Knifefish				
Project Unit Moved from Program Element 0603502N:	1	2019	1	2019
Knifefish Acquisition Program: Milestones: Initial Operations Capability	4	2020	4	2020
Knifefish Acquisition Program: Milestones: Milestone C	3	2019	3	2019
Knifefish Acquisition Program: Milestones: Knifefish Full Rate Production Decision	3	2021	3	2021
Knifefish Acquisition Program: Test Events: VOO DT/OA	1	2019	2	2019
Knifefish Acquisition Program: Test Events: LCS Independence Variant Integration	1	2020	2	2020
Knifefish Acquisition Program: Test Events: LCS Freedom Variant Integration	3	2020	4	2020
Knifefish Acquisition Program: Test Events: Block 0 IOT&E	3	2021	3	2021
Knifefish Acquisition Program: Test Events: Block 1 FOT&E	2	2022	3	2022
Knifefish Acquisition Program: Test Events: Block 2 FOT&E	3	2023	4	2023
Knifefish Production: BLK 0 LRIP	3	2019	2	2021
Knifefish Production: BLK 1 LRIP	3	2020	3	2022
Knifefish Production: BLK 2 FRP	2	2022	4	2024
Knifefish Block Upgrade: Block 1 Integration: Design	1	2018	1	2020
Knifefish Block Upgrade: Block 2 Design and Integration: Design	1	2020	4	2021
Knifefish Block Upgrade: Block 3 Design and Integration: Design	3	2021	1	2024
Knifefish Block Upgrade: Fuel Cell: Shore Based Prototype	2	2020	4	2021
Knifefish Block Upgrade: Fuel Cell: VOO Configuration	1	2022	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	Project (Number/Name) 3785 / *Razorback*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3785: *Razorback*	0.000	0.000	0.000	9.780	-	9.780	33.325	4.093	23.959	10.503	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Razorback is not a new start program. FY 2019 and prior funding in PE 0604218N. Project 3785 Razorback realigned from PE 0604218N starting in FY 2020.

SAFECAP is not a new start program. It is a continuation effort being transferred from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning FY 2020.

A. Mission Description and Budget Item Justification

A part of the UUV Family of Systems (FoS), Littoral Battlespace Sensors - Autonomous Undersea Vehicle, Submarine variant (LBS-AUV(S)) or Razorback is a medium class UUV capable of persistent, autonomous, ocean sensing and data collection in support of Navy Intelligence Preparation of the Operational Environment (IPOE) mission. Razorback is deployed from host submarines in two variants: from the Dry Deck Shelter (DDS) or from the torpedo tube. The DDS deployed Razorback variant has been procured beginning in FY 2017 with Fleet operational deployments planned for FY 2020. Development of requirements and submarine integration efforts commenced in FY 2019 for the torpedo tube deployed variant, which will be competitively sourced to industry by FY 2021.

In order to deploy Razorback or other small or medium class UUVs from a host submarine platform with sufficient endurance to perform a desired mission, high energy density sources such as lithium ion batteries are used. Consequently, safety is paramount and mitigation systems must be in place to prevent or stop a high energy casualty event. SAFECAP is being developed as an active mitigation strategy that includes a shock qualified capsule that aides in the launch and recovery of small and medium sized UUVs through the torpedo tube, including Razorback. It also contains a Battery Casualty Detection System that constantly monitors battery health and status, providing early warning signs of a battery short. In the event of a casualty, the capsule and vehicle portion of SAFECAP are flooded via fire hose connections and the event is extinguished.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Product Development - Razorback	0.000	0.000	4.922	0.000	4.922
Articles:	-	-	-	-	-
FY 2019 Plans: FY 2019 funding in Program Element (PE) 0604218N Project 2345.					
FY 2020 Base Plans: Develop Razorback Request for Proposal (RFP) to industry for the Torpedo Tube Launch & Recovery (TTL&R) variant. Perform risk reduction engineering efforts to increase opportunities for industry competition for critical					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
technologies including command and control, submarine integration, architecture standards, and host platform recovery. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 funding in Program Element (PE) 0604218N Project 2345; FY 2020 funding in PE 0604028N Project 3785. Increased funding due to Razorback integration efforts.					
Title: Product Development - SAFECAP	0.000	0.000	2.150	0.000	2.150
Articles:	-	-	-	-	-
FY 2019 Plans: FY 2019 funding in Program Element (PE) 0603561N Project 2033. ***FY 2020 Base Plans:*** SAFECAP transitions from Program Element (PE) 0603561N Project 2033. - Perform SAFECAP Capstone Test - Li-Ion Battery Certification - VIRGINIA CLASS Shock Assessment - Continue Early Fault Detection Effort ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** No significant change. FY 2019 funding in Program Element (PE) 0603561N Project 2033; FY 2020 funding realigned to PE 0604028N Project 3785.					
Title: Support	0.000	0.000	2.250	0.000	2.250
Articles:	-	-	-	-	-
FY 2019 Plans: N/A ***FY 2020 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Provide acquisition and engineering support for competitive procurement activities and submarine integration efforts, including TEMPALT development and technical reviews, and Li-ion battery certification efforts. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 funding in Program Element (PE) 0604218N Project 2345; FY 2020 funding in PE 0604028N Project 3785. Increased funding due to support required for Razorback integration efforts.					
Title: Management Services ***Articles:*** ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** Provide technical guidance, project planning, program management, financial and contracting management, and travel for RFP release and submarine integration efforts. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 funding in Program Element (PE) 0604218N Project 2345; FY 2020 funding in PE 0604028N Project 3785. Increased funding due to management required for Razorback integration efforts.	0.000 -	0.000 -	0.458 -	0.000 -	0.458 -
Accomplishments/Planned Programs Subtotals	0.000	0.000	9.780	0.000	9.780

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• OPN 1611: *Small & Medium UUV*	0.000	0.000	40.547	-	40.547	38.817	24.310	8.564	35.170	Continuing	Continuing

Remarks

The above OPN funding line accounts for several programs, of which the RAZORBACK program is only a portion.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

D. Acquisition Strategy

The Razorback torpedo tube deployed variant will be a competitively sourced Medium class UUV to support missions for the Submarine Force. Razorback will leverage lessons learned about mission capabilities and submarine integration from previous science and technology UUV demonstrations, the LBS-AUV systems operated by Naval Oceanographic Command (NAVO) and from the Razorback Dry Deck Shelter variant. Requirements generation and initial submarine integration efforts occur in FY 2019, followed by Request for Proposal (RFP) development and release to industry in FY 2020. SAFECAP development and submarine integration efforts will continue in parallel to requirements and RFP development in order to provide Li-ion battery casualty mitigations to support Razorback vehicles.

E. Performance Metrics

Successful RFP release to industry in FY 2020 and competitive award in FY 2021. Successful certification of SAFECAP for use of Lithium Ion (Li-ion) batteries on Razorback on host submarines.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development - SAFECAP	WR	NUWC NPT : Newport, RI	0.000	0.000		0.000		1.354	Oct 2019	-		1.354	Continuing	Continuing	Continuing
Product Development - SAFECAP	C/CPFF	Sandia National Labs : Albuquerque, NM	0.000	0.000		0.000		0.450	Oct 2019	-		0.450	Continuing	Continuing	Continuing
Product Development - SAFECAP	WR	NSWC CD : West Bethesda, MD	0.000	0.000		0.000		0.150	Oct 2019	-		0.150	Continuing	Continuing	Continuing
Product Development - SAFECAP	WR	PNSY : Portsmouth NH	0.000	0.000		0.000		0.150	Oct 2019	-		0.150	Continuing	Continuing	Continuing
Product Development - RAZORBACK	C/CPIF	NUWC NPT : Newport, RI	0.000	0.000		0.000		4.922	Mar 2020	-		4.922	0.000	4.922	-
		Subtotal	0.000	0.000		0.000		7.026		-		7.026	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support - RAZORBACK	WR	NUWC Newport : Newport, RI	0.000	0.000		0.000		2.250	Nov 2019	-		2.250	0.000	2.250	-
		Subtotal	0.000	0.000		0.000		2.250		-		2.250	0.000	2.250	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel - SAFECAP	Various	NAVSEA HQ : Washington DC	0.000	0.000		0.000		0.046	Oct 2019	-		0.046	Continuing	Continuing	Continuing
Travel - RAZORBACK	Various	NAVSEA HQ : Washington DC	0.000	0.000		0.000		0.050	Oct 2019	-		0.050	0.000	0.050	-
Management - RAZORBACK	Various	Various : Various	0.000	0.000		0.000		0.408	Dec 2019	-		0.408	0.000	0.408	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	0.000		0.000		0.504		-		0.504	Continuing	Continuing	N/A

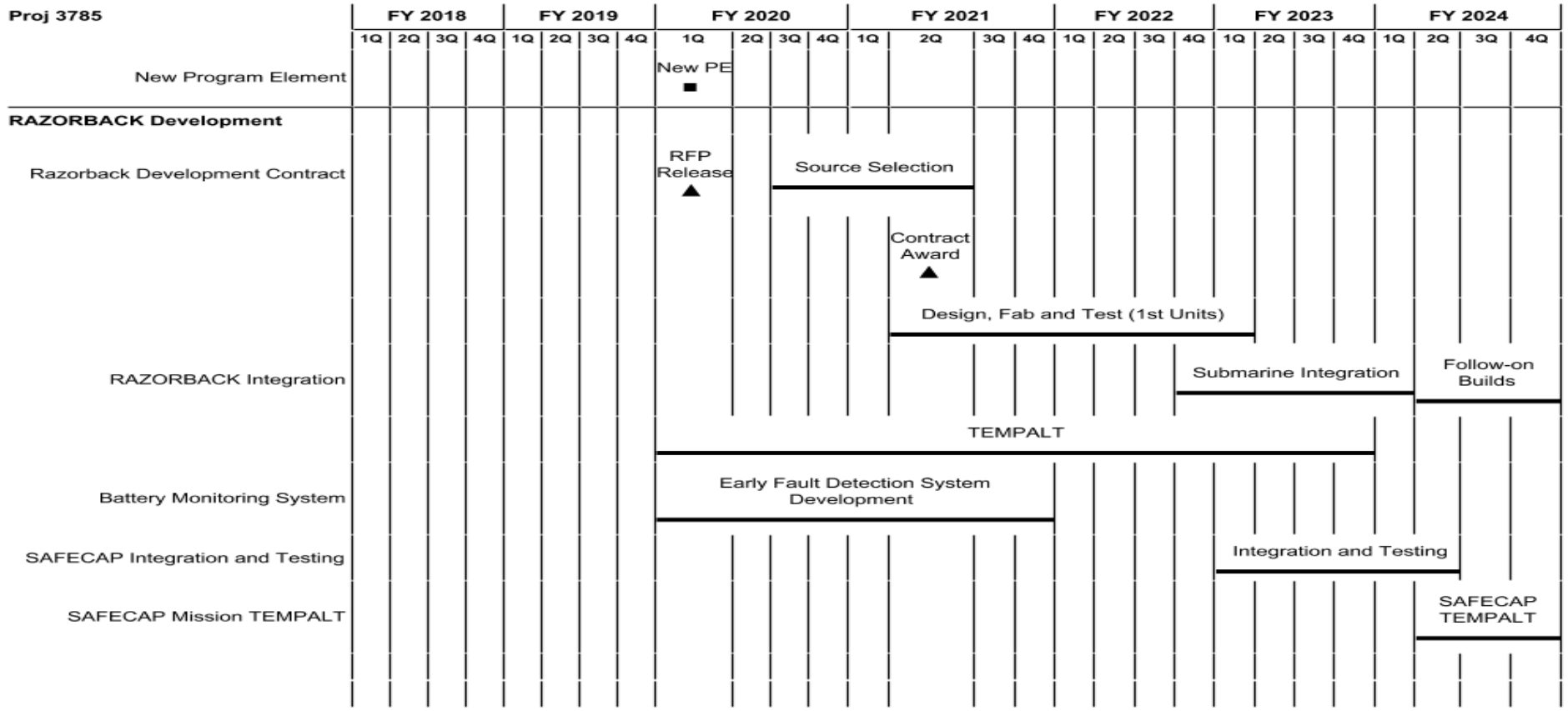
	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		9.780		-		9.780	Continuing	Continuing	N/A

Remarks

Razorback is not a new start program. Razorback realigned from Program Element (PE) 0604218N Project 2345 to PE 0604028N Project 3785 beginning in FY 2020.

SAFECAP is not a new start. SAFECAP realigned from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning in FY 2020.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*



2020PB - 0604028N - 3785

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *(U)Small and Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3785				
New Program Element: Schedule Detail	1	2020	1	2020
RAZORBACK Development: Razorback Development Contract: RFP	1	2020	1	2020
RAZORBACK Development: Razorback Development Contract: Source Selection	3	2020	2	2021
RAZORBACK Development: Razorback Development Contract: Contract Award	2	2021	2	2021
RAZORBACK Development: Razorback Development Contract: Design, Fabricate, and Test	2	2021	1	2023
RAZORBACK Development: RAZORBACK Integration: Submarine Integration	4	2022	1	2024
RAZORBACK Development: RAZORBACK Integration: Follow-on Builds	2	2024	4	2024
RAZORBACK Development: RAZORBACK Integration: TEMPALT	1	2020	4	2023
RAZORBACK Development: Battery Monitoring System: Early Fault Detection System Development	1	2020	4	2021
RAZORBACK Development: SAFECAP Integration and Testing: System Shakedown Testing	1	2023	2	2024
RAZORBACK Development: SAFECAP Mission TEMPALT: TEMPALT	2	2024	4	2024