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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Navy **Date:** March 2024

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604245M / H-1 UPGRADES
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COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	217.887	42.712	29.766	39.023	-	39.023	45.633	37.703	33.621	32.796	Continuing	Continuing
3359: <i>H-1 Improvements</i>	217.887	42.712	29.766	39.023	-	39.023	45.633	37.703	33.621	32.796	Continuing	Continuing

A. Mission Description and Budget Item Justification

The mission of the AH-1 attack helicopter is to provide rotary wing close air support, anti-armor, armed escort, armed/visual reconnaissance, survivability enhancements, and fire support coordination capabilities under day/night and adverse weather conditions. The mission of the UH-1 utility helicopter is to provide command and control and combat assault support under day/night and adverse weather conditions and special operations support; supporting arms coordination and aeromedical evacuation. Major modifications for both aircraft include 37 AH-1Ws converted to AH-1Zs, build 152 new AH-1Zs, remanufacture ten (10) H-1N helicopters and build 150 new UH-1Y models. AH-1Z and UH-1Y models include a 4-bladed, composite rotor system with semi-automatic blade fold, performance-matched transmissions, T700 Engine Digital Electronic Control Units, 4-bladed tail rotors and drive systems, more effective stabilizers, upgraded landing gear, and common, fully integrated cockpits and avionics systems. These upgrades add 10,000 flight hours to AH-1Z/UH-1Y airframes. The fully integrated cockpits reduce operator workload and improve situational awareness, thus increasing safety and reducing the rate of aircraft attrition. They provide considerable growth potential for future weapon systems and avionics to significantly increase mission effectiveness and survivability. The cockpits also include integration of onboard mission planning, communications, digital fire control, self-navigation, night navigation/targeting, air-to-ground missile and air-launched intercept missile weapon systems management in nearly identical crew stations, which significantly reduces training requirements. These upgrades maximize commonality between the two aircraft and provide needed improvements in crew and passenger survivability, payload, power available, endurance, range, airspeed, maneuverability and supportability.

This budget is required for follow-on improvements to H-1 aircraft via integration of sensors and weapons, avionics, and air vehicle components that will address deficiencies, systems safety, obsolescence, readiness, reliability, supportability, and relevance in the battlespace. Improvements will include all associated System Configuration Set (SCS) updates and address hazard reports against air vehicle and engine, sensors and weapons, and avionics components, systems, and subsystems, training, and aircrew systems as well as integration and testing related to the aircraft platforms.

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B. Program Change Summary (\$ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	43.759	29.766	33.764	-	33.764
Current President's Budget	42.712	29.766	39.023	-	39.023
Total Adjustments	-1.047	0.000	5.259	-	5.259
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.047	0.000			
• Program Adjustments	0.000	0.000	5.250	-	5.250
• Rate/Misc Adjustments	0.000	0.000	0.009	-	0.009

Change Summary Explanation

Cost: FY 2025 funding request was adjusted since the previous President's Budget submission, \$5.259 million for Distributed Aperture Infrared Countermeasures (DAIRCM) system integration development and testing.

Technical: None

Schedule: None

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Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604245M / H-1 UPGRADES				Project (Number/Name) 3359 / H-1 Improvements			
COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
3359: H-1 Improvements	217.887	42.712	29.766	39.023	-	39.023	45.633	37.703	33.621	32.796	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The objective of H-1 Improvements is to provide follow-on Research, Development, Test and Evaluation efforts in support of all H-1 aircraft.

Air Vehicle and Engine improvements include Analysis of structural data to formulate Damage Limits and Tolerances for structural components in order to reduce life cycle costs and maintenance workload; development and test of structural components. These improvements include tail boom, fuselage, and airframe components, minimizing excessive and premature wear, increased reliability, decreased component fatigue and improve existing design deficiencies. Air Vehicle will develop solutions to support compartments containing avionics equipment; development and testing of aircrew and flight safety systems and storage systems; develop an auxiliary fuel cell capability and Rotocraft Station Control Unit (RSCU) Software development. RSCU efforts will include software development, testing, cybersecurity, and acquisition of test assets. Improvements to address hazard reports against air vehicle and engine platform systems which may include structural performance, engine and rotor systems performance, aircrew and flight safety system performance, electrical systems performance, and fuel system performance. All air vehicle and engine improvements include related Software Configuration Set (SCS) development updates and address hazard reports including software, test assets, cybersecurity, and testing.

Avionics improvements target digital inter-operability, integrated avionics, safety and survivability, and situational awareness for both the pilot and aircrew safety. This includes Degraded Visual Environment (DVE), cockpit displays, precision and Global Positioning System (GPS) non-precision landing capability, collision avoidance, improved Embedded Global Positioning System (EGI), Radar Altimeter (RADALT), Inertial Navigation System (INS), Health and Monitoring System Upgrade (HMU), and mission computer. H-1 capability improvements include improved digital operations and transfer of data, digital interoperability, digital video recording, video and data networking, and information integration with aviation combat elements and Marine Air Ground Task Force elements. Mandated capability efforts include - Communications and COMSEC modernization to include Tactical Secure Voice/Second generation Anti-Jam Tactical Ultra-High frequency Radio for NATO (TSV/ SATURN), Navigation and Surveillance system/Air Traffic Management (CNS/ ATM), Required Navigation Performance/ Area Navigation (RNP/RNAV), Automatic Dependent Surveillance - Broadcast (ADS-B), Crash Survivable Flight Incident Recorder and information technology/protection of the platform. Mobile User Objective System (MUOS) allows the H-1 to retain satellite communication capabilities. Efforts include the integration and test of Beyond Line of Sight (BLOS) satellite systems. Digital Interoperability (DI), the expansion of DI to include integration of Adaptive Network Wideband Waveform (ANW-2), advanced Flite Scene mapping and mission planning updates shortens the kill chain and improves information and intelligence sharing on the battlefield. DI incorporates a family of systems that includes ANW-2, Advanced Data Transfer System (ADTS), Full Motion Video (FMV), Radio Frequency Identification (RFID), Small Tactical Terminal (STT), and Cross Domain Solution (CDS). Improvements to address hazard reports against avionic platform systems which may include attitude trim performance, flight control systems performance, communication and navigation systems performance, data link and waveform systems performance, display and recorder systems performance, and aircraft health data system performance. All avionics improvements include related SCS development updates and address hazard reports including software, test assets, cybersecurity, and testing.

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Sensors, Weapons, Aircraft Survivability Equipment (ASE), and Helmet Mounted Display System improvements include manufacturing process improvements, hardware and software redesign to improve reliability, improve production methodologies, implement program security initiatives and increase the collective capability to address emerging battlefield threats. These improvements address reliability and obsolescence. The technical interfaces between the aircraft sensor, helmet, and weapons systems require extensive software and hardware upgrades to translate data into sensor fusion based solutions that provide both battlefield and situational awareness to the H-1 platform. The AN/AAQ-30 Target Sight System (TSS) will implement several obsolescence upgrade efforts with improvements to the Cameras as well as adding software driven capabilities such as increased field-of-views and auto-focus. The BRITE Star Block II Target Location Error will be corrected. The Optimized TopOwl (OTO) reliability upgrades will increase reliability and readiness for components that are currently driving high repair costs. Radar and missile warning improvements, including APR-39D(V)2 and the Distributed Aperture Infrared Countermeasures (DAIRCM), require extensive integration and testing. Funds required for development, test, and integration efforts for Joint Air-to-Ground Missile (JAGM), AGM-114 Hellfire, Advanced Precision Kill Weapons (APKWS), M299 Launcher improvements, Digital Rocket Launcher (DRL), AIM-9X, AN/ALQ-231 (V) Intrepid Tiger II Electronic Warfare Pod and loitering munitions. Improving and integrating weapon systems and expendables will align with these upgrades to improve the overall accuracy, lethality, and survivability of the H-1 platform. Improvements to address hazard reports against sensors and weapons platform systems which may include helmet and display systems performance, sensor systems performance, and weapon systems performance. All weapon and sensor improvements include related SCS development updates and address hazard reports including software, test assets, cybersecurity, and testing.

These improvements will provide considerable growth potential for future weapon systems, air vehicle improvements, software improvements, and avionics upgrades, which will significantly increase mission effectiveness and survivability, while potentially reducing life cycle costs. The efforts will also include integration of onboard mission planning, communications, digital fire control, self-navigation, night navigation/targeting, precision guided munitions, and air-launched intercept missile weapon systems management in nearly identical crew stations, which significantly reduces training requirements. These upgrades maximize commonality between all H-1 Type/Model/Series aircraft and provide needed improvements in crew and passenger reliability, survivability, payload, power available, endurance, range, airspeed, maneuverability and supportability.

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

	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Weapons and Sensors Testing and Integration	6.916	5.540	10.390	0.000	10.390
Articles:	-	-	-	-	-
FY 2024 Plans:					
Complete prototype developmental testing of TSS and continue OTO design Obsolescence Upgrade initiatives to include software compatibility, functionality of replacement cameras and performance improvements. Continue Aircraft Survivability Equipment (ASE) development and test and evaluation. Continue development and testing and evaluation of Distributed Aperture Infrared Countermeasures (DAIRCM). Weapons and Sensors improvements include test asset components to support software and cybersecurity testing efforts.					
FY 2025 Base Plans:					
Continue OTO design Obsolescence Upgrade initiatives to include software compatibility, functionality of replacement cameras and performance improvements. Continue Aircraft Survivability Equipment (ASE) development and test and evaluation. Continue integration development and testing and evaluation of					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Distributed Aperture Infrared Countermeasures (DAIRCM). Weapons and Sensors improvements include test asset components to support software and cybersecurity testing efforts. FY 2025 OCO Plans: N/A FY 2024 to FY 2025 Increase/Decrease Statement: Increase in funding from FY 2024 to FY 2025 due to ramp up of DAIRCM integration development and testing.					
Title: Air Vehicle and Engines Improvements Articles:	4.286 -	5.120 -	7.270 -	0.000 -	7.270 -
FY 2024 Plans: Continue redesign and test of structural components to minimize excessive and premature wear, increase reliability and fatigue life, increase aircraft load capabilities. Improve existing design deficiencies including Fuel Systems and aircrew safety and flight safety systems. Develop and test System Configuration Set (SCS) including software. Air vehicle and engine improvements include test asset components to support software and cybersecurity testing efforts.					
FY 2025 Base Plans: Continue redesign and test of structural components to minimize excessive and premature wear, increase reliability and fatigue life. Improve existing design deficiencies including aircrew safety and flight safety systems. Air vehicle and engine improvements include test asset components to support software and cybersecurity testing efforts.					
FY 2025 OCO Plans: N/A FY 2024 to FY 2025 Increase/Decrease Statement: Increase in funding from FY2024 to FY2025 due to ramp up in design and test efforts in support of UH-1Y/AH-1Z structural improvement and reinforcement initiatives, component redesign efforts, and survivability upgrades.					
Title: Avionics Improvements Articles:	31.510 -	19.106 -	21.363 -	0.000 -	21.363 -
FY 2024 Plans: Continue with software integration, system integration laboratories, Development Testing (DT) activities associated with SCS and Model Based Systems Engineering (MBSE). Continue design, development and testing for Digital Interoperability (DI) improvements, to include Advanced Network Waveform 2 (ANW2) UH-1Y					

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

	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
<p>Aft Cabin Display for situational awareness, portable tablet improvements for Marine Air-Ground Task, Advanced Data Transfer System (ADTS), and a switch and Cross Domain Solution (CDS) that support NSA security requirements for airborne networks. Continue to develop and test communication solutions to enable Second Generation Anti-Jam Tactical UHF Radio for NATO (SATURN), Variable Message Format (VMF), and Tactical Secure Voice 2 (TSV2) Protocol for ARC-210 RT-1939A Radio. Avionics components / systems obsolescence mitigation efforts including, Health and Monitoring System Upgrade (HMU), peculiar avionics support equipment, automatic test equipment and mission computer SCS improvements. Continue enhancement of digital map and data storage capabilities, digital video recording, display systems, digital systems upgrades. Initiate design and development on Terrain Awareness Warning System (TAWS). Avionics improvements include test asset components to support software and cybersecurity testing efforts.</p> <p>FY 2025 Base Plans: Continue with software integration, system integration laboratories, Development Testing (DT) activities associated with SCS and Model Based Systems Engineering (MBSE). Continue design, development and testing for Digital Interoperability (DI) improvements, to include Adaptive Network Wideband Waveform 2 (ANW-2) UH-1Y Aft Cabin Display for situational awareness, portable tablet improvements for Marine Air-Ground Task, Advanced Data Transfer System (ADTS), Small Tactical Terminal (STT), and a switch and Cross Domain Solution (CDS) that support NSA security requirements for airborne networks. Continue to develop and test communication solutions for inclusion of Variable Message Format (VMF) for ARC-210 RT-1939A Radio. Develop and test Mobile User Objective System (MUOS) to allow the H-1 to retain satellite communication capabilities. Avionics components / systems obsolescence mitigation efforts including, Health and Monitoring System Upgrade (HMU), peculiar avionics support equipment, automatic test equipment and mission computer SCS improvements. Continue enhancement of digital map and data storage capabilities, digital video recording, display systems, digital systems upgrades. Continue design and development on Terrain Awareness Warning System (TAWS). Develop Embedded Global Positioning System/Inertial Navigation System (INS) Modernization; or EGI-M, to provide open architecture that enables rapid responses to future threats. The fully modernized system integrates new M-Code capable GPS receivers, provides interoperability with civil controlled air space, and implements a new resilient time capability and will include a federated Radar Altimeter (RADALT) solution. Avionics improvements include test asset components to support software and cybersecurity testing efforts.</p> <p>FY 2025 OCO Plans: N/A</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Increase in funding from FY2024 to FY2025 due to ramp up of software development test and evaluation efforts.					
Accomplishments/Planned Programs Subtotals	42.712	29.766	39.023	0.000	39.023

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

<u>Line Item</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025 Base</u>	<u>FY 2025 OCO</u>	<u>FY 2025 Total</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>FY 2029</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• APN/0178: UH-1Y/AH-1Z APN1	0.000	4.292	8.701	-	8.701	8.736	6.448	7.406	7.562	0.000	10,599.451
• APN/0532: H-1 Series	126.454	114.284	153.006	-	153.006	155.288	168.181	175.305	179.004	1,424.791	3,582.255

Remarks

D. Acquisition Strategy

Follow-on H-1 Improvements will be developed using cost plus fixed fee type contracts.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy **Date:** March 2024

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Product Development (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Primary Hardware Development	SS/CPFF	BHTI : Amarillo, TX	23.090	1.000	Sep 2023	1.701	Feb 2024	1.929	Feb 2025	-		1.929	34.309	62.029	62.029
Primary Hardware Development	Various	Various : Various	2.044	0.000		0.179	Jan 2024	0.203	Jan 2025	-		0.203	0.000	2.426	-
Systems Engineering	WR	NAWCAD : Patuxent River, MD	6.447	0.467	Jan 2023	0.381	Nov 2023	0.432	Nov 2024	-		0.432	2.961	10.688	-
Systems Engineering	SS/CPFF	BHTI : Amarillo, TX	29.162	3.030	Jan 2023	1.968	Jan 2024	2.232	Jan 2025	-		2.232	24.254	60.646	60.646
Systems Engineering	Various	Various : Various	2.635	0.695	Nov 2022	0.183	Jan 2024	0.208	Jan 2025	-		0.208	0.000	3.721	-
Subtotal			63.378	5.192		4.412		5.004		-		5.004	61.524	139.510	N/A

Remarks
Increase in Primary Hardware Development and System Engineering from FY2024 to FY2025 due to USMC reprioritization.

Support (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Software Development	SS/FP	Northrup Grumman : Woodland Hills, CA	57.412	15.010	Jan 2023	12.334	Feb 2024	19.241	Feb 2025	-		19.241	5.669	109.666	109.666
Software Development	WR	NAWCWD : China Lake, CA	7.232	0.000		0.433	Nov 2023	0.491	Nov 2024	-		0.491	11.385	19.541	-
Software Development	WR	NAWCAD : Patuxent River, MD	4.235	0.418	Jan 2023	0.309	Nov 2023	0.351	Nov 2024	-		0.351	0.000	5.313	-
Software Development	Various	Various : Various	4.046	0.000		0.178	Jan 2024	0.202	Jan 2025	-		0.202	0.000	4.426	-
Subtotal			72.925	15.428		13.254		20.285		-		20.285	17.054	138.946	N/A

Remarks
Funding provides for USMC top three priorities: Digital Interoperability (DI), survivability, and lethality. DI is a software-only development effort to the baseline DI system. This critical capability improvement is needed to keep pace with currently planned upgrades and operational requirements and will ensure H-1 has access to the same data link as other DOD and Joint partners on the modern battlespace.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy **Date:** March 2024

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Test and Evaluation (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Operational Test & Evaluation (OT&E)	WR	COMOPTEVFOR : Norfolk, VA	5.736	0.055	Feb 2023	0.397	Nov 2023	0.450	Nov 2024	-		0.450	6.448	13.086	-
Operational Test & Evaluation (OT&E)	Various	Various : Various	2.707	0.698	Jan 2023	0.188	Jan 2024	0.213	Jan 2025	-		0.213	0.000	3.806	-
Developmental Test & Evaluation (DT&E)	WR	NAWCAD : Patuxent River, MD	55.414	14.582	Nov 2022	10.450	Nov 2023	11.852	Nov 2024	-		11.852	61.374	153.672	-
Developmental Test & Evaluation (DT&E)	Various	Various : Various	3.936	0.350	Jan 2023	0.164	Jan 2024	0.186	Jan 2025	-		0.186	0.000	4.636	-
Subtotal			67.793	15.685		11.199		12.701		-		12.701	67.822	175.200	N/A

Remarks
Increase in Test and Evaluation from FY2024 to FY2025 due to USMC reprioritization.

Management Services (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Contractor Engineering Support	Various	Various : Various	3.313	2.013	Feb 2023	0.376	Nov 2023	0.427	Nov 2024	-		0.427	0.605	6.734	-
Program Management Support	Various	Various : Various	9.589	4.237	Nov 2022	0.500	Nov 2023	0.578	Nov 2024	-		0.578	2.610	17.514	-
Travel	WR	NAVAIR : Patuxent River, MD	0.889	0.157	Oct 2022	0.025	Oct 2023	0.028	Oct 2024	-		0.028	Continuing	Continuing	Continuing
Subtotal			13.791	6.407		0.901		1.033		-		1.033	Continuing	Continuing	N/A

Remarks
Increase in Management Services from FY2024 to FY2025 due to USMC reprioritization.

	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	217.887	42.712	29.766	39.023	-	39.023	Continuing	Continuing	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy **Date:** March 2024

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H-1 Improvements	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Systems Development																												
Hardware/Software Development																												
Test & Evaluation																												
Development Test																												
Operational Test																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2025 Navy		Date: March 2024
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
H-1 Improvements				
Systems Development: Hardware/Software Development: Schedule Detail	1	2023	4	2029
Test & Evaluation: Development Test: H-1 Improvements DT	1	2023	4	2029
Test & Evaluation: Operational Test: H-1 Improvements OT	1	2023	4	2029