Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	168.571	49.316	43.759	29.766	-	29.766	33.764	40.849	30.818	32.087	Continuing	Continuing
3359: *H-1 Improvements*	168.571	49.316	43.759	29.766	-	29.766	33.764	40.849	30.818	32.087	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 bladefold, 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 as well as integration and testing related to the aircraft platforms.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	50.158	43.759	30.829	-	30.829
Current President's Budget	49.316	43.759	29.766	-	29.766
Total Adjustments	-0.842	0.000	-1.063	-	-1.063
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.842	0.000			
• Program Adjustments	0.000	0.000	-1.217	-	-1.217

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy					Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*		R-1 Program Element (Number/Name) PE 0604245M *I H-1 UPGRADES*			
• Rate/Misc Adjustments	0.000	0.000	0.154	-	0.154

Change Summary Explanation

Cost: FY 2024 funding request was adjusted since the previous President's Budget submission for the following: reduced by $1.217 million due to USMC reprioritization; and increased by $0.154 million to account for working capital rate adjustments.

Technical: None

Schedule: None

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy											Date: March 2023	
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 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
3359: *H-1 Improvements*	168.571	49.316	43.759	29.766	-	29.766	33.764	40.849	30.818	32.087	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, airframe and drive system 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; develop an auxiliary fuel cell capability and Remote Stores Control unit (RSCU) Software development. RSCU efforts will include software development, testing, cybersecurity, and acquisition of test assets. All air vehicle and engine improvements include related Software Configuration Set (SCS) development updates 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), 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. Digital Interoperability (DI), the expansion of DI to include integration of ANW-2 (Advanced Network Wideband Waveform), 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, ADTS (Advanced Data Transfer System), FMV (Full Motion Video), RFID (Radio Frequency Identification) and TACDS (Tactical Cross Domain Solution). All avionics improvements include related SCS development updates including software, test assets, cybersecurity, and testing.

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 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

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

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 will align with these upgrades to improve the overall accuracy, lethality, and survivability of the H-1 platform. All weapon and sensor improvements include related SCS development updates 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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Weapons and Sensors Testing and Integration	12.795	6.916	5.540	0.000	5.540
Articles:	-	-	-	-	-
FY 2023 Plans: Continue prototype developmental testing of TSS Obsolescence Upgrade initiatives to include software compatibility, replacement camera functionality and performance improvements. Continue Aircraft Survivability Equipment (ASE) test and evaluation. Conduct 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 2024 Base 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 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Decrease in funding from FY 2023 to FY 2024 due to ramp down of weapons and sensors testing and integration.					
Title: Air Vehicle and Engines Improvements	9.851	5.333	5.120	0.000	5.120
Articles:	-	-	-	-	-
FY 2023 Plans: Continue redesign and initiate 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.					
FY 2024 Base 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 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement: Decrease in funding from FY2023 to FY2024 due to reduction 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	26.670	31.510	19.106	0.000	19.106
Articles:	-	-	-	-	-
FY 2023 Plans: Continue with software integration, system integration laboratories, Development Testing (DT) activities associated with SCS and MBSE. Continue design, development and testing for Digital Interoperability (DI) improvements, to include Link 16 development, Advanced Network Waveform 2 (ANW2) UH-1Y 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. Develop communication solutions to enable Second Generation Anti-Jam Tactical UHF Radio for NATO (SATURN), Variable Message Format (VMF), and Tactical Secure Voice 2					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
(TSV2) Protocol for ARC-210 RT-1939A Radio. Complete development efforts on the Mission Computer (TRMC) firmware redesign. Avionics components / systems obsolescence mitigation efforts including, 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). ***FY 2024 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 Advanced Network Waveform 2 (ANW2) UH-1Y 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. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease in funding from FY2023 to FY2024 due to ramp down of software development test and evaluation efforts.					
Accomplishments/Planned Programs Subtotals	49.316	43.759	29.766	0.000	29.766

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• APN/0178: *UH-1Y/AH-1Z APN1*	0.935	0.000	4.292	-	4.292	8.688	8.722	6.433	7.390	0.000	10,591.831
• APN/0532: *H-1 Series*	118.778	122.498	114.284	-	114.284	152.833	155.062	167.929	175.024	957.393	2,931.515

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost

Remarks

D. Acquisition Strategy

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

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	SS/CPFF	BHTI : Amarillo, TX	19.225	3.865	Feb 2022	3.346	Feb 2023	1.701	Feb 2024	-		1.701	36.238	64.375	64.375
Primary Hardware Development	Various	Various : Various	2.044	0.000		0.350	Jan 2023	0.179	Jan 2024	-		0.179	0.000	2.573	-
Systems Engineering	WR	NAWCAD : Patuxent River, MD	5.650	0.797	Nov 2021	0.750	Nov 2022	0.381	Nov 2023	-		0.381	3.393	10.971	-
Systems Engineering	SS/CPFF	BHTI : Amarillo, TX	18.761	10.401	Apr 2022	4.197	Jan 2023	1.968	Jan 2024	-		1.968	26.486	61.813	61.813
Systems Engineering	Various	Various : Various	2.020	0.615	Mar 2022	0.360	Jan 2023	0.183	Jan 2024	-		0.183	0.000	3.178	-
		Subtotal	47.700	15.678		9.003		4.412		-		4.412	66.117	142.910	N/A

Remarks

Decrease in Primary Hardware Development and System Engineering from FY2023 to FY2024 due to USMC reprioritization.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development	SS/FP	Northrup Grumman : Woodland Hills, CA	44.393	13.019	Feb 2022	17.776	Feb 2023	12.334	Feb 2024	-		12.334	20.061	107.583	107.583
Software Development	WR	NAWCWD : China Lake, CA	6.708	0.524	Nov 2021	0.851	Nov 2022	0.433	Nov 2023	-		0.433	11.876	20.392	-
Software Development	WR	NAWCAD : Patuxent River, MD	3.717	0.518	Nov 2021	0.607	Nov 2022	0.309	Nov 2023	-		0.309	0.000	5.151	-
Software Development	Various	Various : Various	3.038	1.008	Mar 2022	0.350	Jan 2023	0.178	Jan 2024	-		0.178	0.000	4.574	-
		Subtotal	57.856	15.069		19.584		13.254		-		13.254	31.937	137.700	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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604245M / *H-1 UPGRADES*	Project (Number/Name) 3359 / *H-1 Improvements*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Operational Test & Evaluation (OT&E)	WR	COMOPTEVFOR : Norfolk, VA	4.162	1.574	Jan 2022	0.780	Nov 2022	0.397	Nov 2023	-		0.397	6.898	13.811	-
Operational Test & Evaluation (OT&E)	Various	Various : Various	2.242	0.465	Feb 2022	0.370	Jan 2023	0.188	Jan 2024	-		0.188	0.000	3.265	-
Developmental Test & Evaluation (DT&E)	WR	NAWCAD : Patuxent River, MD	43.389	12.025	Nov 2021	12.229	Nov 2022	10.450	Nov 2023	-		10.450	73.228	151.321	-
Developmental Test & Evaluation (DT&E)	Various	Various : Various	3.885	0.051	Mar 2022	0.323	Jan 2023	0.164	Jan 2024	-		0.164	0.000	4.423	-
		Subtotal	53.678	14.115		13.702		11.199		-		11.199	80.126	172.820	N/A

Remarks

Decrease in Test and Evaluation from FY2023 to FY2024 due to USMC reprioritization.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	Various : Various	2.555	0.758	Nov 2021	0.740	Nov 2022	0.376	Nov 2023	-		0.376	1.032	5.461	-
Program Management Support	Various	Various : Various	6.148	3.441	Nov 2021	0.680	Nov 2022	0.500	Nov 2023	-		0.500	3.177	13.946	-
Travel	WR	NAVAIR : Patuxent River, MD	0.634	0.255	Oct 2021	0.050	Oct 2022	0.025	Oct 2023	-		0.025	Continuing	Continuing	Continuing
		Subtotal	9.337	4.454		1.470		0.901		-		0.901	Continuing	Continuing	N/A

Remarks

Decrease in Management Services from FY2023 to FY2024 due to USMC reprioritization.

	Prior Years	FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	168.571	49.316		43.759		29.766		-		29.766	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604245M / *H-1 UPGRADES*	**Project (Number/Name)** 3359 / *H-1 Improvements*

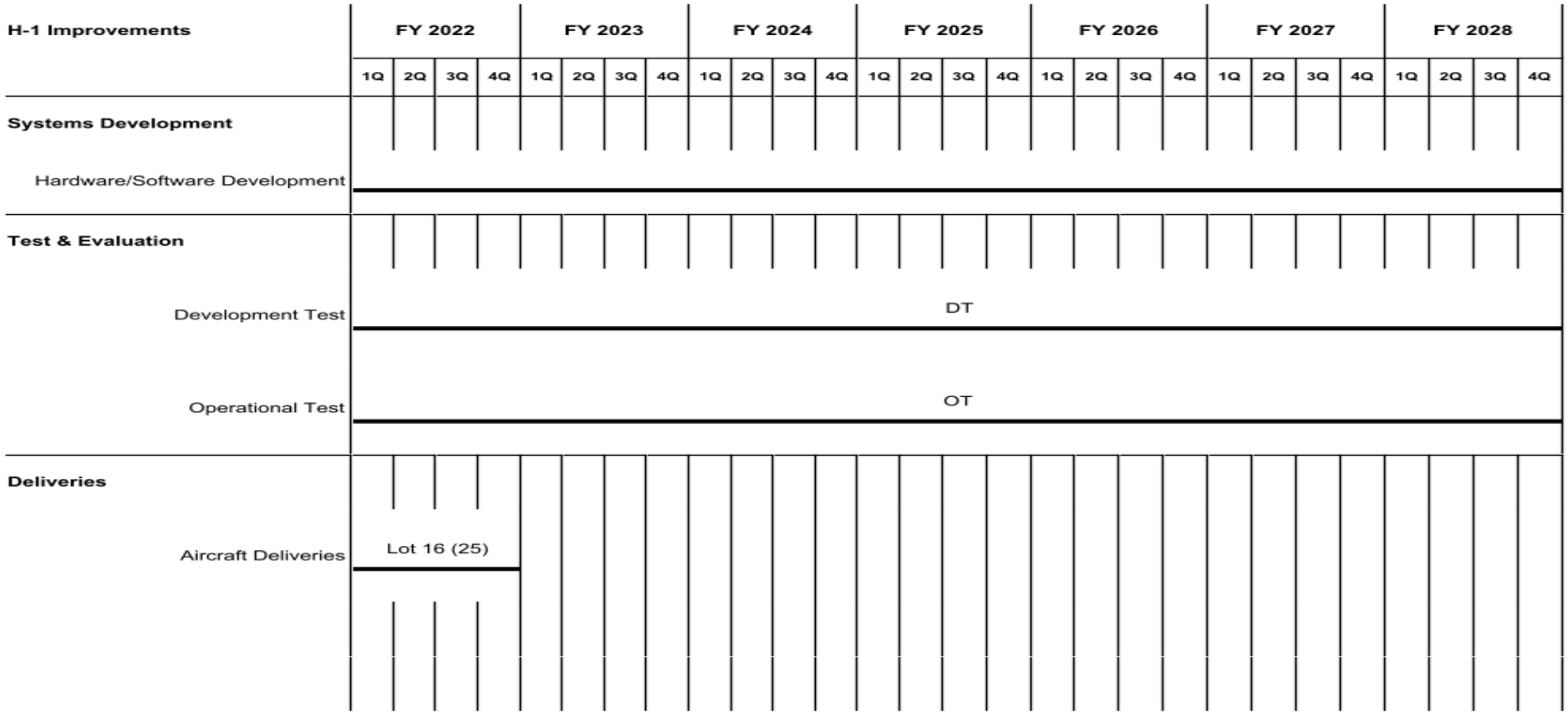

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Exhibit R-4A, RDT&E Schedule Details: PB 2024 Navy		Date: March 2023
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
H-1 Improvements				
Systems Development: Hardware/Software Development: Schedule Detail	1	2022	4	2028
Test & Evaluation: Development Test: H-1 Improvements DT	1	2022	4	2028
Test & Evaluation: Operational Test: H-1 Improvements OT	1	2022	4	2028
Deliveries: Aircraft Deliveries: Lot 16 FRP Z	1	2022	4	2022