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 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 0604262N / *V-22A*							
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	9,351.238	176.804	135.504	185.105	-	185.105	133.059	110.392	125.330	110.769	64.057	10,392.258
1425: *V-22*	9,351.238	162.319	135.504	185.105	-	185.105	133.059	110.392	125.330	110.769	64.057	10,377.773
9999: *Congressional Adds*	0.000	14.485	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.485
Program MDAP/MAIS Code: **Project MDAP/MAIS Code(s):** 212												

A. Mission Description and Budget Item Justification

The V-22 Osprey is an Acquisition Category IC Joint Program led by the Department of the Navy for the purpose of developing, testing, evaluating, procuring and fielding a tilt rotor, vertical takeoff and landing aircraft for Joint Service application. The V-22 program is designed to provide an aircraft to meet the amphibious/vertical assault needs of the Marine Corps, the Carrier Onboard Delivery (COD) needs of the Navy, and the special operations needs of the Air Force and the United States Special Operations Command (USSOCOM). The MV-22 variant is replacing the CH-46E in the Marine Corps and the CMV-22 will replace the C-2A in the Navy. The CV-22 variant replaced the MH-53J and MH-53M and augments the C-130 in the Air Force and USSOCOM. The V-22 is capable of flying over 2,100 nautical miles, with a single refueling, giving the services the advantage of a Vertical/Short Take-off and Landing aircraft that can rapidly self-deploy to any location in the world. This program is funded under Engineering Manufacturing and Development (EMD) for correction of deficiencies and includes Block A and Block B upgrades which encompassed engineering and manufacturing development of new end-items prior to the production incorporation decision as well as Block C suitability and effectiveness development upgrades. Capability Development Document interoperability requirements were addressed through a spiral upgrade acquisition strategy. It was the first spiral providing Key Enabling Department of Defense mandated open systems architecture upgrades for the mission computer hardware and software while simultaneously addressing required interoperability common avionics upgrades and current avionics obsolescence issues. Future development efforts will include Pre-Planned-Product-Improvements in the Capability Development Document and Re-design efforts to correct critical Reliability, Maintainability and Availability issues in support of readiness Operational Safety Improvement Program as prioritized by the United States Marine Corps or an Urgent Universal Needs Statement. Development efforts include Mission System Upgrades, Electrical System Upgrades, Engine Air Particle Separator (EAPS), Mid-Wing Process Unit, ARC 210 Series Radio, Mission Computer Obsolescence Initiative, Weapon Systems Development, Time on Wing, Digital Interoperability (DI), Technology Insertion efforts such as: Infrared Suppressor (IRS), Modular Avionics Mission Computer Re-design / CyberSecurity, Center Console Re-design, Flight Control System Re-design, Degraded Visual Environment (DVE), Helmet Mounted Display and Multi-Spectral Sensor, Aircraft Mission Maneuvering Envelope Expansion and testing of Additive Manufacturing processes for selected MV-22 components.

The V-22 Hardware Development Airframe continues to fund development efforts in support of V-22 Block upgrades, Time on Wing and Safety Improvement efforts such as Cockpit Engine Health Indicator and gearbox vibration monitoring. Continue engineering, logistics, flight test, flight test support and address the correction of deficiencies and obsolescence. Continue V-22 software development/mission computer obsolescence initiatives such as transition tech demo and modular avionics mission computer redesign. Continue V-22 Integrated Aircraft Survivability Equipment to include correcting deficiencies; radar warning system, integration with an upgraded missile warning and active infrared countermeasure system, rotor blade tabs, nacelle sails, Miniature Airborne Global Positioning System Receiver, Defensive

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
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Weapons capabilities and providing integrated threat warning information on the aircraft's main flight displays. Continue correcting deficiencies of the current EAPS and development of particle separation solutions. Continue Nacelle redesign efforts that will improve maintainability and reliability, as well as wiring redesign.

V-22 Hardware Development Propulsion will continue to fund the flight/engine hours that are necessary for the design, development, validation and verification of the V-22 propulsion and power systems at the Patuxent River squadron. Rolls-Royce will continue to provide engine support and development of V-22 flight testing.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under OPERATIONAL SYSTEMS DEVELOPMENT because it includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate funding in the current or subsequent fiscal year.

Note:
1st 2 CMV production aircraft are test aircraft. They will be delivered to Patuxent River to support Development Testing (DT).
OT will be conducted as part of a carrier air wing work-up prior to deployment. Operational Testing (OT) will focus on assessing the effectiveness and suitability of the CMV-22 as the Carrier Onboard Delivery platform in the carrier strike group.
There is no Milestone C, because CMV-22 is being executed as an ECP to V-22 Block C. Initial Operational Capability for CMV-22 is FY-21.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	171.386	143.079	132.805	-	132.805
Current President's Budget	176.804	135.504	185.105	-	185.105
Total Adjustments	5.418	-7.575	52.300	-	52.300
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-7.575			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.112	0.000			
• Program Adjustments	0.000	0.000	51.900	-	51.900
• Rate/Misc Adjustments	0.000	0.000	0.400	-	0.400
• Congressional Directed Reductions Adjustments	-3.470	-	-	-	-
• Congressional Add Adjustments	15.000	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 9999: *Congressional Adds*		
Congressional Add: *MV-22 CC-RAM Nacelle Improvements*	14.485	0.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Congressional Add Subtotals for Project: 9999	14.485	0.000
Congressional Add Totals for all Projects	14.485	0.000

Change Summary Explanation

FY 2020 increase for CMV hardware development and testing.

Schedule:

1. Hardware Development Schedule - As a result of reprioritization of development efforts Improved Inlet Solution development and flight test were deleted in FY18. Defense Weapon System Re-design, Flight Control System Re-design and Software Data Set Release have been added to the schedule as new requirements.
2. CMV Schedule - FY16 Risk Reduction requirements were reviewed and incorporated in design which delayed Critical Design (CDR) Review and should have been included on the FY19 Presidents Budget. Physical Configuration Audit updated to reflect first aircraft delivery. Initial Operational Capability added 4Q21 and Live Fire Event added 3Q20 as they were missing from the schedule. Production quantities and deliveries have been updated to reflect increased quantities. The FY22 Developmental Testing reflects new capabilities being developed. OT testing will begin in FY25 and out.
3. DI Schedule - Schedule updated to reflect additional detail as provided in the Congressional RFI.
4. VARS Schedule - Flight Test deleted as it is part of DT/OT. DT/OT slid to the right due to design updates.
5. Electrical System Redesign - Schedule updated to reflect additional detail as provided in the Congressional RFI.
6. IRS Schedule - Schedule updated to reflect additional detail as provided in the Congressional RFI.
7. Technology Insertion Schedule - Contract Award and System Requirements Review added as they were missing on the schedule. Beginning in FY20, efforts are included in the Open System Architecture / Cyber Security line.
8. Multi-Spectral Schedule - Contract Award, CDR and Flight Testing have moved one year to the right as requirements were further refined.
9. Swashplate Actuator schedule deleted as program is no longer funded.
10. Beginning in FY20 Open System Architecture/Cyber Security was established in order to correctly capture all of the Open System Architecture/Cyber Security efforts under one project.

Technical: Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604262N / *V-22A*				Project (Number/Name) 1425 / *V-22*			
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**
1425: *V-22*	9,351.238	162.319	135.504	185.105	-	185.105	133.059	110.392	125.330	110.769	64.057	10,377.773
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 212

A. Mission Description and Budget Item Justification

The V-22 Osprey is an Acquisition Category IC Joint Program led by the Department of the Navy for the purpose of developing, testing, evaluating, procuring and fielding a tilt rotor, vertical takeoff and landing aircraft for Joint Service application. The V-22 program is designed to provide an aircraft to meet the amphibious/vertical assault needs of the Marine Corps, the Carrier Onboard Delivery (COD) needs of the Navy, and the special operations needs of the Air Force and the United States Special Operations Command (USSOCOM). The V-22 is replacing the CH-46E in the Marine Corps with the MV-22; will supplement the H-60 in the Navy with the MV-22; and replace the MH-53J and MH-53M as well as augment the C-130 in the Air Force and USSOCOM with the CV-22. The V-22 is capable of flying over 2,100 nautical miles, with a single refueling, giving the services the advantage of a Vertical/Short Take-off and Landing aircraft that can rapidly self-deploy to any location in the world. This program is funded under Engineering Manufacturing and Development (EMD) for correction of deficiencies and includes Block A and Block B upgrades which encompassed engineering and manufacturing development of new end-items prior to the production incorporation decision as well as Block C suitability and effectiveness development upgrades. Capability Development Document interoperability requirements were addressed through a spiral upgrade acquisition strategy. It was the first spiral providing Key Enabling Department of Defense mandated open systems architecture upgrades for the mission computer hardware and software while simultaneously addressing required interoperability common avionics upgrades and current avionics obsolescence issues. Future development efforts will include Pre-Planned-Product-Improvements in the Capability Development Document and Re-design efforts to correct critical Reliability, Maintainability and Availability issues in support of readiness Operational Safety Improvement Program as prioritized by the United States Marine Corps or a Urgent Universal Needs Statement. Development efforts include Mission System Upgrade, Electrical System Upgrades, Engine Air Particle Separator (EAPS), Mid-Wing Process Unit, ARC 210 Series Radio, Mission Computer Obsolescence Initiative, Weapon Systems Development, Time on Wing, Digital Interoperability (DI), Technology Insertion such as: Infrared Suppressor (IRS), Modular Avionics Mission Computer Re-design / CyberSecurity, Center Console Re-design, Flight Control System Re-design, Degraded Visual Environment (DVE), Helmet Mounted Display and Multi-Spectral Sensor, Aircraft Mission Maneuvering Envelope Expansion and testing of Additive Manufacturing processes for selected MV-22 components.

The V-22 Hardware Development Airframe continues to fund development efforts in support of V-22 Block upgrades, Time on Wing and Safety Improvement efforts such as Cockpit Engine Health Indicator and gearbox vibration monitoring. Continue engineering, logistics, flight test, flight test support and address the correction of deficiencies and obsolescence. Continue V-22 software development/mission computer obsolescence initiatives such as transition tech demo and modular avionics mission computer redesign. Continue V-22 Integrated Aircraft Survivability Equipment to include correcting deficiencies; radar warning system, integration with an upgraded missile warning and active infrared countermeasure system, rotor blade tabs, nacelle sails, Miniature Airborne Global Positioning System Receiver (MAGR2K), Defensive Weapons capabilities and providing integrated threat warning information on the aircrafts main flight displays. Continue correcting deficiencies of the current EAPS and development of particle separation solutions. Continue Nacelle redesign efforts that will improve maintainability and reliability, as well as wiring redesign.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

V-22 Hardware Development Propulsion will continue to fund the flight/engine hours that are necessary for the design, development, validation and verification of the V-22 propulsion and power systems at the Patuxent River squadron. Rolls-Royce will continue to provide engine support and development of V-22 flight testing.

FY20 continues DI, United States Marine Corps Aviation wide implementation of software defined radios, such as Software Reprogrammable Payload, capable of migration to advanced waveforms and payloads, providing enhanced digital connectivity between forces using dissimilar waveforms and/or protocols. DI will enable fleet integration of new capability through the use of tablets with custom applications. DI is also envisioned to include logistics tracking (cargo and personnel) with the use of Radio Frequency Identification technology, advanced Electronic Warfare/Cyber capability, and threat data capturing/off-boarding.

FY20 continues the CMV-22 Hardware Development efforts which consist of an Engineering Change Proposal (ECP) to modify MV-22 into the CMV-22 configuration to perform the COD mission. The ECP will add such things as (1) the capability to meet the range requirements that the COD mission demands, (2) a high frequency (HF) radio to transmit/receive beyond line of sight over water and (3) a public address system for use while transporting passengers. CMV-22 will begin development testing to include preliminary envelope expansion, Electromagnetic Environment Effects testing, HF radio testing and begin Carrier Suitability and integration testing. CMV will continue to support development efforts such as: EAPS, Electrical System (IRS) Re-design, Center Console Re-design and Modular Avionics / Cyber Security Implementation.

FY20 continues Electrical System re-design and reliability improvement efforts. Upgrading the V-22 electrical system reliability and capacity is required to accommodate demands on electrical power system as additional systems are added to the V-22 aircraft. This effort will design, develop, validate and verify engineering solutions to improve (1) the Constant Frequency Generator, (2) the Variable Frequency Generator and (3) all associated electrical system interfaces.

FY20 continues IRS Re-design and Reliability improvement efforts. The IRS system masks the infrared signature of the V-22 aircraft, which increases operational survivability. The current IRS system fails to meet reliability requirements. This effort will design, develop, validate and verify engineering solutions to improve the V-22 IRS system to include funds for the EMD and instrumented flight test of IRS system solutions.

FY20 continues development efforts for Technology Insertion under Open Systems Architecture Maturation of aircraft interfaces to support Cyber-Resilient interoperability. Also includes risk reduction and development efforts such as Modular Avionics/Cyber Security Implementation, Cyber/Safe Flight Controls improvements and Center Console Redesign.

FY20 continues V-22 Multi-Spectral Sensor risk reduction and developmental efforts for an improved Navigation Sensor including added capabilities such as targeting and designating as well as DVE improvements.

FY20 Continues development efforts started under the Technology Insertion line.Open System Architecture / Cyber Security provides new capabilities focused on enhancing survivability; software and hardware modularity and maturation of aircraft interfaces to support Cyber-Resilient interoperability.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under OPERATIONAL SYSTEMS DEVELOPMENT because it includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate funding in the current or subsequent fiscal year.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: V-22 Hardware Development Airframe	9.150	20.335	28.029	0.000	28.029
Articles:	-	-	-	-	-
Description: The V-22 Hardware Development Airframe continues to fund development efforts. Continue development in support of V-22 Block upgrades, electrical system capacity efforts, Time on Wing/Reliability Improvements efforts such as testing of Additive Manufacturing processes for selected V-22 components and Safety Improvement efforts such as Cockpit Engine Health Indicator (CEHI) and gearbox vibration monitoring. Continue engineering, logistics, flight test, flight test support and address the correction of deficiencies and obsolescence. Continue V-22 software development/sustainment efforts such as transition tech demo, Modular Avionics Mission Computer Obsolescence Initiative re-design and Flight Control System. Continue V-22 integrated aircraft survivability equipment to include correcting deficiencies; radar warning system, integration with an upgraded missile warning and active infrared countermeasure system, cockpit interface units, electrical power system, rotor blade tabs, nacelle sails, Miniature Airborne Global Positioning System Receiver (MAGR2K) - which is part of DI, Defensive Weapons capabilities and providing integrated threat warning information on the aircraft main flight displays. Continue correcting deficiencies of the current EAP's and development of particle separation solutions. Continue Nacelle redesign efforts that will improve maintainability and reliability, as well as wiring redesign.					
FY 2019 Plans: Continued MV-22 development efforts. Continue MV-22 software development/sustainment efforts. Continue development in support of MV-22 Block upgrades, MAGR2K, Time on Wing/Reliability Improvements such as testing of Additive Manufacturing processes for selected MV-22 components and Safety Improvement efforts such as CEHI and gearbox vibration monitoring. Continue engineering, logistics, flight test, flight test support and address correction of deficiencies and obsolescence efforts such as Engine Air Particle Separator, also including training upgrades and developments. Continue reliability improvement efforts as well as Re-design efforts to correct critical Reliability, Maintainability and Availability issues in support of readiness Operational Safety Improvement Program.					
FY 2020 Base Plans: Continue V-22 development efforts including but not limited to: rotor blade tabs, nacelle sails and MAGR2K. Continue V-22 software development efforts. Continue development in support of V-22 Block upgrades, Time on Wing/Reliability Improvements such as testing of Additive Manufacturing processes for selected V-22 components and Safety Improvement efforts such as CEHI and gearbox vibration monitoring. Continue engineering, logistics, flight test, flight test support, address correction of deficiencies and obsolescence efforts such as Engine Air Particle Separator, Flight Control System, Air Data Unit, Defensive Weapons capabilities,					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
radar warning system, integration with an upgraded missile warning and active infrared countermeasure system, cockpit interface units and also including training upgrades and developments. Continue reliability improvement efforts as well as Re-design efforts to correct critical Reliability, Maintainability and Availability issues in support of readiness Operational Safety Improvement Program. . ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in FY 2020 for Hardware Development due to design changes to the Flight Control System and Air Data Unit due to obsolescence.					
Title: V-22 Hardware Development Propulsion/Mission Care	1.487	1.712	2.139	0.000	2.139
Articles:	-	-	-	-	-
Description: Hardware Development Propulsion / Mission Care funds the flight/engine hours that are necessary for the design, development, validation and verification of the V-22 propulsion and power systems at the Patuxent River squadron. In addition, it pays for Rolls Royce to provide engine support and development of the V-22 flight testing. ***FY 2019 Plans:*** Funds continued for Mission Care flight & engine hours for developmental testing at Patuxent River squadron. ***FY 2020 Base Plans:*** Funds continue for flight/engine hours that are necessary for the design, development, validation and verification of the V-22 propulsion and power systems at the Patuxent River squadron. Rolls Royce will continue to provide engine support and development of V-22 flight testing. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in FY 2020 for Hardware Development Propulsion / Mission Care is due to increased engine hardware and software improvement efforts.					
Title: V-22 Digital Interoperability	10.361	32.514	28.254	0.000	28.254
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Description: Digital Interoperability (DI) is the United States Marine Corps Aviation wide implementation of gateway and software defined radios, such as Software Reprogrammable Payload, capable of migration to advanced waveforms and payloads, providing enhanced digital connectivity between forces using dissimilar waveforms and/or protocols. DI will enable fleet integration of new capability through the use of tablets with custom applications. DI is also envisioned to include logistics tracking (cargo and personnel) with the use of Radio Frequency Identification technology, advanced Electronic Warfare/Cyber capability, and threat data capturing/off-boarding. ***FY 2019 Plans:*** Funds continued for the maturation of Marine Air Ground Task Force Agile Network Gateway Link. This includes DI and assessment of effectiveness via gateway messaging, data flow, data assurance, and quality of service to support the Information Exchange Requirements to support the approved integrated aviation survivability equipment information systems Initial Capability Document, distributed electronic warfare operations, data fusion, and mission thread Information exchange Requirements across the range of military operations. ***FY 2020 Base Plans:*** Funds continue for the maturation of Marine Air Ground Task Force Agile Network Gateway Link. This includes DI, Mesh Network Manager and assessment of effectiveness via gateway messaging, data flow, data assurance, and quality of service to support the Information Exchange Requirements to support the approved Integrated Aviation Survivability Equipment information systems Initial Capability Document, distributed electronic warfare operations, data fusion, and mission thread Information exchange Requirements across the range of military operations. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease for DI is due to the fact that hardware was procured in FY 2019 and is not required in FY 2020.					
Title: V-22 Software Reprogrammable Payload (SRP) ***Articles:*** ***Description:*** SRP is a single common payload module that is open architecture, government owned, flexible, and reconfigurable to support simultaneous missions and applications making maximum use of available bandwidth and ensuring interoperability. Provides a bridge and translator to allow various systems/waveforms to collaborate and provides the V-22 operator and passenger with a common operating picture.	12.543 -	0.000 -	0.000 -	0.000 -	0.000 -

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 Plans: N/A ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A					
Title: V-22 CMV Development	63.089	20.781	45.359	0.000	45.359
Articles:	-	-	-	-	-
Description: Funding supports the implementation of an Engineering Change Proposal (ECP) to incorporate the new systems required for the CMV-22 configuration to perform the Carrier Onboard Delivery (COD) mission. The ECP will add (1) the capability to meet the range requirements that the COD mission demands (2) a High Frequency (HF) radio to transmit/receive Beyond Line Of Sight (BLOS) over water and (3) a Public Address system for use while transporting passengers. CMV-22 will begin development testing to include things such as preliminary envelope expansion, Electromagnetic Environment Effects testing , HF radio testing and begin Carrier Suitability and Integration testing. Continue CMV-22 integrated aircraft survivability equipment to include correcting deficiencies of the current EAPS, Electrical System Re-design, Infrared Suppressor (IRS) Re-design, Center Console Re-design and Modular Avionics / Cyber Security Implementation. ***FY 2019 Plans:*** Continued funding for the V-22 CMV Development effort to perform the COD mission. Support the development of Functional Test Plans for the High Frequency (HF) radio to transmit/receive BLOS over water and the PA system. Development of the Joint Vertical Experimental Application System Software (JASS) will continue. Continue Modular Avionics software development / sustainment efforts such as Mission Computer obsolescence initiative redesign and modular software. Continue developmental efforts such as swashplate actuator, electrical system re-design, EAPS, IRS re-design and Cyber Security implementation. Begin the test instrumentation design and planning for the CMV aircraft. Begin Carrier Suitability and Integration testing and will complete developmental test risk reduction activities on PA system and HF radio and begin Alternate Live Fire Test and Evaluation development activities. ***FY 2020 Base Plans:*** Continues funding for the V-22 CMV Development effort to perform the COD mission. Support the development of Functional Test Plans for the HF radio to transmit/receive beyond line of sight over water and the PA					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
system. Development of the Joint Vertical Experimental Application System Software will continue. Begin the development testing for the CMV-22 with preliminary envelope expansion testing and Electromagnetic Environment Effects testing. Continue Modular Avionics software development / sustainment efforts such as Mission Computer obsolescence initiative redesign and modular software. Continue developmental efforts such as electrical system re-design, EAPS, IRS re-design and Cyber Security implementation. Continue the test instrumentation design and planning for the CMV-22 aircraft. Continue the Carrier Suitability and Integration testing and will complete developmental test risk reduction activities on the HF radio and complete Alternate Live Fire Test and Evaluation development activities. Begin Operational testing. Begin Interoperability development for additional critical capabilities such as Link-16, Mobile Users Objective System, Required Navigation Performance / Area Navigation, and secondary BLOS. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase for CMV Development for Integration of critical interoperability capabilities, open architecture and readiness improvements.					
Title: V-22 Electrical System Re-design ***Articles:*** ***Description:*** Continue Electrical System re-design and reliability improvement efforts. Upgrading the V-22 electrical system reliability and capacity is required to accommodate demands on electrical power system as additional systems are added to the V-22 aircraft. This effort will design, develop, validate and verify engineering solutions to improve: (1) the Constant Frequency Generator (CFG), (2) the Variable Frequency Generator (VFG) and (3) all associated electrical system interfaces. ***FY 2019 Plans:*** Continued Electrical System re-design and reliability improvement efforts noting the revised Acquisition strategy that will redesign and replace only the CFG GCU without relocating the GCU. ***FY 2020 Base Plans:*** Continues Electrical System re-design and reliability improvement efforts with the design, development, validation and verification of engineering solutions to improve the V-22 CFG/GCU. ***FY 2020 OCO Plans:***	0.000 -	5.839 -	5.926 -	0.000 -	5.926 -

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY2020 funds the validation and verification of engineering solutions for the CFG/GCU.					
Title: V-22 Aerial Refueling System Development	19.366	13.574	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: V-22 Aerial Refueling System (VARS) will provide V-22 tanker capability to the Marine Air Ground Task Force, enabling safe and efficient execution of all missions, tactical or humanitarian. The system will allow the V-22 to provide fuel to other Air Combat Element aircraft, such as F-35B, F-18, AV-8B, V-22 and CH-53E/K, while en-route, in the objective area, or during recovery, extending the operational reach/duration. With the V-22 deployed onboard, amphibious assault ships would gain an organic aerial refueling capability, maximizing response time and agility. ***FY 2019 Plans:*** Continued funding for the VARS Development Capability. VARS will provide V-22 tanker capability to the Marine Air Ground Task Force, enabling safe and efficient execution of all missions, tactical or humanitarian. The FY19 funding will be used to supply engineering support for any issues identified during flight test and initial fleet deployment as well as continued support equipment development and delivery. ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease from FY 2019 to FY 2020 due to the cancellation of the VARS program.					
Title: V-22 Infrared Suppressor (IRS) Re-design	0.150	3.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Continue Infrared Suppressor (IRS) redesign and reliability improvement efforts. The IRS system masks the infrared signature of the V-22 aircraft, which increases the operational survivability. The current IRS system fails to meet reliability requirements and continues to be a high readiness degrader. V-22 IRS system to include funds for the Engineering & Manufacturing Development (EMD) and instrumented flight test of IRS system solutions.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 Plans: Funding continued for the development of a new IRS system for the V-22. The ISR system masks the infrared signature of an aircraft which increases the survivability. FY19 funding will provide for continued Engineering & Manufacturing Development of an upgraded IRS system. ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease in IRS Re-design to support higher Marine Corp priorities.					
Title: V-22 Technology Insertion ***Articles:*** ***Description:*** The V-22 Technology Insertion development effort will provide new capabilities focused on enhancing survivability; software and hardware modularity and maturation of aircraft interfaces to support interoperability. Tech Insertion includes risk reduction and development efforts such as Modular Avionics/Cyber Security Implementation, Enhanced Defensive Weapons Capabilities, Radio Frequency Threat Protection, and Airborne Networking. ***FY 2019 Plans:*** Decreased in FY19 due to congressional mark. Funding was realigned to VARS and Electrical System Redesign. ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A	14.776 -	0.000 -	0.000 -	0.000 -	0.000 -
Title: V-22 Development Support, Test and Evaluation ***Articles:*** ***Description:*** Funds Government Engineering, Contractor Engineering, including Follow-On Test Evaluation (FOT&E), Developmental Test & Engineering (DT&E), and Operational Test & Evaluation (OT&E) for the V-22 flight events. Perform Government oversight. Execute test program risk reduction efforts, as well as fund Tactical	29.897 -	34.378 -	48.499 -	0.000 -	48.499 -

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Training Theatre Assessment and Planning Phase III program to ensure that all Navy training and testing at sea is compliant with the major Federal environmental laws. ***FY 2019 Plans:*** Funds provided for continued support of FOT&E, DT&E and OT&E to include flight control software, vehicle system operating software, inlet distortion, APR-39D(V)2, structural fatigue, envelope expansion, software airframe loads, integrated aircraft survivability equipment, Traffic Collision Avoidance System, Bonded Tabs, Aerial Refueling System and Refueling Envelope, Tactical Training Theatre Assessment and Planning Phase III and CMV risk reduction. ***FY 2020 Base Plans:*** Funds provided for continued support of FOT&E, DT&E and OT&E to include flight control software, vehicle system operating software, inlet distortion, APR-39D(V)2, structural fatigue, envelope expansion, software airframe loads, Integrated Aircraft Survivability Equipment, Traffic Collision Avoidance System, Bonded Blade Tabs, V-22 Aerial Refueling System and Refueling Envelope Expansion, Tactical Training Theatre Assessment and Planning Phase III (Environmental Testing), Sea Trials, Cockpit Engine Health Indicator and CMV Developmental Test and Live Fire. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in funding for CMV-22 Initial Operational Test and Evaluation (IOT&E) and Engineering Design Studies.					
Title: V-22 Multi-Spectral Sensor / Helmet Mounted Display	1.500	3.371	15.706	0.000	15.706
Articles:	-	-	-	-	-
Description: The V-22 Multi-Spectral Sensor / Helmet Mounted Display will provide risk reduction and developmental efforts for an improved Navigation Sensor and a Helmet Mounted Display. ***FY 2019 Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY19 continued the V-22 Multi-Spectral Sensor/Helmet Mounted Display risk reduction and developmental efforts started in the Technology Insertion line for an improved Navigation Sensor (including added capabilities such as targeting designating and Degraded Visual Environment improvements) and a Helmet Mounted Display. ***FY 2020 Base Plans:*** FY20 continues the V-22 Multi-Spectral Sensor risk reduction and developmental efforts for an improved Navigation Sensor including added capabilities such as targeting and designating. Will continue Degraded Visual Environment development efforts to improve safety when landing in obscured tactical zones. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in Multi-Spectral Sensor for the elevation of multiple sensors prior to down select of vendors.					
Title: V-22 Open Systems Architecture / Cyber Security	0.000	0.000	11.193	0.000	11.193
Articles:	-	-	-	-	-
Description: Open System Architecture / Cyber Security provides new capabilities focused on enhancing survivability; software and hardware modularity and maturation of aircraft interfaces to support Cyber-Resilient interoperability. Also includes risk reduction and development efforts such as Modular Avionics / Cyber Security Implementation, Cyber / Safe Flight Control improvements and Center Console Redesign. ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** Continues development efforts started under the Technology Insertion line. This effort provides new capabilities focused on enhancing survivability; software and hardware modularity and maturation of aircraft interfaces to support Cyber-Resilient Interoperability. Also includes risk reduction and development efforts such as Modular Avionics / Cyber Security Implementation, Cyber / Safe Flight Control Improvements and Center Console Redesign. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2020 realigned Technology Insertion line funding into the new Open Systems Architecture / Cyber Security line. New schedule has been added.					
Accomplishments/Planned Programs Subtotals	162.319	135.504	185.105	0.000	185.105

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
• APN 0164: *V-22*	1,260.538	1,157.726	995.421	-	995.421	963.546	1,110.269	928.746	479.423	345.413	35,987.643
• APN 0590: *V-22 Series*	222.524	197.993	325.367	-	325.367	332.901	477.442	494.946	489.749	4,027.853	7,981.654
• APN 0605/J0164: *V-22 Inital Spares*	4.723	3.744	2.523	-	2.523	5.096	3.234	1.475	2.031	377.899	400.725
• RDTE 1160403BB: *CV-22 Special Operations, Aviation Systems*	14.259	22.533	28.461	-	28.461	8.500	8.000	18.000	0.000	0.000	118.336
• RDTE BA07 0401318F: *CV-22 USAF BA07*	22.519	18.502	17.606	-	17.606	14.873	15.183	15.459	0.000	41.970	239.333

Remarks

D. Acquisition Strategy

The V-22 is a post Milestone III ACAT-IC program. As a result of mishaps during and subsequent to V-22 Operational Evaluation (Apr and Dec 00), the program was restructured employing a phased approach to return to flight and tactical introduction. The Contractor and Government defined deficient areas within the program/ aircraft requiring correction prior to return to flight. A Block Upgrade approach was planned, with required efforts identified in Block "A", "B", and "C". Block "A" included those efforts necessary to return the V-22 to safe and operational fleet operations. Block "B" included those efforts necessary to improve the effectiveness and suitability of the aircraft. Block "C" includes mission enhancements like weather radar, cabin effectiveness suitability improvements, i.e., Environmental Control System, and Forward Firing ALE-47. Non-recurring development activities are to be initiated and completed for all efforts identified in Block "A", "B", and "C". The Contractor will develop specific Statements of Work and Preliminary Specification Change Notices required to integrate the Block Upgrade efforts into the baseline Program. A Systems Requirements Review, Initial Design Review, and Final Design Review was held for each of the Block efforts so the design maturity could be reviewed and the Government could redirect activities as appropriate. The CV-22 Engineering Manufacturing and Development program is also structured in Blocks to define an evolutionary approach to achieving full operational capability. Block "0" is the initial baseline CV-22 variant. Block "10" enhances mission capability with the addition of terrain following radar, additional fuel tanks, additional radios, and Block "20" includes capabilities such as radio frequency and infrared countermeasures improvements. Additional Blocks are in the planning stages to continue the growth process throughout the operational life of the weapon system. The CMV-22 will add (1) the capability to meet the range requirements that the Carrier Onboard Delivery (COD) mission demands (2) a high frequency radio to transmit/receive beyond line of sight over water and (3) a public address system for use while transporting passengers in support of the COD mission.

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E. Performance Metrics

Milestone Reviews.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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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
V-22 Hardware Dev Airframe	Various	Various : Various	104.611	9.150	Jan 2018	20.335	Jan 2019	28.029	Jan 2020	-		28.029	122.519	284.644	-
V-22 Hardware Dev Propulsion	SS/CPIF	Rolls-Royce Corp. : Indianapolis, IN	196.638	1.487	Nov 2017	1.712	Nov 2018	2.139	Nov 2019	-		2.139	2.125	204.101	204.101
V-22 Digital Interoperability	Various	Various : Various	19.365	10.361	Jan 2018	32.514	Mar 2019	28.254	Mar 2020	-		28.254	25.210	115.704	-
V-22 Software Reprogrammable Payload (SRP)	Various	NRL : Washington, DC	13.632	12.543	Jan 2018	0.000		0.000		-		0.000	0.000	26.175	-
V-22 CMV Development	Various	Various : Various	70.778	63.169	Nov 2017	20.782	Nov 2018	45.359	Nov 2019	-		45.359	27.994	228.082	-
V-22 Aerial Refueling System Development	SS/CPIF	Bell Boeing : Ridley Park, PA	27.813	19.366	Jan 2018	13.574	Dec 2018	0.000		-		0.000	0.000	60.753	60.753
V-22 Electrical System Re-Design	SS/FFP	Hamilton Sundstrand Corp : Rockford, IL	0.852	0.000		5.839	Mar 2019	5.926	Mar 2020	-		5.926	71.105	83.722	83.722
V-22 IRS Re-design	SS/CPFF	Various : Various	3.809	0.150	Jan 2018	3.000	Jan 2019	0.000		-		0.000	0.000	6.959	6.959
V-22 Tech Insertion	C/CPFF	Various : Various	7.306	14.696	Mar 2018	0.000		0.000		-		0.000	0.000	22.002	22.002
V-22 Multi-Spectral Sensor / Helmet Mounted Display	C/CPIF	Bell Boeing : Ridley Park, PA	0.247	1.500	Mar 2018	3.371	Mar 2019	15.706	Mar 2020	-		15.706	41.979	62.803	62.803
V-22 Open Systems Architecture / Cyber Security	Various	Various : Various	0.000	0.000		0.000		11.193	Mar 2020	-		11.193	84.290	95.483	-
Prior year Prod Dev no longer funded in the FYDP	Various	Various : Various	5,106.472	0.000		0.000		0.000		-		0.000	0.000	5,106.472	-
		Subtotal	5,551.523	132.422		101.127		136.606		-		136.606	375.222	6,296.900	N/A

Remarks

Increase in Hardware Development supports Flight Control System Redesigns due to obsolescence and Miniature Airborne Global Positioning System (GPS) Receiver (MAGR 2K) development. Increase for Hardware Development Propulsion / Mission Care is due to increased Developmental Testing for Engine particle separation, hardware and software improvements. Swashplate Actuator deleted as a development program as it is no longer funded. CMV Development increase in funding supports integration of critical interoperability capabilities and open architecture and readiness improvements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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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
V-22 Govt Engineering Sppt	WR	Various : Pax River, MD	1,114.055	2.887	Nov 2017	2.167	Nov 2018	3.066	Nov 2019	-		3.066	23.500	1,145.675	-
V-22 CMV Govt Engineering Sppt	WR	Various : Pax River, MD	4.404	6.818	Nov 2017	7.989	Nov 2018	9.797	Nov 2019	-		9.797	13.527	42.535	-
Prior Year Support no longer funded in the FYDP	Various	Various : Various	189.718	0.000		0.000		0.000		-		0.000	0.000	189.718	-
		Subtotal	1,308.177	9.705		10.156		12.863		-		12.863	37.027	1,377.928	N/A

Remarks

Increase in V-22 Government Engineering supports the design changes for the Flight Control System.
Increase in CMV Government Engineering supports Engineering Design Studies and Requirements development for Link-16/Iridium and Required Navigation Performance / Area Navigation.

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
V-22 Dev Test & Evaluation	WR	NAWCAD : Pax River, MD	1,057.060	11.445	Nov 2017	13.033	Nov 2018	16.563	Nov 2019	-		16.563	54.983	1,153.084	-
V-22 Operational Test & Evaluation	WR	OT&E Force : Norfolk, VA	59.247	3.218	Dec 2017	2.521	Dec 2018	2.771	Dec 2019	-		2.771	23.006	90.763	-
V-22 CMV Dev Test & Evaluation	WR	NAWCAD : Pax River, MD	0.000	3.061	Nov 2017	6.230	Nov 2018	12.800	Nov 2019	-		12.800	23.280	45.371	-
V-22 CMV Operational Test & Evaluation	WR	OT&E Force : Norfolk, VA	0.000	0.000		0.000		1.000	Dec 2019	-		1.000	2.000	3.000	-
Prior Year T & E no longer funded in the FYDP	Various	Various : Various	48.200	0.000		0.000		0.000		-		0.000	0.000	48.200	-
		Subtotal	1,164.507	17.724		21.784		33.134		-		33.134	103.269	1,340.418	N/A

Remarks

CMV DT&E begins Live Fire Test & Evaluation (LFT&E) and Initial Operational Test & Evaluation (OT&E) . Increase in V-22 Operational Test and Evaluation reflects the hourly rate increase provided by COMOPTEVFOR. V-22 DT testing begins Cyber Obsolescence testing.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
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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
V-22 Engineering Tech Sppt	Various	Various : Various	1,047.880	0.259	Nov 2017	0.264	Dec 2018	0.272	Dec 2019	-		0.272	6.650	1,055.325	-
V-22 Management Sppt Svc	Various	Various : Various	158.233	0.681	Nov 2017	0.695	Jan 2019	0.716	Jan 2020	-		0.716	7.718	168.043	-
V-22 Program Mgmt Support	WR	NAWCAD : Pax River, MD	62.511	0.894	Nov 2017	0.816	Nov 2018	0.839	Nov 2019	-		0.839	9.641	74.701	-
V-22 Travel	WR	Various : Various	16.879	0.185	Sep 2018	0.185	Sep 2019	0.185	Sep 2020	-		0.185	2.500	19.934	-
V-22 CMV Travel	WR	Various : Various	0.056	0.040	Sep 2018	0.060	Sep 2019	0.060	Sep 2020	-		0.060	0.140	0.356	-
V-22 CMV Engineering Tech Sppt	Various	Various : Various	0.385	0.409	Jan 2018	0.417	Jan 2019	0.430	Jan 2020	-		0.430	1.440	3.081	-
Prior Year Mgmt Svcs no longer funded in the FYDP	Various	Various : Various	41.087	0.000		0.000		0.000		-		0.000	0.000	41.087	-
		Subtotal	1,327.031	2.468		2.437		2.502		-		2.502	28.089	1,362.527	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	9,351.238	162.319		135.504		185.105		-		185.105	543.607	10,377.773	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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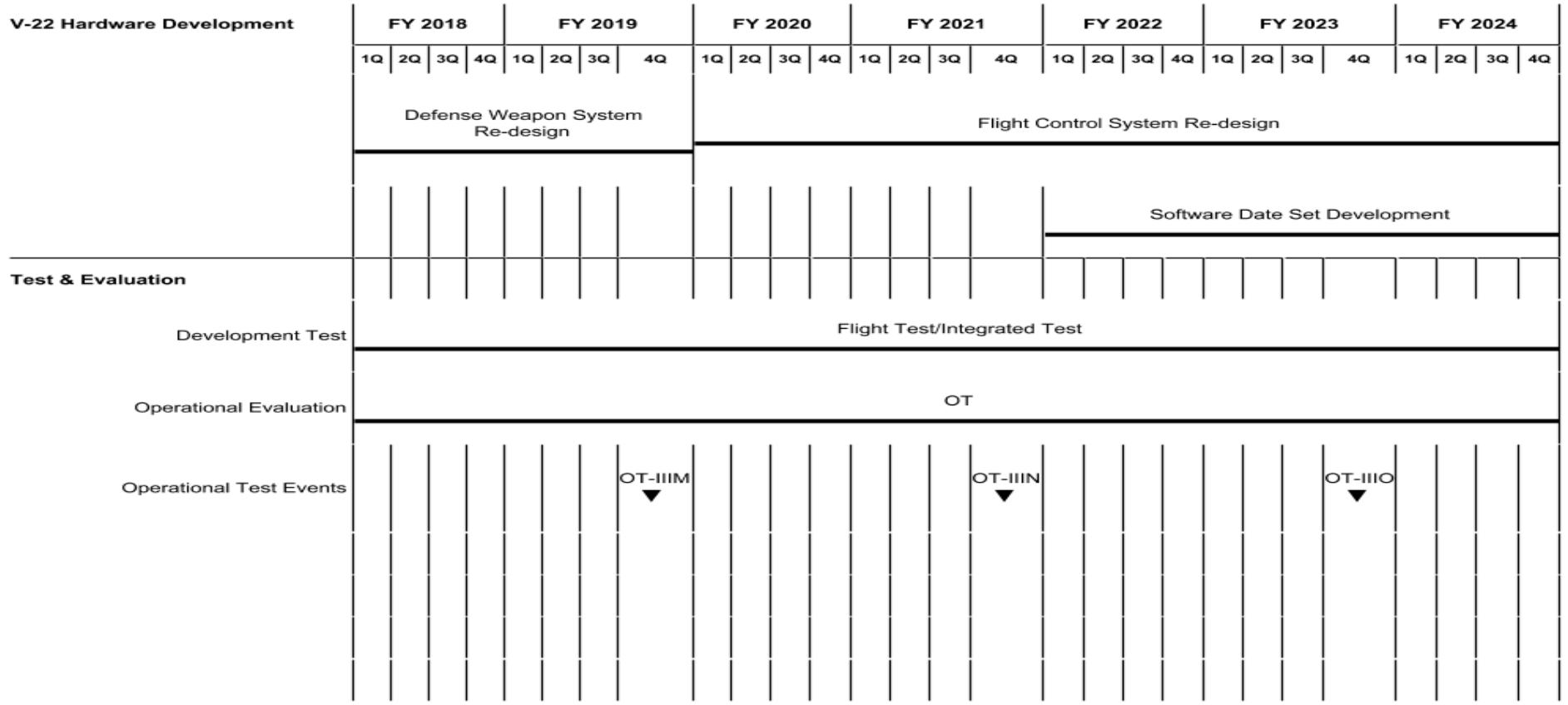

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604262N / *V-22A*	**Project (Number/Name)** 1425 / *V-22*

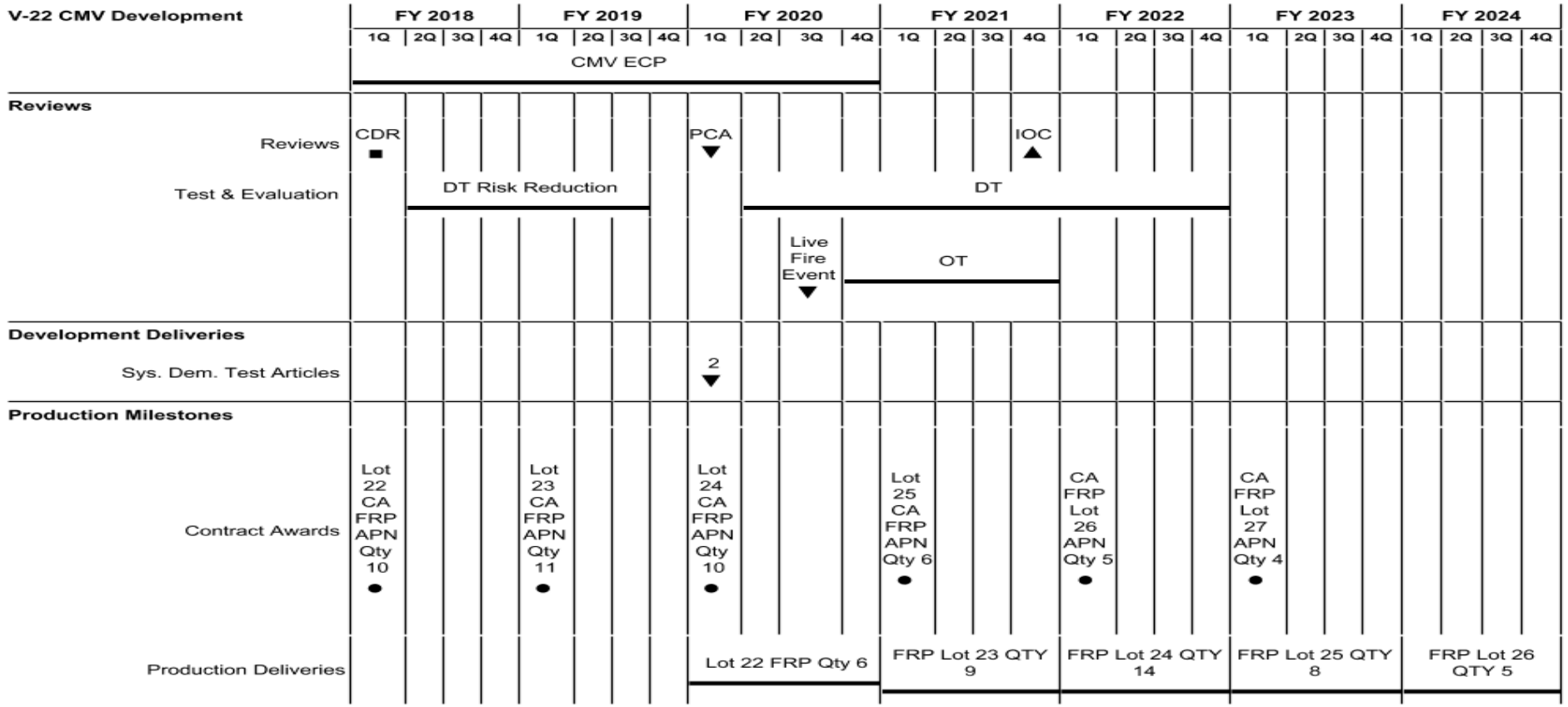

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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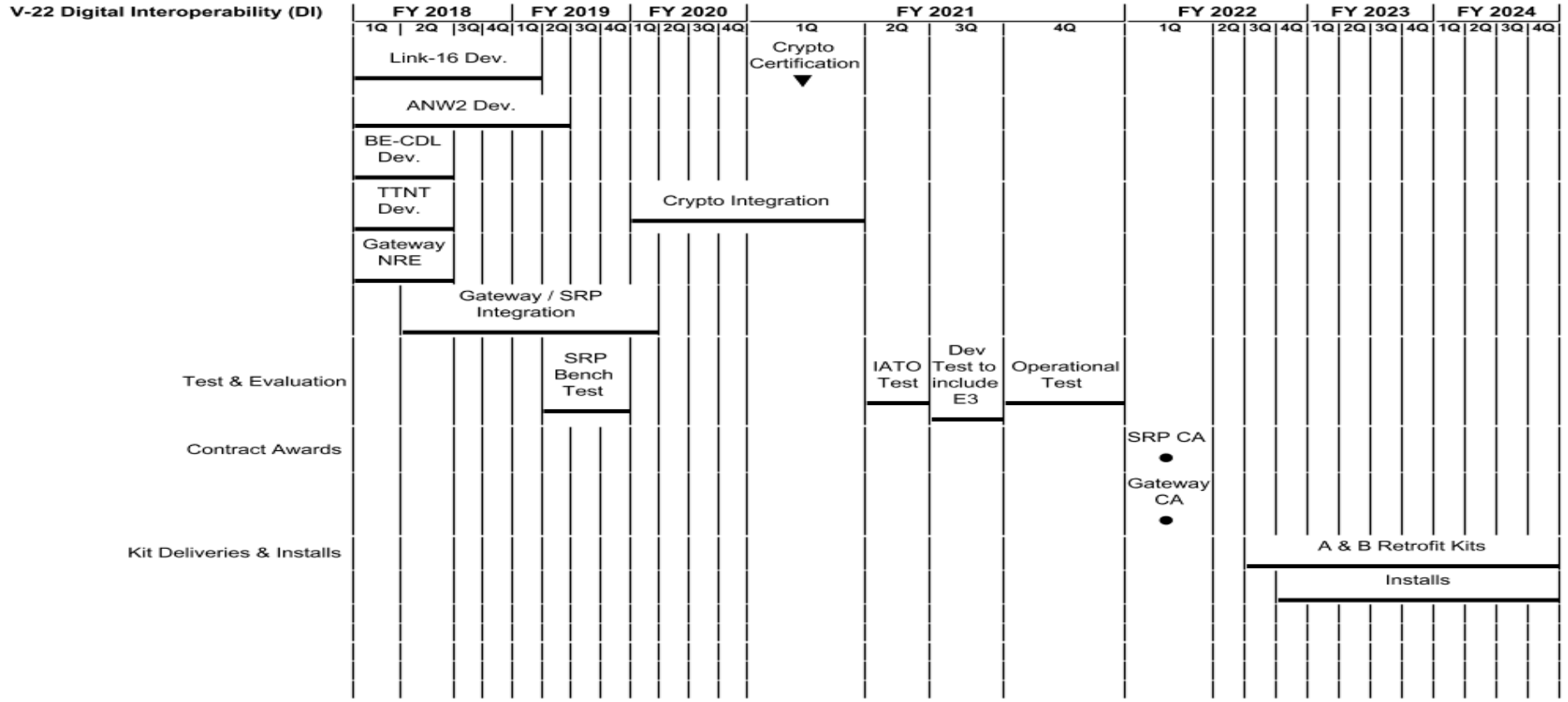

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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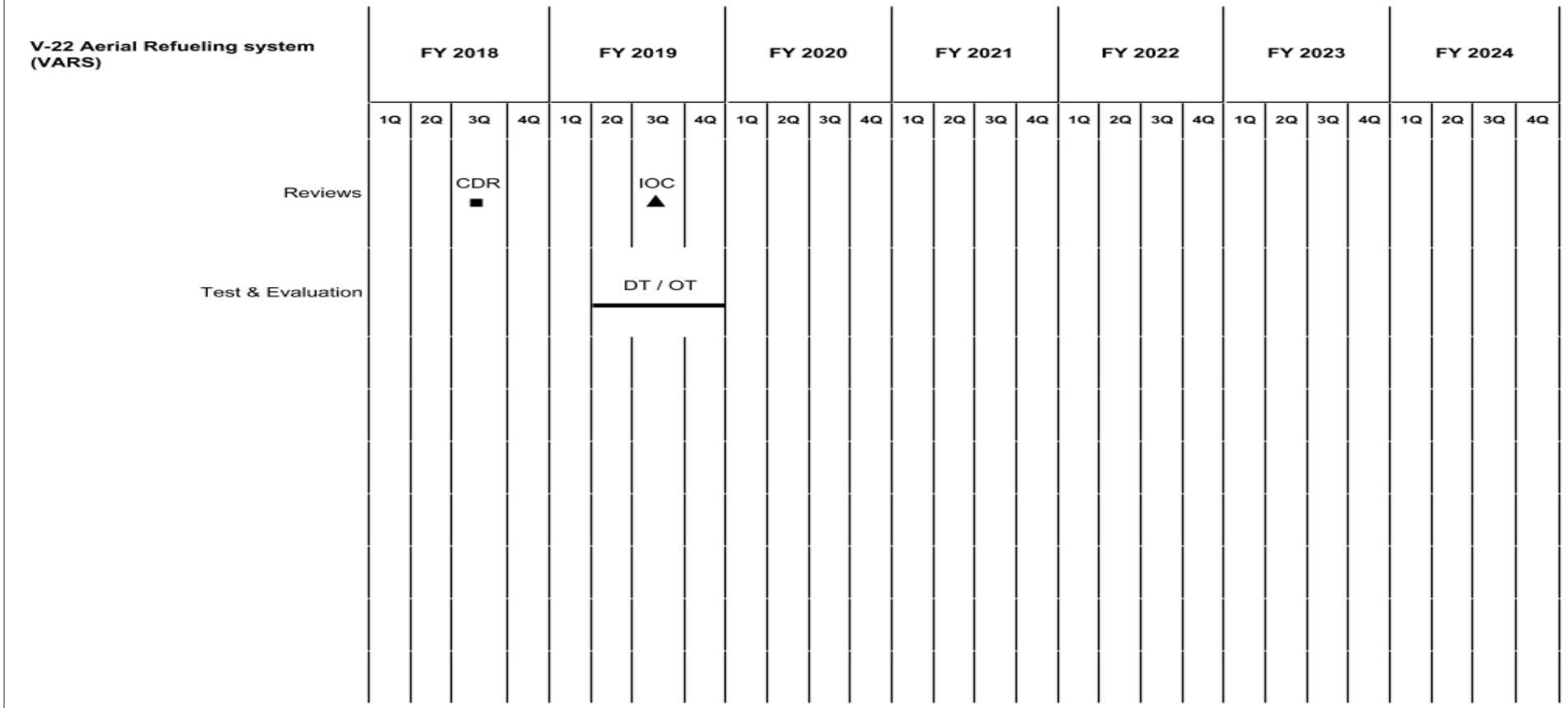

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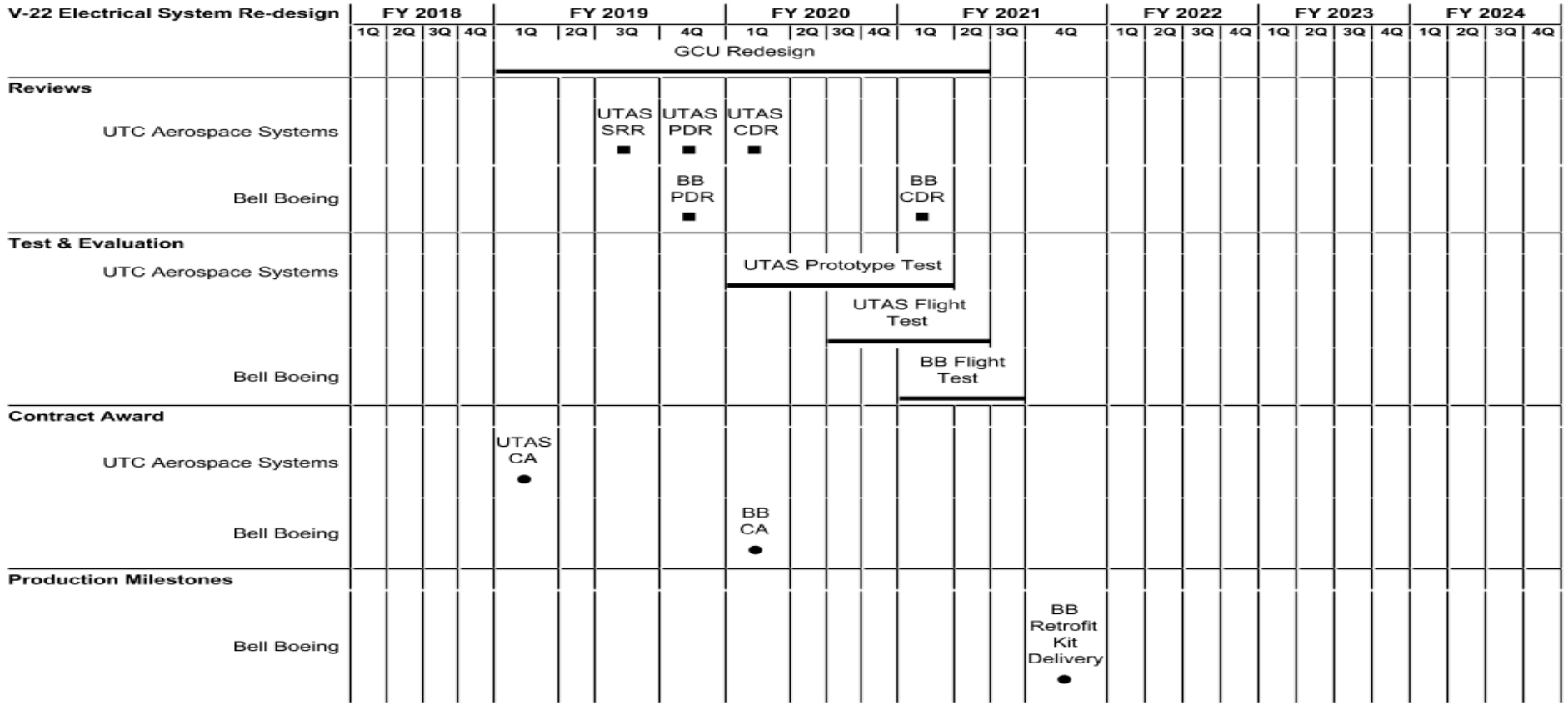

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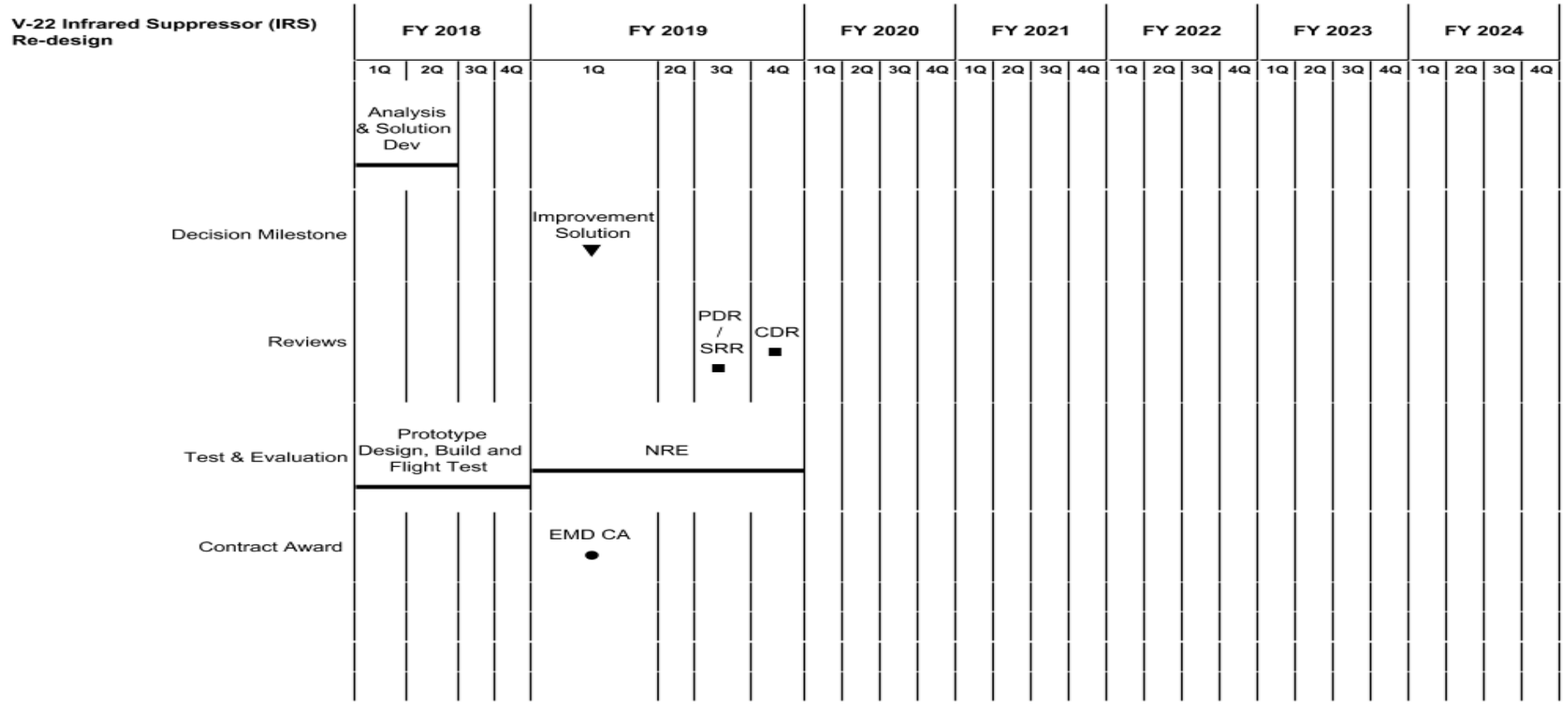

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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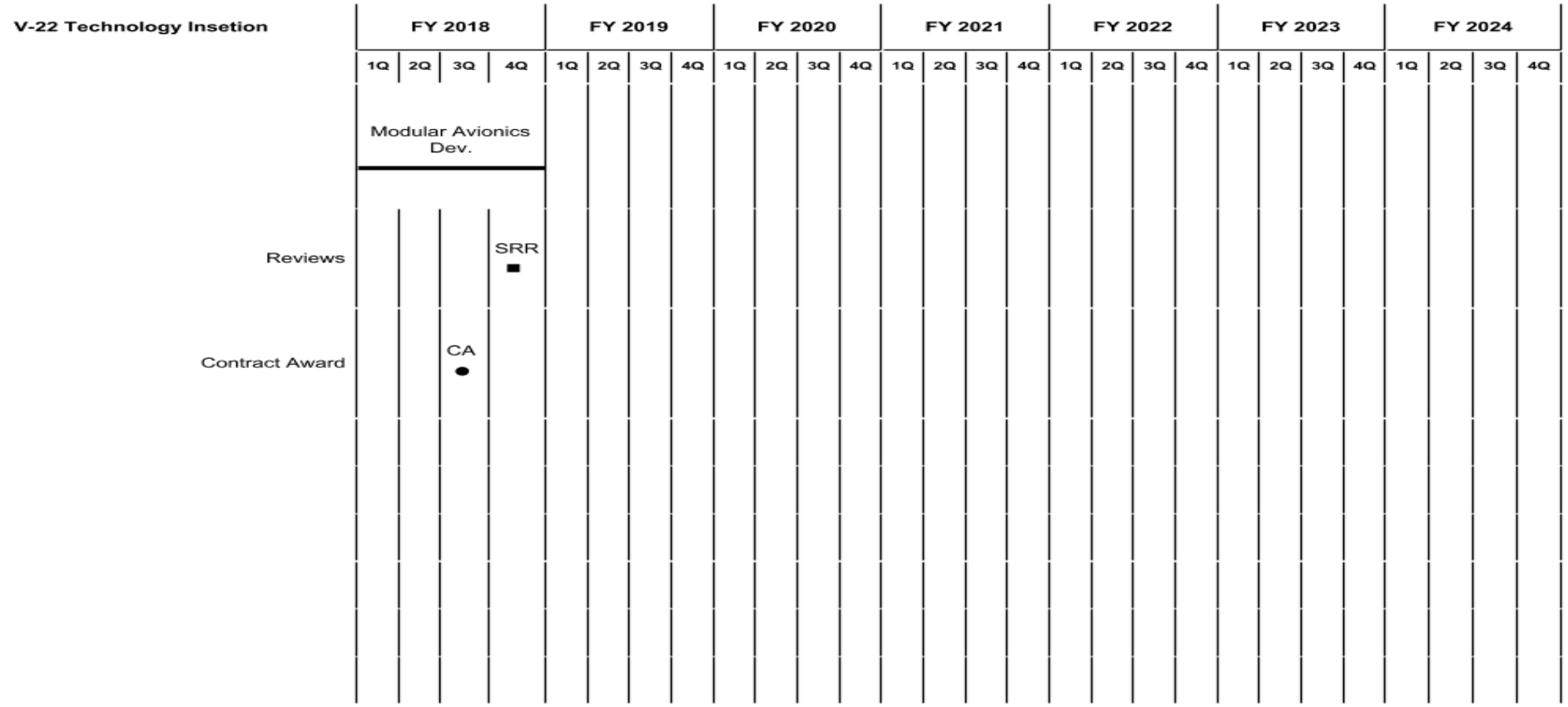

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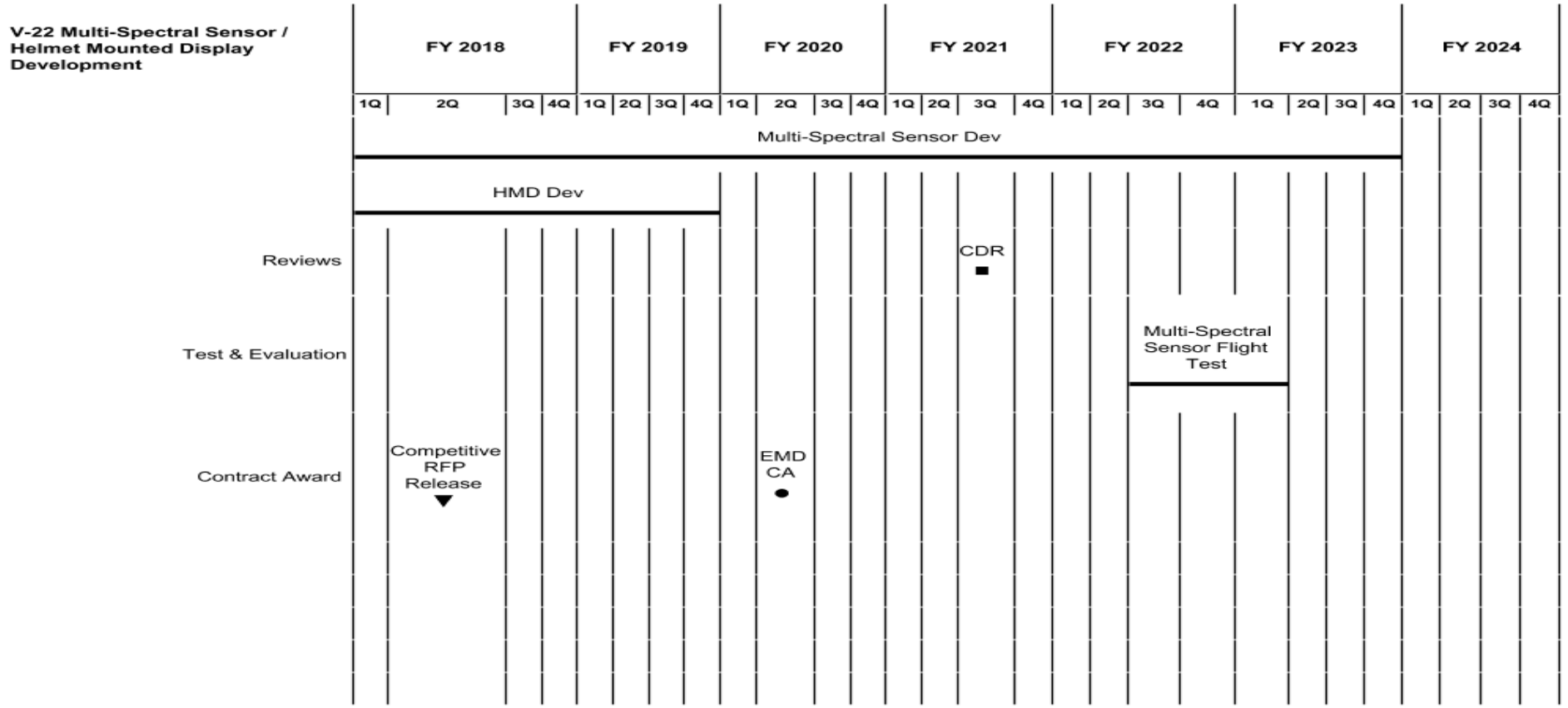

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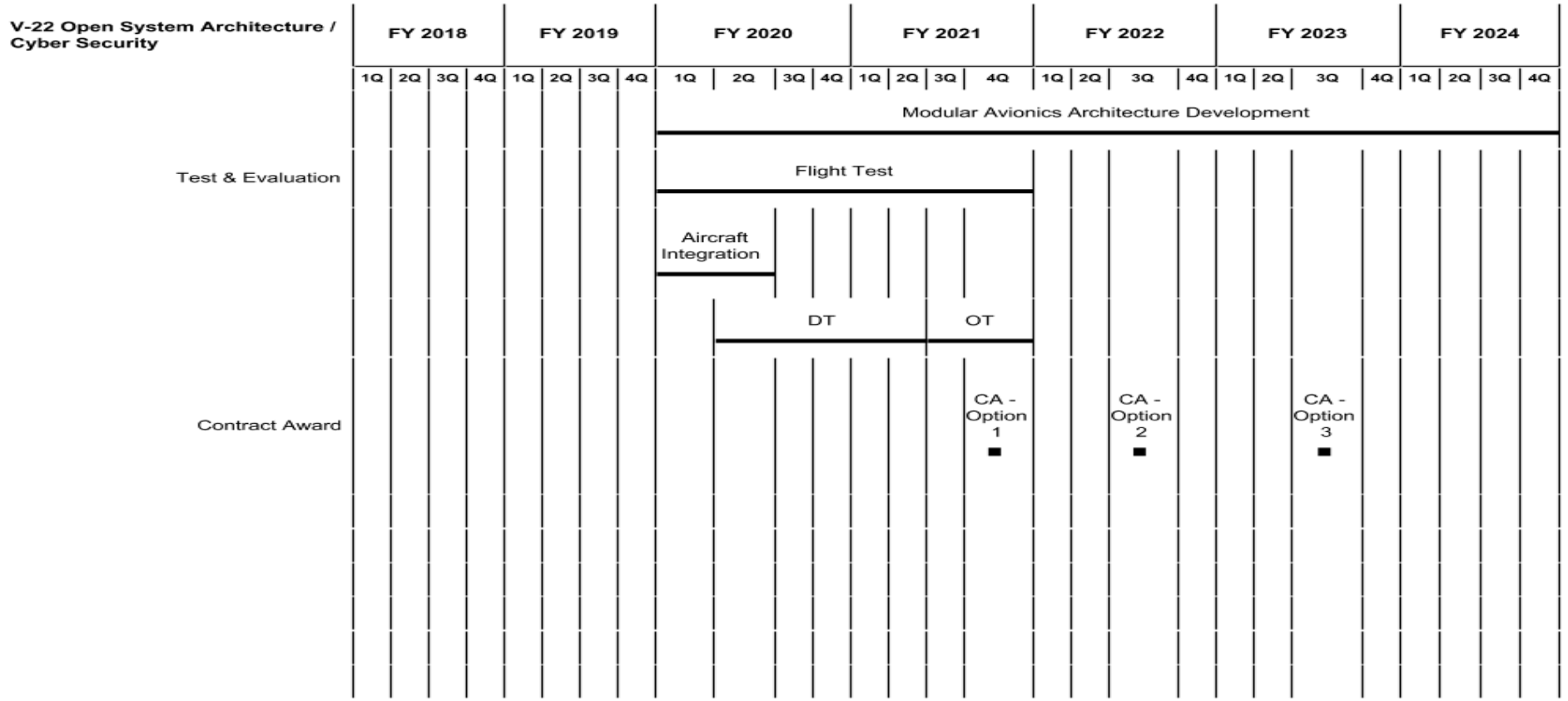

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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
V-22 Hardware Development				
Defense Weapon System Re-design	1	2018	4	2019
Flight Control System Re-design	1	2020	4	2024
Software Data Set Release Development	1	2022	4	2024
Test & Evaluation: Development Test: Development Flight Test / Integrated Test (IT-IIID) & Continuous software sustainment developmental testing	1	2018	4	2024
Test & Evaluation: Operational Evaluation: Operational Testing	1	2018	4	2024
Test & Evaluation: Operational Test Events: Operational Testing (OT-IIIM)	4	2019	4	2019
Test & Evaluation: Operational Test Events: Operational Testing (OT-IIIN)	4	2021	4	2021
Test & Evaluation: Operational Test Events: Operational Testing (OT-IIIO)	4	2023	4	2023
V-22 CMV Development				
Engineering Change Proposal	1	2018	4	2020
Reviews: Reviews: Critical Design Review	1	2018	1	2018
Reviews: Reviews: Initial Operational Capability	4	2021	4	2021
Reviews: Reviews: Physical Configuration Audit	1	2020	1	2020
Reviews: Test & Evaluation: Developmental Test Risk Reduction	2	2018	3	2019
Reviews: Test & Evaluation: Developmental Test (DT)	2	2020	4	2022
Reviews: Test & Evaluation: Live Fire Event	3	2020	3	2020
Reviews: Test & Evaluation: Operational Test (OT)	4	2020	4	2021
Development Deliveries: Sys. Dem. Test Articles: Sys. Dem. Test Articles	1	2020	1	2020
Production Milestones: Contract Awards: Lot 22 APN MV22 CMV Qty 10	1	2018	1	2018
Production Milestones: Contract Awards: Lot 23 APN MV22 CMV Qty 11	1	2019	1	2019
Production Milestones: Contract Awards: Lot 24 APN MV22 CMV Qty 10	1	2020	1	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Production Milestones: Contract Awards: Lot 25 APN MV22 CMV Qty 6	1	2021	1	2021
Production Milestones: Contract Awards: Lot 26 APN MV22 CMV Qty 5	1	2022	1	2022
Production Milestones: Contract Awards: Lot 27 APN MV22 CMV Qty 4	1	2023	1	2023
Production Milestones: Production Deliveries: Lot 22 APN Qty 6	1	2020	4	2020
Production Milestones: Production Deliveries: Lot 23 APN CMV Qty 9	1	2021	4	2021
Production Milestones: Production Deliveries: Lot 24 APN CMV Qty 14	1	2022	4	2022
Production Milestones: Production Deliveries: Lot 25 APN CMV Qty 8	1	2023	4	2023
Production Milestones: Production Deliveries: Lot 26 APN CMV Qty 5	1	2024	4	2024
V-22 Digital Interoperability (DI)				
Crypto Certification	1	2021	1	2021
Link-16 Development	1	2018	1	2019
Adaptive Networking Wideband Waveform Development	1	2018	2	2019
Bandwidth Efficient Common Data Link Development	1	2018	2	2018
Tactical Targeting Network Technology Development	1	2018	2	2018
Crypto Integration	1	2020	1	2021
Gateway Non-Recurring Engineering (NRE)	1	2018	2	2018
Gateway / Software Reprogrammable Payload (SRP) Integration	2	2018	1	2020
Test & Evaluation: SRP Bench Test	2	2019	4	2019
Test & Evaluation: Interim Authority To Operate Test	2	2021	2	2021
Test & Evaluation: Developmental Test to Include E3	3	2021	3	2021
Test & Evaluation: Operational Test	4	2021	4	2021
Contract Awards: Software Reprogrammable Payload Contract Award	1	2022	1	2022
Contract Awards: Gateway Contract Award	1	2022	1	2022
Kit Deliveries & Installs: Kit Deliveries	3	2022	4	2024
Kit Deliveries & Installs: Installs	4	2022	4	2024
V-22 Aerial Refueling system (VARS)				

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Reviews: Critical Design Review	3	2018	3	2018
Reviews: Initial Operational Capability	3	2019	3	2019
Test & Evaluation: Developmental Testing / Operational Testing	2	2019	4	2019
V-22 Electrical System Re-design				
Generator Control Unit Re-design	1	2019	2	2021
Reviews: UTC Aerospace Systems: UTAS System Requirements Review	3	2019	3	2019
Reviews: UTC Aerospace Systems: UTAS Preliminary Design Review	4	2019	4	2019
Reviews: UTC Aerospace Systems: UTAS Critical Design Review	1	2020	1	2020
Reviews: Bell Boeing: Bell Boeing Preliminary Design Review	4	2019	4	2019
Reviews: Bell Boeing: Bell Boeing Critical Design Review	1	2021	1	2021
Test & Evaluation: UTC Aerospace Systems: UTAS Prototype Testing	1	2020	1	2021
Test & Evaluation: UTC Aerospace Systems: UTAS Flight Test	3	2020	2	2021
Test & Evaluation: Bell Boeing: Bell Boeing Flight Test	1	2021	3	2021
Contract Award: UTC Aerospace Systems: UTAS Contract Award	1	2019	1	2019
Contract Award: Bell Boeing: Bell Boeing Contract Award	1	2020	1	2020
Production Milestones: Bell Boeing: Bell Boeing Retrofit Kit Delivery	4	2021	4	2021
V-22 Infrared Suppressor (IRS) Re-design				
Analysis and Solution Development	1	2018	2	2018
Decision Milestone: Improvement Solution Down Select	1	2019	1	2019
Reviews: Preliminary Design Review / Systems Requirements Review	3	2019	3	2019
Reviews: Critical Design Review	4	2019	4	2019
Test & Evaluation: Prototype Design, Build and Flight Test	1	2018	4	2018
Test & Evaluation: Non-Recurring Engineering	1	2019	4	2019
Contract Award: Engineering & Manufacturing Development Contract Award	1	2019	1	2019
V-22 Technology Insetion				
Modular Avionics Development	1	2018	4	2018

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Reviews: System Requirements Review	4	2018	4	2018
Contract Award: Contract Award	3	2018	3	2018
V-22 Multi-Spectral Sensor / Helmet Mounted Display Development				
Multi-Spectral Sensor Development	1	2018	4	2023
Helmet Mounted Display Development (HMD)	1	2018	4	2019
Reviews: Critical Design Review	3	2021	3	2021
Test & Evaluation: Flight Test	3	2022	1	2023
Contract Award: Competitive RFP Release	2	2018	2	2018
Contract Award: Engineering & Manufacturing Development Contract Award	2	2020	2	2020
V-22 Open System Architecture / Cyber Security				
Modular Avionics Architecture Development	1	2020	4	2024
Test & Evaluation: Flight Test	1	2020	4	2021
Test & Evaluation: Aircraft Integration	1	2020	2	2020
Test & Evaluation: Developmental Testing	2	2020	2	2021
Test & Evaluation: Operational Testing	3	2021	4	2021
Contract Award: Contract Award - Option 1	4	2021	4	2021
Contract Award: Contract Award - Option 2	3	2022	3	2022
Contract Award: Contract Award - Option 3	3	2023	3	2023

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
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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
9999: *Congressional Adds*	0.000	14.485	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.485
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add. The V-22 Common Configuration-Readiness And Modernization (CC-RAM) Nacelle Improvement funds engineering and manufacturing development efforts that will improve reliability and maintain commonality of nacelle components / structure across all V-22 variants. Planned improvements include improved inlet particle separation via optimization of the Engine Air Particle Separator system, and reliability improvements to the V-22 exhaust system to include aft nacelle structure and infrared suppressor components. Improved inlet particle separation development will provide critical safety and readiness improvements projected to increase engine reliability by a factor of 2x increasing engine /aircraft readiness in austere operational environments. Development of improvements in the aft nacelle will focus on increasing the reliability and maintainability of current aft nacelle structure and infrared compressor components through targeted changes to correct in service revealed deficiencies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: MV-22 CC-RAM Nacelle Improvements	14.485	0.000
FY 2018 Accomplishments: Development of an improved inlet particle separation solution will be executed under the current IIS development contract. Development will be focused on improving the efficiency of the EAPS system through increased scavenge ratios, optimization of inlet splitter flow aerodynamic performance, and increased EAPS blower efficiency. Solution will be common to all V-22 variants. Development of improvements to the aft nacelle include detailed design/manufacturing/material improvements to increase reliability and maintainability of the components in service to include the aft nacelle cowling, side panels, infrared transition duct and centerbody, and associated hardware.		
FY 2019 Plans: N/A		
Congressional Adds Subtotals	14.485	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The V-22 is a post Milestone III ACAT-IC program. As a result of mishaps during and subsequent to V-22 Operational Evaluation (Apr and Dec 00), the program was restructured employing a phased approach to return to flight and tactical introduction. The Contractor and Government defined deficient areas within the program/ aircraft requiring correction prior to return to flight. A Block Upgrade approach was planned, with required efforts identified in Block "A", "B", and "C". Block "A" included

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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those efforts necessary to return the V-22 to safe and operational fleet operations. Block "B" included those efforts necessary to improve the effectiveness and suitability of the aircraft. Block "C" includes mission enhancements like weather radar, cabin effectiveness suitability improvements, i.e., Environmental Control System, and Forward Firing ALE-47. Non-recurring development activities are to be initiated and completed for all efforts identified in Block "A", "B", and "C". The Contractor will develop specific Statements of Work and Preliminary Specification Change Notices required to integrate the Block Upgrade efforts into the baseline Program. A Systems Requirements Review, Initial Design Review, and Final Design Review was held for each of the Block efforts so the design maturity could be reviewed and the Government could redirect activities as appropriate. The CV-22 Engineering Manufacturing and Development program is also structured in Blocks to define an evolutionary approach to achieving full operational capability. Block "0" is the initial baseline CV-22 variant. Block "10" enhances mission capability with the addition of terrain following radar, additional fuel tanks, additional radios, and Block "20" includes capabilities such as radio frequency and infrared countermeasures improvements. Additional Blocks are in the planning stages to continue the growth process throughout the operational life of the weapon system. The CMV-22 will add (1) the capability to meet the range requirements that the Carrier Onboard Delivery (COD) mission demands (2) a high frequency radio to transmit/receive beyond line of sight over water and (3) a public address system for use while transporting passengers in support of the COD mission.

E. Performance Metrics

Milestone Reviews

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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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
V-22 Nacelle Improvements	SS/CPIF	Bell Boeing : Ridley Park, PA	0.000	14.485	Aug 2018	0.000		0.000		-		0.000	0.000	14.485	14.485
		Subtotal	0.000	14.485		0.000		0.000		-		0.000	0.000	14.485	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	14.485		0.000		0.000		-		0.000	0.000	14.485	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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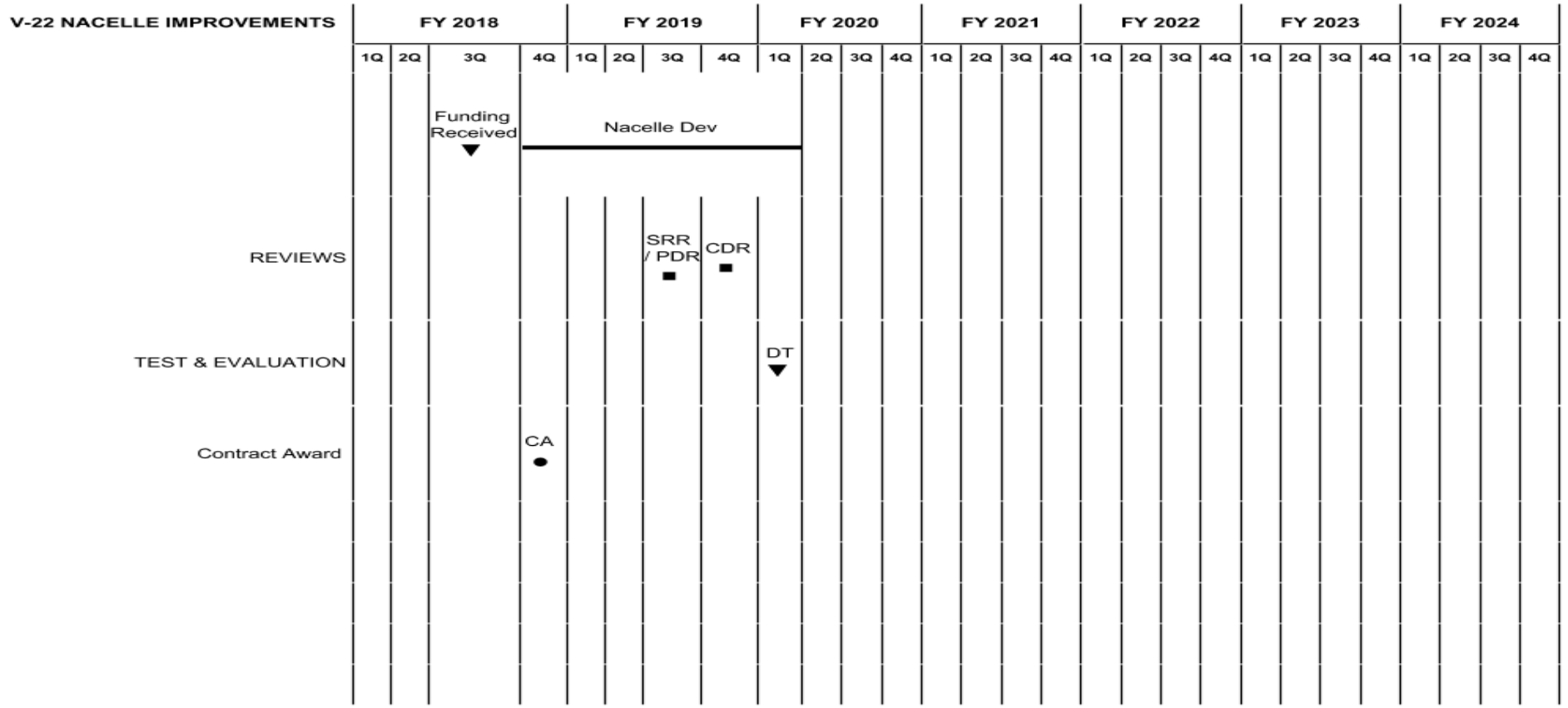

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Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
V-22 NACELLE IMPROVEMENTS				
Funding Received	3	2018	3	2018
Nacelle Development	4	2018	1	2020
REVIEWS: System Requirements Review / Preliminary Design Review	3	2019	3	2019
REVIEWS: Critical Design Review	4	2019	4	2019
TEST & EVALUATION: Developmental Testing	1	2020	1	2020
Contract Award: Contract Award	4	2018	4	2018