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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603860N / <i>JNT Precision Approach & Ldg Sys</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	1,332.078	47.417	33.612	24.450	-	24.450	-	-	-	-	-	-
2329: <i>JPALS</i>	1,332.078	47.417	33.612	24.450	-	24.450	-	-	-	-	-	-

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 238

A. Mission Description and Budget Item Justification

The FY 2022 funding request was reduced by \$1.778 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Joint Precision Approach and Landing System (JPALS) is the primary precision approach and landing system for CVN and LHA/D ships to support aircraft without SPN-46 Automatic Carrier Landing Systems (ACLS) capability including F-35B, F-35C, MQ-25A and future platforms. JPALS ship systems are required to provide CVN and LHA/D ships a primary precision approach capability during night and instrument flight conditions, including coupled approach capability to a hover transition point for LHA/D ships, and coupled approach to the deck (auto-land) capability aboard CVN ships. JPALS also provides the over-the-air inertial alignment capability for CVN and LHA/D ships to support aircraft platforms without Link-4A capability, including F-35, MQ-25A and future platforms. JPALS efforts include addressing broadened CyberSecurity requirements to remain compliant with software CyberSecurity directives and Information Assurance mandates.

The Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS) Future Naval Capabilities (FNC) program will execute an industry/government collaborative technology development program required to enhance Navy and Marine Corps unmanned, and potentially manned, platforms' Precision Ship-Relative Navigation (PS-RN) in a contested environment. LANTERNS will provide shipboard unmanned aircraft resilient launch and recovery during Distributed Maritime Operations (DMO).

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in high fidelity and realistic operating environments.

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Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603860N / <i>JNT Precision Approach & Ldg Sys</i>
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B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	51.341	33.612	25.284	-	25.284
Current President's Budget	47.417	33.612	24.450	-	24.450
Total Adjustments	-3.924	0.000	-0.834	-	-0.834
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-3.000	0.000			
• SBIR/STTR Transfer	-0.924	0.000			
• Program Adjustments	0.000	0.000	0.722	-	0.722
• Rate/Misc Adjustments	0.000	0.000	-1.556	-	-1.556

Change Summary Explanation

Technical: N/A

Schedule: N/A

Financial: FY 2022 changes are due to the increase to the Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS) effort and decreases to account for the availability of prior year execution balances and rate adjustments.

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys	Project (Number/Name) 2329 / JPALS
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2329: JPALS	1,332.078	47.417	33.612	24.450	-	24.450	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 238

A. Mission Description and Budget Item Justification

This budget reflects the Department of Defense certified Component Cost Position of the restructured Joint Precision Approach and Landing System (JPALS) program that funds the developmental, testing, and integration activities to implement and field JPALS ship systems that deliver the primary precision approach, landing, on-deck inertial alignment, surveillance, and auto-land capability for current and future low observable manned and unmanned platforms onboard all CVN and LHA/D ships. JPALS provides for development, integration, installation, and test of JPALS on CVN and LHA/D ships in accordance with the Joint Requirements Oversight Council (JROC) March 2016 approved JPALS Capability Development Document (CDD). JPALS Engineering Development Model (EDM) articles have been delivered to support JPALS EMD activities.

JPALS EDMs have been installed at shore based test facilities and (temporarily) on CVN and LHA/D ships to support F-35B/C developmental and operational testing and MQ-25A concept refinement, system requirements identification, allocation, surrogate risk reduction, and test. Two JPALS EDMs were procured in FY 2017 to support testing and F-35 shipboard operational deployments. JPALS will continue to invest in software development in direct support of precision approach and auto-land capabilities for the F-35B/C, MQ-25A, and future air platforms. JPALS effort includes addressing broadened CyberSecurity requirements to remain compliant with software CyberSecurity directives and Information Assurance mandates. Remaining costs are associated with the completion of the test and support to fielded EDM units. Additionally, costs are to enhance Precision Ship-Relative Navigation (PS-RN) for Navy and Marine Corps unmanned, and potentially manned, platforms, enabling resilient Distributed Maritime Operations (DMO) via the Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS) Future Naval Capabilities (FNC).

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: JPALS Ship Systems and Test	41.616	27.702	15.921	0.000	15.921
Articles:	-	-	-	-	-
Description: JPALS provides for development, integration, installation, and test of Sea-Based JPALS on CVN and LHA/D ships.					
FY 2021 Plans: Close out Operational Test (OT), Initial Operational Test and Evaluation (IOT&E) Phase II. Continue to support F-35 operational deployments.					
FY 2022 Base Plans:					

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Appropriation/Budget Activity 1319 / 4		R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys		Project (Number/Name) 2329 / JPALS	
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
Complete EMD phase. Continue to support F-35 operational deployments. Begin research and evaluation of M-code for implementation into the JPALS ship system.					
FY 2022 OCO Plans: N/A					
FY 2021 to FY 2022 Increase/Decrease Statement: Decrease of \$11.781M is due to the completion of the EMD phase.					
Title: Joint Strike Fighter (JSF) F-35B Marine Corp STOVL and F-35C Navy Carrier Variant Support					
Articles:					
Description: Provide technical development, shore based, and ship based support for F-35B and F-35C JPALS Integration and Developmental Test (DT) and Operational Test (OT) events. Provide JPALS system certification and documentation to certify shipboard all weather precision approach capability for F-35 operational test and deployments.					
FY 2021 Plans: Continue support of operational deployments of JPALS UDB capable F-35 aircraft including delivery, installation, and ship rider technical support of the JPALS Early Operational Capability (EOC) units onto ships. Continue development of JPALS two-way and autoland implementation into F-35 aircraft.					
FY 2022 Base Plans: Continue support of operational deployments of JPALS UDB capable F-35 aircraft including delivery, installation, and shiprider technical support of the JPALS Early Operational Capability (EOC) units onto ships. Continue development of JPALS two-way and autoland implementation into F-35 aircraft.					
FY 2022 OCO Plans: N/A					
FY 2021 to FY 2022 Increase/Decrease Statement: Increase of \$.084M from FY 2021 to FY 2022 is due to inflation.					
Title: MQ-25 Support					
Articles:					
	4.101	4.180	4.264	0.000	4.264
	-	-	-	-	-
	1.700	1.730	1.765	0.000	1.765
	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys	Project (Number/Name) 2329 / JPALS

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>Description: Provide technical support, lab support, requirements identification, allocation and test activities for MQ-25. Support MQ-25 concept refinement, requirements development, integration specifications, and risk reduction activities for JPALS integration. Support MQ-25 concept refinement and JPALS integration and developmental activities.</p> <p>FY 2021 Plans: Continue JPALS algorithm integration support and testing. Continue preparation of JPALS system integration lab at Patuxent River for MQ-25 shore testing.</p> <p>FY 2022 Base Plans: Continue JPALS algorithm integration support and testing. Continue preparation of JPALS system integration lab at Patuxent River for MQ-25 shore testing.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Increase of \$.035M from FY 2021 to FY 2022 is due to inflation.</p>					
<p>Title: LANTERNS</p> <p align="right">Articles:</p> <p>Description: The LANTERNS program will develop capabilities required to enable Navy and Marine Corps aircraft to safely and consistently operate to and from various air-capable Naval surface ships in all operational environments (including contested environments). The concept will execute an industry/government collaborative technology development program. LANTERNS will leverage substantial landing system S&T investments performed within the ONR/NAVAIR basic and applied research portfolio referred to as the Sea-based Automated Landing and Recovery System (SALRS) program.</p> <p>FY 2021 Plans: N/A</p> <p>FY 2022 Base Plans: Perform simulation analysis, evaluate prototype concepts to select preferred hardware/software solution. Demonstrate interoperability within target ship and aircraft architecture.</p>	0.000 -	0.000 -	2.500 1	0.000 -	2.500 1

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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys	Project (Number/Name) 2329 / JPALS
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Validate compatibility of legacy message structure with prototype system and exercise the most promising solution concept. FY 2022 OCO Plans: N/A FY 2021 to FY 2022 Increase/Decrease Statement: Increase of \$2.5M from FY 2021 to FY 2022 is due to the start of the LANTERNS effort.					
Accomplishments/Planned Programs Subtotals	47.417	33.612	24.450	0.000	24.450

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

<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022 Base</u>	<u>FY 2022 OCO</u>	<u>FY 2022 Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• OPN/2867: JPALS	85.445	96.751	35.386	-	35.386	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

Technology Development phase was conducted jointly by NAVAIRSYSCOM (PMA-213), USAF Electronic Systems Command (Global Air) and multiple industry partners. This effort provided the concept of operations, performance specifications and technology readiness levels necessary to provide the foundation from which to launch the Increment 1 System Development and Demonstration (SDD) phase development. Joint Precision Approach and Landing System (JPALS) reached MS-B on 14 July 2008 and the SDD phase development contract was awarded on 17 July 2008. Tasking consisted of sea-based JPALS, related ship and airborne reference systems, end-to-end software algorithms, necessary ship installation hardware, test equipment, system simulation software, and other RDT&E deliverable products. The SDD contract was awarded after full and open competition. JPALS is being developed by the Navy with an open system architecture in order to facilitate the compatible integration of many different aircraft and avionics architectures. JPALS provides for development, integration, installation, and test of Sea-Based JPALS to meet Initial Operation Capability of CVN and LHA/D ships in accordance with the JPALS Capability Development Document (CDD). Additionally, this requirement provides critical enabling technology for Joint Strike Fighter (JSF) F-35B Marine Corps Short Take-Off and Vertical Landing (STOVL) and F-35C Navy Carrier Variant, ship-based MQ-25A, and future Navy and Marine Corps air platforms.

As a result of the DON Resource and Requirements Review Board approved PALC Roadmap, the JPALS production phase was deferred to include design improvements to provide manned and unmanned aircraft with autoland capabilities. The current Engineering and Manufacturing Development (EMD) contract was modified in FY14 to add detailed requirements and design trade studies to identify specific system design improvements. An extension for pre-Milestone B efforts was awarded in fourth quarter FY15.

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Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)
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A Development RFP Release Decision Point (DRRDP) Defense Acquisition Board (DAB) was completed and the RFP for JPALS EMD 16 was released on 24 November 2015. A Milestone B (MS B) DAB was completed 02 June 2016. The MS B Acquisition Decision Memorandum (ADM) was approved 27 June 2016, which granted entry into the EMD phase for the restructured JPALS program and officially completed all actions required to exit Nunn-McCurdy. JPALS now has an approved Acquisition Program Baseline (APB) and has been designated an Acquisition Category (ACAT) 1C program. Sole Source contract was awarded to Raytheon in fourth quarter FY16. Completed Milestone C in April 2019.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys	Project (Number/Name) 2329 / JPALS
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
Ship Integration	WR	NAWCAD : Pax River, MD	77.867	3.653	Nov 2019	1.575	Nov 2020	0.000		-		0.000	-	-	-
Primary Hardware Development - EMD Phase I	C/CPIF	Raytheon : Fullerton, CA	410.181	0.000		0.000		0.000		-		0.000	-	-	-
Primary Hardware Development - New EMD Contract	C/CPIF	Raytheon : Fullerton, CA	208.118	26.149	Nov 2019	21.021	Nov 2020	17.288	Nov 2021	-		17.288	-	-	-
JPALS Modifications for ARC-210	C/CPFF	RCI : Cedar Rapids, IA	6.953	1.650	Nov 2019	0.758	Nov 2020	0.000		-		0.000	-	-	-
Risk Reduction for Auto-land - FFRDC Support	FFRDC	JHU : Laurel, MD	0.493	0.000		0.000		0.000		-		0.000	-	-	-
Primary Hardware Development - LANTERNS	TBD	Various : Various	0.000	0.000		0.000		2.500	Nov 2021	-		2.500	-	-	-
Prior Year Prod Dev no longer funded in the FYDP	TBD	Various : Various	249.870	0.000		0.000		0.000		-		0.000	-	-	-
Subtotal			953.482	31.452		23.354		19.788		-		19.788	-	-	N/A

Remarks
Decrease in Primary Hardware Development from FY 2021 to FY 2022 is due to Modification for ARC-210 completion, Ship Integration completion and EMD phase ramping down.

Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
Systems Engineering Support	WR	NAWCAD : Pax River, MD	208.578	7.035	Nov 2019	5.605	Nov 2020	2.967	Nov 2021	-		2.967	-	-	-
Integrated Logistics Support	WR	NAWCAD : Pax River, MD	22.054	0.725	Nov 2019	0.000		0.000		-		0.000	-	-	-
Prior Year Support Costs non longer funded in FYDP	Various	Various : Various	21.514	0.000		0.000		0.000		-		0.000	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / JNT Precision Approach & Ldg Sys	Project (Number/Name) 2329 / JPALS
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Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
Subtotal			252.146	7.760		5.605		2.967		-		2.967	-	-	N/A

Remarks
Decrease in Systems Engineering support between FY 2021 and FY 2022 is due to EMD phase ramping down.

Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
Developmental Test & Evaluation	WR	NAWCAD : Pax River, MD	76.770	0.000		0.000		0.000		-		0.000	-	-	-
Operational Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	5.583	0.726	Nov 2019	0.605	Nov 2020	0.000		-		0.000	-	-	-
Operational Test & Evaluation	WR	NAWCAD : Pax River, MD	0.000	6.387	Nov 2019	2.994	Nov 2020	0.716	Nov 2021	-		0.716	-	-	-
Subtotal			82.353	7.113		3.599		0.716		-		0.716	-	-	N/A

Remarks
Decrease in Test and Evaluation between FY 2021 and FY 2022 is due to EMD testing phase ramping down.

Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
Program Management	WR	NAWCAD : Pax River, MD	28.802	0.917	Nov 2019	0.899	Nov 2020	0.837	Nov 2021	-		0.837	-	-	-
PM Support - MSS	C/CPFF	Amelex : Pax River, MD	10.753	0.000		0.000		0.000		-		0.000	-	-	-
PM Support - MSS	C/CPFF	Avian : Pax River, MD	1.592	0.000		0.000		0.000		-		0.000	-	-	-
PM Support - MSS	C/CPFF	SAIC : Pax River, MD	2.487	0.000		0.000		0.000		-		0.000	-	-	-

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy

Date: May 2021

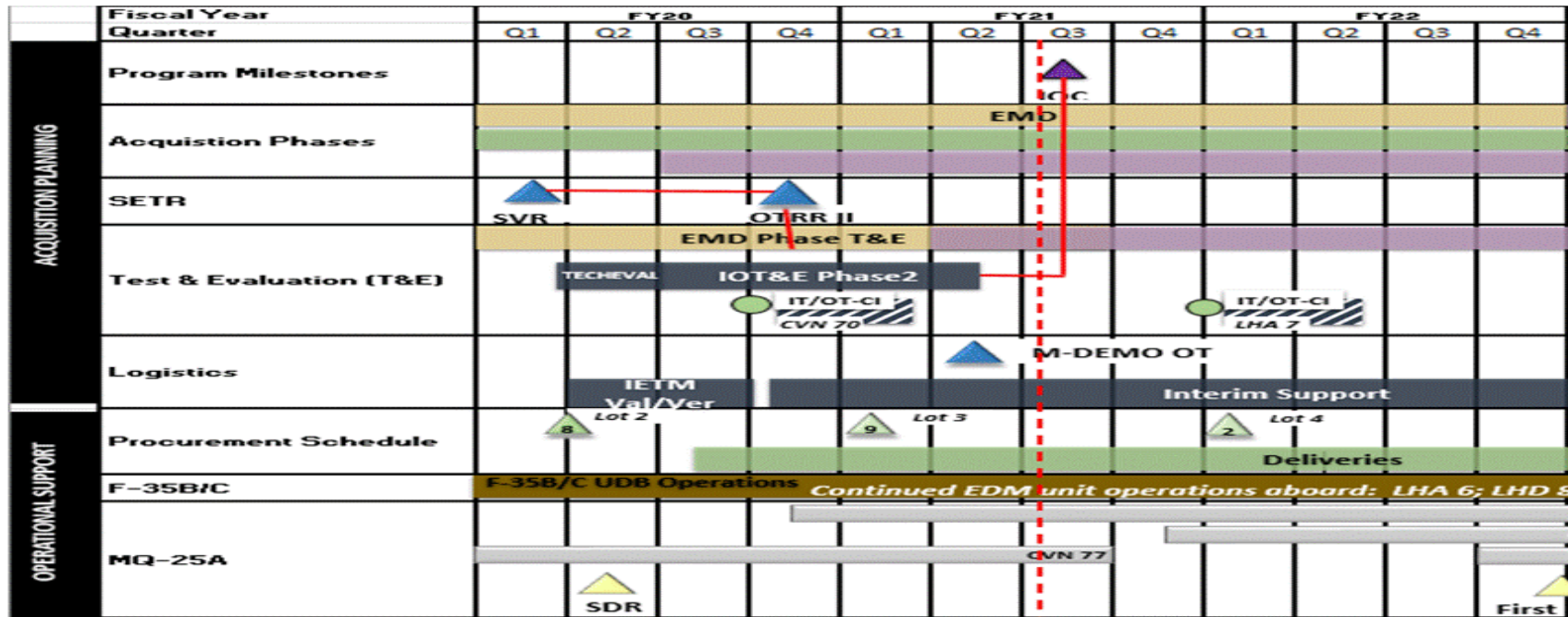
Appropriation/Budget Activity
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PE 0603860N / JNT Precision Approach & Ldg Sys

Project (Number/Name)
2329 / JPALS



JPALS Program Schedule



Legend:
 - Critical Path to JPALS IOC
 - Production Unit
 - Lot Buys
 - Projected Test/Cert

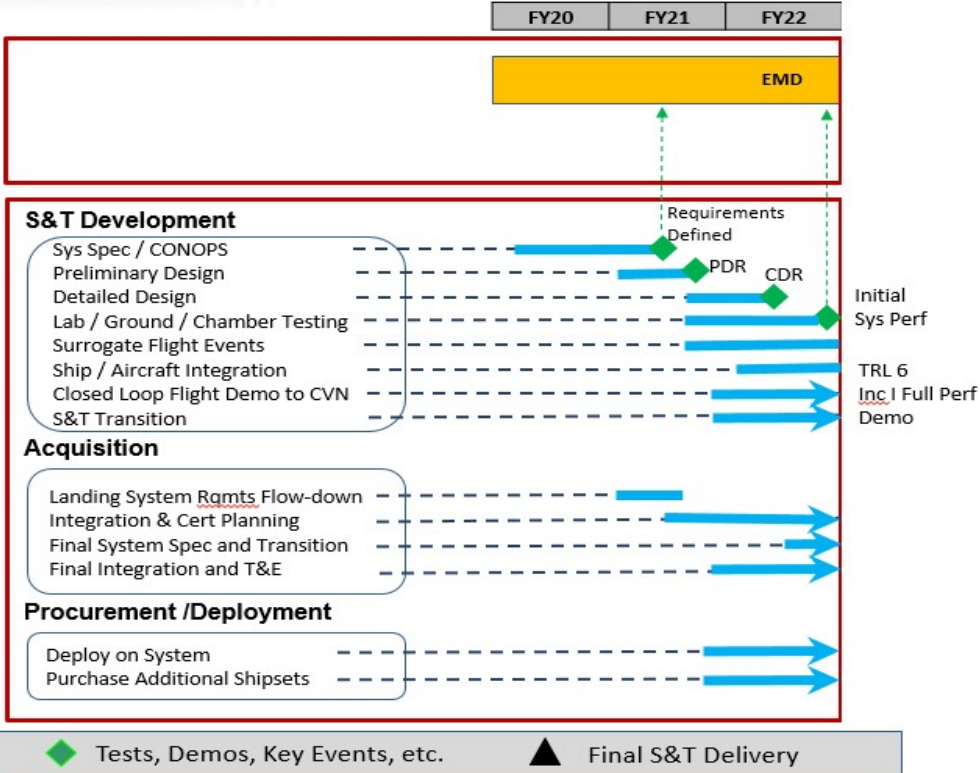
Revision Date: APRIL 15 2021

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
JPALS				
Acquisition Milestones: Initial Operating Capability (IOC)	1	2021	1	2021
Systems Development: Engineering and Manufacturing Development	1	2020	4	2022
Test & Evaluation: Operational Test and Evaluation (IOT&E) Phase II	3	2020	2	2021
Test & Evaluation: JPALS Operational Test Readiness Review (OTRR) II	4	2020	4	2020
LANTERNS				
Acquisition Milestones: Critical Design Review	3	2022	3	2022
Systems Development: Integration and Cert Planning	1	2022	4	2022