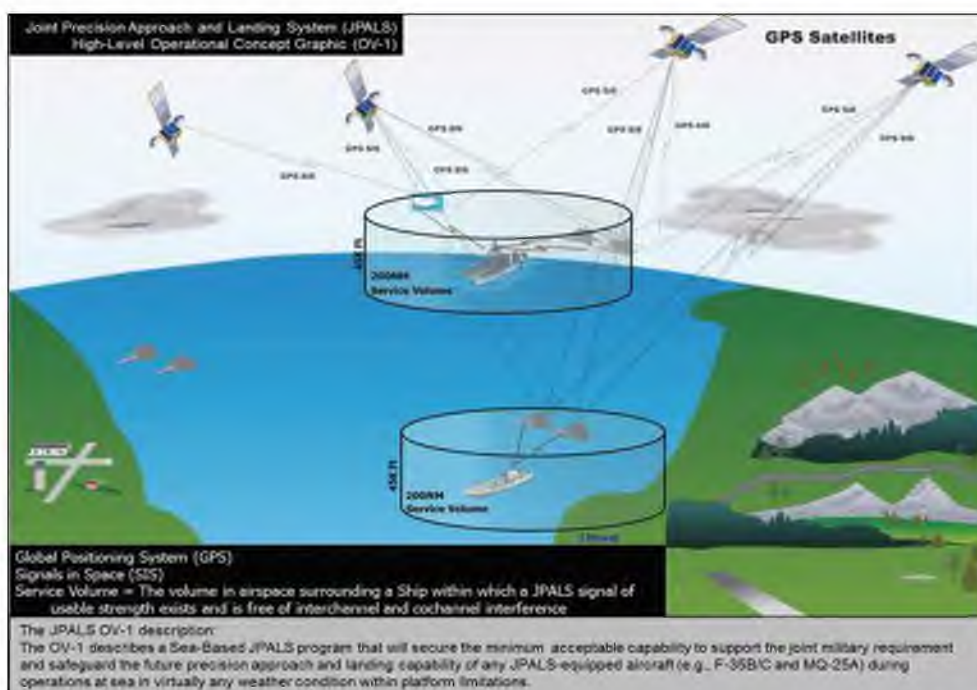




## Selected Acquisition Report (SAR)

RCS: DD-A&T(Q&A)823-238



## Joint Precision Approach and Landing System (JPALS)

As of FY 2020 President's Budget

Defense Acquisition Management  
Information Retrieval  
(DAMIR)

This document contains information that may be exempt from mandatory disclosure under the FOIA.

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## Sensitivity Originator

**Organization:** COMNAVAIRSYSCOM PEO(T) PMA-213  
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## Common Acronyms and Abbreviations for MDAP Programs

Acq O&M - Acquisition-Related Operations and Maintenance  
ACAT - Acquisition Category  
ADM - Acquisition Decision Memorandum  
APB - Acquisition Program Baseline  
APPN - Appropriation  
APUC - Average Procurement Unit Cost  
\$B - Billions of Dollars  
BA - Budget Authority/Budget Activity  
Blk - Block  
BY - Base Year  
CAPE - Cost Assessment and Program Evaluation  
CARD - Cost Analysis Requirements Description  
CDD - Capability Development Document  
CLIN - Contract Line Item Number  
CPD - Capability Production Document  
CY - Calendar Year  
DAB - Defense Acquisition Board  
DAE - Defense Acquisition Executive  
DAMIR - Defense Acquisition Management Information Retrieval  
DoD - Department of Defense  
DSN - Defense Switched Network  
EMD - Engineering and Manufacturing Development  
EVM - Earned Value Management  
FOC - Full Operational Capability  
FMS - Foreign Military Sales  
FRP - Full Rate Production  
FY - Fiscal Year  
FYDP - Future Years Defense Program  
ICE - Independent Cost Estimate  
IOC - Initial Operational Capability  
Inc - Increment  
JROC - Joint Requirements Oversight Council  
\$K - Thousands of Dollars  
KPP - Key Performance Parameter  
LRIP - Low Rate Initial Production  
\$M - Millions of Dollars  
MDA - Milestone Decision Authority  
MDAP - Major Defense Acquisition Program  
MILCON - Military Construction  
N/A - Not Applicable  
O&M - Operations and Maintenance  
ORD - Operational Requirements Document  
OSD - Office of the Secretary of Defense  
O&S - Operating and Support  
PAUC - Program Acquisition Unit Cost

PB - President's Budget  
PE - Program Element  
PEO - Program Executive Officer  
PM - Program Manager  
POE - Program Office Estimate  
RDT&E - Research, Development, Test, and Evaluation  
SAR - Selected Acquisition Report  
SCP - Service Cost Position  
TBD - To Be Determined  
TY - Then Year  
UCR - Unit Cost Reporting  
U.S. - United States  
USD(AT&L) - Under Secretary of Defense (Acquisition, Technology and Logistics)  
USD(A&S) - Under Secretary of Defense (Acquisition and Sustainment)

## Program Information

**Program Name**

Joint Precision Approach and Landing System (JPALS)

**DoD Component**

Navy

## Responsible Office

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**Date Assigned:** July 23, 2015

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## References

### SAR Baseline (Development Estimate)

Defense Acquisition Executive (DAE) Approved Acquisition Program Baseline (APB) dated June 15, 2016

### Approved APB

Component Acquisition Executive (CAE) Approved Acquisition Program Baseline (APB) dated March 14, 2018



## Mission and Description

Joint Precision Approach and Landing System (JPALS), in conjunction with the F-35B/C Joint Strike Fighter program, will provide precision guidance in support of coupled flight to 200 feet height above touchdown for the F-35B to Amphibious Assault (LH) type ships and precision guidance in support of auto-land for the F-35C and MQ-25A Unmanned Aerial Vehicle to Nuclear Aircraft Carriers (CVN). JPALS will also support the F-35B/C and MQ-25A interim Precision Approach and Landing Capability (PALC).

When delivered, the JPALS program will secure the minimum acceptable capability to support the military requirement and safeguard the future PALC requirements of any JPALS-equipped aircraft (e.g., F-35B/C and MQ-25A) during operations at sea in virtually any weather condition within platform limitations. These enhancements will support the Joint Force Commander's (JFC's) vital sea-based combat capabilities across a broad range of military operations in an uncertain future.

JPALS is a Global Positioning System-based precision approach and landing system that will function in more operational environments, and support all DoD sea-based applications. The National Defense Strategy of the United States of America calls for highly mobile forces that can rapidly respond to crises worldwide. Success in meeting this challenge requires the ability to land aviation assets virtually anywhere, at any time. JPALS will provide this capability by being rapidly deployable, survivable, and interoperable with U.S. allies. JPALS will support manned and unmanned aircraft and will be able to operate during restricted emission control conditions.



## Executive Summary

### Program Highlights Since Last Report

The Joint Precision Approach and Landing System (JPALS) is a ship-based system installed on Nuclear Aircraft Carriers (CVN) and Amphibious Assault (LH) type ships, providing the minimum acceptable capability to support the military requirement and safeguard the future Precision Approach Landing Capability requirements of F-35B/C, MQ-25A Unmanned Aerial Vehicle and all future CVN and LH based air platforms during operations at sea in virtually any weather condition.

JPALS supports the Joint Force Commander's vital sea-based combat capabilities across a broad range of military operations in an uncertain future.

JPALS is a Global Positioning System based precision approach and landing system that will function in more operational environments than the legacy systems and will support all CVN and LH type ships. JPALS provides on-deck, over the air inertial alignment capability, relative navigation capability, surveillance capability for Low Observable and Unmanned Aircraft, and precision guidance capability that supports coupled flight approaches for the F-35B and future platforms to LH type ships and coupled flight approaches to auto-land for the F-35C, MQ-25A, and future platforms to CVN type ships.

On June 15, 2016, USD(AT&L) approved the JPALS APB and delegated MDA for the JPALS program to the Navy and designated the program as ACAT IC. On June 27, 2016, Assistant Secretary of the Navy (Research, Development & Acquisition) (ASN(RDA)) approved Milestone B and authorized the JPALS program to enter the EMD phase. At Milestone B, ASN(RDA) also authorized award of the EMD contract and approved an LRIP quantity of up to 12 units.

In September 2016, the JPALS EMD contract was awarded to Raytheon for the procurement of two Engineering Development Model (EDM) units, the upgrade of the original eight EDM units, and the completion of the JPALS developmental effort. In November 2016, the previous JPALS Increment 1A contract with Raytheon was completed and the JPALS program accepted delivery of eight EDM units and the Increment 1A Technical Data Package.

An Integrated Baseline Review (IBR) was held in March 2017 and a Critical Design Review was held in May 2017. An Operational Test Readiness Review for JPALS Ultra High Frequency (UHF) Data Broadcast (UDB) and a Gate 6/IBR review were completed in August 2017. Operational Tests on JPALS UDB to include M-Demo and Cyber Testing were completed in September 2017. Early Operational Capability (EOC) of JPALS UDB was declared in June 2018. JPALS systems are currently supporting F-35B/C Block 3F operational ship deployments. Additionally, Commander, Operational Test Forces (COTF) performed an operational assessment of JPALS UDB during the CVN-72 F-35C Initial Operational Test & Evaluation (IOT&E).

The first JPALS two-way capable EDM was delivered in January 2018 and installed on CVN-69. A Test Readiness Review for JPALS two-way capability was completed in April 2018 to enable entry into Integrated Test. Developmental Test (DT) events began in FY 2018 with IT-B3 (LH) completed in May 2018 and IT-B1 (Shore) completed in October 2018. DT on JPALS two-way M-Demo was completed in September 2018. Production Readiness Review was conducted in December 2018. Product development and data collection efforts will continue in support of further development and anomaly resolution of the JPALS ship system configuration. A Milestone C decision is planned for March 2019. Due to CVN-69 ship availability, IT-B2 (CVN) has been delayed until April 2019. An Operational Assessment will be conducted concurrently with IT-B2 (CVN). In order to mitigate the Milestone C entrance criteria of System Verification Review (SVR) completion, SVR was divided into two phases. SVR-1 was conducted in December 2018 completing 75% of the requirements traceability and verifying critical hardware requirements were met. Post IT-B2 (CVN), SVR-2 will verify software related guidance quality and the remaining System of System Integration, Shipboard Power, E3 and Datalink requirements.

A JPALS LRIP ADM was approved in December 2017, increasing LRIP quantities from 12 to 23 units utilizing Variation in Quantity based on budget availability. Therefore, there will not be a need for a FRP decision since there is no programmatic production requirement beyond the 23 LRIP units. The IOC definition for JPALS was updated based on a revised JPALS IOT&E Phase 2 definition that decoupled JPALS IOC from external programs such as F-35 and MQ-25A. As a result of the IOC definition update, the PM estimate for IOC has changed from September 2024 to September 2020. JPALS will utilize a JPALS-equipped aircraft to evaluate the JPALS ship system during IOT&E Phase 2 per agreement reached between

OPNAV N98; COTF; and Director, Operational Test and Evaluation. JPALS IOT&E Phase 2 will be conducted on the JPALS two-way capability using an F-35B/C equipped with Block 3F (or later) UDB capability and an F/A-18 JPALS Test Bed equipped with full two-way capability. JPALS Follow-on Operational Test and Evaluation will be conducted with F-35B/C and MQ-25A when the respective platforms have integrated JPALS full two-way capability. As a result of these programmatic changes, the APB was updated and approved in March 2018 by the MDA. A JPALS Gate 6/Configuration Steering Board was originally planned for August 2018, but the program was granted a waiver due to system maturity.

In December 2018, an EDM was delivered to the MQ-25A program in support of their development efforts. Additionally, the F-35 JSF Program Office (JPO) procured one JPALS EDM for Italy's Cavour Aircraft Carrier. Italy provided a Directed Source Letter to procure the unit from Raytheon and utilized the cooperative program through the JPO to fund the procurement. The initial Cavour Aircraft Carrier ship survey was completed in February 2018.

The United Kingdom (UK) has a technical services Foreign Military Sales case that allowed for the exchange of pre-procurement technical information and services for both the AN/SPN-41B Instrument Carrier Landing System and the JPALS Ship System in support of Queen Elizabeth Class carrier program. The case Period of Performance (PoP) expired in December 2016 and the UK is still exploring options to extend the PoP to support additional technical discussions prior to an eventual procurement decision. There are no Technology Security/Foreign Disclosure issues related to the technical services case with the UK.

There are no significant software-related issues with this program at this time.



History of Significant Developments Since Program Initiation	
History of Significant Developments Since Program Initiation	
Date	Significant Development Description
1st Quarter FY 2008	In 2008, the JPALS Increment 1A program completed Milestone B and was designated a MDAP ACAT ID. The ADM, APB, Acquisition Strategy (AS), and Section 2366a of Title 10 Milestone B Certification were approved and signed by the USD(AT&L) in July 2008. Also in July, a full and open competition was conducted and the JPALS Increment 1A EMD contract was awarded to Raytheon. Following the award, the Government Accountability Office received a bid protest against the award. In September 2008, a contract restart letter was issued and the ADM included the revised dates. In December 2008, the APB was approved.
1st Quarter FY 2009	In 2009, the JPALS Increment 1A program completed the following System Engineering Technical Review (SETR) events: System Requirements Review (SRR) in January, Integrated Baseline Review (IBR) in April, System Functional Review (SFR) in June, and Preliminary Design Review (PDR) in December. The system allocated baseline was reviewed and approved at PDR.
1st Quarter FY 2010	In 2010, as part of the Gate 6 Post-PDR review in May, a Configuration Steering Board (CSB) was completed. The JPALS Increment 1A Critical Design Review (CDR) was conducted in December. There were no CDD requirement changes. The Naval Air Systems Command (NAVAIR) Technical Review Board determined the JPALS Increment 1A Technical Baseline was stable and performance, cost, and schedule risks were acceptable.
1st Quarter FY 2011	In 2011, all CDR Requests for Action (RFA) were completed and the product baseline was stable. There were no CDD requirements changes. The program office used the should-cost initiative process to offset cost growth within the existing program budget.
1st Quarter FY 2012	In 2012, the program conducted a successful Test Readiness Review (TRR) and commenced Integrated Test (IT) in May. As a result of several shifts in CVN-77 installation availability between 2009 and 2012, the shipboard IT and Operational Assessment (OA) were delayed. A schedule breach to Milestone C in the JPALS Increment 1A APB was reported.
1st Quarter FY 2013	In 2013, the schedule necessitated a decrease in one unit from RDT&E and an increase in one unit to Other Procurement, Navy (OPN) resulting in a new procurement quantity of 27 units. In addition to the increase of one unit to the procurement profile, the program realized fixed cost increases as a result of extending the production schedule. The combination of the increase to the procurement units and the increase in fixed costs caused the program to realize a breach to procurement cost in the approved JPALS Increment 1A APB. The Navy performed an internal analysis of the overall Department of the Navy Precision Approach and Landing Capability (PALC) requirements. The result of the internal analysis was a Navy proposal to accelerate the incorporation of capabilities planned for future increments into the JPALS program. The Navy also determined that legacy aircraft would no longer be retrofit with JPALS, but would use current legacy landing systems. All of the changes culminated in a critical Nunn-McCurdy unit cost breach to the PAUC and APUC. The Secretary of the Navy notified Congress of the breach in March 2014.
1st Quarter FY 2014	In 2014, USD(AT&L) signed the Nunn-McCurdy ADM for the restructured JPALS program in June, which certified the program in lieu of termination. Accordingly, the JPALS Milestone B decision of July 2008 was rescinded. JPALS was directed to continue auto-land trade studies and risk reduction efforts through Third Quarter FY 2016; and return to the DAB for Milestone B approval for the restructured JPALS program no later than Third Quarter FY 2016.
1st Quarter FY 2015	In 2015, Developmental Test (DT) for the restructured program was completed and a Letter of Observation (LOO) was signed by Commander, Operational Test and Evaluation Force (COTF). The auto-land trade studies were also completed and defined the path forward to meet the auto-land requirements for manned and unmanned air vehicles. All JPALS ship system requirements were developed and a successful Government-led SRR was completed in March. A successful

	SFR was conducted in November. In support of the Nunn-McCurdy ADM and in preparation for returning to the DAB for Milestone B approval, a contract extension was awarded in July. The program completed a successful Navy Gate 4 Review in June. The Navy Gate 5 Review with the Assistant Secretary of the Navy for Research, Development & Acquisition (ASN(RDA)) and the DAB Readiness Meeting (DRM) were conducted in October. USD(AT&L) conducted a JPALS Development Request For Proposal (RFP) Release Decision Point (DRRDP) DAB review in November. A signed ADM authorizing the release of the EMD RFP was released in November.
1st Quarter FY 2016	A successful PDR was conducted in March. The USD(AT&L) approved the JPALS APB, delegated the MDA for the JPALS program to the Navy, and designated the program as ACAT IC in June. ASN(RDA) signed the ADM approving Milestone B authorizing the JPALS program to enter the EMD phase and to award the EMD contract. In September, the JPALS EMD contract was awarded to Raytheon.
1st Quarter FY 2017	The JPALS IBR was conducted in March and CDR was conducted in May. An OTRR was completed in August and IOT&E Phase 1 began in September with the completion of the JPALS Block 0 M-demo and Cyber testing. JPALS certification efforts aboard LHD-1 (USS WASP) and CVN-72 (USS Abraham Lincoln) were completed in December to support F-35 Block 3F fleet release and JPALS EOC. ASN(RD&A) increased the approved LRIP quantity to 23 units in December 2017.
1st Quarter FY 2018	JPALS APB was signed March 2018. Block 1 TRR was conducted in April 2018. Class J&A was signed June 2018. Declared EOC June 2018. Completed M-Demo in September 2018. Conducted SVR-1 and PRR December 2018. Completed IT-B3 and IT-B1 hardware and Software validation efforts. F-35 with JPALS UDB capability was flown against CVN-72 at sea for Block 1 regression test in December 2018.



## Threshold Breaches

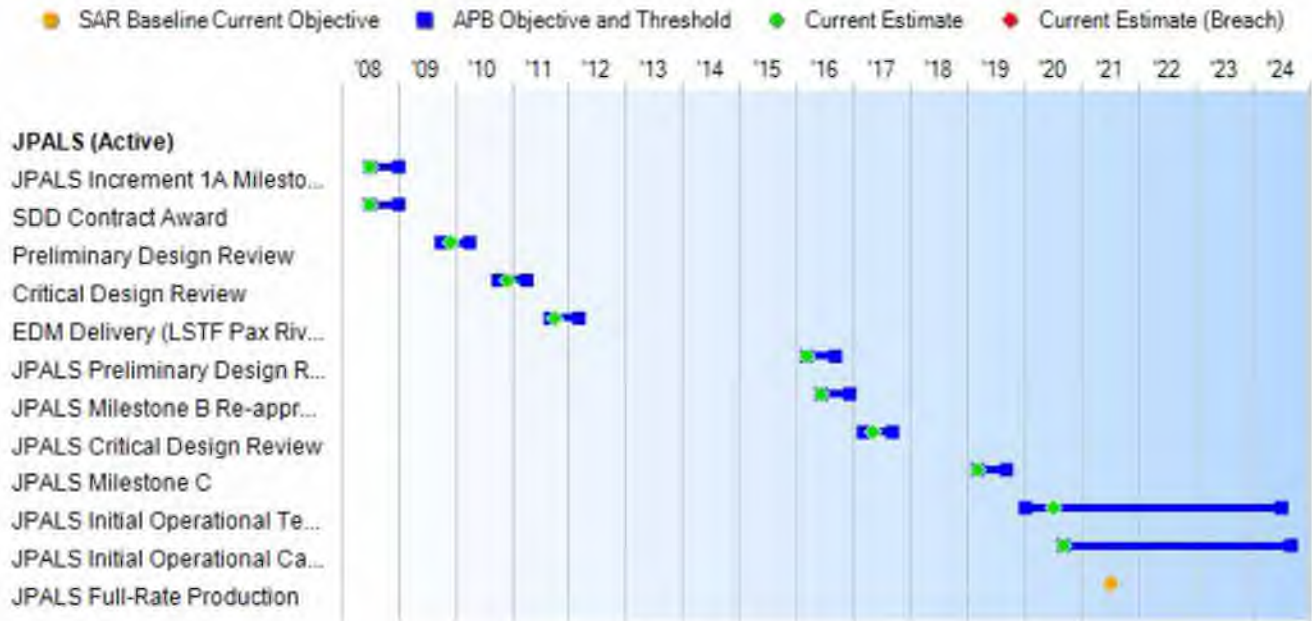
### APB Breaches

- Schedule
- Performance
- Cost
  - RDT&E
  - Procurement
  - MILCON
  - Acq O&M
- O&S Cost
- Unit Cost
  - PAUC
  - APUC

### Nunn-McCurdy Breaches

- Current UCR Baseline
  - PAUC None
  - APUC None
- Original UCR Baseline
  - PAUC None
  - APUC None

### Schedule



Schedule Events					
Events	SAR Baseline Development Estimate	Current APB Development Objective/Threshold	Current Estimate		
JPALS Increment 1A Milestone B	Jul 2008	Jul 2008	Jan 2009	Jul 2008	
SDD Contract Award	Jul 2008	Jul 2008	Jan 2009	Jul 2008	
Preliminary Design Review	Oct 2009	Oct 2009	Apr 2010	Dec 2009	
Critical Design Review	Oct 2010	Oct 2010	Apr 2011	Dec 2010	
EDM Delivery (LSTF Pax River)	Sep 2011	Sep 2011	Mar 2012	Oct 2011	
JPALS Preliminary Design Review	Mar 2016	Mar 2016	Sep 2016	Mar 2016	
JPALS Milestone B Re-approval	Jun 2016	Jun 2016	Dec 2016	Jun 2016	
JPALS Critical Design Review	Mar 2017	Mar 2017	Sep 2017	May 2017	
JPALS Milestone C	Mar 2019	Mar 2019	Sep 2019	Mar 2019	
JPALS Initial Operational Test and Evaluation	Jan 2020	Jan 2020	Jul 2024	Jul 2020	
JPALS Initial Operational Capability	Sep 2020	Sep 2020	Sep 2024	Sep 2020	
JPALS Full-Rate Production	Jul 2021	N/A	N/A	N/A	(Ch-1)

#### Change Explanations

(Ch-1) The current estimate for JPALS FRP changed from Jan 2025 to N/A. ADM dated December 4, 2017 approved an increase in LRIP quantities to 23, therefore removing the requirement for a FRP decision.

**Acronyms and Abbreviations**

CDR - Critical Design Review  
DT&E - Developmental Test and Evaluation  
EDM - Engineering Development Model  
IOT&E - Initial Operational Test and Evaluation  
LSTF - Landing Systems Test Facility  
PAX - Patuxent  
SDD - System Development and Demonstration



**(U//~~FOUO~~) Performance**

<b>(U//<del>FOUO</del>) Performance Characteristics</b>				
<b>SAR Baseline Development Estimate</b>	<b>Current APB Development Objective/Threshold</b>	<b>Demonstrated Performance</b>	<b>Current Estimate</b>	
(b)(3) 10 USC § 130				
<b>Energy Sea-Based JPALS shall use ship's electrical power rated at 115 VAC +/- 10% and 60 Hz) +/- 3% for all system components.</b>				
(T=O) ≤ 7000 Watts	(T=O) ≤ 7000 Watts	≤ 7000 Watts	TBD	(T=O) ≤ 7000 Watts
<b>System Training. Air Traffic Control Maintainer</b>				
(T=O) > 99% of Critical Tasks derived from the TTL & > 80% of Non-critical Tasks derived from the TTL	(T=O) > 99% of Critical Tasks derived from the TTL & > 80% of Non-critical Tasks derived from the TTL	> 99% of Critical Tasks derived from the TTL & > 80% of Non-critical Tasks derived from the TTL	TBD	(T=O) > 99% of Critical Tasks derived from the TTL & > 80% of Non-critical Tasks derived from the TTL

**Requirements Reference**

CDD dated March 11, 2016

**Change Explanations**

None

**Acronyms and Abbreviations**

Am - Materiel Availability  
 Ao - Operational Availability  
 CVN - Carrier Fixed-wing Nuclear  
 Hz - Hertz  
 LHA/D - Amphibious Assault Ship  
 O - Objective  
 T - Threshold  
 TTL - Training Task List  
 VAC - Volts Alternating Current

### Track to Budget

**RDT&E**

Appn	BA	PE
------	----	----

Navy 1319 04 0603860N

Project	Name
---------	------

2329 Joint Precision Approach and Landing System

**Procurement**

Appn	BA	PE
------	----	----

Navy 1611 02 0204112N

Line Item	Name
-----------	------

2001 Carrier Replacement Program (Shared)

2086 CVN Refueling Overhauls (Shared)

Navy 1611 02 0204411N

Line Item	Name
-----------	------

3041 LHA Replacement (Shared)

Navy 1810 02 0305014N

Line Item	Name
-----------	------

2867 Joint Precision Approach and Landing System

Navy 1810 08 0305014N

Line Item	Name
-----------	------

9020 Spares and Repair Parts (Shared)

**MILCON**

Appn	BA	PE
------	----	----

Navy 1205 01 0805376N

Project	Name
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P977 Facilities Restoration and Modification - RDT&E (Sunk)



## Cost and Funding

### Cost Summary

Total Acquisition Cost							
Appropriation	BY 2016 \$M			BY 2016 \$M	TY \$M		
	SAR Baseline Development Estimate	Current APB Development Objective/Threshold		Current Estimate	SAR Baseline Development Estimate	Current APB Development Objective	Current Estimate
RDT&E	1424.0	1424.0	1566.4	1387.6	1396.4	1396.4	1354.0
Procurement	395.7	395.7	435.3	331.1	456.9	456.9	376.3
Flyaway	--	--	--	229.3	--	--	260.6
Recurring	--	--	--	229.3	--	--	260.6
Non Recurring	--	--	--	0.0	--	--	0.0
Support	--	--	--	101.8	--	--	115.7
Other Support	--	--	--	69.4	--	--	79.0
Initial Spares	--	--	--	32.4	--	--	36.7
MILCON	7.4	7.4	8.1	7.4	6.8	6.8	6.8
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1827.1	1827.1	N/A	1726.1	1860.1	1860.1	1737.1

#### Current APB Cost Estimate Reference

JPALS SCP dated May 06, 2016

#### Cost Notes

No cost estimate for the program has been completed in the previous year.

Total Quantity			
Quantity	SAR Baseline Development Estimate	Current APB Development	Current Estimate
RDT&E		10	10
Procurement		23	23
Total		33	33

#### Quantity Notes

Unit of Measure: The physical architecture of JPALS consists of multiple equipment racks, processing equipment, sensors, radios, and antennas.

## Cost and Funding

### Funding Summary

Appropriation Summary									
FY 2020 President's Budget / December 2018 SAR (TY\$ M)									
Appropriation	Prior	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	To Complete	Total
RDT&E	1139.3	101.6	51.3	32.9	28.9	0.0	0.0	0.0	1354.0
Procurement	0.7	49.4	115.0	122.9	53.1	21.3	3.3	10.6	376.3
MILCON	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB 2020 Total	1146.8	151.0	166.3	155.8	82.0	21.3	3.3	10.6	1737.1
PB 2019 Total	1146.2	150.6	126.4	110.0	50.0	58.7	165.0	47.9	1854.8
Delta	0.6	0.4	39.9	45.8	32.0	-37.4	-161.7	-37.3	-117.7

#### Funding Notes

O&S phase follow-on ECP efforts begin in FY23 and are included in the JPALS O&S estimate. These costs are not part of the Total Acquisition Cost. Three new units previously planned for SCN are now being procured with OPN. Three units previously procured w/ RDT&E will be converted to production units w/ SCN funding instead of OPN. These three conversion units will remain counted in RDT&E.

Quantity Summary										
FY 2020 President's Budget / December 2018 SAR (TY\$ M)										
Quantity	Undistributed	Prior	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	To Complete	Total
Development	10	0	0	0	0	0	0	0	0	10
Production	0	0	4	9	8	2	0	0	0	23
PB 2020 Total	10	0	4	9	8	2	0	0	0	33
PB 2019 Total	10	0	4	4	4	1	2	8	0	33
Delta	0	0	0	5	4	1	-2	-8	0	0



**Cost and Funding**

**Annual Funding By Appropriation**

Annual Funding							
1319   RDT&E   Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	TY \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2001	--	--	--	--	--	--	7.4
2002	--	--	--	--	--	--	13.2
2003	--	--	--	--	--	--	15.3
2004	--	--	--	--	--	--	17.7
2005	--	--	--	--	--	--	25.9
2006	--	--	--	--	--	--	32.4
2007	--	--	--	--	--	--	36.0
2008	--	--	--	--	--	--	66.7
2009	--	--	--	--	--	--	74.1
2010	--	--	--	--	--	--	134.5
2011	--	--	--	--	--	--	118.8
2012	--	--	--	--	--	--	64.0
2013	--	--	--	--	--	--	75.5
2014	--	--	--	--	--	--	126.8
2015	--	--	--	--	--	--	41.6
2016	--	--	--	--	--	--	83.2
2017	--	--	--	--	--	--	102.2
2018	--	--	--	--	--	--	104.0
2019	--	--	--	--	--	--	101.6
2020	--	--	--	--	--	--	51.3
2021	--	--	--	--	--	--	32.9
2022	--	--	--	--	--	--	28.9
Subtotal	10	--	--	--	--	--	1354.0

Annual Funding							
1319   RDT&E   Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	BY 2016 \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2001	--	--	--	--	--	--	9.5
2002	--	--	--	--	--	--	16.8
2003	--	--	--	--	--	--	19.2
2004	--	--	--	--	--	--	21.7
2005	--	--	--	--	--	--	30.9
2006	--	--	--	--	--	--	37.5
2007	--	--	--	--	--	--	40.6
2008	--	--	--	--	--	--	73.9
2009	--	--	--	--	--	--	81.1
2010	--	--	--	--	--	--	145.0
2011	--	--	--	--	--	--	125.1
2012	--	--	--	--	--	--	66.3
2013	--	--	--	--	--	--	77.4
2014	--	--	--	--	--	--	128.1
2015	--	--	--	--	--	--	41.5
2016	--	--	--	--	--	--	81.6
2017	--	--	--	--	--	--	98.4
2018	--	--	--	--	--	--	98.1
2019	--	--	--	--	--	--	94.0
2020	--	--	--	--	--	--	46.5
2021	--	--	--	--	--	--	29.2
2022	--	--	--	--	--	--	25.2
Subtotal	10	--	--	--	--	--	1387.6

Annual Funding								
1810   Procurement   Other Procurement, Navy								
Fiscal Year	Quantity	TY \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2019	3	32.3	--	--	32.3	9.9	42.2	
2020	8	70.5	--	--	70.5	34.5	105.0	
2021	7	75.8	--	--	75.8	36.4	112.2	
2022	2	33.8	--	--	33.8	16.9	50.7	
2023	--	5.4	--	--	5.4	3.1	8.5	
Subtotal	20	217.8	--	--	217.8	100.8	318.6	



Annual Funding								
1810   Procurement   Other Procurement, Navy								
Fiscal Year	Quantity	BY 2016 \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2019	3	29.6	--	--	29.6	9.1	38.7	
2020	8	63.3	--	--	63.3	31.0	94.3	
2021	7	66.7	--	--	66.7	32.1	98.8	
2022	2	29.2	--	--	29.2	14.6	43.8	
2023	--	4.6	--	--	4.6	2.6	7.2	
Subtotal	20	193.4	--	--	193.4	89.4	282.8	

Cost Quantity Information		
1810   Procurement   Other Procurement, Navy		
Fiscal Year	Quantity	End Item Recurring Flyaway (Aligned With Quantity) BY 2016 \$M
2019	3	33.2
2020	8	76.7
2021	7	65.0
2022	2	18.5
2023	--	--
Subtotal	20	193.4

Annual Funding 1611   Procurement   Shipbuilding and Conversion, Navy								
Fiscal Year	Quantity	TY \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2016	--	0.1	--	--	0.1	--	0.1	
2017	--	0.1	--	--	0.1	--	0.1	
2018	--	0.4	--	--	0.4	0.1	0.5	
2019	1	5.9	--	--	5.9	1.3	7.2	
2020	1	8.2	--	--	8.2	1.8	10.0	
2021	1	9.2	--	--	9.2	1.5	10.7	
2022	--	0.3	--	--	0.3	2.1	2.4	
2023	--	1.1	10.2	--	11.3	1.5	12.8	
2024	--	1.0	0.4	--	1.4	1.9	3.3	
2025	--	1.2	0.7	--	1.9	3.0	4.9	
2026	--	--	0.2	--	0.2	1.1	1.3	
2027	--	--	2.5	--	2.5	0.5	3.0	
2028	--	--	1.3	--	1.3	0.1	1.4	
Subtotal	3	27.5	15.3	--	42.8	14.9	57.7	

Annual Funding 1611   Procurement   Shipbuilding and Conversion, Navy								
Fiscal Year	Quantity	BY 2016 \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2016	--	0.1	--	--	0.1	--	0.1	
2017	--	0.1	--	--	0.1	--	0.1	
2018	--	0.4	--	--	0.4	0.1	0.5	
2019	1	5.2	--	--	5.2	1.2	6.4	
2020	1	7.1	--	--	7.1	1.6	8.7	
2021	1	7.8	--	--	7.8	1.3	9.1	
2022	--	0.3	--	--	0.3	1.7	2.0	
2023	--	0.9	8.4	--	9.3	1.2	10.5	
2024	--	0.8	0.3	--	1.1	1.6	2.7	
2025	--	0.9	0.6	--	1.5	2.4	3.9	
2026	--	--	0.2	--	0.2	0.8	1.0	
2027	--	--	1.9	--	1.9	0.4	2.3	
2028	--	--	0.9	--	0.9	0.1	1.0	
Subtotal	3	23.6	12.3	--	35.9	12.4	48.3	

Cost Quantity Information		
1611   Procurement   Shipbuilding and Conversion, Navy		
Fiscal Year	Quantity	End Item Recurring Flyaway (Aligned With Quantity) BY 2016 \$M
2016	--	--
2017	--	--
2018	--	--
2019	1	7.0
2020	1	7.6
2021	1	9.0
2022	--	--
2023	--	--
2024	--	--
2025	--	--
2026	--	--
2027	--	--
2028	--	--
Subtotal	3	23.6

Annual Funding 1205   MILCON   Military Construction, Navy and Marine Corps	
Fiscal Year	TY \$M
	Total Program
2008	6.8
Subtotal	6.8



Annual Funding 1205   MILCON   Military Construction, Navy and Marine Corps	
Fiscal Year	BY 2016 \$M
	Total Program
2008	7.4
Subtotal	7.4



## Low Rate Initial Production

Item	Initial LRIP Decision	Current Total LRIP
<b>Approval Date</b>	6/27/2016	12/4/2017
<b>Approved Quantity</b>	12	23
<b>Reference</b>	Assistant Secretary of the Navy (Research, Development & Acquisition) Milestone B ADM	Assistant Secretary of the Navy (Research, Development & Acquisition) ADM
<b>Start Year</b>	2019	2019
<b>End Year</b>	2021	2022

The Current Total LRIP Quantity is more than 10% of the total production quantity in order to establish an initial production base for the system to support operational deployment schedules.

On December 4, 2017, ASN(RD&A) signed an ADM increasing the LRIP quantity to 23 JPALS units with Variation in Quantity flexibility based on budget availability; therefore, current End Year changed from 2023 to 2022.

## Foreign Military Sales

Country	Date of Sale	Quantity	Total Cost \$M	Description
United Kingdom	6/1/2012	1	3.9	This is a technical services case.

### Notes

The United Kingdom (UK) has a technical services Foreign Military Sales case that allowed for the exchange of pre-procurement technical information and services for both the AN/SPN-41B Instrument Carrier Landing System and the JPALS Ship System in support of Queen Elizabeth Class carrier program. The case Period of Performance (PoP) expired in December 2016 and the UK is still exploring options to extend the PoP to support additional technical discussions prior to an eventual procurement decision. There are no Technology Security/Foreign Disclosure issues related to the technical services case with the UK.

### Acronyms and Abbreviations

FMS - Foreign Military Sales  
 JPALS - Joint Precision Approach and Landing System  
 PoP - Period of Performance  
 UK - United Kingdom

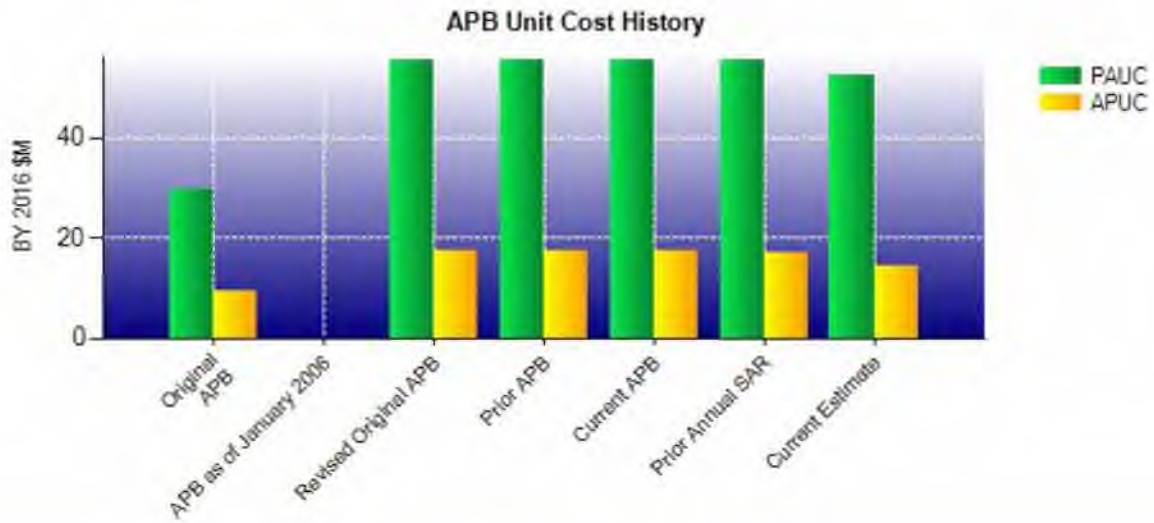
## Nuclear Costs

None

**Unit Cost**

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2016 \$M	BY 2016 \$M	% Change
	Current UCR Baseline (Mar 2018 APB)	Current Estimate (Dec 2018 SAR)	
Program Acquisition Unit Cost			
Cost	1827.1	1726.1	
Quantity	33	33	
Unit Cost	55.367	52.306	-5.53
Average Procurement Unit Cost			
Cost	395.7	331.1	
Quantity	23	23	
Unit Cost	17.204	14.396	-16.32
Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2016 \$M	BY 2016 \$M	% Change
	Revised Original UCR Baseline (Jun 2016 APB)	Current Estimate (Dec 2018 SAR)	
Program Acquisition Unit Cost			
Cost	1827.1	1726.1	
Quantity	33	33	
Unit Cost	55.367	52.306	-5.53
Average Procurement Unit Cost			
Cost	395.7	331.1	
Quantity	23	23	
Unit Cost	17.204	14.396	-16.32





APB Unit Cost History					
Item	Date	BY 2016 \$M		TY \$M	
		PAUC	APUC	PAUC	APUC
Original APB	Dec 2008	29.527	9.204	27.889	9.748
APB as of January 2006	N/A	N/A	N/A	N/A	N/A
Revised Original APB	Jun 2016	55.367	17.204	56.367	19.865
Prior APB	Jun 2016	55.367	17.204	56.367	19.865
Current APB	Mar 2018	55.367	17.204	56.367	19.865
Prior Annual SAR	Dec 2017	55.297	17.174	56.206	19.852
Current Estimate	Dec 2018	52.306	14.396	52.639	16.361

**SAR Unit Cost History**

Current SAR Baseline to Current Estimate (TY \$M)									
PAUC Development Estimate	Changes								PAUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
56.367	0.076	0.000	-0.770	0.000	-1.361	0.000	-1.673	-3.728	52.639

Current SAR Baseline to Current Estimate (TY \$M)									
Initial APUC Development Estimate	Changes								APUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
19.865	0.057	0.000	-1.104	0.000	-0.057	0.000	-2.400	-3.504	16.361

SAR Baseline History				
Item	SAR Planning Estimate	SAR Development Estimate	SAR Production Estimate	Current Estimate
Milestone A	N/A	N/A	N/A	N/A
Milestone B	N/A	Jun 2016	N/A	Jun 2016
Milestone C	N/A	Mar 2019	N/A	Mar 2019
IOC	N/A	Sep 2020	N/A	Sep 2020
Total Cost (TY \$M)	N/A	1860.1	N/A	1737.1
Total Quantity	N/A	33	N/A	33
PAUC	N/A	56.367	N/A	52.639

**Cost Variance**

Summary TY \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Development Estimate)	1396.4	456.9	6.8	1860.1
Previous Changes				
Economic	-1.9	-3.2	--	-5.1
Quantity	--	--	--	--
Schedule	--	+3.3	--	+3.3
Engineering	--	--	--	--
Estimating	-3.1	-1.4	--	-4.5
Other	--	--	--	--
Support	--	+1.0	--	+1.0
Subtotal	-5.0	-0.3	--	-5.3
Current Changes				
Economic	+3.1	+4.5	--	+7.6
Quantity	--	--	--	--
Schedule	--	-28.7	--	-28.7
Engineering	--	--	--	--
Estimating	-40.5	+0.1	--	-40.4
Other	--	--	--	--
Support	--	-56.2	--	-56.2
Subtotal	-37.4	-80.3	--	-117.7
Total Changes	-42.4	-80.6	--	-123.0
CE - Cost Variance	1354.0	376.3	6.8	1737.1
CE - Cost & Funding	1354.0	376.3	6.8	1737.1



Summary BY 2016 \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Development Estimate)	1424.0	395.7	7.4	1827.1
Previous Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	+0.1	--	+0.1
Engineering	--	--	--	--
Estimating	-1.6	-1.2	--	-2.8
Other	--	--	--	--
Support	--	+0.4	--	+0.4
Subtotal	-1.6	-0.7	--	-2.3
Current Changes				
Economic	--	--	--	--
Quantity	--	+1.4	--	+1.4
Schedule	--	-19.1	--	-19.1
Engineering	--	--	--	--
Estimating	-34.8	-1.4	--	-36.2
Other	--	--	--	--
Support	--	-44.8	--	-44.8
Subtotal	-34.8	-63.9	--	-98.7
Total Changes	-36.4	-64.6	--	-101.0
CE - Cost Variance	1387.6	331.1	7.4	1726.1
CE - Cost & Funding	1387.6	331.1	7.4	1726.1

Previous Estimate: December 2017



RDT&E	\$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	+3.1
Realignment of funding for Production and Operating and Support phase efforts. (Estimating)	-28.5	-33.4
Decrease due to budget Executive Realignment. (Estimating)	-2.3	-2.4
Decrease due to latest Earned Value Reporting. (Estimating)	-2.2	-2.8
Adjustment for current and prior escalation. (Estimating)	-1.8	-1.9
<b>RDT&amp;E Subtotal</b>	<b>-34.8</b>	<b>-37.4</b>

Procurement	\$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	+4.5
Quantity variance resulting from an increase of three units from 17 to 20 (Other Procurement, Navy (OPN)). (Quantity)	+24.2	+27.8
Additional Quantity Variance to capture costs associated with system installation (OPN). (Quantity)	+2.8	+3.2
Quantity variance resulting from a decrease of three units from six to three (Shipbuilding and Conversion, Navy (SCN)). (Quantity)	-25.6	-31.0
Acceleration of Procurement Buy Profile from FY 2024 to FY 2020, FY 2021, and FY 2022 (OPN). (Schedule)	0.0	-5.5
Additional Schedule Variance to capture costs associated with system installation costs (OPN). (Schedule)	-19.1	-23.2
Revised allocation of Contractor costs resulting in cost shift from OPN to SCN (OPN). (Estimating)	-15.4	-17.9
Revised allocation of Contractor costs resulting in cost shift from OPN to SCN (SCN). (Estimating)	+14.9	+17.9
Revised EDM conversion plan resulting in cost shift from OPN to SCN (OPN). (Estimating)	-10.6	-12.0
Revised EDM conversion plan resulting in cost shift from OPN to SCN (SCN). (Estimating)	+10.1	+12.4
Adjustment for current and prior escalation. (Estimating)	-0.4	-0.3
Adjustment for current and prior escalation. (Support)	0.0	-0.1
Decrease in Other Support due to accelerated procurements and associated staffing reductions (OPN). (Support)	-51.2	-62.8
Decrease in Initial Spares due to revised component prices and accelerated procurements (OPN). (Support)	-1.2	-2.5
Increase in Other Support due to revised staffing requirements for new construction ships (SCN). (Support)	+8.8	+10.6
Decrease in Initial Spares due to revised component prices (SCN). (Support)	-1.2	-1.4
<b>Procurement Subtotal</b>	<b>-63.9</b>	<b>-80.3</b>

## Contracts

Contract Identification	
<b>Appropriation:</b>	RDT&E
<b>Contract Name:</b>	JPALS Engineering & Manufacturing Development Contract
<b>Contractor:</b>	Raytheon Company
<b>Contractor Location:</b>	1801 Hughes Drive Fullerton, CA 92833-2200
<b>Contract Number:</b>	N00019-16-C-0052
<b>Contract Type:</b>	Cost Plus Incentive Fee (CPIF)
<b>Award Date:</b>	September 21, 2016
<b>Definitization Date:</b>	September 21, 2016

Contract Price							
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
254.6	N/A	10	264.7	N/A	12	265.8	264.7

Target Price Change Explanation
The difference between the Initial Contract Price Target and the Current Contract Price Target is due to award of contract options for two Engineering Development Model (EDM) units. One EDM was procured for the F-35 JSF Program Office (JPO) for Italy's Cavour Aircraft Carrier in support of the F-35B. Italy provided a Directed Source Letter to procure the unit from Raytheon and utilized the cooperative program through the JPO to fund the procurement. Additionally, one unit was procured for MQ-25A development efforts by the MQ-25 program.

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	+0.4	-1.1
Previous Cumulative Variances	-1.0	-1.8
Net Change	+1.4	+0.7

Cost and Schedule Variance Explanations
The favorable net change in the cost variance is due to efficient close out of Ship Processor unit testing and Software Trouble Report resolutions.
The favorable net change in the schedule variance is due to schedule improvements with Interactive Electronic Technical Manual validation efforts.



## Deliveries and Expenditures

Deliveries					
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered	
Development	10	10	10	100.00%	
Production	0	0	23	0.00%	
Total Program Quantity Delivered	10	10	33	30.30%	

Expended and Appropriated (TY \$M)			
Total Acquisition Cost	1737.1	Years Appropriated	19
Expended to Date	1149.6	Percent Years Appropriated	67.86%
Percent Expended	66.18%	Appropriated to Date	1297.8
Total Funding Years	28	Percent Appropriated	74.71%

The above data is current as of March 12, 2019.

Notes	
RDT&E costs include 10 ship system EDM units. Procurement/Production costs data includes 20 OPN and 3 NAVSEA, SCN funded ship system units.	

## Operating and Support Cost

### Cost Estimate Details

<b>Date of Estimate:</b>	January 15, 2019
<b>Source of Estimate:</b>	POE
<b>Quantity to Sustain:</b>	26
<b>Unit of Measure:</b>	System
<b>Service Life per Unit:</b>	20.00 Years
<b>Fiscal Years in Service:</b>	FY 2020 - FY 2045

JPALS will be installed on 24 Navy ships and at 2 Naval Air Technical Training Center (NATTC) trainers.

The sustainment quantity of 26 systems is based on the 20 production systems funded by Other Procurement, Navy (OPN); 3 Engineering Development Model (EDM) funded by Research, Development, Test and Evaluation (RDT&E) will be converted to the production configuration funded with Shipbuilding and Conversion, Navy (SCN); and 3 systems procured by the Naval Sea Systems Command (NAVSEA) funded by SCN. The remaining 7 of the 33 total delivered were considered test assets and therefore not explicitly identified in the O&S estimate.

The O&S estimate was updated for Milestone B to reflect quantity, schedule, and scope changes of the Technical and Programmatic Baseline following the JPALS Engineering Technical Assurance Board review in January 2016. There was an increase in one NATTC trainer and the schedule was aligned with ship availability. A ramp down schedule was included for each unit after 20 years of service. Three EDM units are expected to become permanent installs at which time the program office will assume responsibility for the sustainment of the units. These units are included in the RDT&E and sustainment quantities, but are not included within the production/procurement schedule.

JPALS: 24 Nuclear Aircraft Carriers (CVN)/Amphibious Assault (LH) Class Ships and 2 NATTC Trainers

Total Operating Years: 520 operating years

Annual Operation Tempo: 4,000 hours per ship and 2,080 hours per NATTC trainer

### Sustainment Strategy

The current maintenance plan of JPALS will use a 2-level Organizational-Depot (O-D) maintenance concept. The sustainment strategy plans to leverage the existing support infrastructure on current Fleet Landing Systems and tailor to JPALS. In addition, the program is conducting a Product Support Business Case Analysis (BCA) to support Milestone C, which includes performance-based logistics considerations for Supply Chain Management, and will identify the Lead System Integrator for the In-Service Engineering Activity (ISEA) and Software Support Activity (SSA). Based on the BCA, the program office will determine the most efficient path forward for the logistics support structure. The maintenance approach is based on a historical average of 4,000 annual operating hours for every ship beginning in the year of installation or certification and utilizes the predicted reliability and maintainability rates. JPALS is expected to be removed from a decommissioned ship and installed on a similar new type ship. The decommissioning schedule is based on a 50-year service life of the ship. Hardware and software improvements are based on comparable system historical percentages.

### Antecedent Information

The antecedent system associated with this estimate is the AN/SPN-46(V)3. The AN/SPN-46(V)3 will remain in service on the ships as the landing system for legacy aircraft. AN/SPN-46(V)3 continues to experience service life adjustments



and system modifications that make the total O&S costs volatile. In addition, the capture of O&S data in available reporting systems has changed significantly over time. The Visibility and Management of Operating and Support costs database, the Navy's official system for collecting and reporting O&S costs, provides costs from 1997 to present. The cost data for platforms in existence prior to 1997 is either unavailable or incomplete. Sufficient historical data and resources do not exist to create comparable prior Total O&S Costs.

Annual O&S Costs BY2016 \$M			
Cost Element	JPALS (Active)		AN/SPN-46(V)3 (Antecedent)
	Average Annual Cost Per System		Average Annual Cost Per System
Unit-Level Manpower	0.000		0.716
Unit Operations	0.000		0.000
Maintenance	0.475		0.051
Sustaining Support	0.252		0.027
Continuing System Improvements	0.110		0.408
Indirect Support	0.000		0.000
Other	--		0.000
<b>Total</b>	<b>0.837</b>		<b>1.202</b>

Item	Total O&S Cost \$M			
	JPALS (Active)			AN/SPN-46(V)3 (Antecedent)
	Current Development APB Objective/Threshold	Current Estimate		
<b>Base Year</b>	440.0	484.0	435.3	N/A
<b>Then Year</b>	627.6	N/A	618.9	N/A

#### Equation to Translate Annual Cost to Total Cost

JPALS Average Annual Unit O&S Cost \* operating system years = Total JPALS O&S Cost

The unitized costs are based on the operating years. This is the cumulative total of system operating through FY 2045. \$435M = \$0.837M \* 520 operating years. The small delta between this calculated value and the total O&S cost shown is due to rounding. The unitized costs include the NATTC units, OPN ships, and SCN ships.

O&S Cost Variance		
Category	BY 2016 \$M	Change Explanations
Prior SAR Total O&S Estimates - Dec 2017 SAR	440.0	
Programmatic/Planning Factors	-4.7	Decrease due to updated procurement profile.
Cost Estimating Methodology	0.0	
Cost Data Update	0.0	
Labor Rate	0.0	
Energy Rate	0.0	

Technical Input	0.0
Other	0.0
Total Changes	-4.7
Current Estimate	435.3

**Disposal Estimate Details**

Date of Estimate:	May 06, 2016
Source of Estimate:	SCP
Disposal/Demilitarization Total Cost (BY 2016 \$M):	23.5

The TY\$ value is \$39.9M. Disposal cost is assumed to be 60% of installation cost of the new system.