Air Traffic Control and Combat Identification
Program Office
Landing Systems

Joint Precision and Approach Landing System (JPALS)
Program Overview

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CNS ATM Conference
on
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CDR J.B. Hornbuckle, USN
PMA213
PMA213 Organization

CAPT CJ JAYNES
PROGRAM MANAGER
TOM CARPENTER
PDPM

MC Liaison: Maj Townsend
Fleet Liaison: Lt Hankinson
PA: B. Folsom
EA: T. McTiernan

Executive Functional
Leads:
BFM: C. Torgersen
CDR Holsinger
PCO: R. Wolfe
D. Veitch
COST: D. Cikovic
CHENG: D. McLaughlin
DOL: J. Francisco
T&E: B. Lynam
LEGAL: R. Woolbright
ACQ: A. Cofield

Product Support Teams:
SPAWAR Charleston
P. Braswell
SPAWAR San Diego
C. Henry
NAWCAD AIR 4.5.8
F. Bouhessain
NAWCAD AIR 4.5.9
G. Penk

“Bring Them Back Alive”
301-995-6300

Secretary: B. Metcalf
Travel: K. James

DPM
Air Traffic Control
Rob Bellamy - Maj Ludlow

DPM
Combat Identification
CDR Herzog - Lee Skagg

DPM
Landing Systems
Tom Benedik - CAPT Davison

Fleet Air Traffic Control
Eric Anderson
Air Station Systems: R. DeForest
TPX-42: E. Eichorn
SPN-43: M. Caggiano

National Airspace System MoD
Chris Mullaney
Radar & Integration: R. DeForest
Processor Display: K. Chesser
FACSFAC: L. Whites

Expeditionary In Service
Jim Hackney
Depot Restoration - B. Smith / B. Harper
Fleet Support: D. Herbert / B. Harper

Expeditionary Platform Production & Integration
Fred Wylie - Maj Townsend
ATNAVICS: B. Katakia
M-P TACAN: B. Chapman
G/ATOR / CAC2S: D. Torres
NAMP: MGySgt Keiler

Mode 5 & Coop ID
Barbara Weathers
Crypto Modernization: J. Thompson

Ship & JPALS Inc-1A
TBD
Gov’t Integration: J. Hemingway
Ship In-Service: T. Gill

Shipboard & Non-Coop ID
Roy Chesley
Ship ID Systems: P. Frasier
Non-Coop ID System: P. Cianfione

Aircraft & JPALS Inc-1B
LCDR Brown
A/C Integration: J.B. Patterson

Shore & JPALS Inc-2
Shirley Franko - MAJ Delaney
Shore In-Service: E. Williams

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JPALS Program Overview

- GPS-based system
- Comprised of Ship and Land-Based Systems, Aircraft Systems, and JPALS specific data link
- Supports Joint Service, civil, and international interoperability
Global Precision Approach Capability

Three System Components:

1. GPS
2. Ground Station
3. Aircraft Integration

Ground Station Variants

- Sea-Based: 2-way data link
- Shore-Based: 1-way data broadcast
Joint Interoperable Solution

**JPALS**

Sea-Based
Land Based, Fixed/Tactical
Spec. Ops Man Portable

- **USN**
  - Automatic Carrier Landing System (SPN-46)
  - LHA/D Landing Sys (SPN-35)
  - Ship TACAN (URN-25)
  - Shore Precision Approach Radar (PAR) (FPN-63)
  - Shore Training Radar (SPN-42)
  - Shore Instrument Landing System (ILS)

- **USMC**
  - Shore PAR (FPN-63)
  - Shore ILS
  - MATCALS TACAN (TRN-44)
  - MATCALS PAR (TPN-22)
  - ATNAVICS (TPN-31A)

- **USA**
  - Fixed Base PAR
  - Fixed Base PAR
  - Fixed Base ILS
  - Fixed Base PAR (mark-20A)
  - Tactical ASR/PAR
  - ATNAVICS AN/TPN-31

- **USAF**
  - PAR (GRN-22)
  - ILS (GPN-29)
  - Mobile Microwave Landing System (TRN-45)
  - Mobile PAR (TPN-19 & MPN-14K)

- **FAA**
  - Instrument Landing System

- **NATO**
  - Potential if Ratified
  - Shore Precision Approach Radar
  - Shore Instrument Landing System

**GBAS/LAAS**

Satellite Based Augmentation System/Wide Area Augmentation System

Ground-Based Augmentation System/Local Area Augmentation System

**Aircraft Avionics**

Interoperable
**FAA**

**Civil Interoperability**

**Present**

- ILS Precision Approaches
  - Phasing Out
- Per draft FAA Navigation Roadmap*, 2012 decision point on commencement of decommissioning
- NDB & VORTAC NAVAIDS
  - Phasing Out

**Future**

- GBAS/LAAS
  - LAAS Precision Approaches
    - Ground Based Augmentation System
- SBAS/WAAS
  - WAAS Precision Approaches
  - Satellite Based Augmentation System
    - EGNOS-European Geostationary Navigation Overlay
    - WAAS-US Wide Area Augmentation System
    - MSAS-Japanese MTSAT Satellite Augmentation System
    - CWAAS-Canadian WAAS
    - SNAS-Chinese Satellite Navigation Augmentation System
JPALS at Sea CONOPS Overview

10 nm
Approach Coverage (10 A/C)
Supports precision nav within 10 nm, 360 deg around the ship. Downlink to ship provides for CATCC, LSO and Primary to monitor approach

60 nm
CCA coverage (50 A/C)
Two-way data link with ship when within 60 nm supports NATOPS requirements under all conditions including EMCON. Position reports supplement radar and IFF data in CCA displays

200 nm
Ship Location coverage (All A/C)
Ship to Air broadcast allows aircraft to find ship under all conditions including EMCON, out to 200 nm
Initial Scope JPALS
Ship System Development, Installation, and Test

**Retrofit**

- **CVN-Class**
  - UHF Antennas (External)
  - GPS Antennas (External)
  - Two 19” Racks (Internal):
    - GPS Receivers
    - UHF Radios
    - INS
    - Processor

- **LH-Class**
  - UHF Antennas (External)
  - GPS Antennas (External)
  - Two 19” Racks (Internal):
    - GPS Receivers
    - UHF Radios
    - INS
    - Processor

**Forward Fit**

- **DDG-1000**
  - Acquiring EDM & LRIP

- **CVN 21-Class**
  - Acquiring LRIP

- **F-35 (JSF)-Navy/CV**
  - Integrating JPALS-UDB

**Selected Shore Installations**

- Test & CVW Sites e.g.:
  - Pax River
  - NAS Lemoore

**Flight Testing**

- Navigation Avionics Platform Integration Emulator (NAPIE)
Three System Components:
1. GPS
2. Ground Station
3. A/C Integration

Future Landing System Incremental Precision/Capability

- Inc-3: 100 ft/¼ SM – Auto-Land Mobile/Fixed – LGGPS
  200 ft/½ NM – Auto-Land Sea-Based – SRGPS
- Inc-4: 100 ft/¼ NM – Auto-Land Sea-Based – SRGPS (UAV Support)
- Inc-5: Man-Pack – LDGPS (Marine Corps/Army)
- Inc-6: Autonomous Enhanced Vision System (EVS)
- Inc-7: Upgrade to Sea-Based back-up system

- Current CDD includes Increments 1 and 2
- Only Increment 1 validated by JROC

JPALS End State

Medium Earth Orbit

Sea-Based Lead Platforms Operational A/C Integration

Inc-1A
200 ft/½ NM Shipboard Relative GPS

Inc-1B
Sea-Based Lead Platforms Operational A/C Integration

Inc-2 (LDGPS)
200 ft/½ SM – Land-Based Fixed and Tactical/Mobile Local Differential GPS (FAA certifiable, Auto-Land)

Inc-3
100 ft/¼ SM – Auto-Land Mobile/Fixed – LGGPS
200 ft/½ NM – Auto-Land Sea-Based – SRGPS

Inc-4
100 ft/¼ NM – Auto-Land Sea-Based – SRGPS (UAV Support)

Inc-5
Man-Pack – LDGPS (Marine Corps/Army)

Inc-6
Autonomous Enhanced Vision System (EVS)

Inc-7
Upgrade to Sea-Based back-up system
Operational Aircraft Integration

JPALs aircraft integration will maximize use of existing avionics modified as necessary to provide required performance.

- Avionics components may include:
  - GPS Sensors
  - Anti-Jam Antenna Systems
  - Inertial Navigation Sensors, EGI
  - Computer Processing Equipment
  - Data Link e.g. ARC-210
  - JPALS Software Algorithms

Notional Increment 1B

In SDD now

There is no JPALs ‘Box’ common to each air system integration.

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JPALS Increment 1A Schedule

Increment 1A Schedule:

- **Acquisition Phases**
  - TD Efforts
  - TD
  - MS/B
  - SDD
  - MS/C
  - LRIP

- **Milestones and Events**
  - Aircraft Integration Guide
  - Increment-1A SDD
  - JPALS Ship System
    - IOC attained when one aircraft can effectively conduct precision approaches and landings against a JPALS Ground Station

- **JSF**
  - UDB Avionics
  - SDD
  - Flight Test & CV Cert
  - OT&E

- **Increment 1B**
  - Pre-Decisional POM10
  - Initial operational aircraft Roadmap

- **Aircraft**
  - Follow-On Test & Evaluation (FOT&E)

- **Increment Integration**
  - Initial operational aircraft Roadmap

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**Events**

- IT 1-3/OA
- IT 4
- IOT&E
- IOC
- Production Installs
- Prod. & Inst.
Summary

• JPALS is a GPS-based system comprised of Ship and Land-Based Systems, Aircraft Systems, and supporting data link.

• JPALS is in development to provide a single Joint system replacement for multiple obsolete ship, shore, and tactical systems.

• JPALS Supports Joint Service, civil, and international interoperability.
Backup
Shipboard ATC Systems

AN/TPX-42A(V)14 DAIR
(Direct Altitude and Identity Readout)

AN/SPN-41/41A ICLS
(Instrument Carrier Landing System)

AN/SPN-43C ASR
(Air Surveillance Radar)

AN/SPN-46 ACLS
(Automatic Carrier Landing System)

TACAN

AN/SPN-35B/C PAR
(Precision Approach Radar for LHA/LHD class ships)

JPALS will replace legacy radar-based PAL systems

SPN-46
SPN-35
TACAN
USMC Expeditionary ATC Systems

AN/TPS-73
Airport Surveillance Radar

AN/TSQ-131(V)
Communications & Control

AN/TSQ-120B
Control Tower

AN/TSQ-216
Remote Landing Site Tower

JPALS will replace legacy systems.

AN/TPN-22
AN/TRN-44A
AN/TRN-46
AN/TPN-31A (PAR)

AN/TPN-22 PAR

AN/TPN-31A ATNAVICS

AN/TRN-44A TACAN

AN/TRN-46 DAME
ARMY ATC Precision Approach Systems

Tactical

ATNAVICS AN/TPN-31

JPALS Replaces PAR Capability ONLY

Fixed Base

THALES MK 20A ILS

FPBAR AN/FPN-67

Legacy PAR remains on line for Joint and Civil Interoperability.

ILS is Replaced
USAF ATC Systems

ASR-11
Digital Airport Surveillance Radar

GPN-22
Fixed Precision Approach Radar

GRN-29
Instrument Landing System

AN/TRN – 45
Mobile Microwave Landing System

MPN -14 K & TPN -19
Mobile Precision Approach Radar

GPN – 22
Fixed Precision Approach Radar

JPALS will replace legacy radar-based PAL systems

AN/TRN-45
MPN-14K
TPN-19
GPN-22
Some GRN-29
Sea-Based JPALS requires 22x and 94x greater accuracy than JSOW and JDAM, respectively.

JPALS Requires Augmented GPS
Better Guidance Quality (GQ) required as the aircraft gets lower and closer

Even better GQ required when the runway is small and/or moving (e.g., an aircraft carrier)