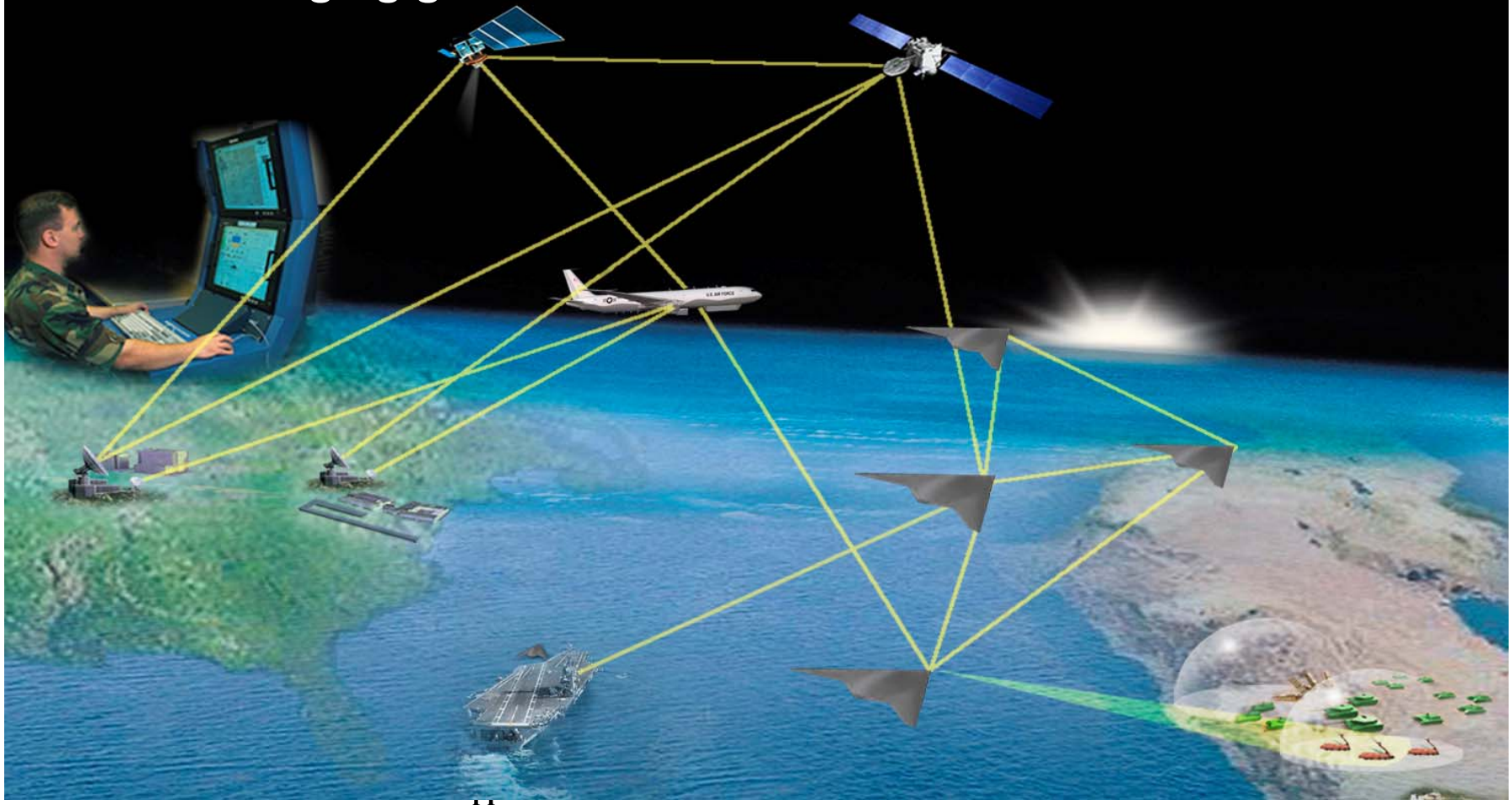
Approved for Public Release
Distribution Unlimited

Joint Unmanned Combat Air System (J-UCAS)

GP14355002.psd

J-UCAS Demonstrator Goal

Demonstrate the technical feasibility for a sea-based Unmanned Combat Air System to effectively and affordably prosecute persistent, 21st century Surveillance / Strike / SEAD missions within the emerging global command and control architecture.



J-UCAS Concept

New Paradigm in System Affordability

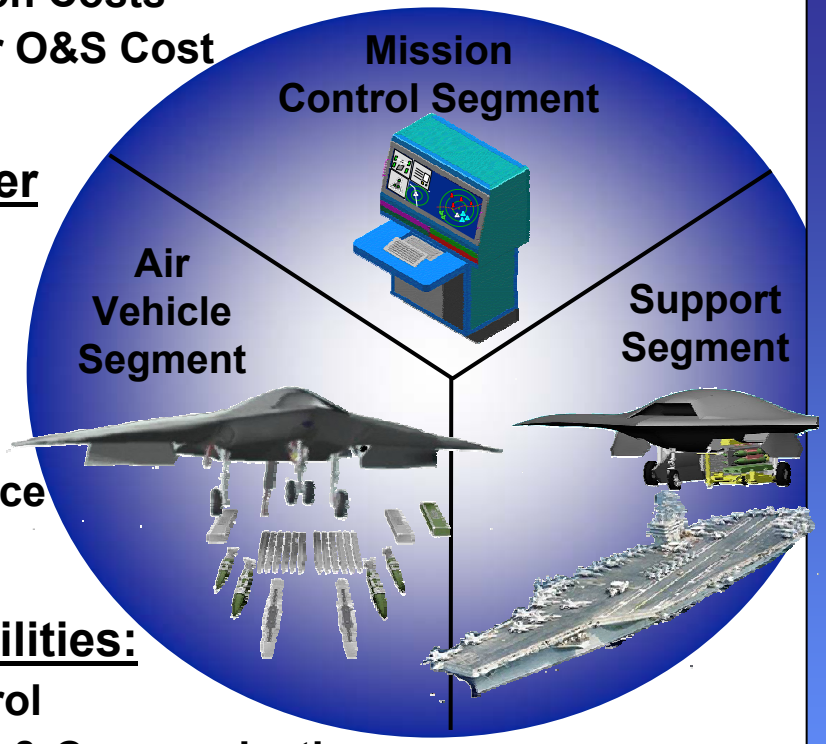
- Reduced Acquisition Costs
- Dramatically Lower O&S Cost

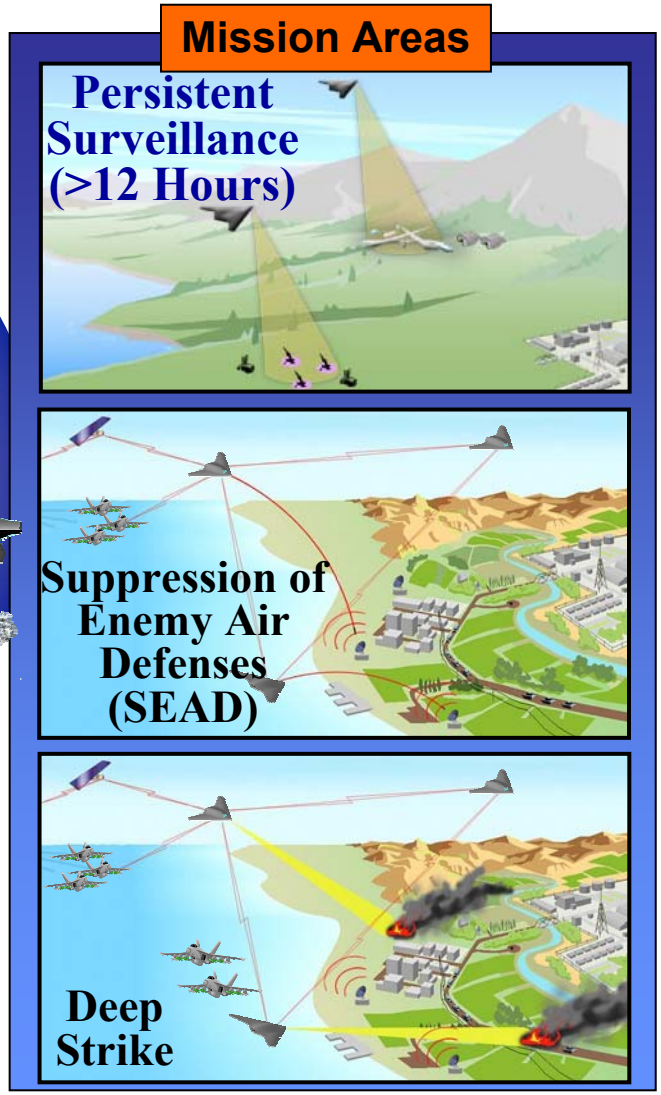
Enhanced Warfighter Effectiveness

- Reduced Cost per Sortie
- Reduced Manned Aircraft Loss Rate
- Improved Battlespace Awareness

Key System Capabilities:

- Multi-Vehicle Control
- Command, Control & Communications
- Dynamic Mission Planning
- Contingency Management
- Mission Effective CV-Based Design





Phase II Objectives

- **CV OPS**
  - **Reliable and repeatable catapult launch and arrested landings at shore-based facilities**
  - **Carrier area ops including departure, marshal, approach, final approach, waveoff and bolter**
- **MCS: functions, interfaces and concept of operations in a near-carrier environment**
- **DECK HANDLING: operations on flight / hangar decks (taxi, towing, maneuver on and off the elevator, engagement and disengagement with the catapult and arresting gear, and fueling / defueling)**
- **CV C3: Robust / suitable for the carrier environment**

Boeing and NGC Awarded Contract to Design and Develop J-UCAS Demonstration Systems

Approved for Public Release Distribution Unlimited

J-UCAS Technical Challenges

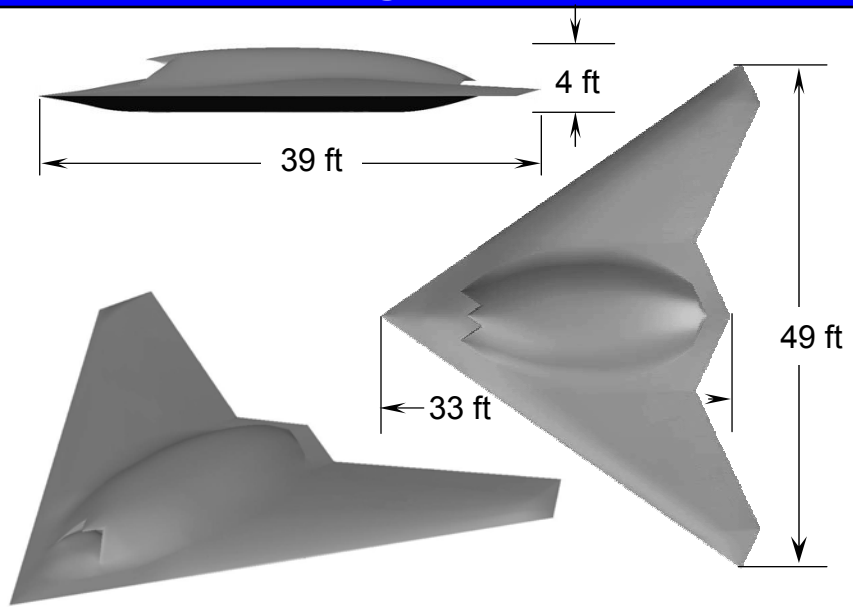
- **Ship Suitable Design**
  - Aircraft/Ship Integration
  - Catapult Launch/Arrested Landing
  - Carrier Landing Solutions - JPALS
- **Mission Control Integration**
  - MCS Ship Integration
  - Air Operations Challenges
  - Interoperability w/ Manned Aircraft
- **Affordable Naval Ops & Support**
  - Supportability by Design
- **Naval CONOPS**
  - J-UCAS Surveillance
  - Future Sensor Development

Focus on Navy-unique technology and integration issues

Approved for Public Release Distribution Unlimited

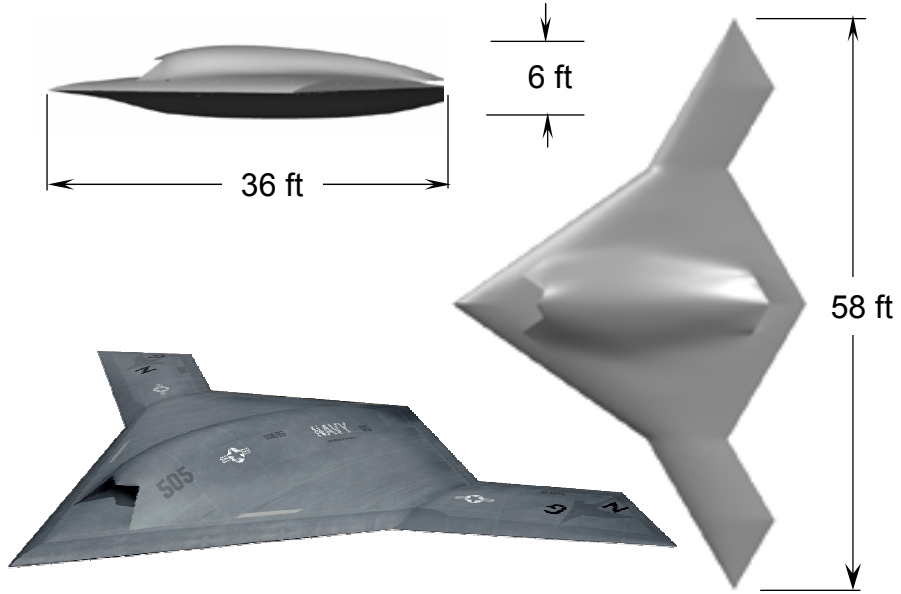
Comparison of J-UCAS Demonstrator AV Configurations

Boeing – X-45CN



Gross Weight:	36,500 lb
Op Weight Empty:	18,000 lb
Fuel Volume:	14,000 lb
Payload Capability:	4,500 lb
Engine:	F404-GE-102D

Northrop Grumman – X-47B



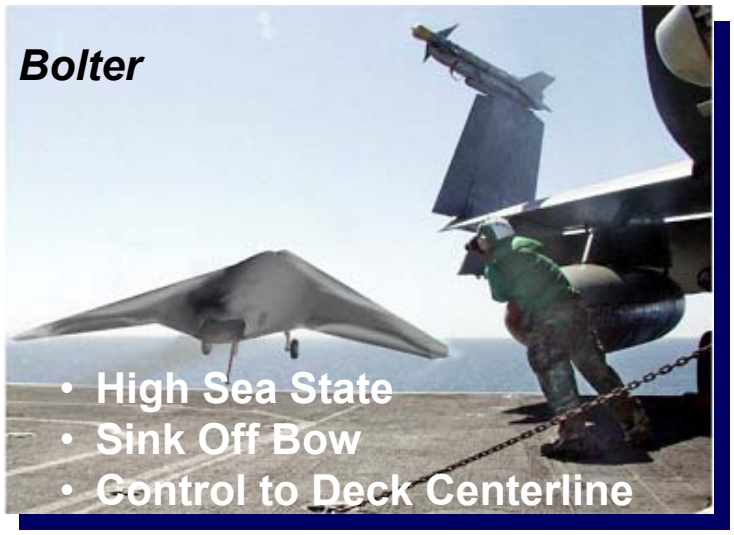
Gross Weight:	29,500 lb
Op Weight Empty:	14,500 lb
Fuel Volume:	10,500 lb
Payload Capability:	4,500 lb
Engine:	P&W 308C

Approved for Public Release Distribution Unlimited

Aircraft/Ship Integration

- **Historic Top 3 Issues for Carrier Aircraft:**
  Weight Wind Over Deck Spot Factor
- **Other CV issues**
  - Catapult Hookup (Geometry, Dynamics, Misposition)
  - Steam ingestion (Jet Blast deflectors)
  - Launch and Recovery Clearances
  - Launch and Recovery Performance & Loads
  - Barricade Compatibility (If Desired)
  - Servicing (Turnaround & Maintenance)
  - Support Equipment Compatibility
  - Taxi Control & Terminal Guidance
  - Tipback - Turnover - Tie Down

Carrier Operation Control Challenges



JPALS Concept

Air Traffic Control – Fully integrated Mission Control with Carrier Air Operations.

- Digital data messaging and support for full manned and unmanned integration
- ATC concepts accommodate moving carrier environment and enhance aircraft carrier launch and recovery efficiency

Navigation – Relative, differential carrier phase GPS-INS with centimeter accuracy

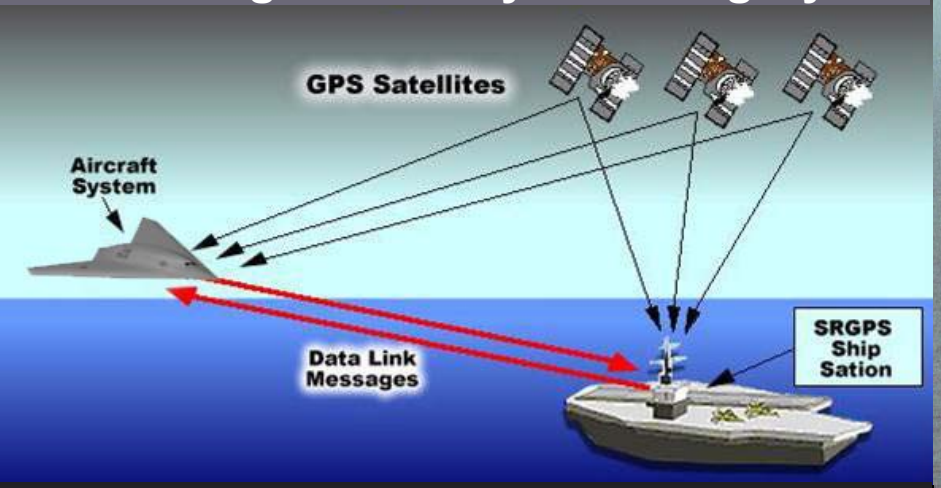
- Integrity 500 times more precise than stand-alone GPS
- Full capability in jamming conditions

Communications – Low latency, high integrity, adaptive data networks with Low Probability of Intercept (LPI) to protect aircraft carrier

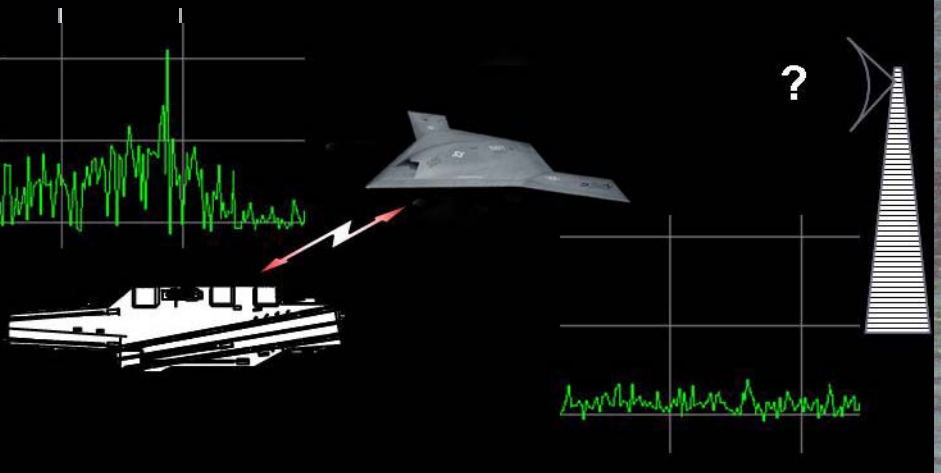
JPALS supports landing ashore and ALL PHASES of flight aboard ship

Landing Solution - JPALS

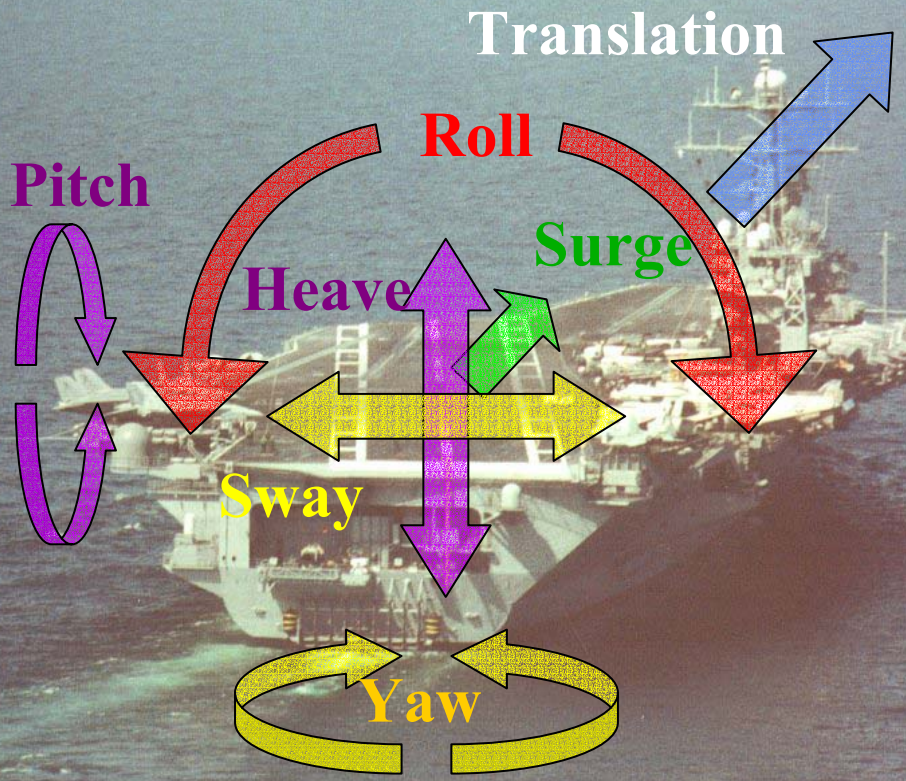
Differential GPS gives relative position with high accuracy and integrity



COMSEC and "Featureless" Spread Spectrum protect the signals



Inertial Navigation System data used to compensate for ship's motion



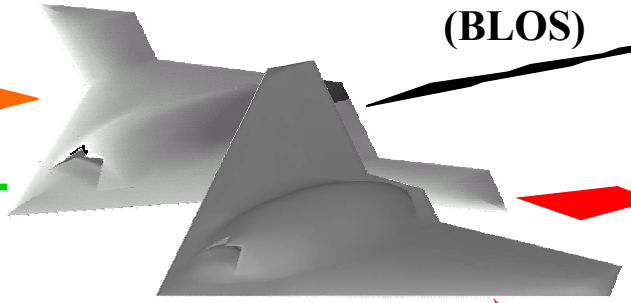
MCS Ship Integration

Deck Controller

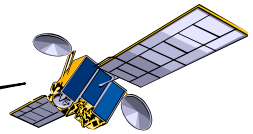
Deck Control Unit

Direct Control on Deck

Visual Cues



SATCOM (BLOS)



JPALS

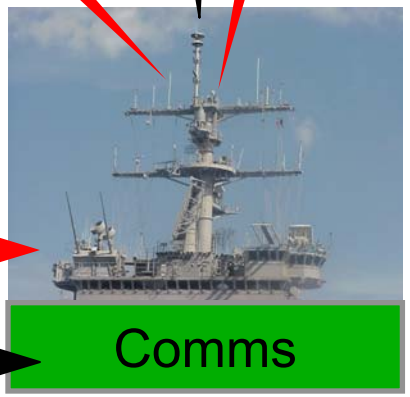
Link-16 (LOS)

Situational Awareness

CATCC

Landing Signals Officer (LSO)

Waveoff



Comms

MCS

- 4 AVs – 1 Operator
- Mission Planning
- Low Latency LAN
- C4I

Approved for Public Release Distribution Unlimited

J-UCAS Air Operations Challenges

(1) Reliability and Safety

- Flight Control Design
- Vehicle Management System
- Reliable, Robust Navigation

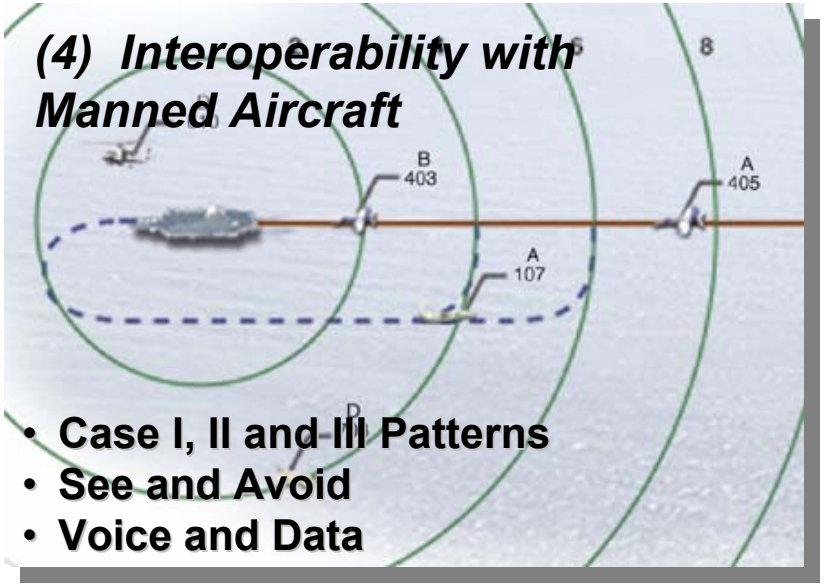
(2) Operations under VFR, IFR, and EMCON flight rules

- Auto vs piloted procedures
- MCS, ATC, and Deck Control
- EMCON Operations

(3) Operator to Vehicle Ratio During ATC

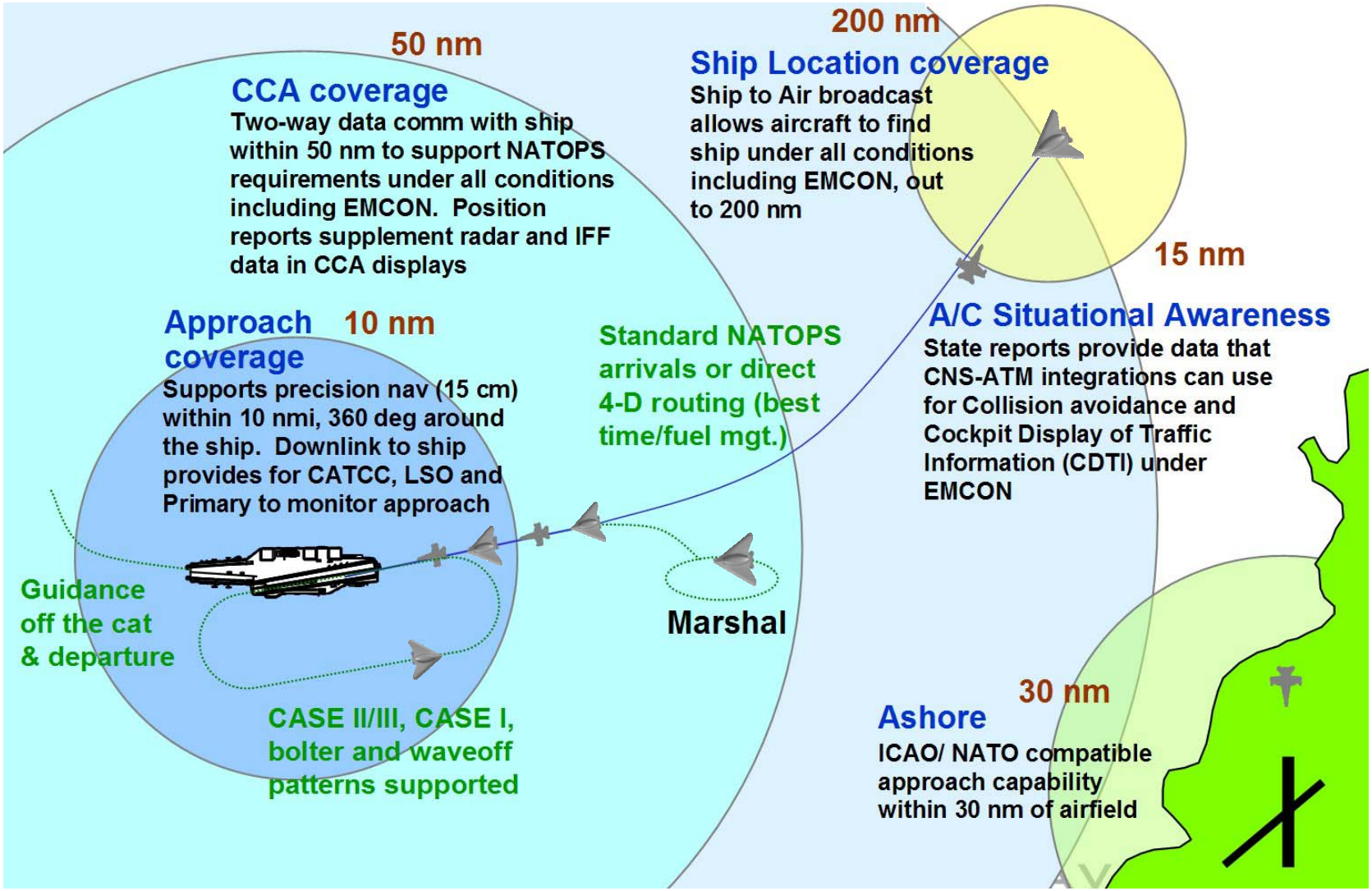
- 4 Simultaneous Voice Freqs
- Eliminate Routine Voice Calls
- ATC Voice to Data Commands

(4) Interoperability with Manned Aircraft



- Case I, II and III Patterns
- See and Avoid
- Voice and Data

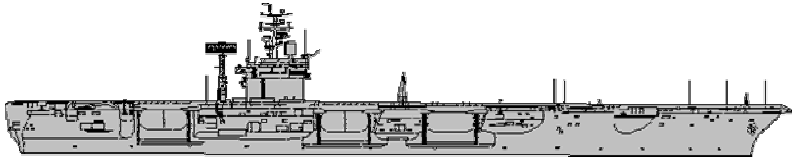
Interoperability with Manned Aircraft: Concept



Approved for Public Release Distribution Unlimited

Supportability by Design

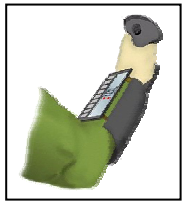
Support Asset Volume



- Minimized unique SE
- Maximize common SE
- Folding wings decrease AV spot factor

Less Volume than Comparable Manned Aircraft

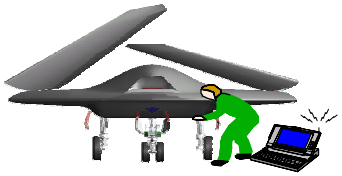
Sortie Generation & Deck Ops



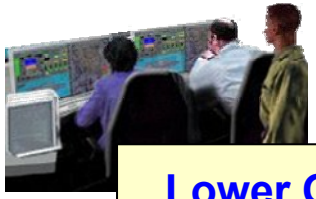
- Rapid Turn Time
- Integrated Vehicle Health Management
- Autonomic Logistics Support Concepts
- Daily Access Without LO Restoration

Affordability Objectives

- Ease of Maintenance
- Technology Enabled Maintainers



- Realistic Simulation Based Virtual Training Environment
- Reduced Manning



Lower O&S $ than F/A-18C

Logistics / Sustainment Personnel & Training

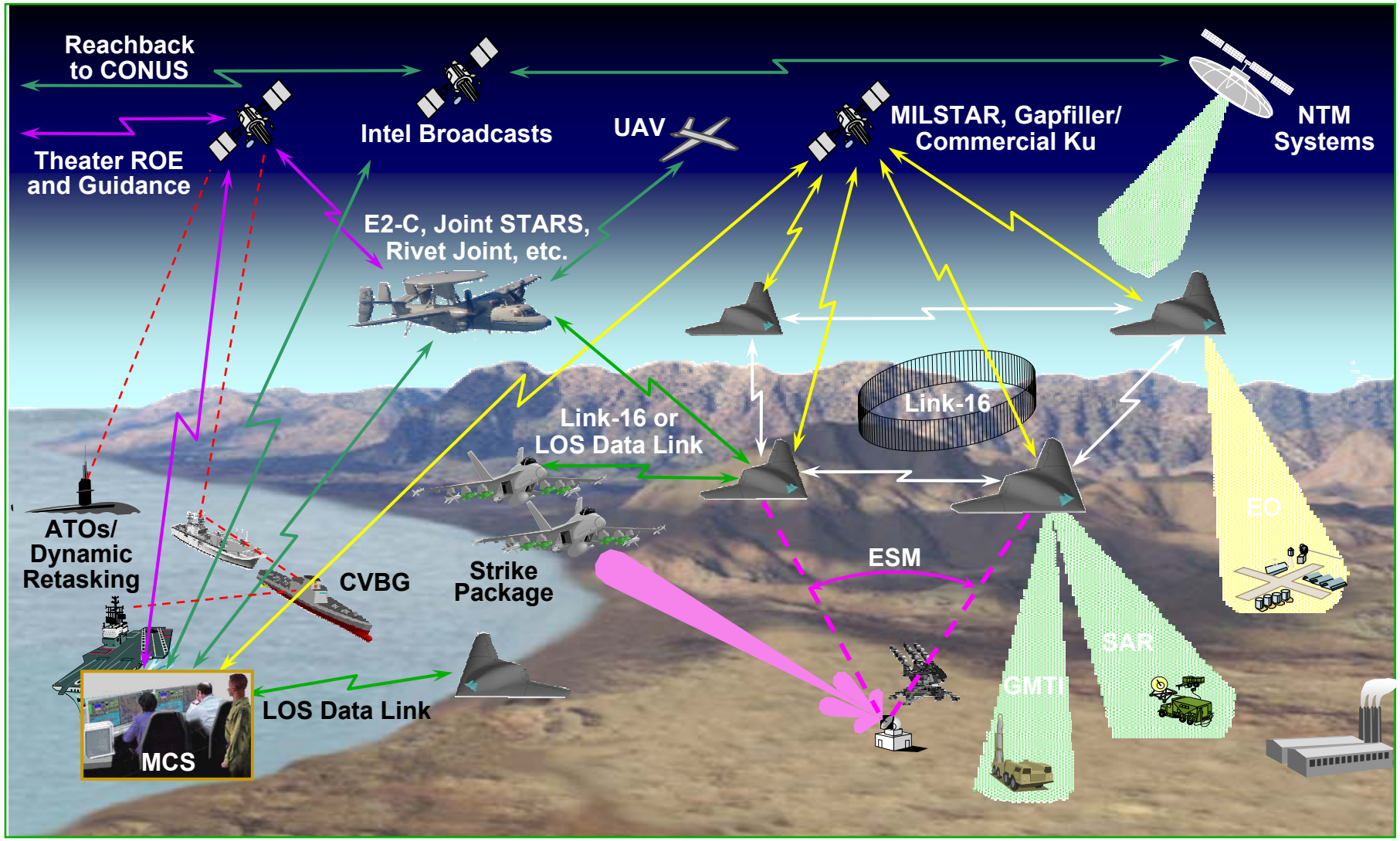
- Combined Hands On & Virtual Training
- Operational Use When Not Deployed
  - Training & Op Exercises
  - Logistics Assessment
- "Autonomic" Support System

Reduction In Manning over F/A-18C

Approved for Public Release Distribution Unlimited

J-UCAS Surveillance

Operational/System Architecture

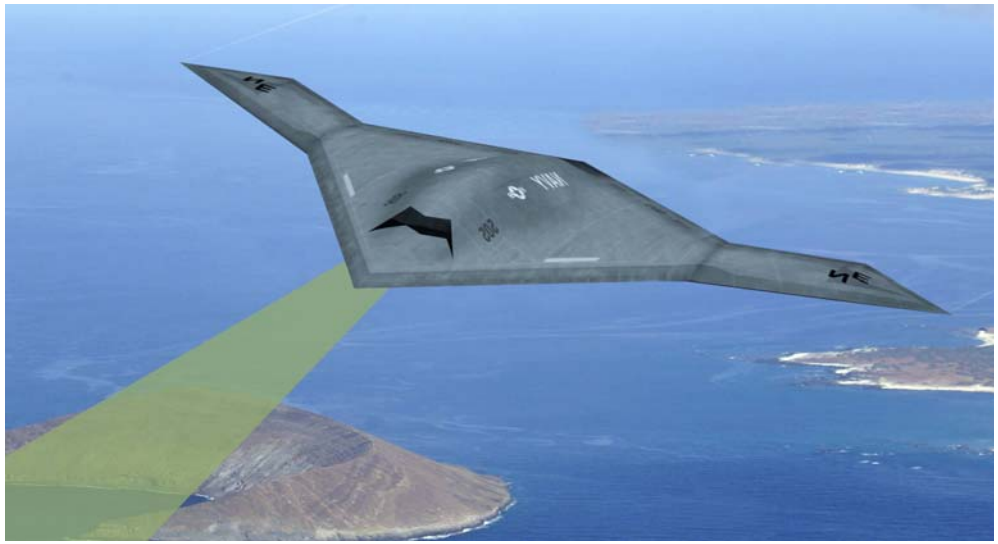


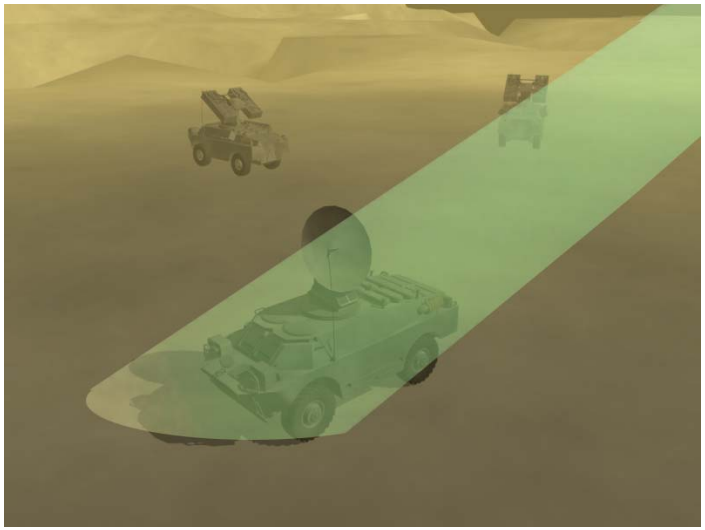
Approved for Public Release Distribution Unlimited

Future Sensor Development

J-UCAS Surveillance Mission

1. SAR/GMTI
2. ESM
3. EO/IR





Questions for experimentation:

- Distributed control of the onboard sensor
- Bandwidth requirements
- Integration of sensor apertures w/ penetrating J-UCAS
- Sensor fusion with ATR
- ESM, AT3
- Sensor-to-Shooter
- Autonomy in mission execution, mission planning

Conclusion

- **J-UCAS Program**
  - Demonstrate technical feasibility for a sea-based J-UCAS
  - Reduced acquisition costs and O&S cost
  - A revolutionary system for the warfighter
- **Phase II moving ahead**
  - CCA Ops Demo Complete
  - Funding Provided for two flight and system demonstrations
    - » Boeing – X-45CN
    - » NGC – X-47B
  - Catapult launch and arrested landings to be conducted at shore-based facilities
  - Controlled Taxi and simulated Deck Ops will be demoed at shore and aboard ship

Preparing to Stand up Joint Systems Management Office (JSMO) by October 1st