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# **J-UCAS Program Update**

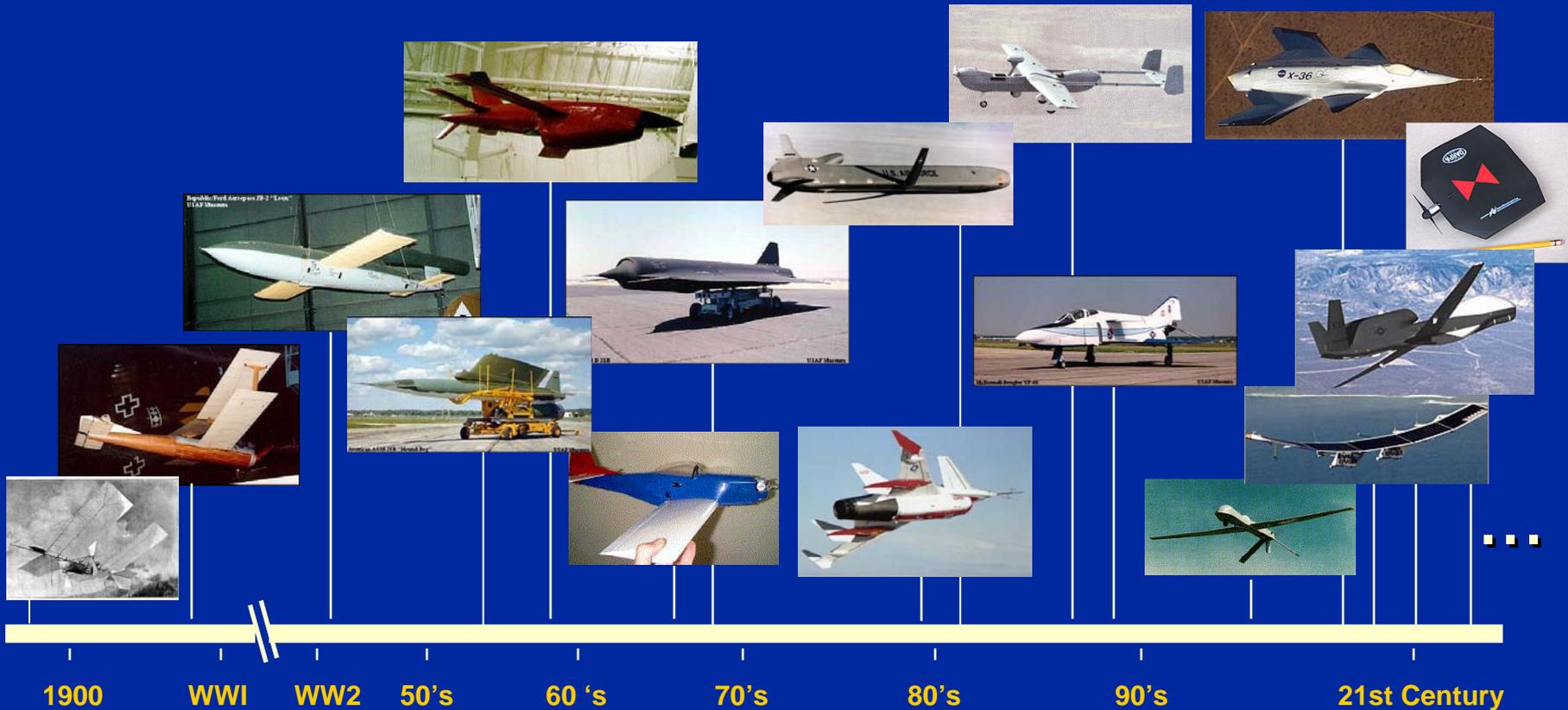
**Michael S. Francis,  
J-UCAS Program Director**



U.S. AIR FORCE



# Unmanned Aircraft -- A Long History



## Early Attributes ...

- Limited Capability & Flexibility
- Niche Applications Only
- Disappointing Reliability
- Not Competitive w/ Manned Systems

## Today ...

- Capabilities ... Beyond Manned Platforms
- Reliable/Safe Operations are Current Focus
- Credible, Affordable Solutions Possible

**Why Has It Taken So Long?**

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Operational UAV Systems --

# Designed for “Dull” ...



- **Historical Legacy**

- Focus on Low Cost Air Vehicles
- Small ... Operate ‘on the Range’
- Reliability Issues ... Technology Limitations

- **Air Vehicle Attributes**

- Reconnaissance-Focused
- Endurance/Persistence
- Relatively Low Speed Designs
- Sized to the Supporting Force

- **An Array of Sensors**

- EO/IR
- Video
- Synthetic Aperture Radar
- Other (e.g. FOPEN, MASINT)

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## Contemporary UAV Systems -- ... to Weaponized UAVs



- **Ryan BGM-34A Firebee ... Combat RPV**

- Based on 1958 Design
- Maverick Missile Launches ... 1971-72
- Employed in Vietnam ... 1970s



- **General Atomics MQ-1 Predator**

- Hellfire Missile Option ... Feb 2001
- Successful Employment in Afghanistan ... Nov 2002

- **Boeing J-UCAS X-45A**

- GPS-Guided Small Smart Bomb
- Successful Weapons Test ... Apr 2004



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# UAVs – The 1<sup>st</sup> Generation -- Moving the Cockpit to the Ground ...

## Predator A



- **Relatively Low Cost System**
- **Pilot-in-the-Loop Control**
  - Modern Glass Cockpit
  - Software Driven Design
  - Operative Intensive System
- **Reliable Communications**
  - Initially, Line-of-Sight Link
  - ... Has Migrated to BLOS Connectivity
- **Modern Payloads**
  - Video (Visible) Sensor is Primary
  - SAR Imager Provides Alternative
  - Hellfire Missile for Lethal Role
- **Conventional Platform Design**
  - Slow, Statically Stable Aircraft
  - Respectable Endurance
  - Limited Survivability
  - Turbine Engine Upgrade

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Contemporary UAV Systems --

# Toward More Autonomy ...

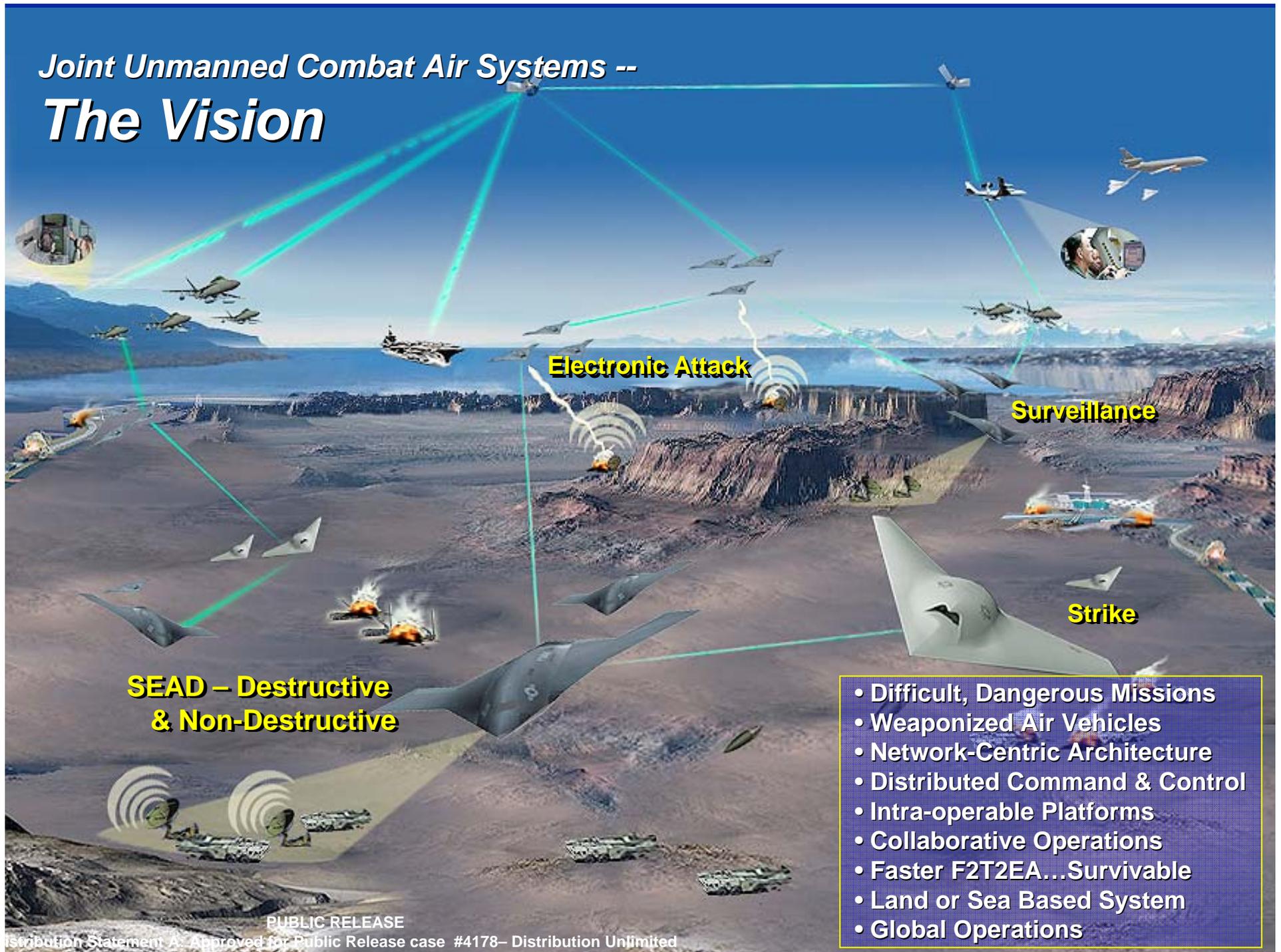
**Global Hawk**



- **Non-Traditional C2 -- Operator-vs-Pilot**
- **High Level of Automation**
  - Auto-Everything ... No Manual Options
- **Extended Range and Reach**
  - Routine BLOS Connectivity (SatCom)
- **Unique, Specialized Platform**
  - Exceptional Range-Payload Performance
  - Very High Altitude Operational Environs
- **Multi-Role Capabilities**
  - SAR – EO/IR Payload Suite
  - Airborne Communications Node ...

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# Joint Unmanned Combat Air Systems -- The Vision



Challenging Objectives --

# Toward an 'Operationalized' System

Boeing X-45C



Northrop Grumman X-47B

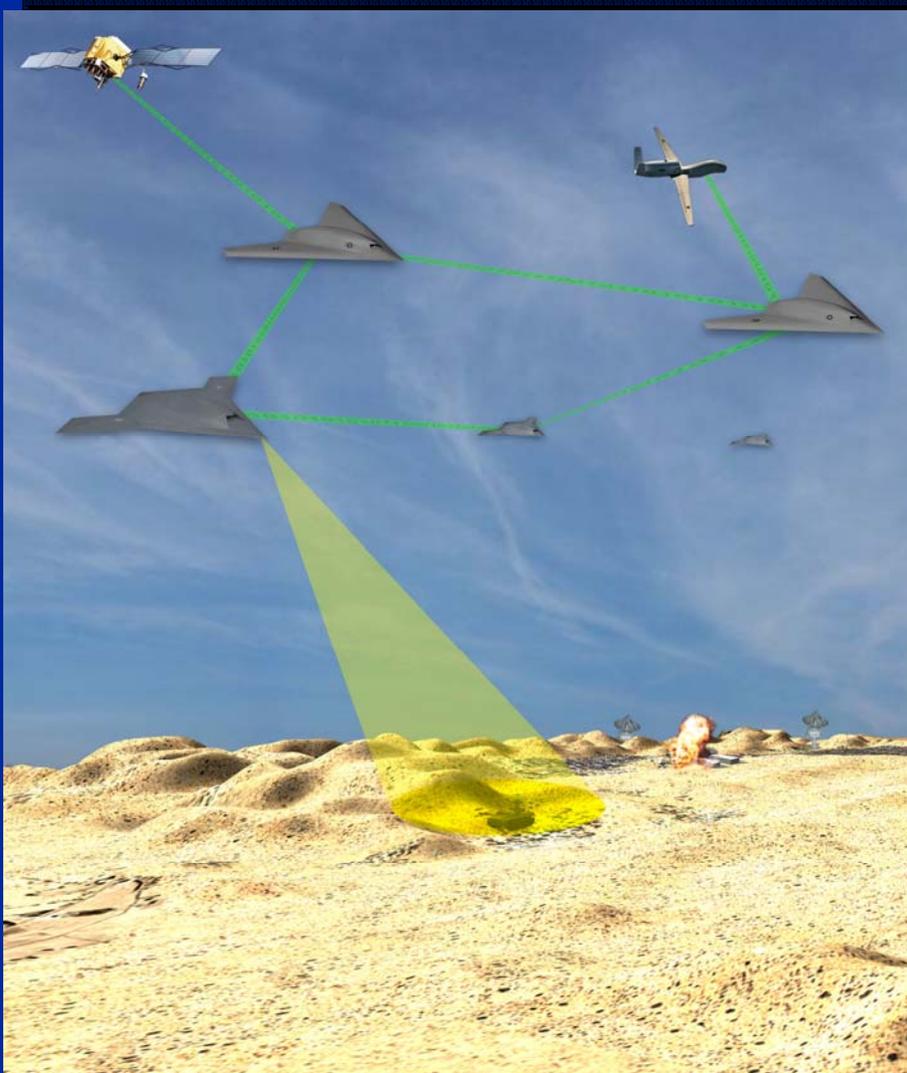


- **Range-Payload Performance**
  - Long Range – Combat Radius (1000+ nm)
  - Significant Endurance/Persistence
  - Payload Capacity (4500# plus Sensors)
- **Diverse, Versatile Sensor Capabilities**
  - ESM Capability
  - Synthetic Aperture Radar
  - EO / IR Sensor
  - EW / Electronic Attack Payload
- **Multiple Basing Environments**
- **Global Operations**
  - Air Refuelable
  - Civil Airspace Compatible
  - BLOS Command & Control
- **Survivable System Design**
- **Phased-in Attributes**
  - Sensors ... Payloads ... LO Features ...
- **Intra-operable Platforms**
  - ... thru the *Common Operating System*
- **Early Operator Exposure**
  - First Flights in 2007 ... OA Start in FY07

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# Collaborative Operations



## ***Increase System Versatility***

- Deep/Denied Environments
- System-of-Systems Threats
- Multiple Engagement Options
- Diverse Missions

## ***Improve System Performance***

- Reduced Target Location Time
- More Assured Target Identification
- Sustained Ground Tracking
- Improved Targeting Precision
- Rapid Battle Damage Assessment

## ***Enhance Survivability***

- Group Self Defense Tactics
- Novel CONOPS (e.g. Bi-static Ops)
- Graceful System Degradation
- Predictable Effects ... Unpredictable Tactics

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# J-UCAS Global Capabilities— AN AIR & SPACE SYSTEM

## Navigation

“Reach Forward –  
Reach Back”

## Communications

- Collaborative Sensing
- Missile Warning
- Sensor Cueing
- Bi-Static Ops

## Global Operations

- Airspace Deconfliction
- Large # of Platforms
- Coordinated C2-ISR
- Near Real Time

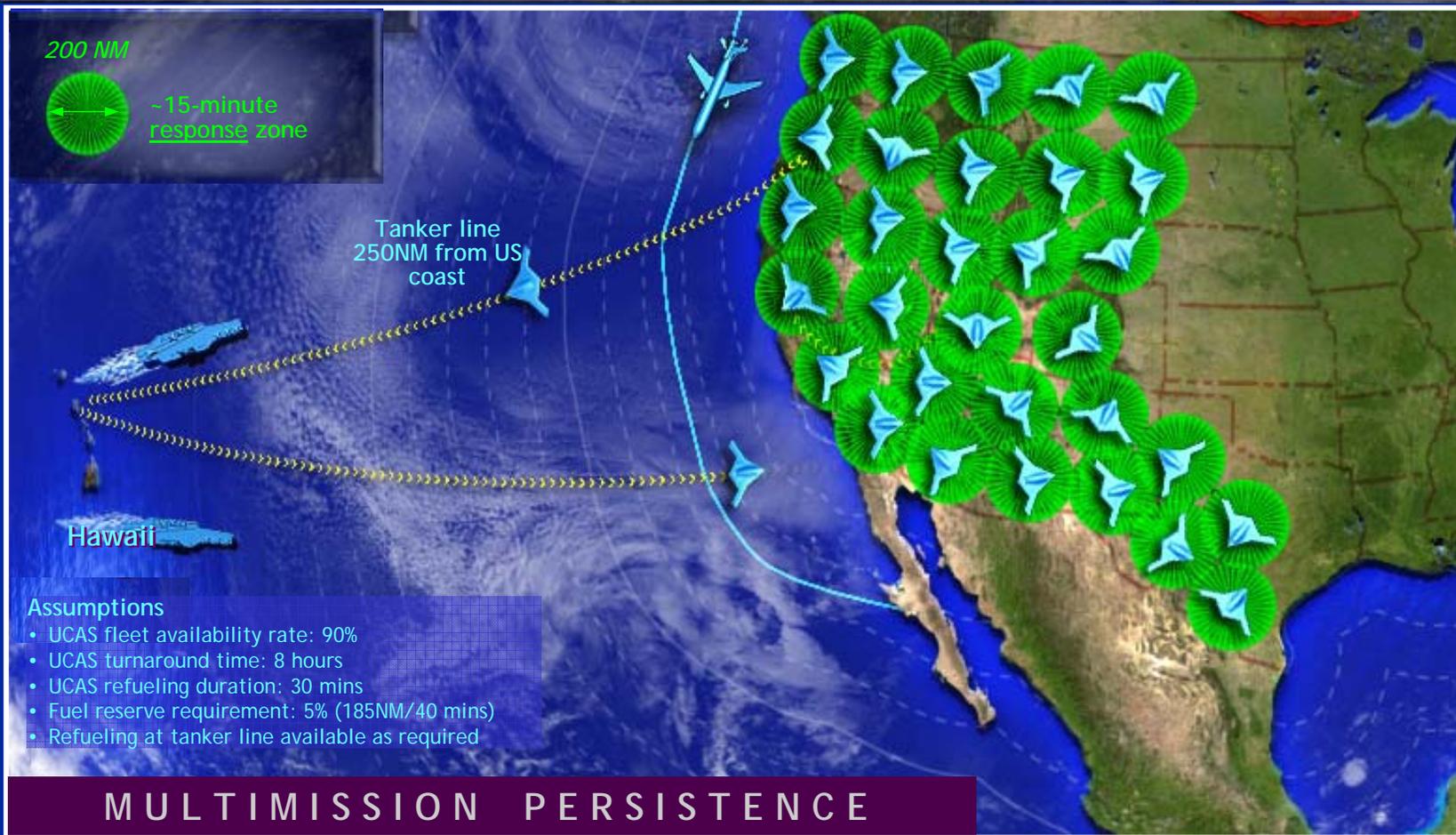
Theater C2

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# J-UCAS Multi-Mission Persistent Coverage in Perspective

*Illustrative 24/7 Surveillance-Attack Coverage of 100 a/c Fleet of X-47B-Class UCAVs*



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# Currently Fielded UAV Functionality & Services' Expectations for J-UCAS



Predator  
Many : 1

Global Hawk  
1 : 1

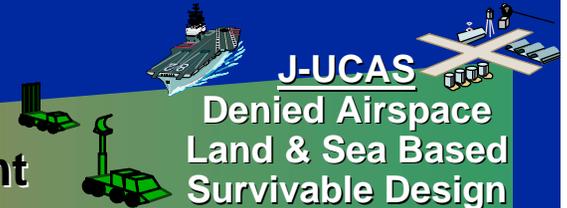
**Operator : Vehicle Ratio**

J-UCAS  
1 : Many

Predator & Global Hawk  
Secured Airspace  
Land Based



**Operational Environment**



J-UCAS  
Denied Airspace  
Land & Sea Based  
Survivable Design

Global Hawk  
Single Ship  
Days

**Mission Planning Time**

J-UCAS  
Multi Ship  
Hours

Global Hawk  
Dedicated Channel  
per Vehicle  
Large Bandwidth Blocks

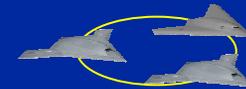


**Communication Management**

J-UCAS  
Shared Channels  
Quality of Service  
Net Ready

Fielded Systems  
Single Ship Only  
Stove-Piped Systems  
No Cooperation

**Cooperative Operations**



J-UCAS  
Multi Ship, Cooperative  
Targeting & Attack  
Interoperable

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# Joint Unmanned Combat Air Systems -- Successful 1<sup>st</sup> Generation Air Vehicles



## First Flight

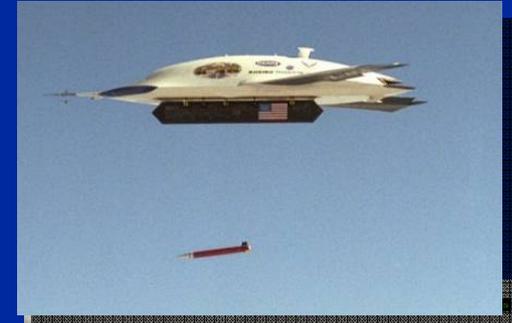
X-45A ... May 2002



X-47A ... Feb 2003



X-45A Guided Weapon Demo ... Apr 2004



## Multi-Vehicle Operations ... Aug 2004 - Present



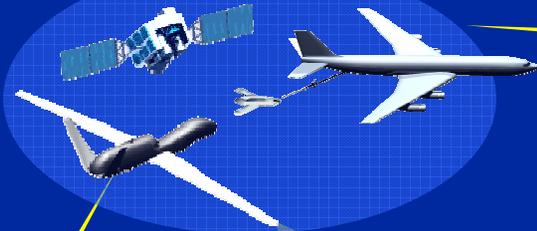
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# J-UCAS System Elements



## Operational Infrastructure



## Air Vehicle(s)

## Communications



## Control Station(s)

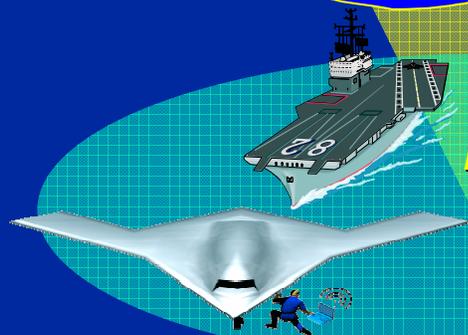
## Operating System

- Command & Control
- Communications
- Mission Planning
- Autonomous Functions
- Human-System Interface
- Health/Status

## Payload Systems

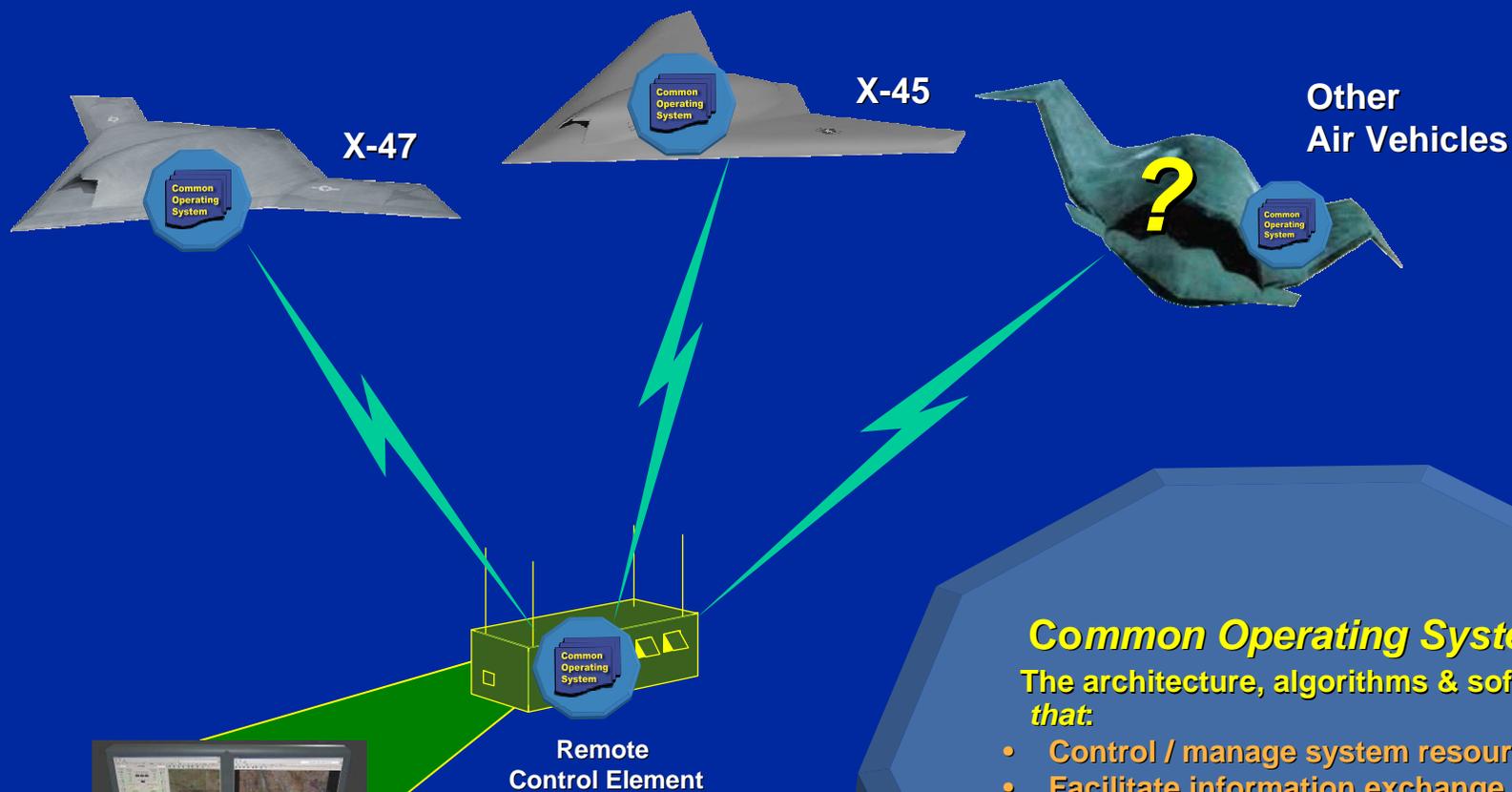


## Direct Support



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# Common Operating System



- Development Team**
- Air Vehicle Primes
  - Integrator-Broker
  - Technology Contributors

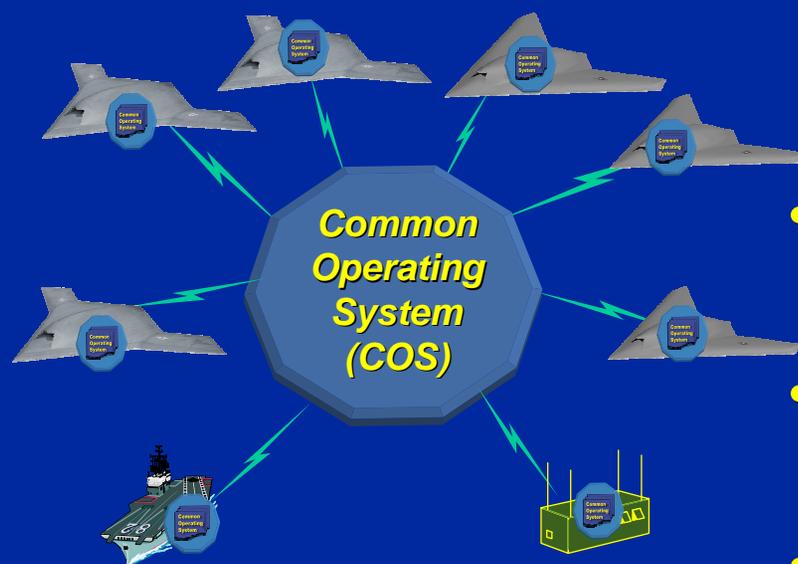
**Common Operating System**  
The architecture, algorithms & software, that:

- Control / manage system resources
- Facilitate information exchange
- Provide battlespace awareness
- Enable inter-platform functionality
- Enable autonomous operations
- Maintain quality of service

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# Common Operating System (COS) -- Why Develop It?



- **System & Mission Flexibility**
  - Create new command & control options
  - High level of integration needed for collaborative operations
  - Facilitate agile bandwidth management ... accommodate multiple platforms
- **Reduce Development Cost & Risk**
  - Build it one time
  - Don't sub-optimize design
- **Reduce Technology Barriers to Entry**
  - Attract 'best-of-breed' algorithms & functionality
- **Assure Intra- and Inter-operability**
  - Primes collaborate to develop
- **Decouple System IT from Platforms**
  - Allow natural development timelines
  - Reduce interdependencies
  - Enable new platform options

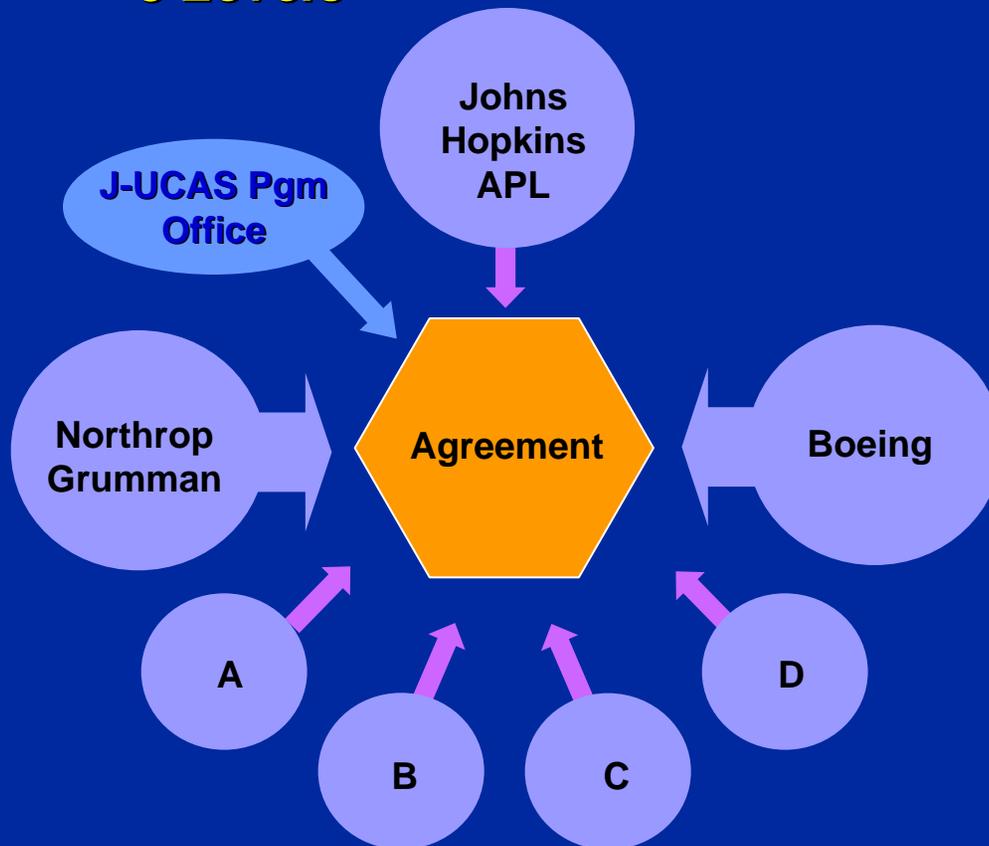
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# Common Operating System

## Consortium-like Business Arrangement

### 3 Levels



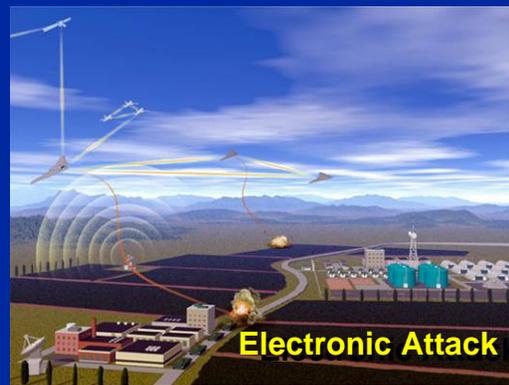
- Integrator/Broker/Observer**  
 Unique Role ... Not an LSI ... No Other Integrator ... Facilitator ... Referee  
 No Intellectual Property
- Program Primes – Key Stakeholders**  
 Fractional Ownership  
 Platform Integrators – Physical, Functional  
 S/W Developers  
 COS Collaborators
- Technology Contributors**  
 Based on Potential Contribution(s)  
 Small Houses, Other Primes, Traditional Subs, Commercial Providers

Business dynamics promote competition & ownership ...  
 Increased idea pool decreases technology risk

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# Joint Unmanned Combat Air Systems -- Operational Assessment

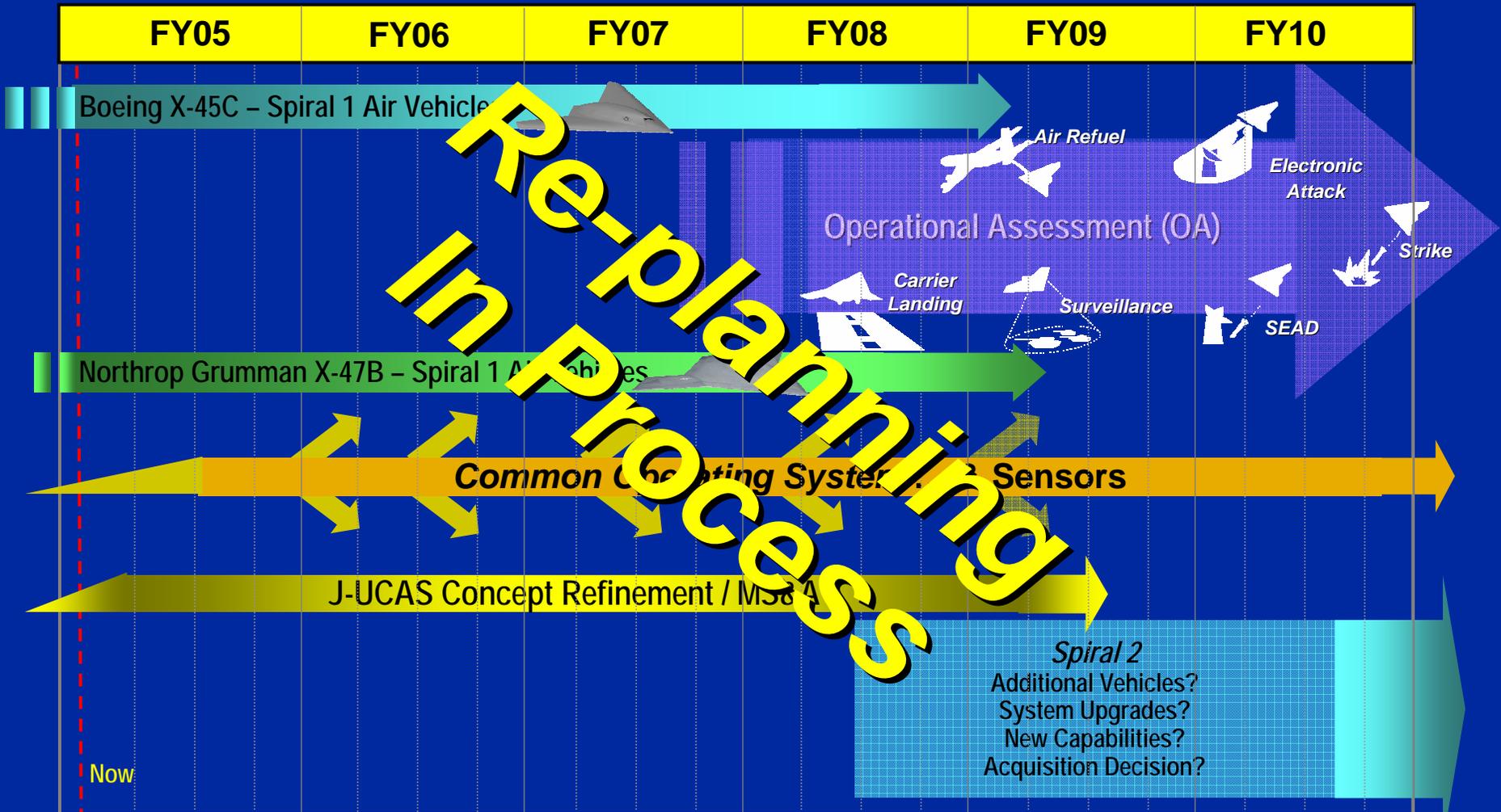


- **Service User Driven Activities**
  - Joint planning team
- **Exploration & Experimentation**
  - JFCOM
  - Sponsor commands
  - Other operational users
- **Assessments include:**
  - Baseline missions
  - CONOPS
  - Tactics exploration
  - Key capabilities
  - Interoperability
  - Crew interface(s) & effectiveness
  - Contingency operations
  - Supportability
  - Vulnerabilities

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# Program Evolution



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UAVs & UCAVs --

## *The Broader Challenges*

- **Building User & Public Confidence - Cultural Acceptance**
  - Reliability & Safety ... Contemporary Expectations
  - Public Awareness & Education
  - Media Attention & Risk Aversion
  - Lethal CONOPs (UCAV)
- **Removing Regulatory Barriers**
  - Routine Airspace Control Accommodation
  - Mixing Manned and Unmanned Systems
  - Vehicle/System Certification
  - Treaty Implications (UCAV)
  - Other Legal & Liability Issues
- **Integration into the Infrastructure**
  - Operations & Basing
  - Logistics & Maintenance
- **Meeting Affordability Expectations**
  - Acquisition Costs
  - Operations & Support Costs
  - ... Surviving the “Bow Wave”



***The Keys to Commercialization***

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# *Status Summary*

- **J-UCAS Program Underway**
  - Major Participants Fully Engaged
- **Versatile Capability Pursued**
  - Complementary Air Vehicles Address Diverse Mission Needs
  - *Common Operating System* Maximizes Operational Flexibility
- **Early Operational Assessment Activities Planned**
  - Provide Venue For Operator Experimentation
  - Address Operational User Needs ... Explore “Opportunities”
  - Facilitate an Acquisition Decision By DoD And The Services
- **FY06 Budget Has Triggered Program Re-planning**
  - Content/Schedule Revisited Due to Revised Budget
  - Transition to New Joint Service Organization in Work
  - Re-plan Oriented to Maintain Program Momentum



# Questions?

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