



U.S. AIR FORCE



J-UCAS

JOINT UNMANNED COMBAT AIR SYSTEMS



Joint Unmanned Combat Air Systems

- to -

**National Defense University
Washington, DC**

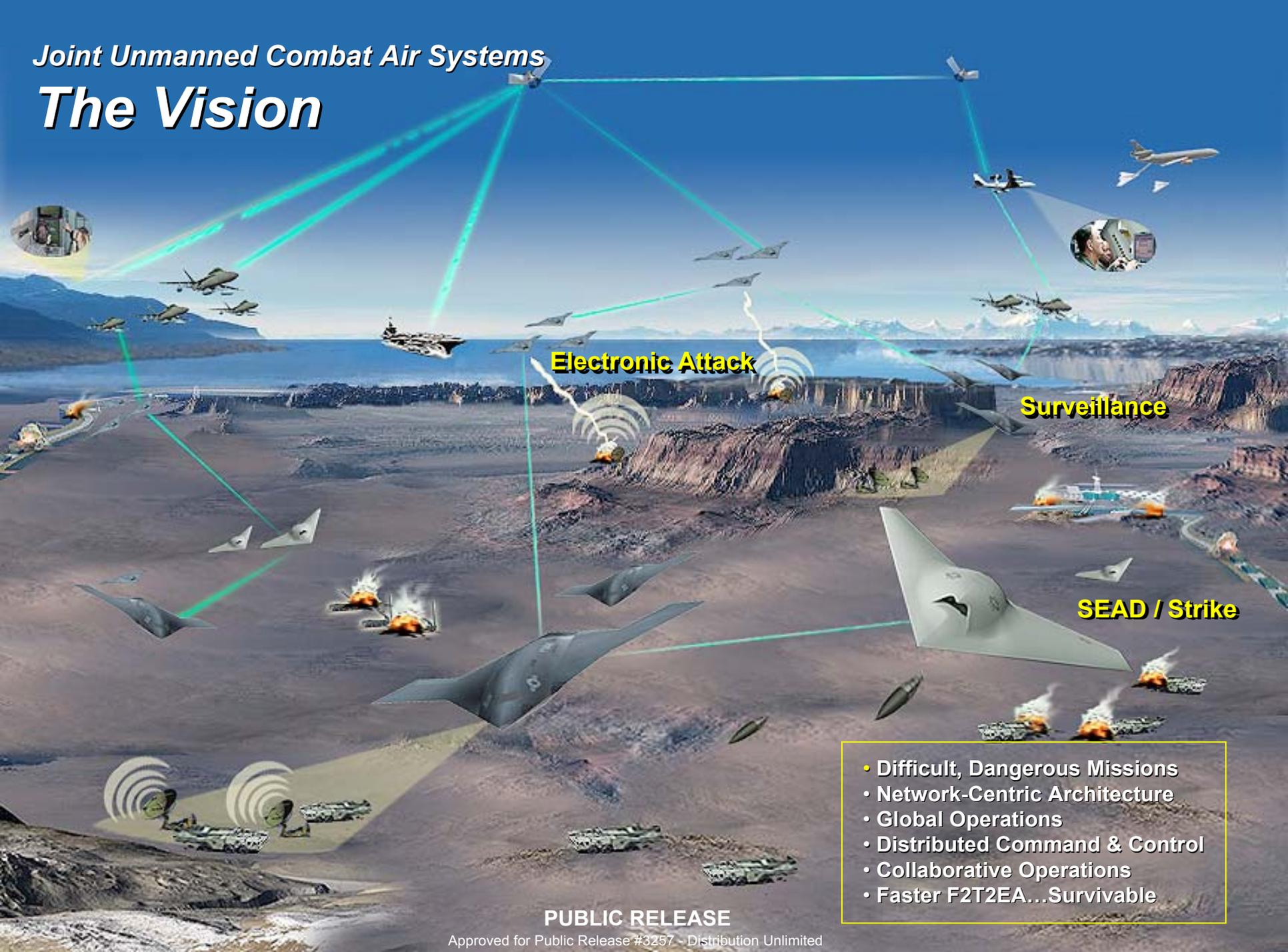


Dr. Michael Francis, Director
September 30, 2004

Joint Unmanned Combat Air Systems -- Unique Joint Program

- **DARPA-Air Force-Navy Development ... Initiated October 2003**
- **DoD Objectives**
 - Demonstrate the Feasibility & Flexibility Of The J-UCAS Concept
 - Conduct Joint Operational Assessment Of J-UCAS Capabilities
 - **Begin in FY07 ... Facilitate Service Decision by the End of the Decade**
 - Maintain Competitive Environment Throughout The Program
- **Investigate Service Driven Missions & System Capabilities**
 - SEAD ... Strike ... Electronic Attack ... Penetrating Surveillance
- **Outgrowth of Earlier DARPA UCAV Programs (1994-2003)**
- **System Concept -- Network-based System-of-Systems**
- **Program Focus -- An 'Operationalized' System**
 - Capability Demonstrations & Experimentations
 - Spiral Development Approach ... Cutting Edge Technology ... ATDs
 - 2 Air Vehicle Prime Contractors --
 - **Boeing (X-45), Northrop Grumman (X-47)**
 - *Common Operating System* Development
- **Large Program >\$4.0B over the FYDP**

Joint Unmanned Combat Air Systems The Vision



Electronic Attack

Surveillance

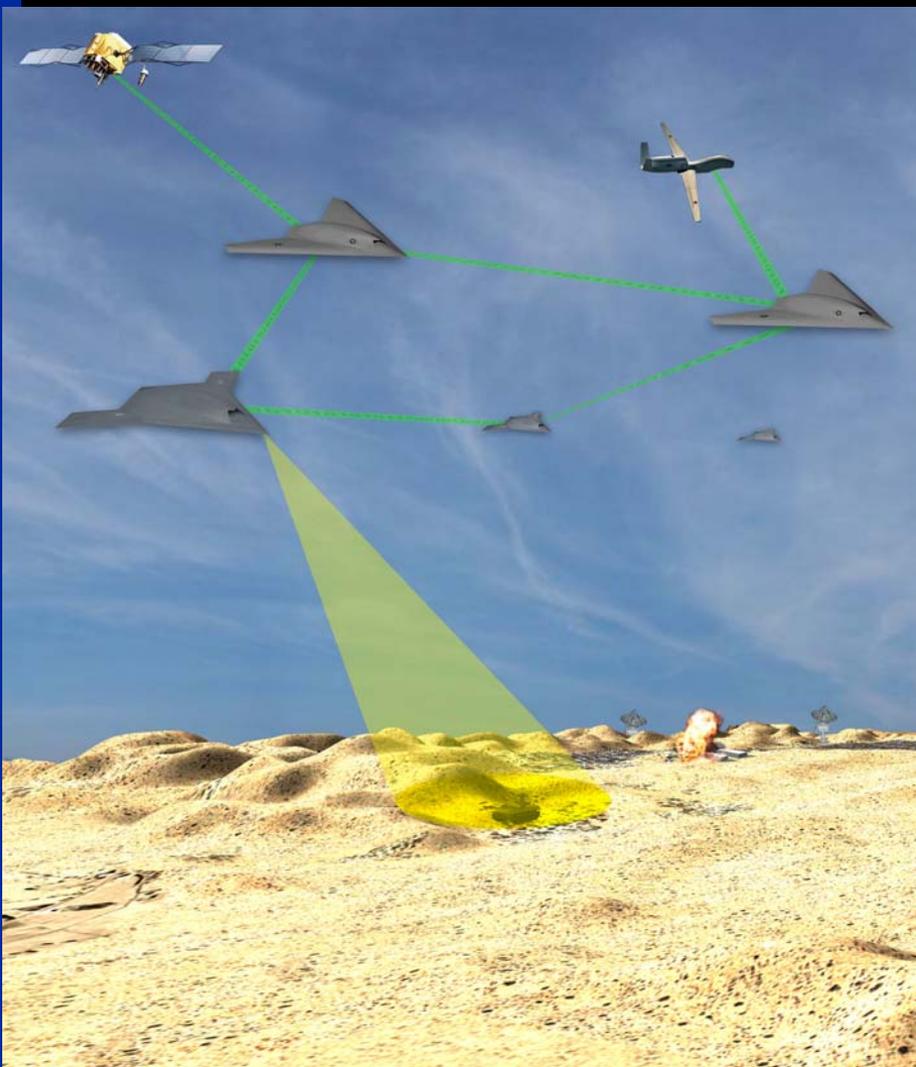
SEAD / Strike

- Difficult, Dangerous Missions
- Network-Centric Architecture
- Global Operations
- Distributed Command & Control
- Collaborative Operations
- Faster F2T2EA...Survivable

PUBLIC RELEASE

Approved for Public Release #3257 - Distribution Unlimited

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

Global Capabilities— SPACE AS INFRASTRUCTURE

Navigation

Communications

- Remote Sensing (Collaborative)
- Missile Warning

“Reach Forward –
Reach Back”

Global Operations

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

Theater C2

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Significant Progress to Date

-- 1st Generation Air Vehicles



• X-45A Accomplishments

- First Flight – May 02
- Max Altitude / Max Speed – Feb 03
- Multi-Vehicle Ground Tests – Feb 04
- Weapons Demos – Mar/Apr 04
- Multi-Vehicle Flight – Aug 04

• Software Develops Critical J-UCAS Functionality

- Vehicle Decision Making
- Multi-Vehicle Collaboration

• X-47A Accomplishments

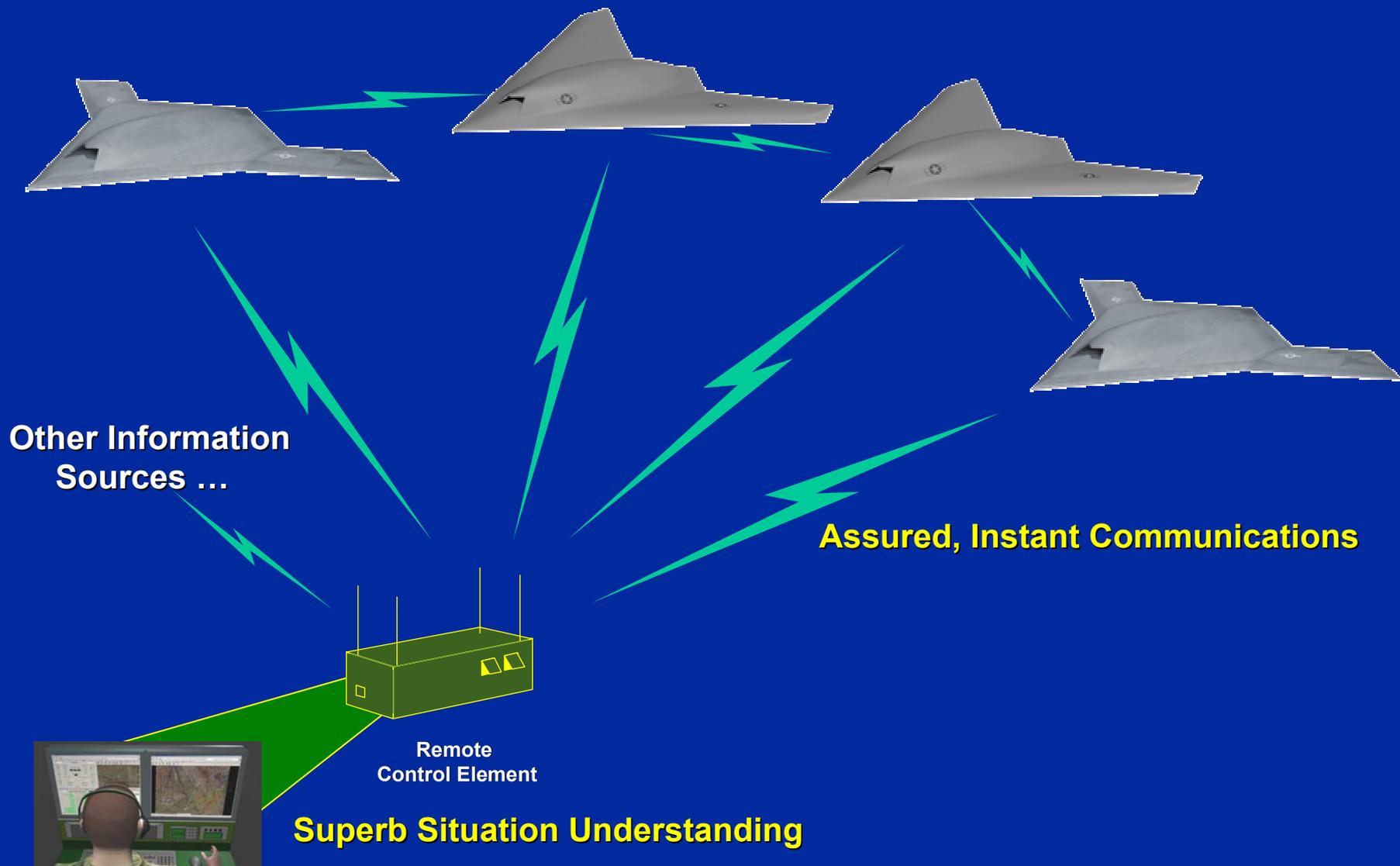
- First Flight – Feb 03
- Low Speed Aerodynamics & Flying Qualities
- Carrier Landing Systems Compatibility

• Design Leverages Global Hawk, Fire Scout, Other UAV Experience

System Technologies --



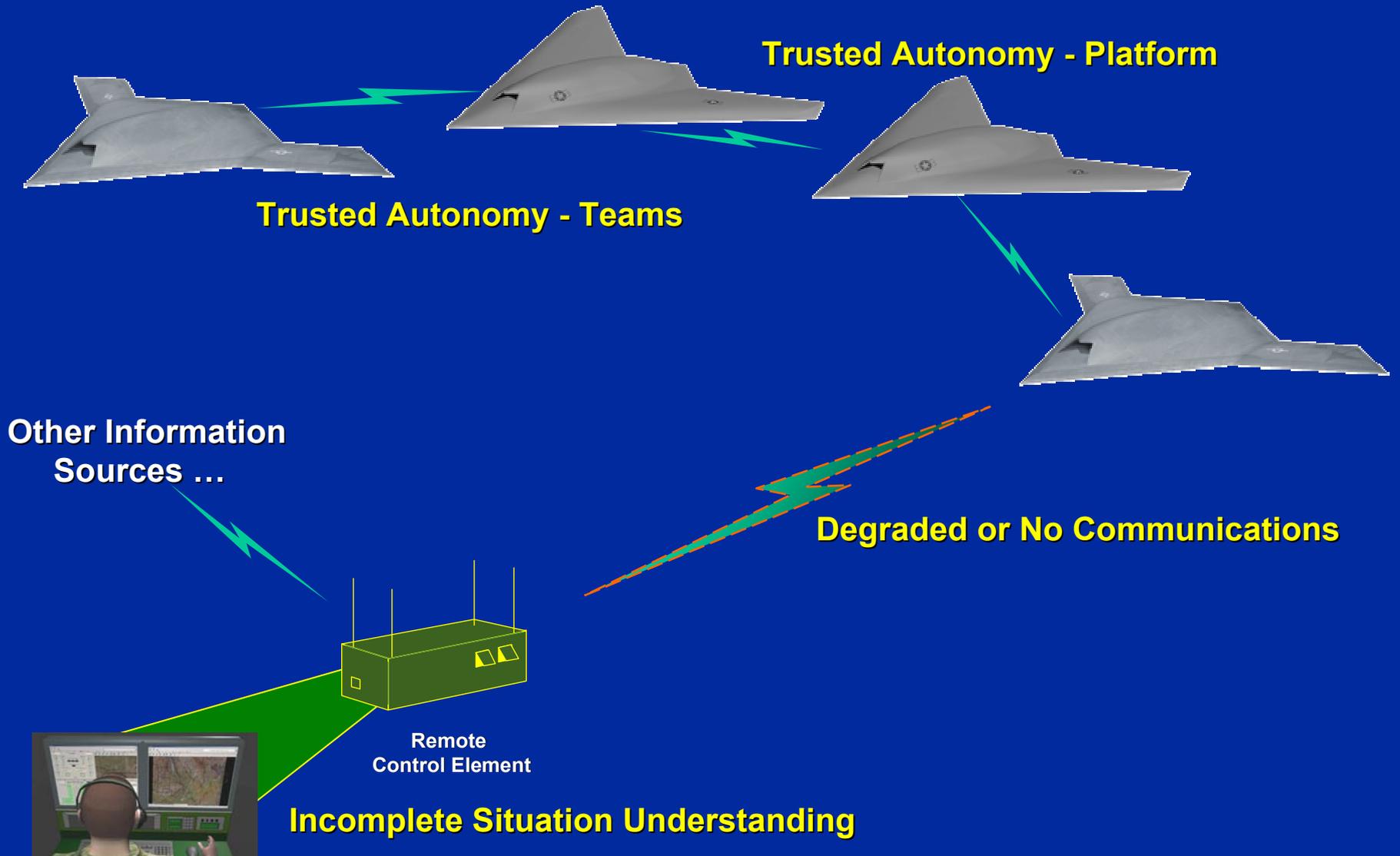
Achieving Mission Functionality



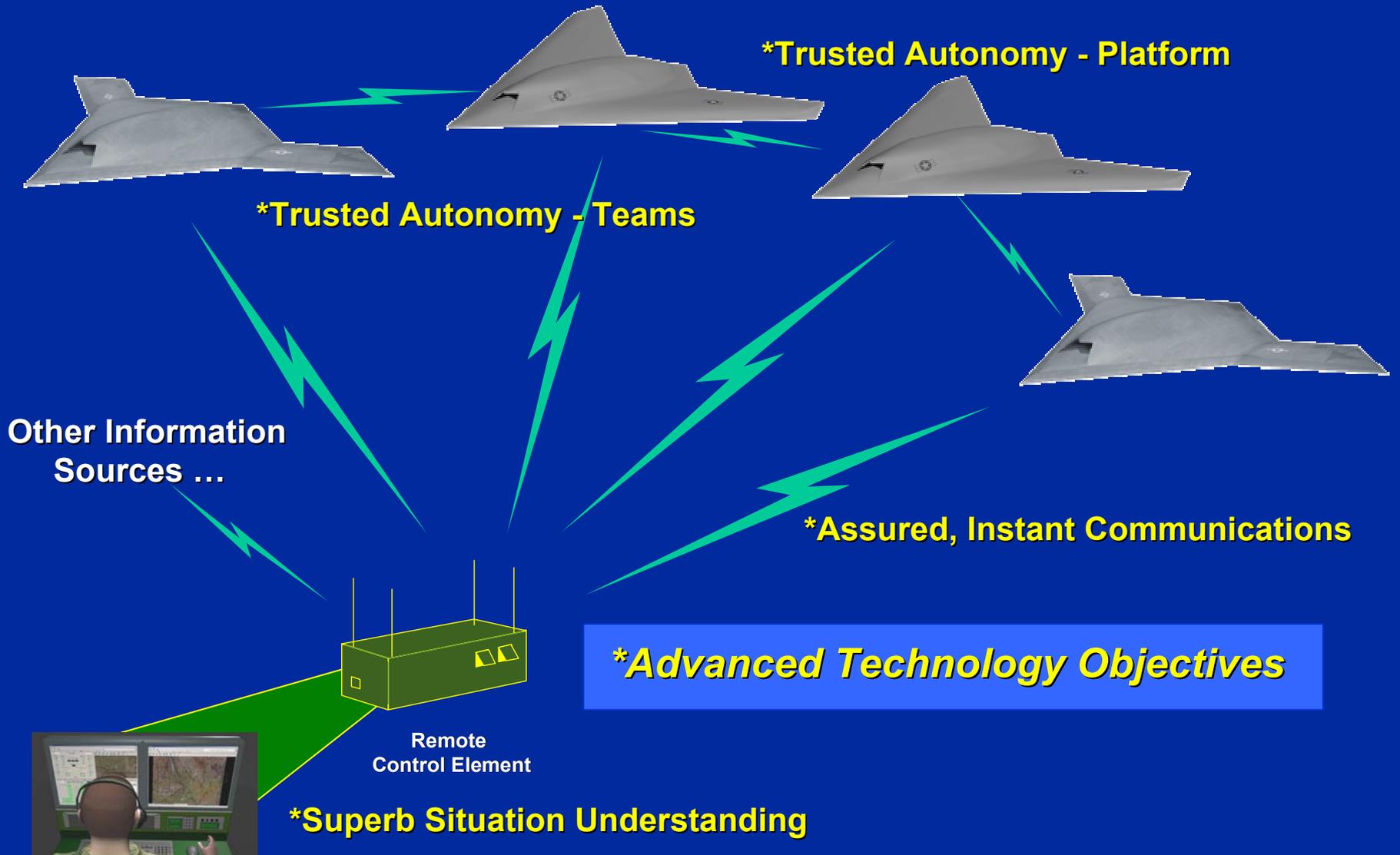
PUBLIC RELEASE

Approved for Public Release #3257 - Distribution Unlimited

Achieving Mission Functionality



Achieving Mission Functionality



J-UCAS System Elements



Operational Infrastructure



Air Vehicle(s)

Communications



Control Station(s)

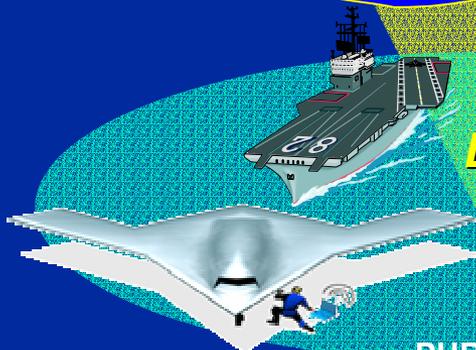
Operating System

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

Payload Systems



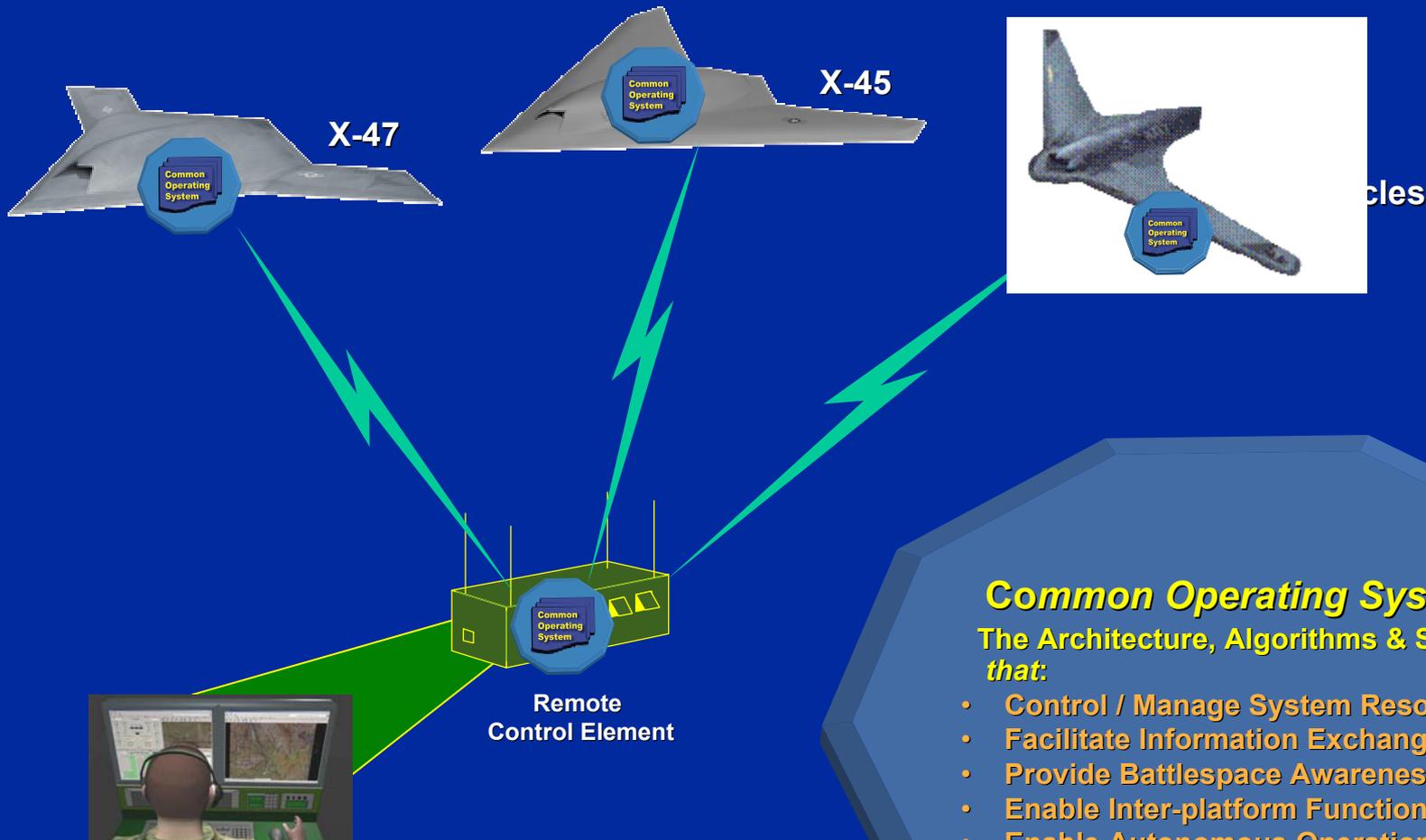
Direct Support



PUBLIC RELEASE

Approved for Public Release #2129 - Distribution Unlimited

Common Operating System



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

PUBLIC RELEASE

Approved for Public Release #2129 - Distribution Unlimited

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

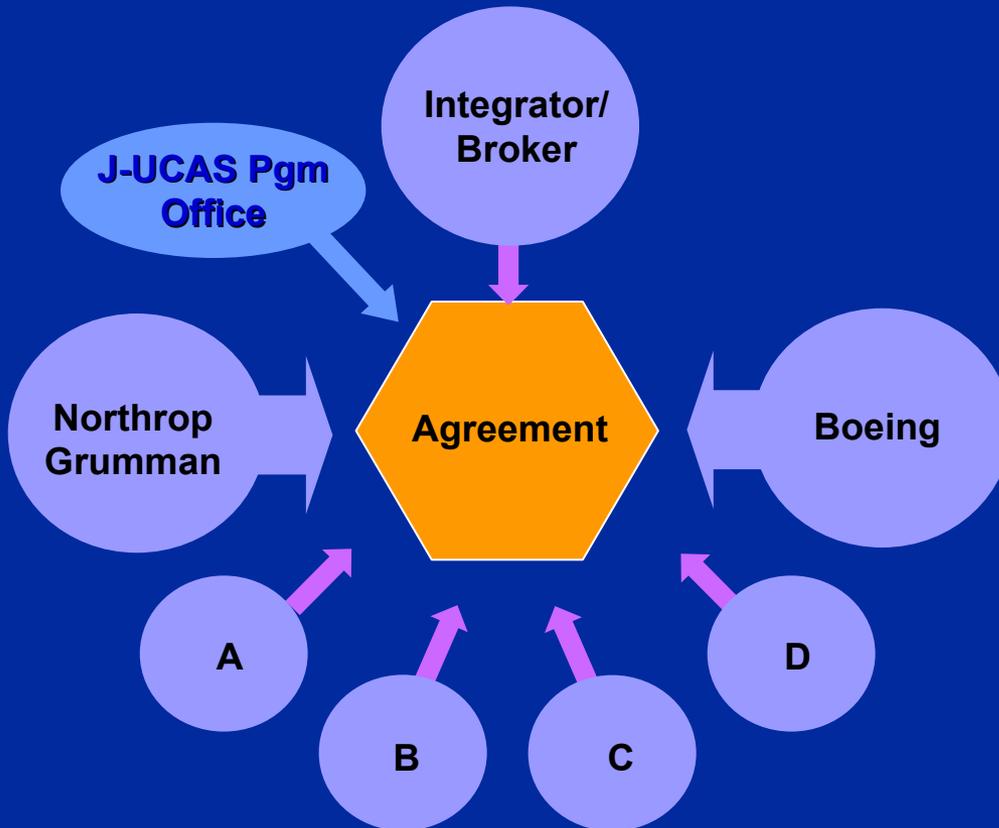


- **System & Mission Flexibility**
 - Create new command & control options
 - High level of integration needed for collaborative operations
 - Facilitate agile bandwidth management ... accommodate multiple platforms
- **Reduce Development Cost & Risk**
 - Build it one time
 - Don't sub-optimize design
- **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

Common Operating System – Development Paradigm

3 Levels

Consortium-like Business Arrangement



- **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

- **Other Contributors**

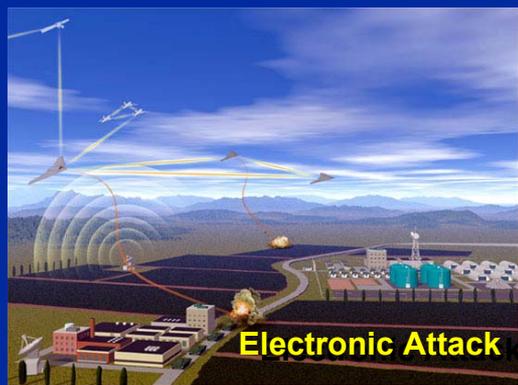
Based on Potential Contribution(s)
Small Houses, Other Primes, Traditional Subs, Commercial Providers

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

PUBLIC RELEASE

Operational Assessment

... Begins in 2007



- **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

PUBLIC RELEASE

Joint Unmanned Combat Air Systems -- Significant Challenges ...

- **Technical**

- Robust Operating System & Network Performance
- Real Time Contingency Management ... Programming the Unexpected
- LO ... to the Next Level
- Building and Integrating *Operational Diversity* into the System
 - **Imposed Intra- and Inter-operability**
- Optimizing the Human (Crew) – System Interaction
- Achieving UAV “Firsts” (e.g. Aerial Refueling, Carrier Operations, ...)

- **Cultural-Institutional**

- User Objectivity – ‘White Scarf’ Cultural Inertia vs. Healthy Skepticism
- Acceptance of the *Common Operating System* Concept & Approach
 - **Microcosm of the Larger Defense Challenge**
 - **Industry Collaboration for “Best-of-Breed”**

- **Combined**

- Sustaining Advocacy for this Very Large Non-Acquisition Program
- Routine Operations across the Civil Airspace
- Opening Up the Operational Envelope

Questions?



PUBLIC RELEASE

Approved for Public Release #2129 - Distribution Unlimited