Precision Strike PEO Forum

July 25-26, 2006

San Diego, CA

Presision Strike PEO Forum 2006 Agenda

Navy Precision Weapons Program: **RADM Timothy Heely, USN**, PEO for Strike Weapons and Unmanned Aviation-NAVAIR

Land Attack Weapons Capability Area Review: **Mr. Clay Davis**, Office of the Under Secretary of Defense for Acquisition, Technology & Logistics

SERVICE PRECISION REQUIREMENTS & PROGRAMS PANEL:

- U.S. Army, **Mr. Sammy Coffman**, Director of the Fort Sill Futures Development and Integration Center (FDIC)

UCAS Development Vision:

- Unmanned Combat Air Systems, **Mr. Dyke Weatherington**, Deputy, OSD UAV Planning Task Force, OUSD (AT&L)
- Navy Unmanned Combat Air System Navy Unmanned Combat Air System Demonstration, **Mr. Marty Deppe**, Navy Unmanned Combat Air Systems

PRECISION WEAPONS COMMAND AND CONTROL:

- Requirements for Air Combat Command, **Colonel Thomas Wozniak, USAF**, Chief, Command & Control, Intelligence, Surveillance and Reconnaissance Division, Directorate of Requirements, HQ Air Combat Command

Predator Precision Weapons Integration and Testing, **Mr. Chris Seat**, Director, USAF Predator Programs Aircraft Systems Group, General Atomics Aeronautical Systems, Inc.

PRECISION STIRKE PEO FORUM
JULY 25-26, 2006-08-11
SAN DIEGO, CA

TUESDAY, 25 JULY

KEYNOTE ADDRESS: ***The Honorable Ken Krieg***
Under Secretary of Defense for Acquisition, Technology and Logistics
(Presentation not available for distribution)

NAVY PRECISION WEAPONS PROGRAM: ***RADM Timothy Heely, USN***
PEO for Strike Weapons and Unmanned Aviation-NAVAIR

LAND ATTACK WEAPONS CAPABILITY AREA REVIEW: ***Clay Davis***
Office of the Under Secretary of Defense for Acquisition, Technology & Logistics

SERVICE PRECISION REQUIREMENTS & PROGRAMS PANEL:
• U.S. Army: ***Sammy Coffman-***Director of the Fort Sill Futures Development and Integration Center (FDIC)
• U.S. Air Force: ***Tom Robillard-***Director, Air to Ground Systems Wing
(Presentation not available for distribution)
• U.S. Navy: ***CAPT Richard "Rhett" Butler-***Deputy Commander Carrier Air Wing 14
(Presentation not available for distribution)

WEDNESDAY, 26 JULY

Precision Weapons Testing: ***Lieutenant Colonel Phil Darcy, USAF***
Commander 17th Weapons Squadron, USAF Weapons School, Nellis, Air Force Base
(Presentation not available for distribution)

UCAS Development Vision:

Dyke Weatherington—Deputy, OSD UAV Planning Task Force, OUSD (AT&L)
Marty Deppe— Navy Unmanned Combat Air Systems
(Presentation not available for distribution)
Rick Ludwig—Director of Business Development, Northrop Grumman Corporation
(Presentation not available for distribution)
Rod Lekey-Business Development—UCAS, The Boeing Company
(Presentation not available for distribution)

Kill Chain Panel: (No presentations)

- Unmanned Air Systems—Current and Future Capabilities of Unmanned Systems of Finding Targets and BDA: ***Commander Ed Wolski, USN***

- Tomahawk Engagement Planning: ***Lieutenant Commander Nicole Shue, USN***
- Kill Chain & Approval Process: ***Captain Christian Sprinkle, USN***
  Reserves 3rd Fleet/Raytheon
- **Wayne Willhite**—Naval Air Warefare Center, Weapons Division
- **Jack Granger**—Cruise Missile Support Activity Atlantic

PRECISION WEAPONS COMMAND AND CONTROL:

•Tactical Targeting Networking Technology: **Lieutenant Colonel Stephen Waller, USAF**
(Presentation not available for distribution)

• Requirements for Air Combat Command: **Colonel Thomas Wozniak, USAF**
Chief, Command & Control, Intelligence, Surveillance and Reconnaissance Division, Directorate of Requirements, HQ Air Combat Command

Naval Precision Strike Weapons Testing: *Daniel Radke*
Chief Test Engineer, NAVAIR-Point Mugu, CA
(Presentation not available for distribution)

Predator Precision Weapons Integration and Testing: *Chris Seat*—Director, USAF Predator Programs Aircraft Systems Group, General Atomics Aeronautical Systems, Inc.

Transforming Army Indirect Fires

Sam Coffman
Director, Futures Development Integration Center

Transforming Army Indirect Fires

- Robust mix of fire support systems is required to address the full spectrum of requirements and mitigate against surprise
- Volume, precision, responsiveness (24/7, all weather, all terrain), and range remain critical attributes of a fire support system
- Networked and precision fires offer opportunity to disrupt/destroy enemy capabilities at extended ranges and with greater precision

Army Brief to DEPSECDEF – Sep 02

Networked through battle command
Fully interoperable with Joint systems
Mobile (strategic and tactical)
Fully integrated with maneuver
Lethal (through precision and volume)
Precise effects with area options
Reduced logistics
Ability to mass effects
24/7, all weather, all terrain

To achieve Destructive, Suppressive and Protective effects while minimizing collateral damage and taking advantage of emerging technology

Looking at Precision Needs

Precision Effects: *Capability* to rapidly and accurately locate and attack targets with the required operational responsiveness matched to desired effects (lethal and non-lethal) and the greatest efficiency.

To achieve precision effects Field Artillery needs:

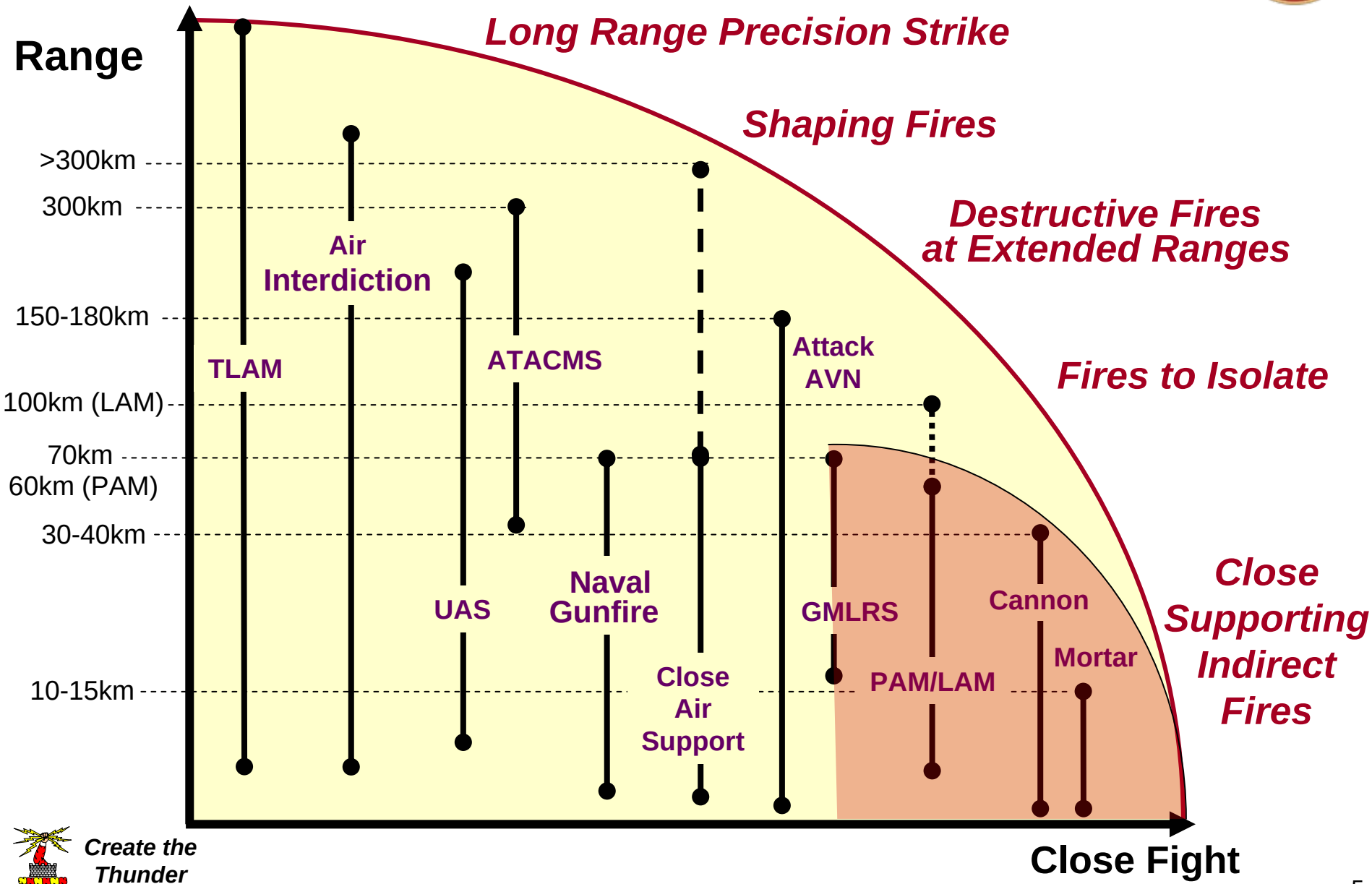
- *Accurate target location and size*
- *Accurate delivery system location and direction*
- *Timely and accurate meteorological data*
- *Accurate computational procedures*
- *Weapon and ammo information*

Current Operational Need

2. . . . ONS succinctly identifies an urgent need for improved munitions in IBCTs . . . Recent XVIII Airborne Corps experience in both Afghanistan and Iraq indicates that GWOT operations requires indirect fire munitions with greater lethality, increased range, and a precision guided capability that limits collateral damage.

XVIII ABC ONS for Improved 105mm Artillery Projectiles
21 Nov 05

Joint Fires Capabilities



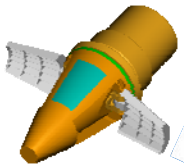
Army Munitions Attributes

Non-Precision (Area) Munition	***Precision*** Munition	***Precision Guided*** Munition	***Precision Smart*** Munition
Munition/ submunitions subject to all ballistic conditions on the way to the AIMPOINT.	Munition corrects for ballistic conditions using guidance and control up to the AIMPOINT or submunitions dispense *with terminal accuracy less than the lethal radius of effects*. Submunitions subject to ballistic conditions to AIMPOINT.	Munition senses *energy reflected from a target* and uses *guidance and control* to the TARGET. Requires a *laser designator* in the loop for target designation.	Munition/ submunitions *autonomously searches, detects, classifies, selects, and engages* TARGET(s). *Has a limited target discrimination capability.*

Available or Programmed

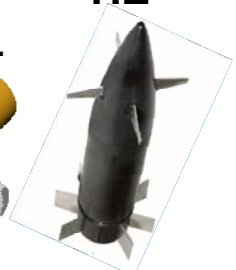
Area Munitions with CEPs > 150M at 2/3 range

PGK INC 1



50M CEP

M982 HE



< 10M CEP GPS

NLOS-LS with PAM

< 10M CEP GPS
< 1M CEP with SAL

HIMARS with GMLRS-U

< 10M CEP IMU

M270A1 with ATACMS QRU

< 10M CEP IMU

Rg

40 70 270 300

Lethality Spectrum

Dominant target in theater today for indirect fires

Create the Thunder

Looking at Responsiveness

		Required Responsiveness (minutes)			
		2	10	60	>60
Range to Target	0 – 15 Km	27	8		15
	15 – 40 Km	4	5	1	24
	40 – 60 Km				24
	60+ Km	9		1	22
	NA			1	
Total Mission Profiles		40	13	3	85

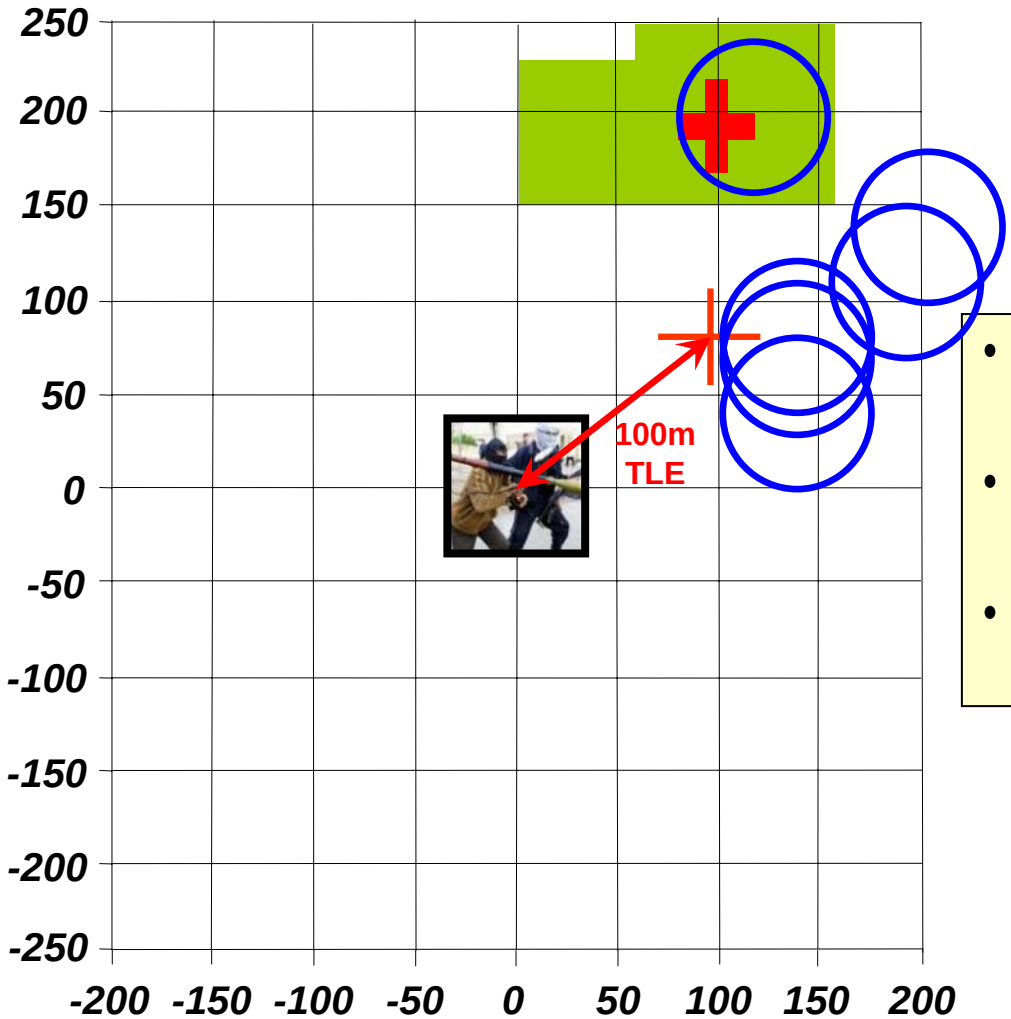
Of the 141 mission profiles:

- 40 required less than 2 minutes
- 13 required more than 2 but less than 10 minutes
- 3 required more than 10 but less than 60 minutes
- 85 required more than 60 minutes

For an FCS-equipped BCT to execute its concept, high payoff targets and most dangerous targets required very responsive fires:

- 28% of the mission profiles required 2-minute responsiveness and 38% required a response within 10 minutes
- 68% of the targets that required a response within 2 minutes were in the range band of 0-15km

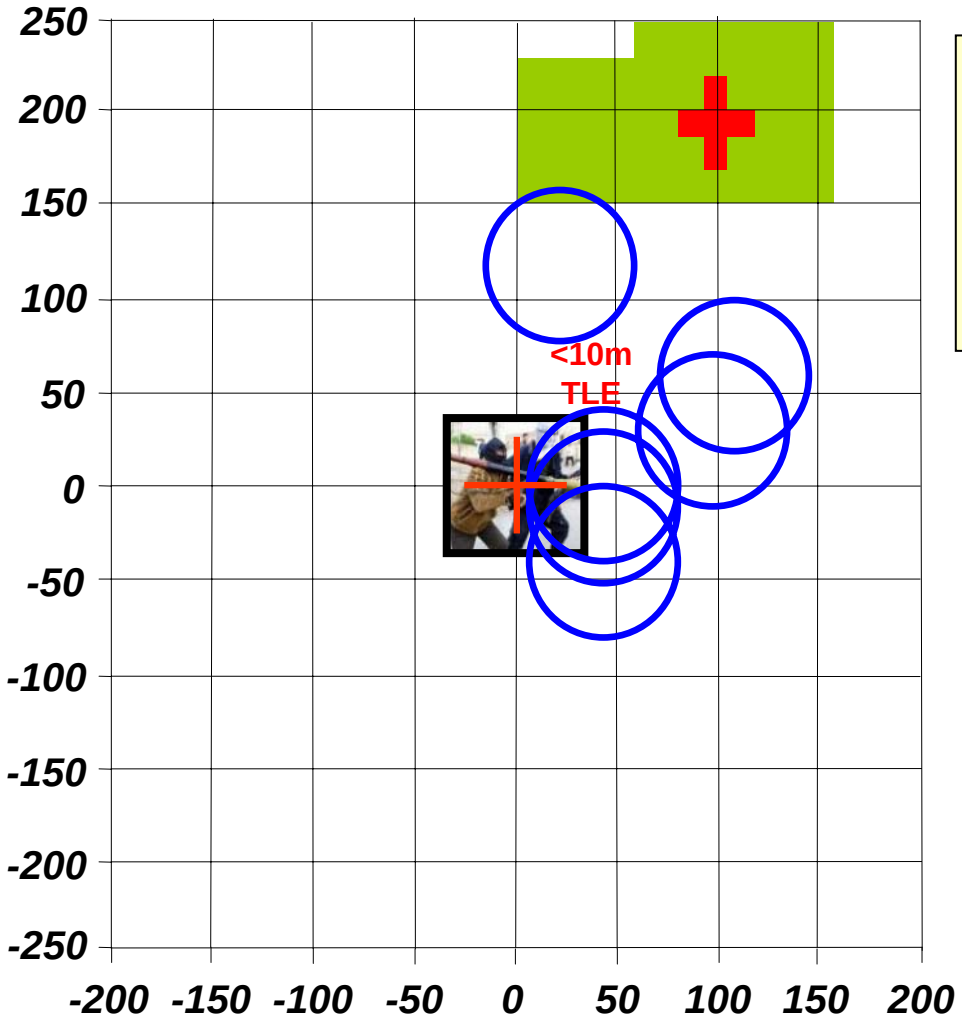
Where We Were . . . .



- High probability of collateral damage
- Low probability of achieving desired effects on target
- Large expenditure of ammunition to have high fractional damage

. . . no precision targeting with area munitions

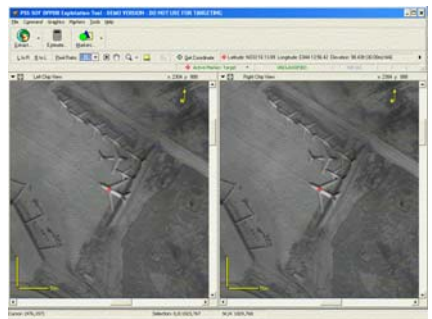
Where We Are . . . .



- Probability of collateral damage precludes use in most urban engagements
- Larger munition expenditures required to achieve desired effects

Fire Support Sensor System – 9M TLE at 10 KM

Precision Strike Software – Special Operating Forces

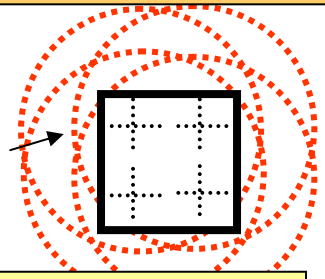


. . . precision targeting with area munitions

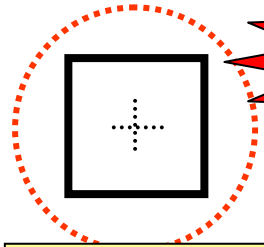
Create the Thunder

Looking at Aiming Points

Area Target – Aim point selection



Conventional Aiming: Accounts for delivery errors (PEr & PEd) to ensure target coverage

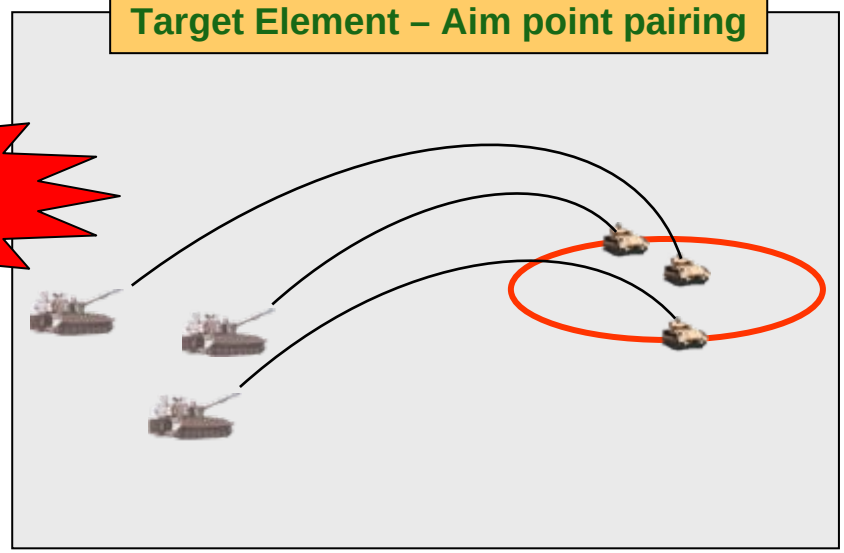


Precision Aiming: Reduced # of aim points & munitions

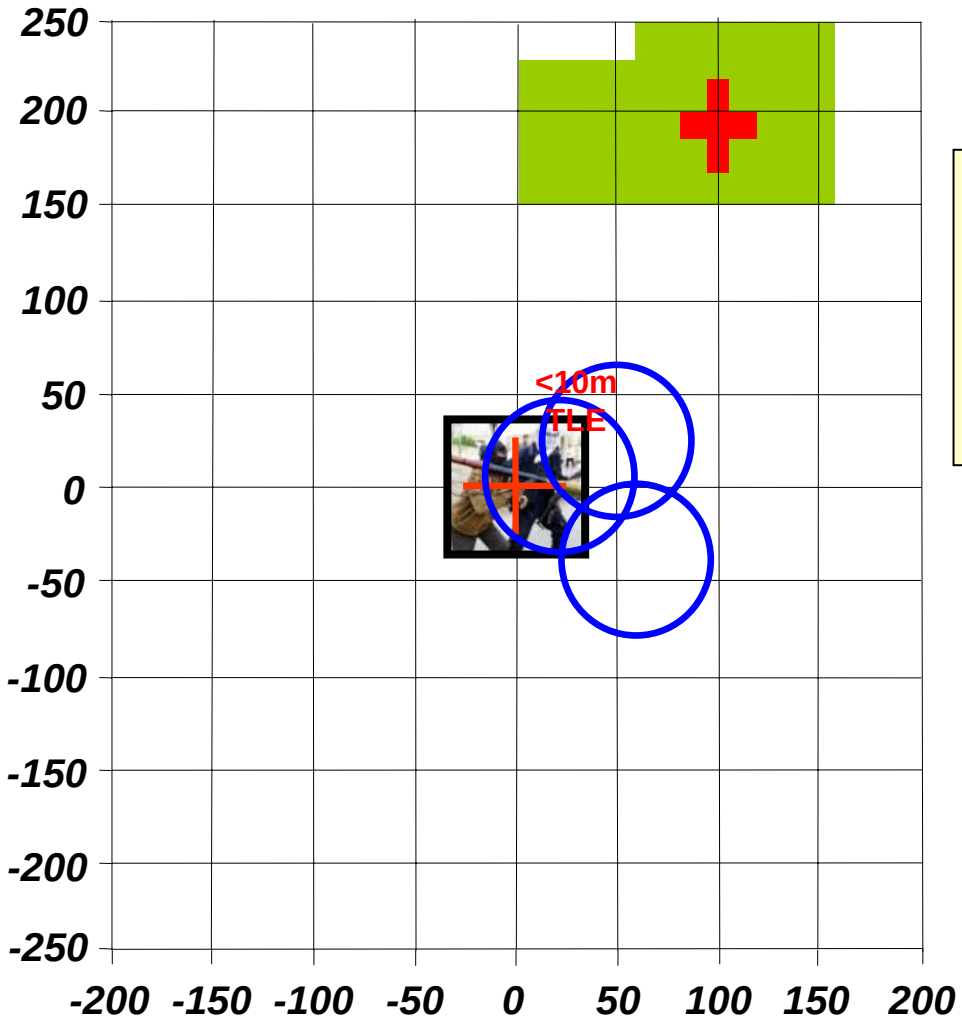
Less rounds for desired effect

Target Element – Aim point pairing

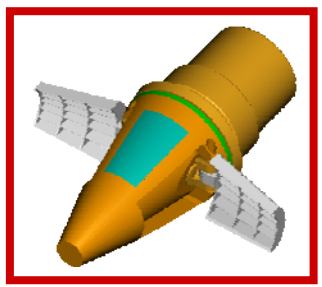
Enables precision targeting



Where We're Headed . . . .



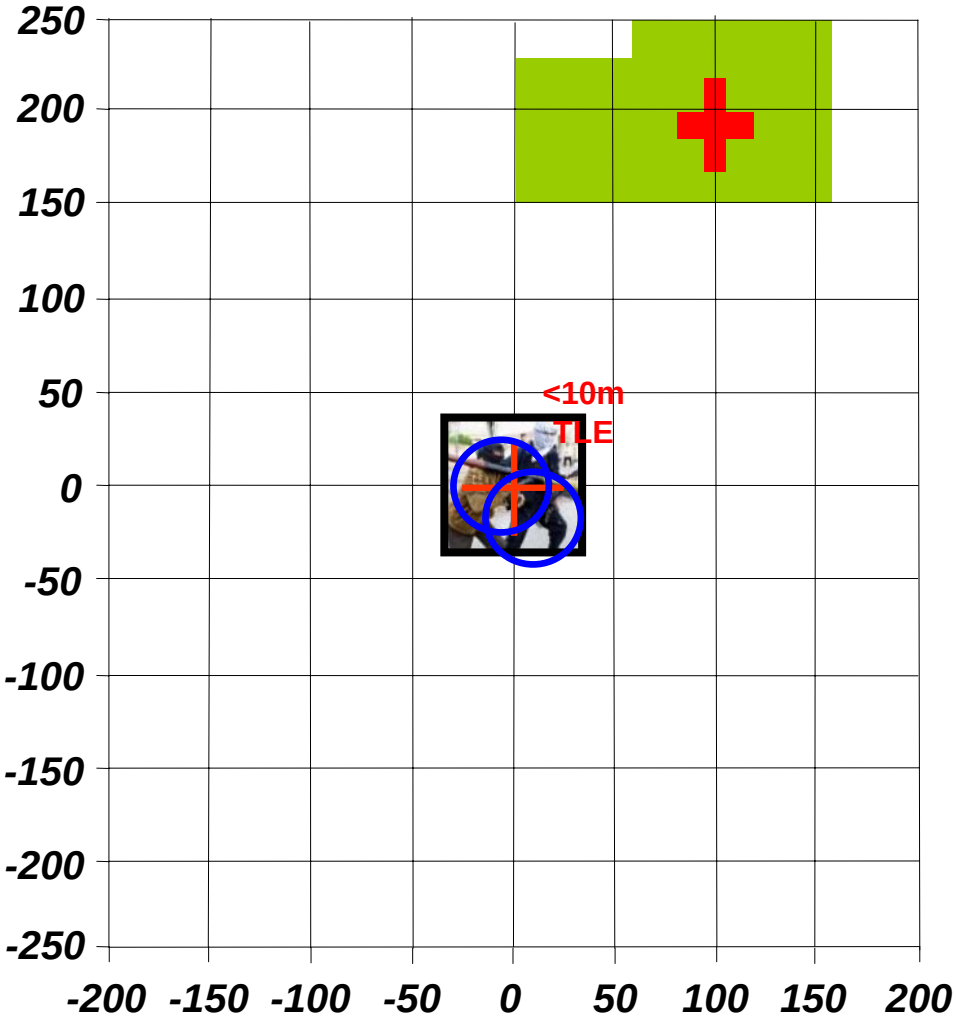
- Reduces CEP to enable more engagements in most urban environments
- Reduces expenditures required to achieve desired effects



- <50M CEP Initial
- <30M CEP Threshold
- <10M CEP Objective
- Both 155mm and 105mm

. . . precision targeting with Precision Guidance Kit

Where We Need to Be . . .



- Preferred choice when collateral damage must be minimized
- Vertical trajectory desired
- Need scaleable lethality
- Ability to discriminate without designation
- Significantly fewer rounds expended to achieve desired effects

. . . precision targeting with precision munitions

Other Requirements

Common:

- Location
- Direction
- Elevation

Improved Positioning and Azimuth Determining System

- Meteorological data on demand
- < 30 minutes staleness
- Target area met capability

Profiler

- Routine digital operations
- All members of the team

Create the Thunder


1093

Create the Thunder

Precision Munitions Mix Analysis

- The FY08 HBCT forces and the FY14 HBCT and FCS BCT forces will be able to accomplish their missions with *a subset* of the Army's collection of precision munitions programs.
- Employing a subset of Army precision munitions (APM) can cause a greater reliance on joint capabilities.
- APM can be layered into 4 tiers based upon PMMA findings, Threat and operational considerations:

  - Tier 1: those *central to any mix*, capable of engaging multiple *likely* mission profiles and that clearly dominate mix lethality.
  - Tier 2: those that best augment Tier 1 to engage the *most likely* Threat behaviors or dispositions.
  - Tier 3: those that *mitigate risk to the force* in case of *less likely* Threat behaviors or dispositions.
  - Tier 4: those that *provide a marginal capability* to the force under prevailing conditions.

Tier 1: Excalibur (U), Hellfire, MRM, GMLRS (U)	
Tier 2: PGMM, PGK	
Tier 3: PAM or CSS	
Tier 4: APKWS Blk I, GMLRS (D)	

- APM mixes *reduced* the overall *logistics burden*.

Enhanced Delivery

Paladin

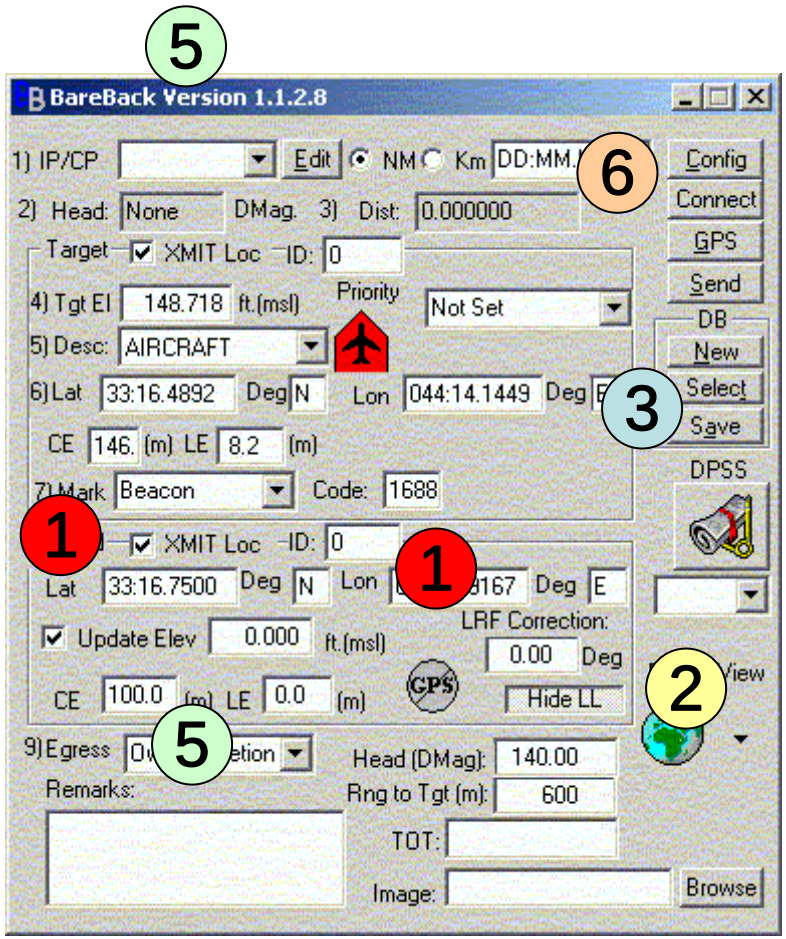
- Remains a great system
- Challenge is to ensure keep it operationally viable for many years to come
- Probably the system in Fire Brigades for at least 30 more years

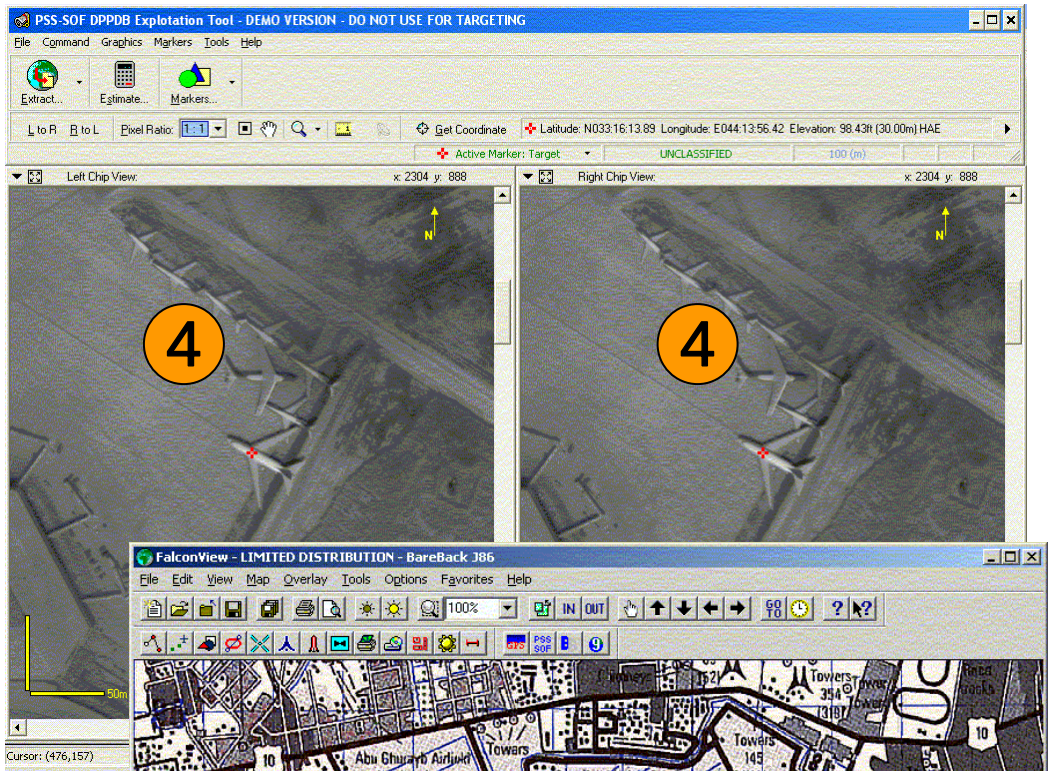
FCS NLOS Cannon

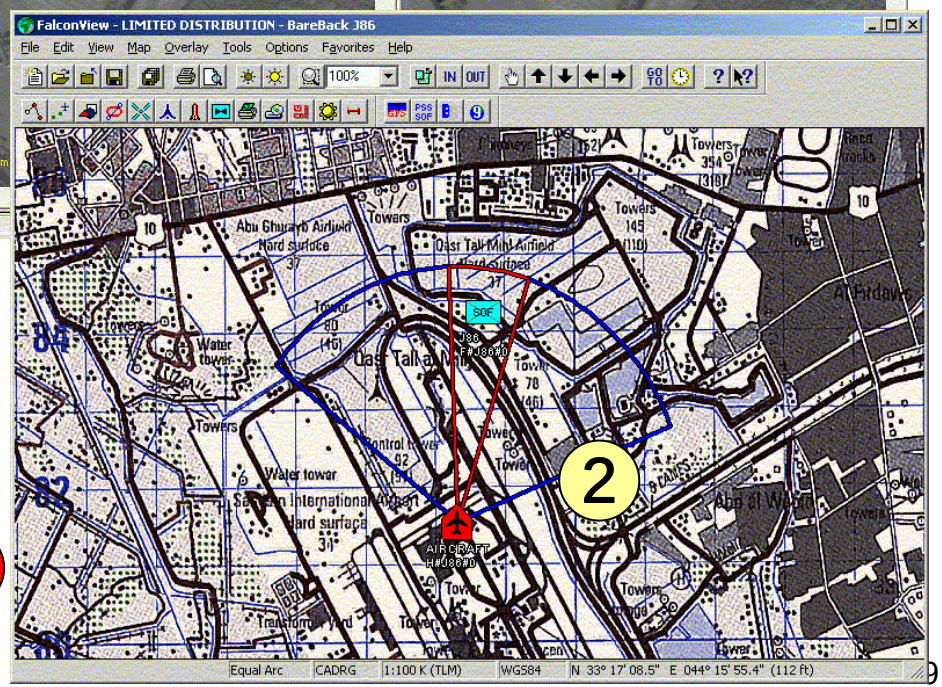
- Prototype delivery begins in FY 08
- Challenge is to maintain commonality with other MGV
- Migrate to Stryker BCT at some point

- *Fewer types of systems*
- *Enhanced deployability*
- *Enhanced sustainability*

PSS-SOF Targeting



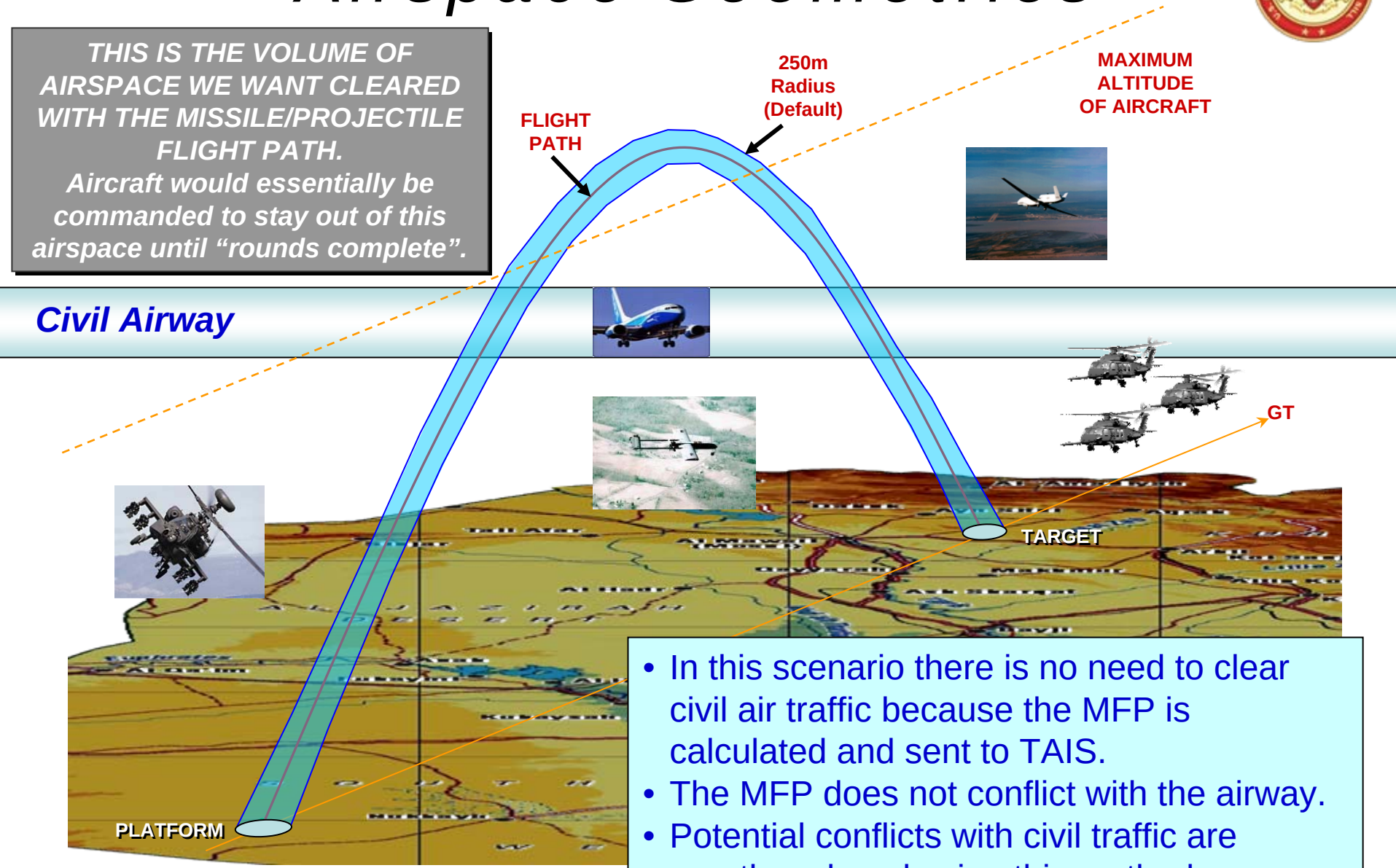




Create the Thunder

Airspace Geometries

THIS IS THE VOLUME OF AIRSPACE WE WANT CLEARED WITH THE MISSILE/PROJECTILE FLIGHT PATH. Aircraft would essentially be commanded to stay out of this airspace until "rounds complete".



- In this scenario there is no need to clear civil air traffic because the MFP is calculated and sent to TAIS.
- The MFP does not conflict with the airway.
- Potential conflicts with civil traffic are greatly reduced using this method.

Create the Thunder

Land Attack Weapons Capability Area Review

An Update

July 25, 2006

Clayton V. Davis
Staff Specialist
DUSD(A&T)/PSA-AW

Capability Area Reviews

Capability Roadmaps

- Provides Department an overall context and understanding of a mission area
  - Integrated Air and Missile Defense, Joint Battle Management Command and Control, Electronic Warfare, Land Attack Weapons
- Critical Link to roadmaps
  - Provide a framework for decision-making
    - Highlight trade spaces, inform decision-makers, and capture decisions made
    - For Land Attack Weapons – Conventional Engagement Capability Roadmap (Version 0 released, and Version 1 in work)

Conventional Engagement Portfolio

- **Large Portfolio:**
- **Army, Air Force, Navy, Marine Corps**
- **Air-, ground-, and surface-launched**
- **Precision capability (INS/GPS, seekers, etc)**
- **Direct attack to long range standoff**
- **Prosecute fixed, relocatable, and moving targets**

Agenda

- Calendar year 2005 activities
- 2005 Overarching Integrated Product Team (OIPT) and Defense Acquisition Board (DAB) meetings
- Focus for 2006
- Way ahead

CY 2005 Focus

Topics of Interest

- Energetic Technologies
  - Warheads
  - Fuzes
  - Insensitive Munitions
- Geo-Intelligence
  - Targeting
  - Target Location Error*
- SAASM Policy*

* *USD(AT&L) Special Interest*

CY 2005 Focus

Topics of Interest (cont)

- Moving Target Challenges
- Munitions Requirements Process
- Joint Organizational Structures
  - Joint Air Dominance Organization (JADO)
- Test/Training Range Infrastructure
- Conventional Engagement Capability Roadmap

CY 05 CECR Activity

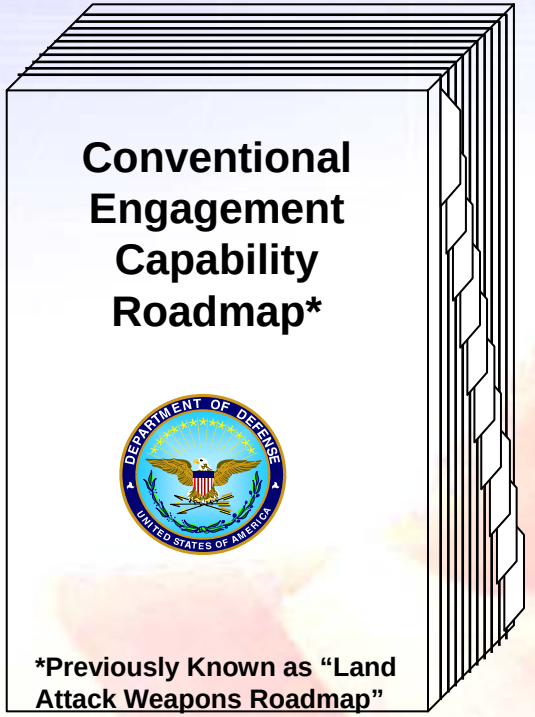
- Completed Version 0 in late Spring
  - Incorporated two Joint Staff (J8) assessments
    - Moving Target Gaps
    - Area Weapons (submunitions) sufficiency
- Routed for 06 Review, followed by FO/GO
- Vetted through the JCIDS process
- Signed jointly by VCJCS and USD(AT&L)
- Presented at the July DAB

Version 0 Overview

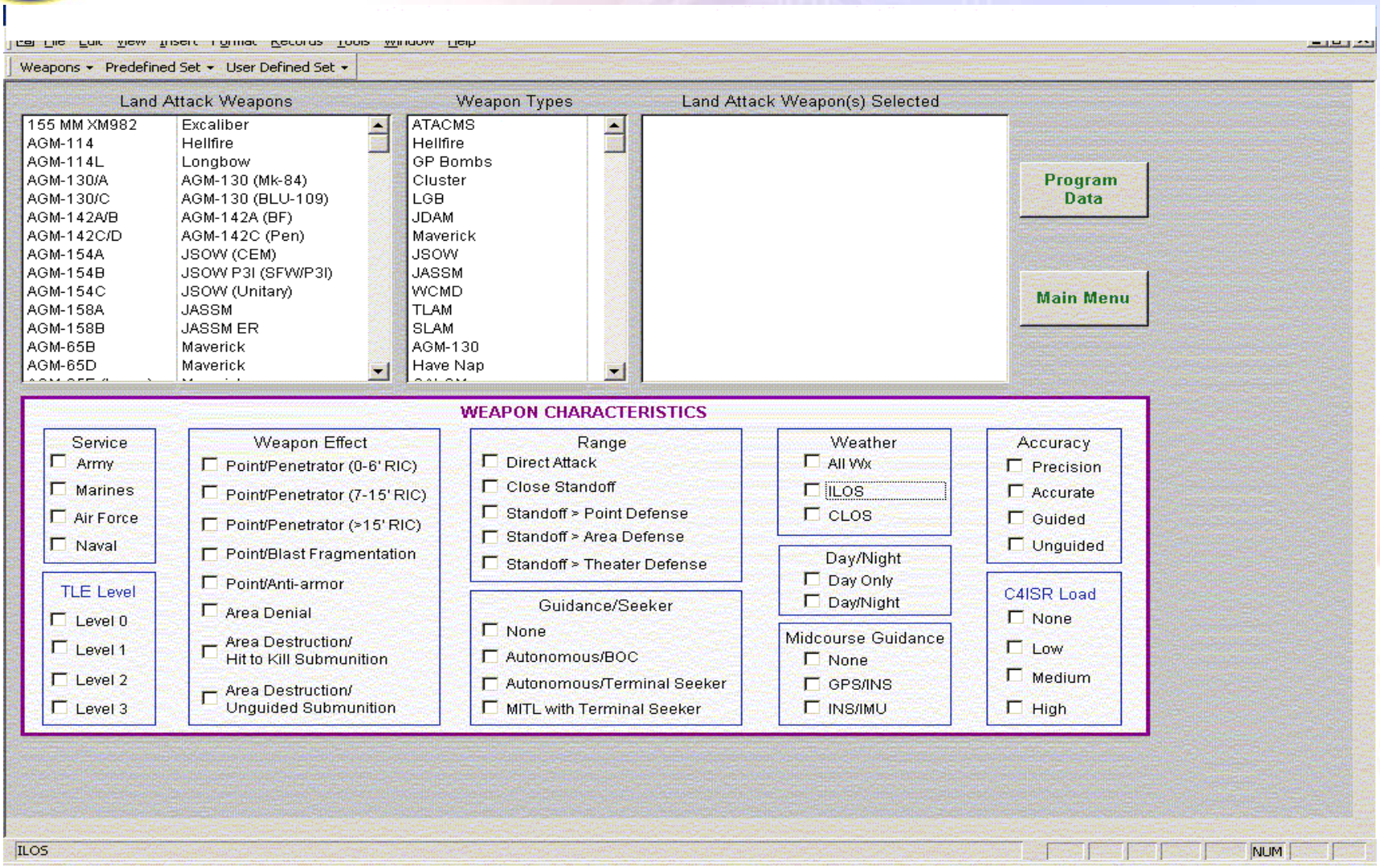
- **Purpose**
  - Document an initial capabilities-based review of the DOD's ability to attack land-based targets
  - Inform decision makers of known weapons-related issues and surface issues for action
- **Scope**
  - Focus is on Engage link of the Find, Fix, Track, Target, Engage, and Assess kill chain, specifically the weapon component
  - Included are conventional kinetic munitions in inventory or proposed for production during next two FYDPs (as of PB-05)
  - Target engagement capabilities of interest
    - Moving targets
    - Area targets

Version 0 Document Structure

1. INTRODUCTION
   - Purpose
   - Scope
   - Key Terms and Understandings
   - Assumptions and Limitations
   - Challenges
2. ROADMAP CONTEXT
   - Strategy-to-Solution Construct
3. DEPENDENCIES AND ISSUES
   - Kill Chain
   - Engagement Interdependencies and Issues
4. WEAPONS INFORMATION
   - DOD Weapons Portfolio
   - Joint Conventional Munitions Database
5. ENGAGEMENT CAPABILITY ASSESSMENT RESULTS AND GAP ANALYSIS
   - Moving Target Assessment
   - Area Target Assessment
6. ROADMAP
7. EXPERIMENTATION AND EMERGING TECHNOLOGY
   - Conventional Weapon Science and Technology Investments
   - Future ACTDs
   - Other Emerging Technology Efforts
8. CONCLUSIONS & RECOMMENDATIONS
9. APPENDICES



Joint Conventional Munitions Database (JCMD) – source data for Roadmap



Roadmap Content

FY 05 CAR DAB

- ADM Direction:
  - Continue LAW IIPT; build Conventional Engagement Capability Roadmap Version 1
    - Include weapon/target pairing and surface-to-surface area fires assessments
      - Focus on gaps, overages, and identification of marginal value in inventory
    - Updated Munitions Requirements Process and test range information
  - Maintain the Joint Conventional Munitions Database and Land Attack Module
  - OUSD(AT&L), in coordination with the Joint Staff (J8) and Services, assess potential joint solutions for INS/GPS/laser-guided munitions

CY 06 Efforts

- Joint Staff (J8) completed the weapons targets pairing assessment
  - In JCIDS staffing
- The Army, in coordination with Marine Corps and Naval Surface gunfire, developed a plan of action for surface-to-surface fires assessment
  - The LAW IIPT reviewed and agreed the plan was feasible
  - The plan calls for bi-monthly Interim Progress Reports with a final assessment, JCIDS-ready by April 2007
- Continued attention to Joint Management Structures
  - Joint Air Dominance Organization

CY 06 Efforts (cont)

- Continued improvements in Geo-Intelligence and Target Location Error (TLE)
- Continued attention by Director, Defense Research and Engineering to allocating weapon-related Science and Technology
  - Fuze and warhead technologies
  - Power sources
- Continue to monitor Munitions Requirements Process
- Cross-weapon programmatic issues
  - Universal Armament Interface & Common Launcher
  - Weapons Data Link – Network
  - Test ranges infrastructure

Surface-to-Surface/Area Fires

- The Army, Training and Doctrine (TRADOC) has Lead on this assessment
  - Working with Naval Gunfire, ground Marine Corps and Air Forces
- Assessment requires one year – completes April 2007
  - Informs CECR and POM 10 – 15
- Categories of Munitions
  - Surface-to-surface indirect fires, area fires for suppression, precision and non-precision fires, air-to-surface
    - direct fires not considered

Surface-to-Surface/Area Fires

- Scenarios/Vignettes will represent the approved Multi-Service Force Deployments (MSFD)
  - Department of Defense Analytic Agenda
  - Consistent with the Defense Planning Scenario descriptions
  - Consider multiple types of terrain such as urban, desert and mixed
- Target Sets will include mobile, fixed, hard and soft, or any combination
- Timeframe for the analysis is FYDP 2010-2015

Surface-to-Surface/Area Fires

Issues

- **What are the Joint fires doctrinal, organizational, and operational concepts for Army, Navy, Air Force and Marine Corps delivered munitions?**
- **Where, when, and why do we need to be precise?**
- **What are the Joint fires capability gaps?**
- **What are the required C4ISR enablers?**
- **What redundancy or duplication of capability is needed to reduce risk?**
- **What target sets/profiles require what munitions?**
- **What are the capability trades among Joint surface-to-surface and air-to-surface fires for the comprehensive set of surface targets?**
- **What are the capability trades among target location error, weapon precision, and weapon effects radius for Army surface-to-surface and air-to-surface munitions for the comprehensive set of surface targets?**
- **How do concepts of operation and doctrine change over time to reflect force transformation?**

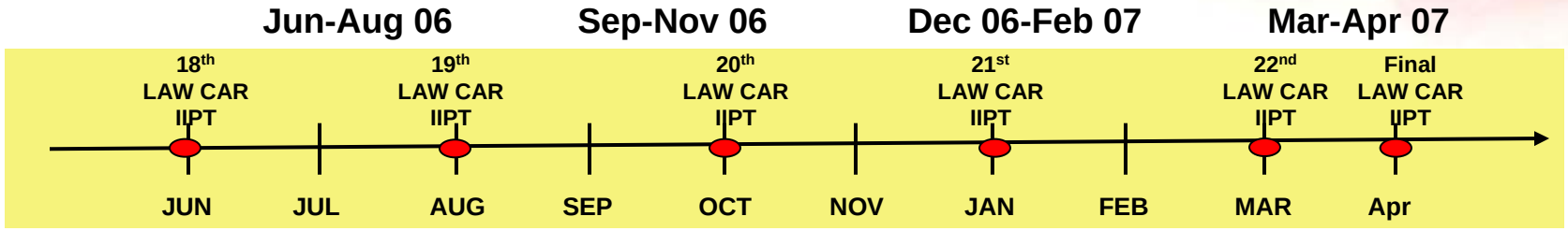
Surface-to-Surface/Area Fires

Study Implementation Timeline

Phases

1	2	3	4
Joint Doctrine	*Previous Useful Work*	*Gaps*	*Trade space*
Interoperability Capability *Capabilities* *Tasks. Conditions, and Standards* *Gaps*	*ICD Joint Fires in Support of Expeditionary Operations in the Littorals* *Alternative Indirect Fire Study* *US Army Field Artillery Center* *Lessons Learned*	*Scenario Development* *Data Calls* *Adjudicate across capabilities*	*Deficiencies* *Mitigate Risks*
Doctrine	***Literature Search***	***New Work***	***New Analysis***

Joint Products



Surface-to-Surface/Area Fires

Proposed Army Educational Topics

Near-term:

- Army will present FCS Organizational and Operational Concept at the LAW CAR IIPT (Aug 15, 2006)

Mid-term:

- CAA present a QWARRM brief
- OPNAV and Air Force A5R present NNOR and NCAA briefs
- U.S. Marines presentation on Supporting Fires Operational Concept (TBD)

Long-Term:

- Army will present Modular Force Organizational and Operational Concept at the LAW CAR IIPT (Oct 06 – Date TBD)

Joint Management Structures

- Joint Air Dominance Organization (JADO)
  - Mission is to produce and *maintain* a *coherent*, joint Air Dominance and Airborne Electronic Attack Roadmap
  - A formalized process that will survive the Resource Officer tenure
  - Three pillars
    - Counter-air/counter Air-defense
    - Air-launched strike weapons
    - Airborne Electronic Attack
  - Charter MOA at Army Staff

Geo-Intelligence/TLE

- National Geospatial Intelligence Agency (NGA)
  - Continues activities enhancing GEOINT
    - Comprehending objects and events
    - Planning and executing operations
    - Assessing effects
  - Meets most stringent TLE requirements for weapons
    - non-expedient methods of DMPI mensuration
  - Pursuing multiple technical approaches to bring necessary accuracy and consistency to expedient methods of DMPI mensuration

Science and Technology Resource Allocation to Weapons

- Continue to monitor DoD Fuze IPT activities
  - Technology plan status
  - Industrial base policy
  - POM 08 Issue to increase S&T
- Insensitive Munitions Technologies
- Novel energetic materials
- Thermobaric and dial-an-effect warheads

Munitions Requirements Process

- Fall of 06 will begin POM 10 MRP
  - Advance schedule from previous cycles
  - Munitions Requirements may suffer as Department focus changes
    - Force Structure, Stability Ops, Special Ops, etc.
  - Focus will be on precision munitions
  - Affect to Industrial base
    - Fewer procurements
    - Requirements such as IM drive higher costs
    - Munitions generally pay bills

Cross-Weapon Programmatics

- Universal Armament Interface and Common Launcher
- Weapons Data Link – Network
- Test Ranges Infrastructure

Summary

- A good forum for multi-organization team
- LAW CAR process has been a good communication tool
- Lots of diverse focus areas being reviewed
- We continue to investigate opportunities for improving weapons portfolio

Back-up

Surface-to-Surface/Area Fires

US Army Precision Munitions Candidates

155 mm Cannon:

- **M549A1 HE w/ PGK**
- **M864 DP ICM w/ PGK**
- **Excalibur (Unitary)**
- **Common Smart Submunition (CSS)**
- **M2005 HE w/ CCF (From the Advanced Cannon Artillery Ammunition Program)**
- ***KEAPER - Kinetic Energy Artillery with Precision & Extended Range (Excursion)***

120 mm Mortar:

- **PGMM**

MLRS/HIMARS:

- **GMLRS (Unitary)**
- **GMLRS (DP ICM)**
- **Common Smart Submunition (CSS)**
- **ATACMS (Unitary)**
- **ATACMS (DP ICM)**

NLOS-LS:

- **PAM**

MCS/M1A2SEP/MGS:

- **MRM**

***ARV variants:**

- **PAM**
- **Hellfire**

AH64/ARH:

- **Hellfire**
- **APKWS Blk I**

AUAV:

- **Hellfire**
- **APKWS Blk I**
- **Viper Strike**

*ammunition resupply vehicle, armored recovery vehicle, armored repair vehicle

Surface-to-Surface/Area Fires

Joint Precision Munitions Candidates

US Air Force/Naval Air Force

- **AGM 88 (HARM)**
- **GBU 10,12 (LGB)**
- **GBU 31,32,38 (JDAM)**
- **AGM 65 (MAVERICK)**
- **AGM 158 (JASSM)**
- **GBU 29 (SDB/250 lb)**
- **WCMD (SFW/CEM)**
- **AGM 154 (JSOW)**
- **GBU 24 (BLU 109)**

US Navy Surface

- **Naval Fire Support (ERGM)**

US Marine Corps

- **HIMARS**

Surface-to-Surface/Area Fires

Non-Precision Munitions Candidates

(Surface-to-Surface and Air-to-Surface)

US Army

ADD/modify

Cannon

155 mm

105 mm

Mortars

81 mm

61 mm

AH-64

Hydra-Rockets

US Air Force

MK 82

MK 83

MK 84

CBU 87/B

US Marine Corps

ADD/modify

US Navy

CBU 78

MK 82

MK 83

MK 84

Surface-to-Surface/Area Fires

Definitions

- Area Fires
  - Area bombing (DoD, NATO) – Bombing of a target which is in effect a general area rather than a small pinpoint target
  - Area target (DoD, NATO) – A target consisting of an area rather than a single point
- Suppressive Fires
  - Suppressive Fire (DoD) – Fires on or about a weapons system to degrade its performance below the level needed to fulfill its mission objectives, during the conduct of the fire mission
  - Suppression Mission (DoD) – A mission to suppress an actual or suspected weapons system for the purpose of degrading its performance below the level needed to fulfill its mission objectives at a specific time for a specified duration

Surface-to-Surface/Area Fires

Additional Definitions

- Neutralization Fire (DoD) – Fire which is delivered to render the target ineffective or unusable

- Destruction Fire (DoD) – Fire delivered for the sole purpose of destroying material objects

Surface-to-Surface/Area Fires

Use of Area/Suppressive Fires

- **Echelons that use Area/Suppressive Fires**
  - Maneuver elements, Brigade and below (DS Artillery Battalion and organic mortars)
  - Divisions (SEAD in support of rotary and fixed-wing missions)

- **Area/Suppressive Fires are used when:**
  - Responsiveness is more important than precision
  - Target is a large formation or facility
  - Large Target Location Error is indicated
  - Target is undefined/unobserved

Surface-to-Surface/Area Fires

How are Area/Suppressive Fires:

- **Called** – FM Voice or digital call for fire, generally initiated at small unit (platoon/company) level.

- **Controlled** – Generally initiated as an “Adjust Fire” mission, meaning the firing unit delivers one round at the reported target location and the observer adjusts subsequent rounds before “Fire for Effect”

- **Delivered** – Area/Suppressive Fires may be delivered from any number of weapons systems, including Artillery and Mortars, Naval Surface Fires, Fixed/Rotary-wing CAS, as well as direct fire weapons

Surface-to-Surface/Area Fires

Roles for Area/Suppressive Fires

- Standard Roles for Area/Suppressive Fires
  - Screening the initial Point of Penetration
  - Preparatory Fires
  - Close fire support
  - Disruptive deep fires
- Non-Standard Roles for Area/Suppressive Fires
  - Clearing IEDs from routes
  - Clearing minefields

Surface-to-Surface/Area Fires
Fallujah 2004

US Army After Action Reports (AAR) Comments

"…the physical and psychological effects of massed artillery fires were the *preferred* effects."

"…Close Air Support (though extremely effective on planned targets) was not a substitute for responsive artillery and mortars."

"Fire missions took less than two minutes from call-for-fire to rounds down range."

Fallujah 2004

USMC AAR Comments

"Fixed wing CAS is an enormous weapon that has great effects on the ground. It took entirely too long for bombs to be dropped when Marines were in contact. The minimum safe distance of the ordnance was too great in order for even the block to be isolated and that allowed the enemy to escape countless times."

"…rotary wing CAS was extremely timely, but the effects on target were not extraordinary."

"Mortars and artillery proved effective by forcing the enemy to stay in the houses and not allowing the enemy to fight the Marines in the streets."

Surface-to-Surface/Area Fires
Considerations

- Target Location Error (TLE)
  - Observer error, unobserved or undefined target
- Responsiveness
  - Situation requires immediate support vice allows time for increased precision
- Volume
  - Quantity desired to allow maneuver course of action
- Proximity of friendly forces
  - Location, degree of protection, situation

Navy Unmanned Combat Air System Demonstration

Presentation to

Precision Strike Association

25-26 Jul 2006

CAPT Rich Brasel, USN
Navy UCAS Program Manager

NAVAIR

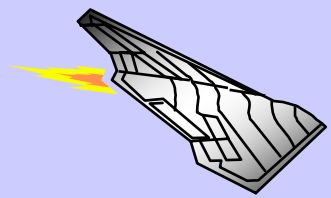
Outline

- **Introduction**
- **Navy UCAS Evolution**
- **Carrier Demonstration (UCAS-D)**
- **UCAS-D Schedule**
- **Summary**

Introduction

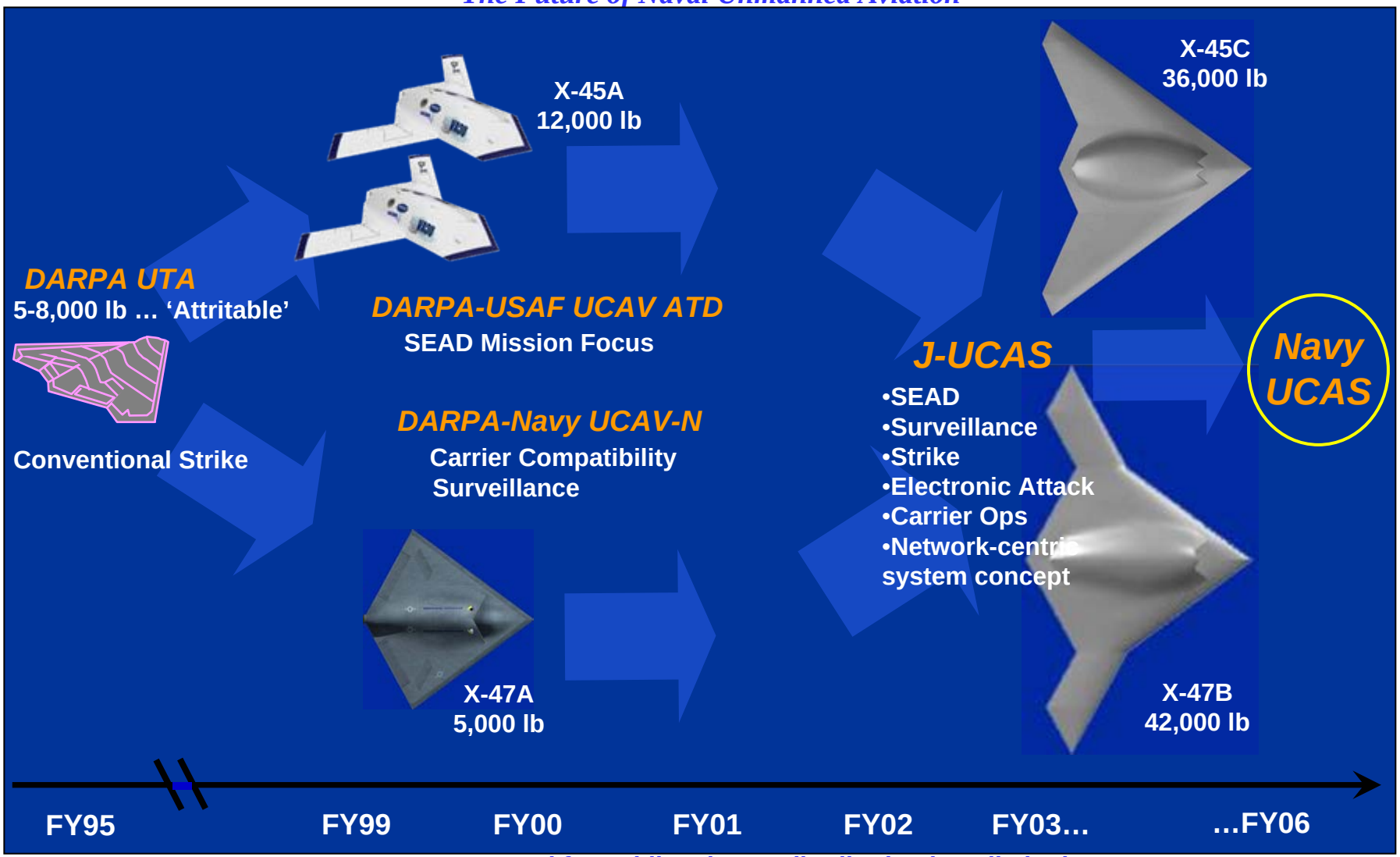
- **Program Goals:**
  - **Demonstrate Carrier Suitability of Persistent ISR Relevant, Unmanned, LO-Planform Air Vehicle**
  - **Mature Critical Technologies Prior to Potential Milestone Decision**
  - **Maintain Competitive Environment**

UCAS-D System Not Intended For Operational Use



UCAS Evolution

The Future of Naval Unmanned Aviation



Navy UCAS Development Roadmap

The Future of Naval Unmanned Aviation

Transition

Technology Development

IOC

Spiral

UCAS CV Demo (UCAS-D)

Attributes:
- CV Suitable
- LO Planform
- Relevant to CV ISR Mission

Possible Attributes:
- CV Suitable
- Persistent ISR
- Some Strike Capability
- Aerial Refueling
- Survivable

Improved ISR/Strike Capability, Persistence, Survivability

2006 2012 2018 2023+

Examples of UCAS Critical Technologies

The Future of Naval Unmanned Aviation

- **Propulsion Technologies**
  - Low Specific Fuel Consumption and High Specific Thrust Core
  - Integrated power generation
  - Thermal management system
  - Active inlet flow control
- **Command & Control Technologies**
  - GIG interface
  - Autonomous operations
- **Survivability Technologies**
  - Material supportability
  - Sensor integration
- **AV Structure Technologies**
  - Material weight/strength
  - Planform optimization
  - Manufacturing
- **CV Integration Technologies**
  - Deck Handling
  - CV operations

The Technology Maturation Assessment and studies and analyses by Johns Hopkins University APL will better define this list.

UCAS-D Scope

The Future of Naval Unmanned Aviation

- **Objective**
  - **Carrier Suitability of Unmanned, Low Observable Planform UAS**
- **Scope**
  - **Carrier Control Area Operations**
  - **Launch Performance**
  - **Arrested Landing Performance Including Approach, Waveoff and Bolter**
  - **Deck Operations**
  - **Mission Control Segment (MCS) CV Integration**
  - **UCAS interface to CV**
    - » **Primary Flight Control (PriFly), Landing Signal Officer (LSO), and Carrier Air Traffic Control Center (CATCC)**

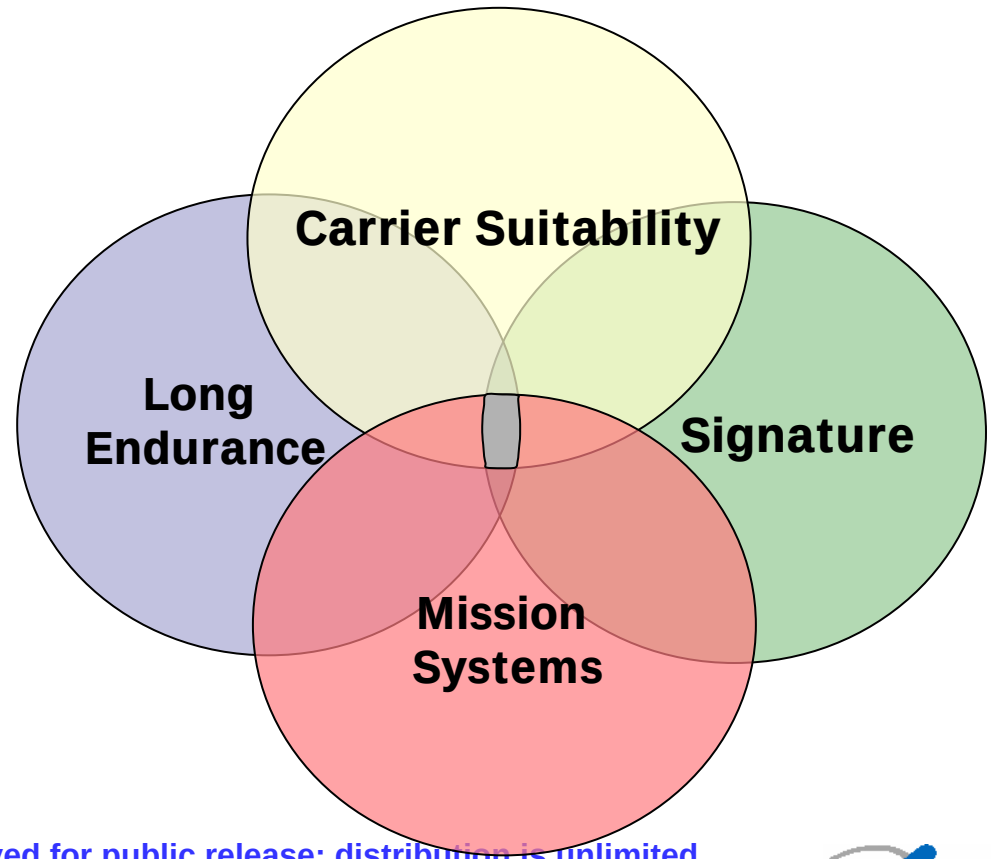
Maturity Challenge

The Future of Naval Unmanned Aviation

Technology Does Not exist today to make all four circles intersect

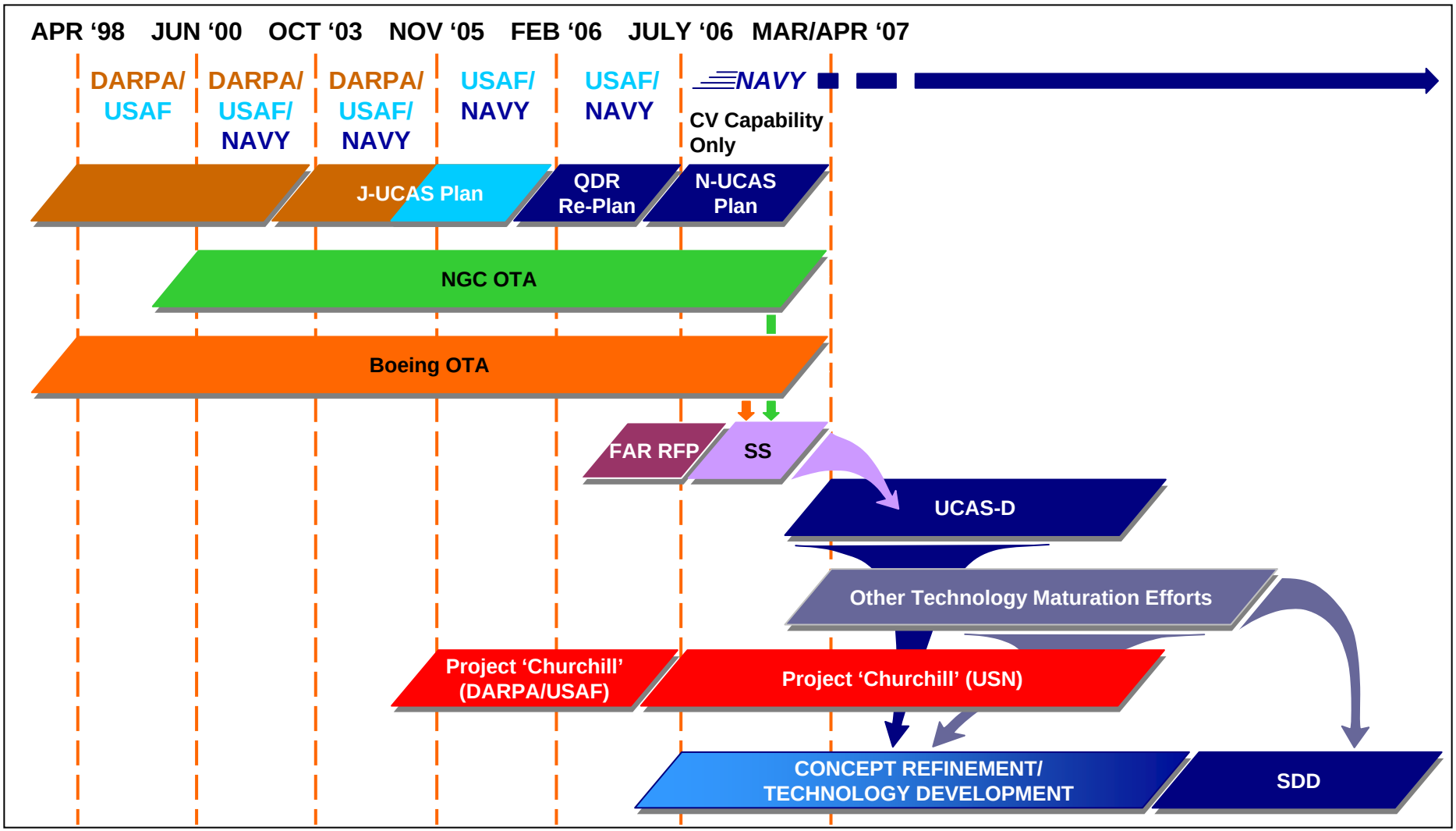
TRL 6 Definition:

- Representative model or prototype system tested in a relevant environment.
- Represents a major step up in a technology's demonstrated readiness
- Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment



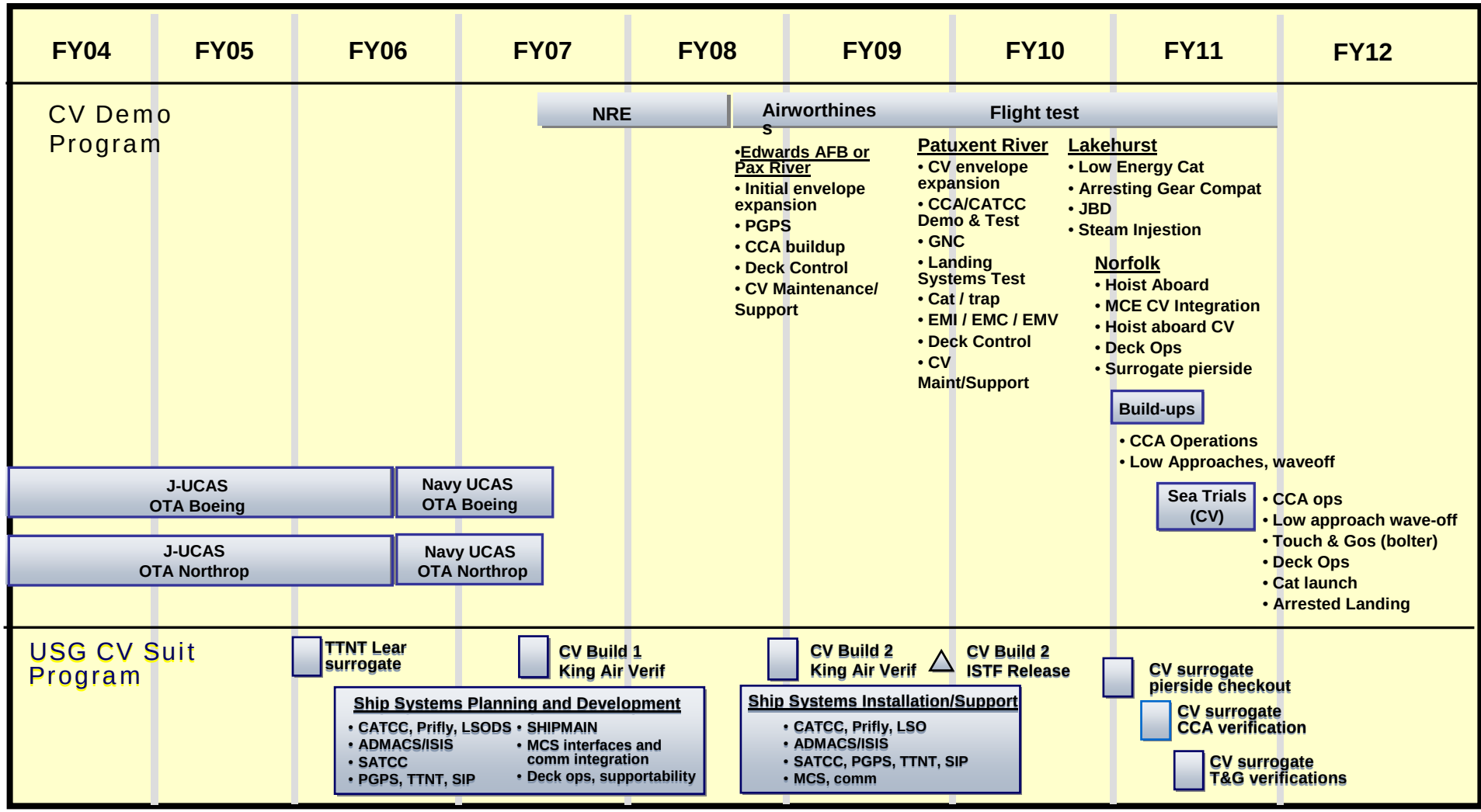
UCAS Overview & Transition

The Future of Naval Unmanned Aviation



CV Demo Schedule

The Future of Naval Unmanned Aviation



Summary

- **Planning for UCAS-D Phase on track**
- **Focused on demonstrating the technical feasibility of operating a tailless, unmanned, LO planform aboard a carrier**
- **Potential follow-on efforts will be the result of detailed planning and available resources**

Integrated Joint Battlespace Management

Creating Desired Effects on the Battlefield

RADM Tim Heely
Program Executive Officer
Strike Weapons and Unmanned Aviation
July 25-26, 2006

NAVAIR

The Joint Warfighting Arena

Looking ahead...Jointly

- Joint surface Warfare ACTD
- Global Hawk Maritime Demonstration

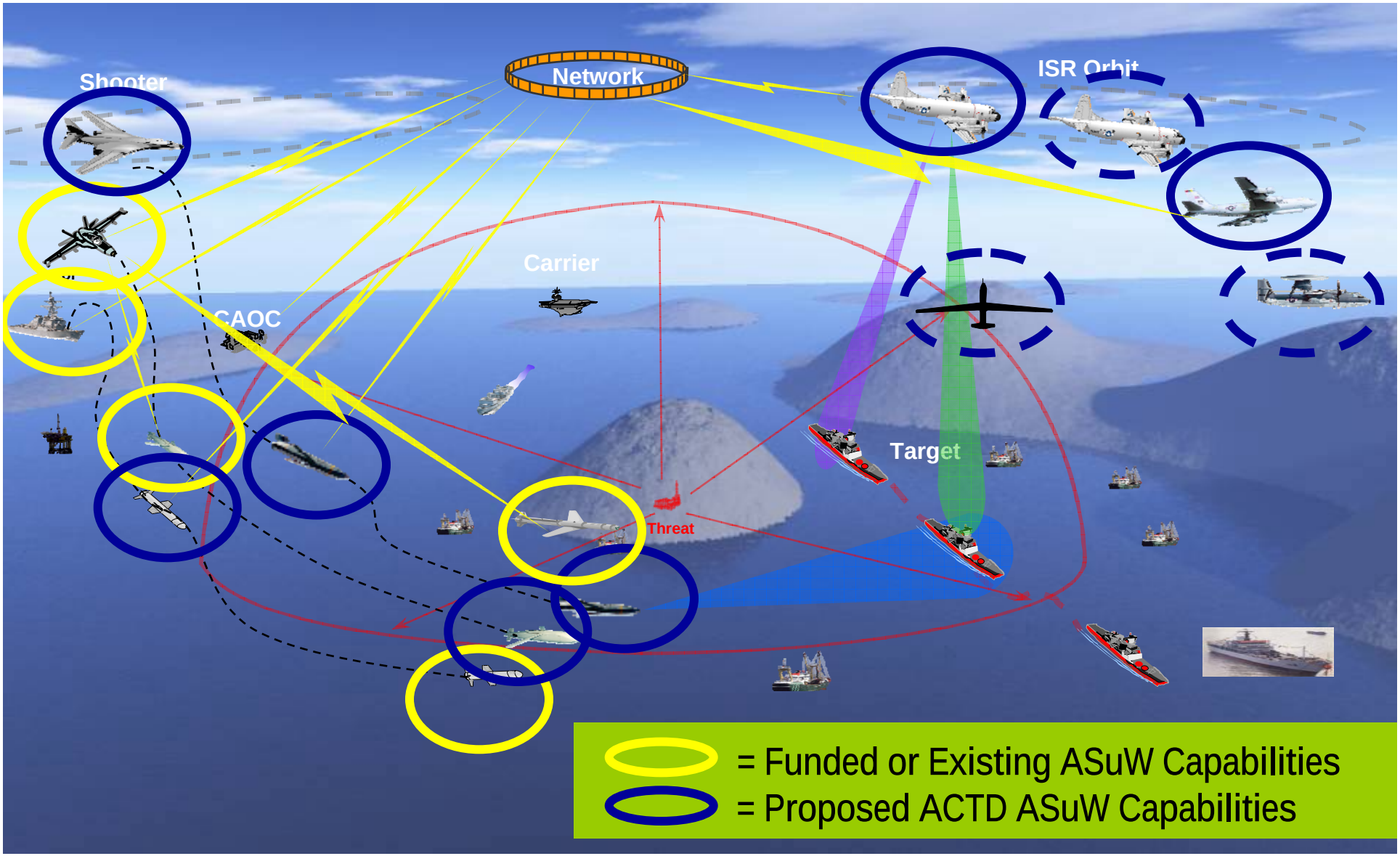
....But addressing the needs of today

- Scan Eagle

NAVAIR

Joint Surface Warfare (SuW) Concept

Multiple Interchangeable ISR Assets
Targeting Multiple Weapons



JSuW ACTD Solution

- Current *Service funded* SuW efforts
  - JSOW-C Block III (F/A-18E/F Kill Chain)
  - Harpoon III (Aegis Kill Chain)
  - JASSM maritime seeker improvements
  - Weapon Data Link Network (WDLN) ACTD
  - JSTARS ELMM
  - LSRS Maritime Modes

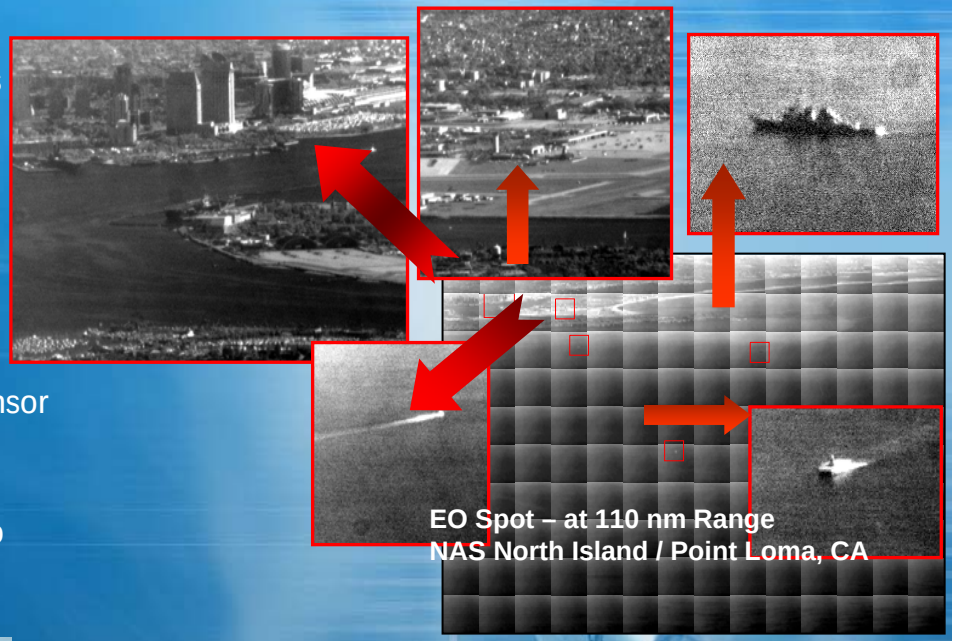
- Proposed *ACTD expansion* of SuW Kill Chains
  - WDLN messages in more fix, track, target assets: JSTARS, LSRS
  - CONOPS and Tactics, Training and Procedures

Multiple, interchangeable ISR assets targeting for multiple weapons

NAVAIR

Global Hawk Maritime Demonstration

- Commonality of AF & USN Global Hawk Systems
  - Simplified Sys Spec and Design for Contractor
    - Common tasks at Prime & Sub-Contractor activities
  - Common Ground Segment Software
    - Reduces SIL throughput
    - Reduces overall cost to the Government
    - Common CM & DM
    - Common Upgrades
  - Common ISS software
    - Discussions ongoing to bring both AF and Navy sensor software into a common build
      - Provides both services with same ISS modes
      - Provides mode flexibility without distraction to service requirements

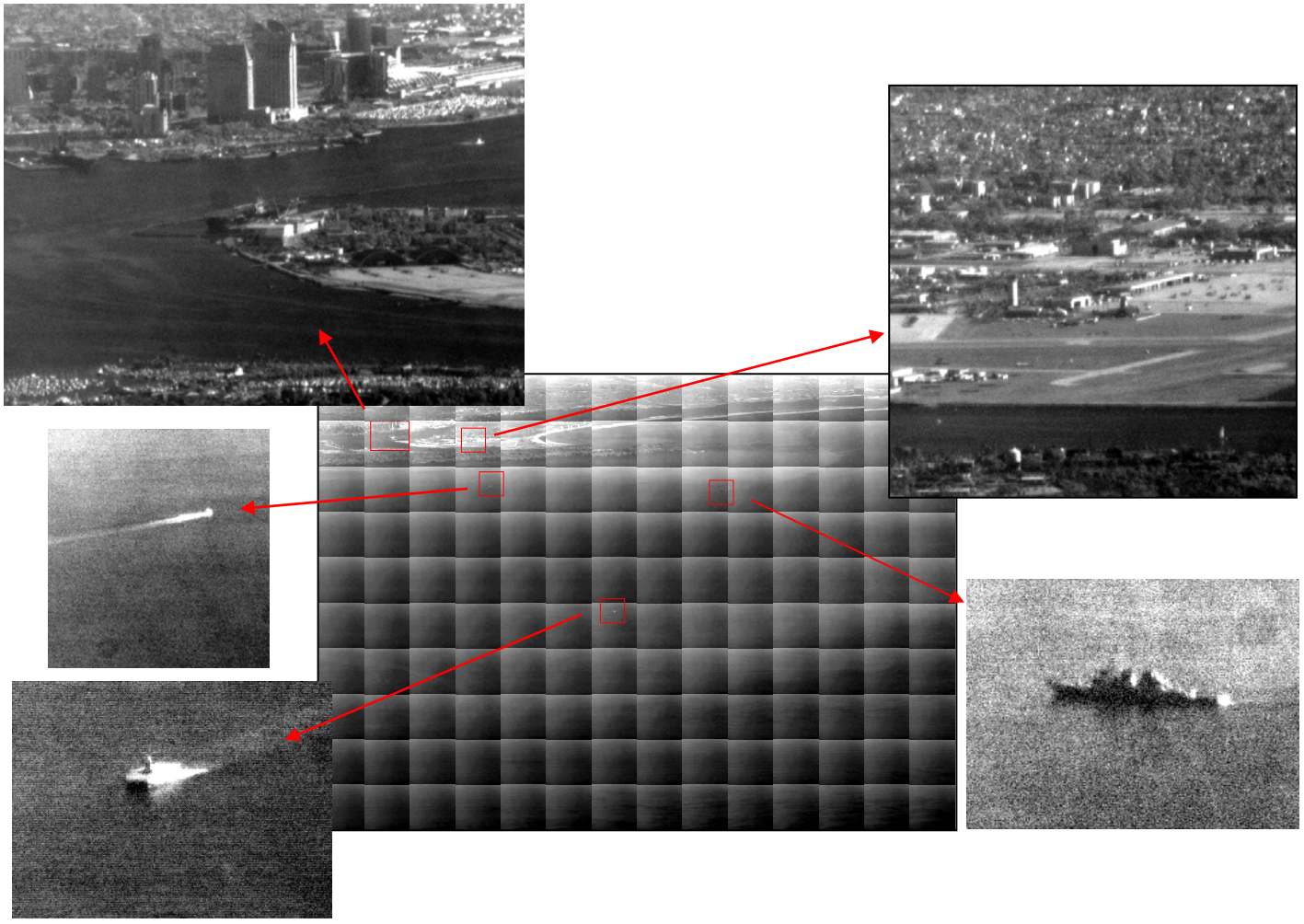


EO Spot – at 110 nm Range
NAS North Island / Point Loma, CA

NAVAIR

Global Hawk

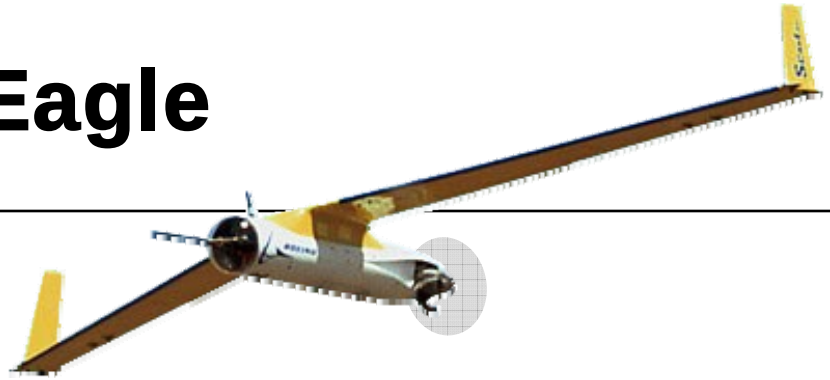
Global Hawk



ScanEagle

Launch & Recovery

ScanEagle



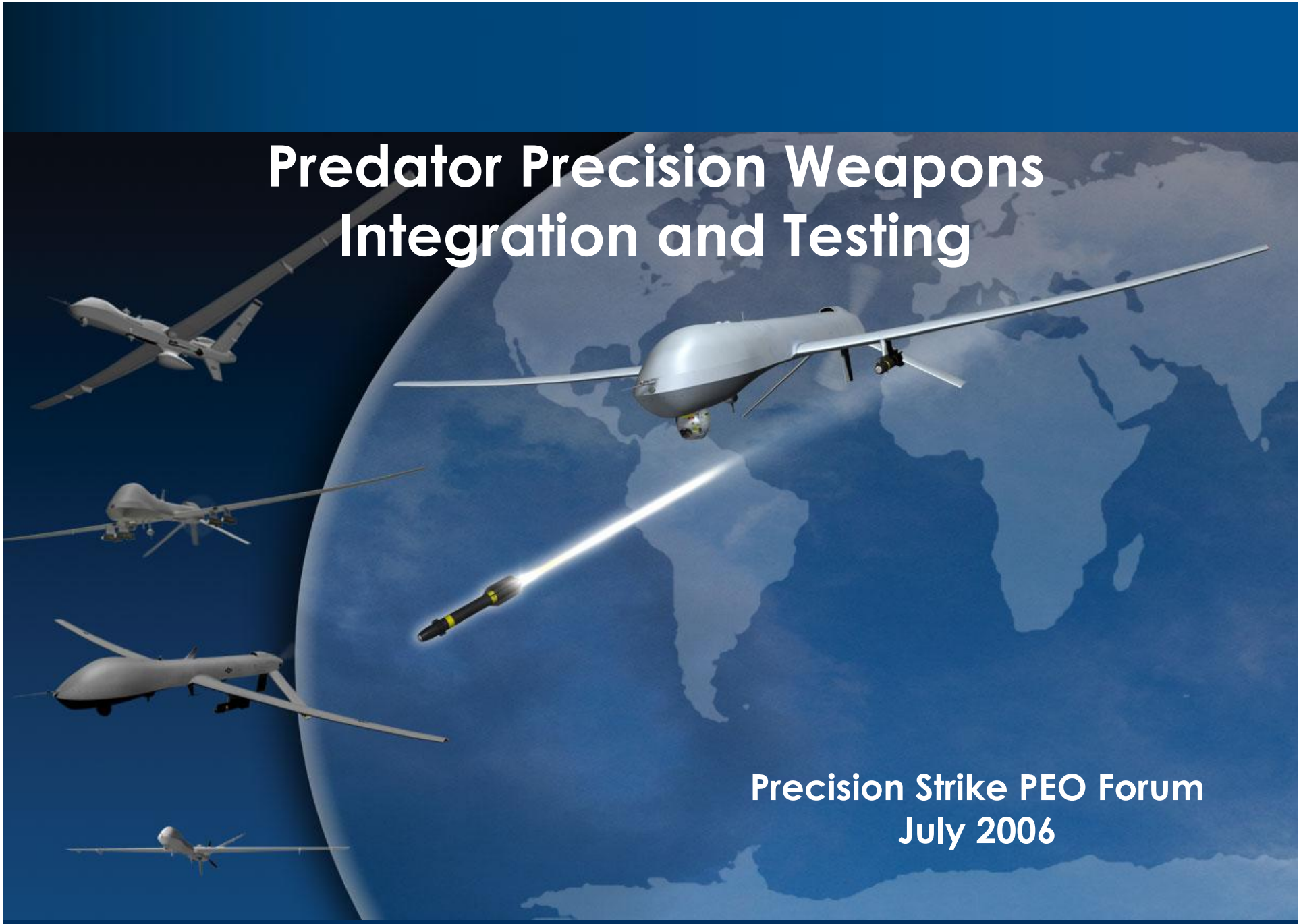

Slant R 477m GroundR 361m IGI Size 28m
UAV MSL 1256m IGI MSL 943m Zoom 6.4
IGI LAT 36.682764 IGI LON -115.66362
Steering HOLD RF Block OFF Frames/S 15.0Hz
Connect via IFC Ping 140ms Frame # 242649

Predator

Questions

NAVAIR

Predator Precision Weapons Integration and Testing



Precision Strike PEO Forum
July 2006

GENERAL ATOMICS
AERONAUTICAL SYSTEMS

Overview

- **Predator mission**
- **Predator weapons integration objective**
- **MQ-1B Predator weapons integration and test**
  - Hellfire
  - Stinger
- **MQ-9 Predator B weapons integration and test**
  - GBU-12
  - Hellfire
- **Summary**

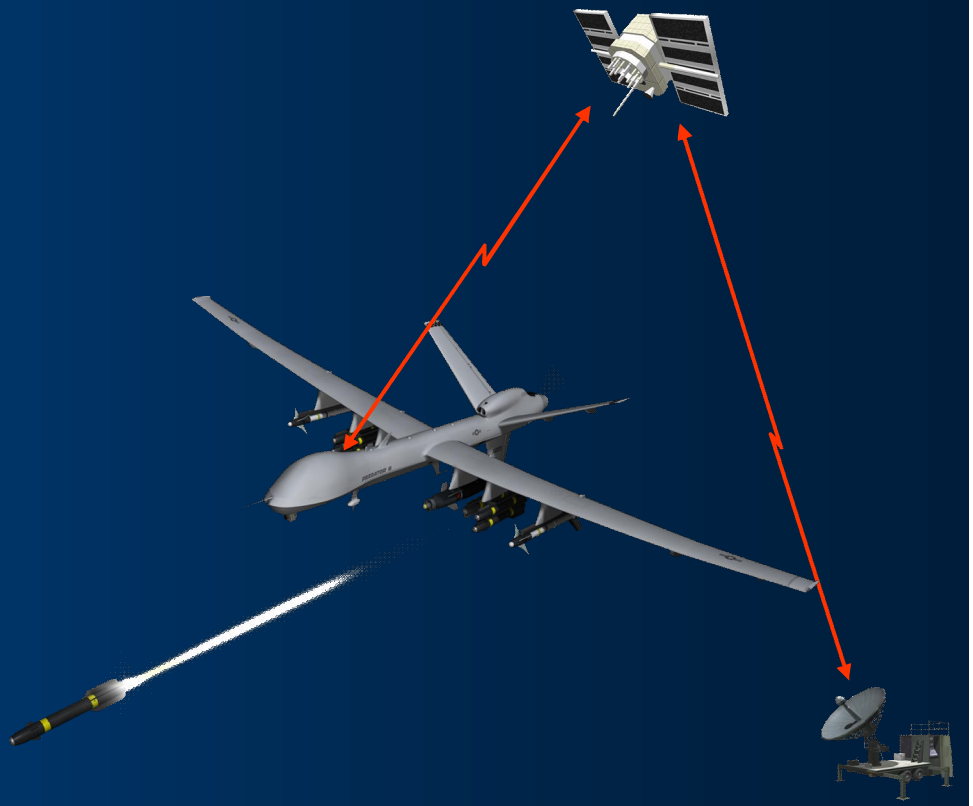
Predator Mission

- Interdiction and armed reconnaissance against critical, perishable targets
- Reconnaissance, surveillance and target acquisition in support of the Joint Forces commander

Mission

Armed

- Is what it has always been
- Weapons coming off airplanes
- But now with precision accuracy



Mission

- **Reconnaissance is now accomplished with:**
  - Persistent airborne platform
  - Day and night streaming video
  - Synthetic aperture radar to image through clouds
  - Near instantaneous distribution world wide

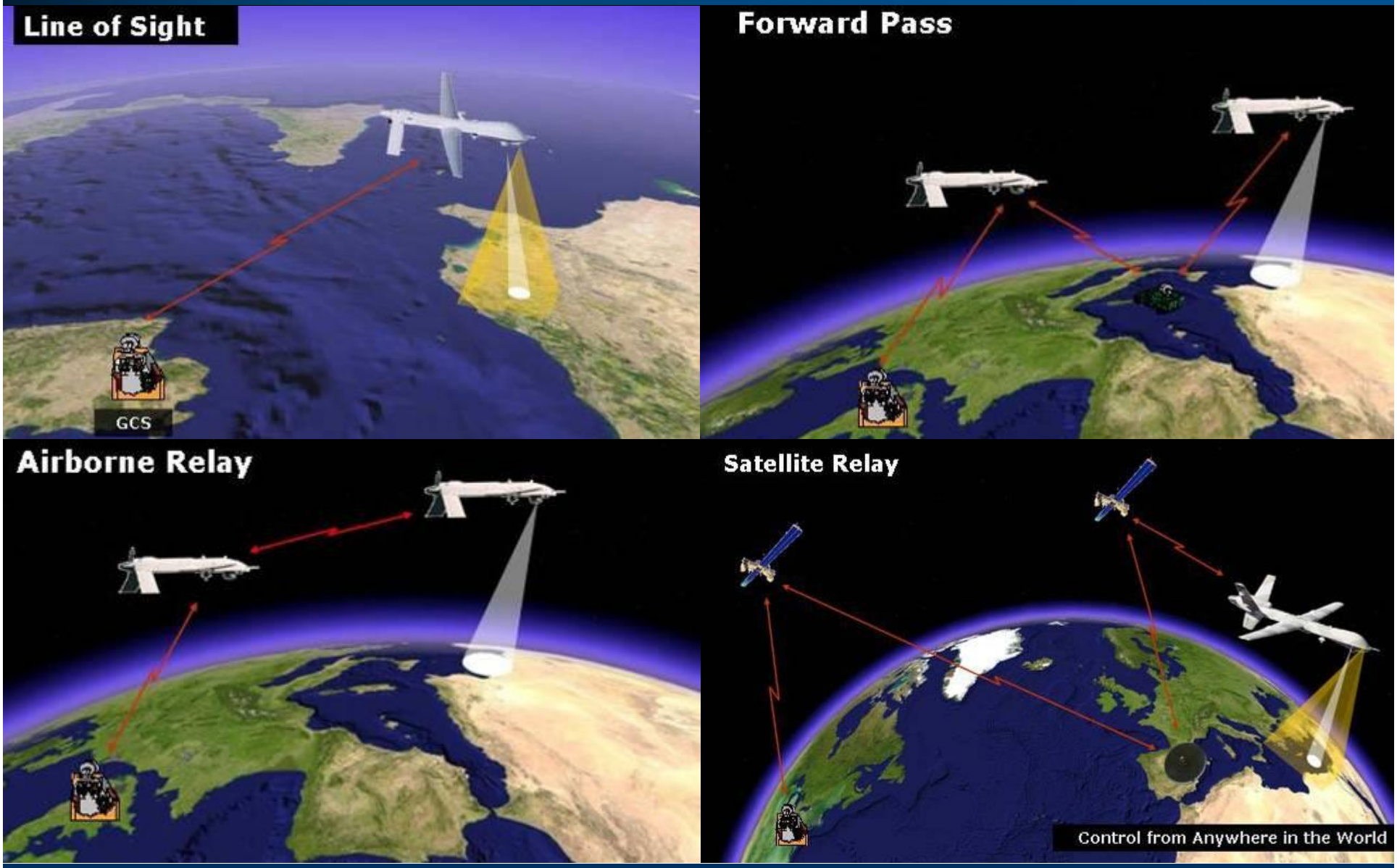
Mission

- **Long Endurance Armed Reconnaissance**
  - 30-50 hr flight times
  - Camera and radar sensors to detect
  - Precision weapons to destroy
- **To make it routine**
  - The pilot/crew had to come out of the airplane
  - The airplane had to be reliable enough to run for 30 – 50 hr per flight
  - A control scheme had to be developed in order to fly the airplane anywhere
  - Unique distribution and reception systems

Ground Control Station (GCS)

- C-Band Line-of-Sight (LOS) data link for take off, landing
- K_U-Band satellite link for missions over the horizon

Multi-Aircraft Control GCS


Line of Sight
GCS
Forward Pass
Airborne Relay
Satellite Relay
Control from Anywhere in the World

Weapons Integration Objective

- **Overall objective of Predator precision weapons integration:**
  - Provide persistent ability to hold time sensitive targets at risk any time, any place
  - Enable compression of end-to-end kill chain

Predator History

- First flown 1994, deployed to the Balkans 1995
- Modified to carry Hellfire 2001
- Fleet hours now over 215,000, 2/3 in combat

Hellfire

HELLFIRE AGM-114C	
Weight	98 lb
Length	64 in
Min range	0.5 km
Max range	8.0 km
Velocity	Mach 1.3

M-299 Hellfire Launcher	
Weight (4 rail)	145 lb
Weight (2 rail)	96 lb
Standard	14'' lugs
Built-in safe arm switch	

MQ-1 Hellfire Testing

- **Incremental build-up**
  - Ground static live fire
  - Phase 1 flight test: AGM-114C at low altitude
  - Phase 2 flight test: AGM-114K/M at higher operational altitudes
  - AGM-114 P flight test: AGM-114P designed specifically for Predator to allow high off boresight shots

Hellfire Static Ground Launch

Static Ground Launch (Cont.)

Hellfire Phase 2 Flight Test

Operational Mission Using Hellfire

Air-to-Air Stinger Weapon System

- **Accurate and lethal system**
  - Fire and forget missile
  - Two color IR/UV seeker
  - Effective against all known countermeasures
- **Currently fielded on OH-58C, OH-58D, and MH-60 helicopters**

Missile Length	58 in
Missile Diameter	2.75 in
Missile Weight	23 lbs
Missile Speed	Up to Mach 2
Air-to-Air Carriage System	Two per launcher

Predator Stinger Flight Test Program

- **Contract award 25 Sep 02, completed in 56 days**
- **Captive Carry Tests**
  - Functional air-to-ground tests
  - CONOPs development
    - Cessna 206 engagements
    - F-16 engagements
- **Live-Fire Tests**
  - All air-to-ground launches
  - Operations based from China Lake NAWC
  - Varied aircraft communications
    - C-band LOS
    - Ku-band SATCOM
  - Eight missile launches
    - Four Blast Test Vehicles
    - Four Full-up Rounds

Predator Stinger Flight Test Program

- **Captive Carry Test Results**
  - Robust air-to-ground capability
  - Initial air-to-air CONOPs developed
- **Live Fire Demonstration Results**
  - Safe separation from all eight missile shots
  - Four Full-up Rounds
    - Shot 1: Impact between ground targets
    - Shot 2: Timed self-destruct prior to target
    - Shot 3: Timed self-destruct prior to target
    - Shot 4: No self-destruct – potential missile failure
  - Set world record for highest Stinger Missile launch (20,000' MSL)

Stinger Operational Use

MQ-9 Predator B System Description

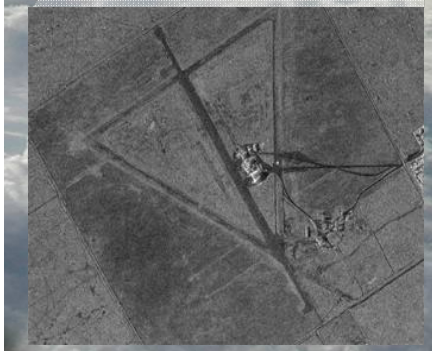
- **Mission:**
  - Hunter-Killer: Prosecute critical emerging time sensitive targets as a radar-based attack asset with organic hard-kill capability
  - ISR and target acquisition
- **History**
  - First flown 2001
  - Currently integrating GBU-12, GBU-38 and Hellfire under the MQ-9 System Development and Demonstration (SDD) program

MQ-9 Predator B System Description (cont)

	Predator	Predator B	Factor
GTOW	2,250 lb (1022 kg)	10,500 lb (4772 kg)	4.6
HP	105	900	8.6
Maximum Altitude	25,000	50,000+	2
Maximum Speed	120 KTAS	240 KTAS	2
Fuel	600 lb	4,000 lb	6.6
Payload Nose	450 lb (204 kg)	800 lb (363 kg)	1.8
Payload Wing	250 lb (113 kg)	3,000 lb (1363 kg)	12
Endurance	40 hr	30 hr+	.75

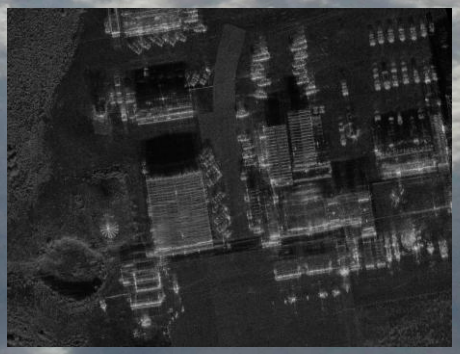
MTS-B EO/IR Payload

Lynx SAR

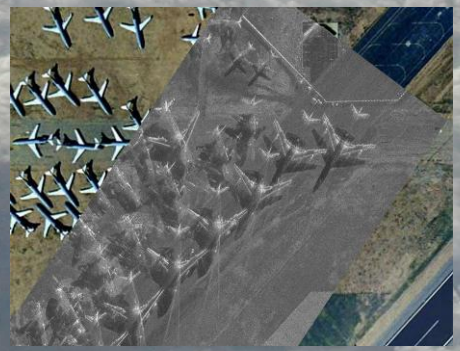


1m resolution

0.3m resolution



Dwell spot 0.1m

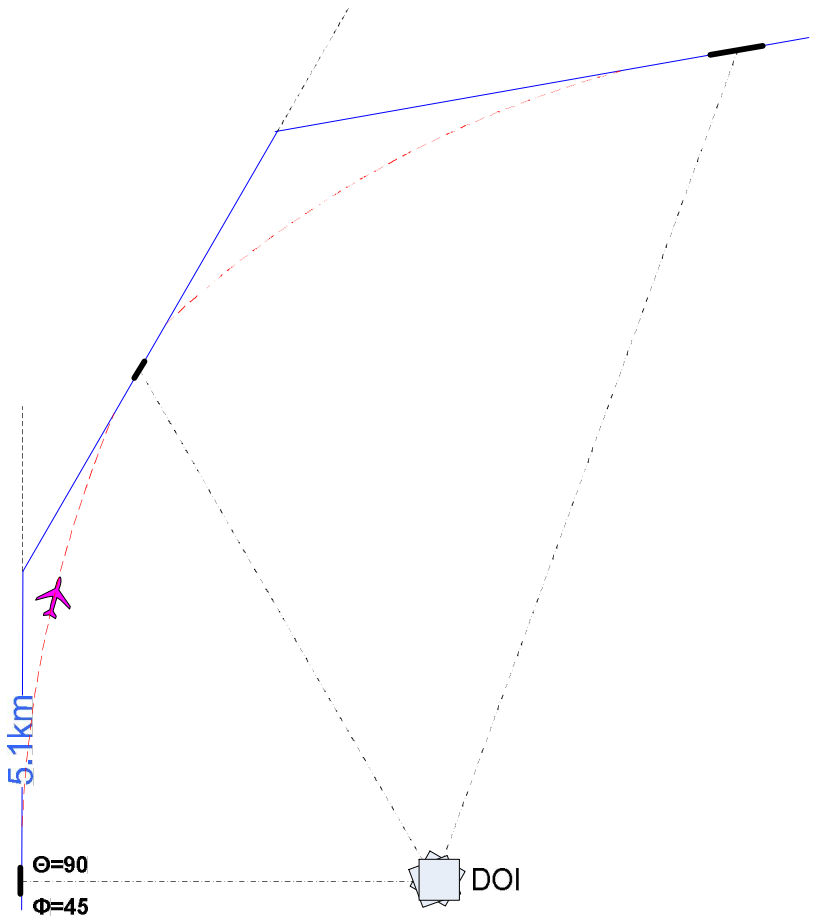


Drill-down zoom sequence with SAR and EO-imagery

Lynx 3D Targeting

- Spot images collected at three (3) points
- Ability to cue EO/IR sensor or pass target coordinates to weapons

Example 30 Kft Flight Path



GBU-12 Munition

- **GBU-12 Munition**
  - 500 lb class weapon
  - Part of the Paveway II family of munitions
  - Semi-active laser guidance
  - Bang-bang autopilot control
  - No electrical connection to the host aircraft
- **Currently in service with the US Air Force and US Navy**

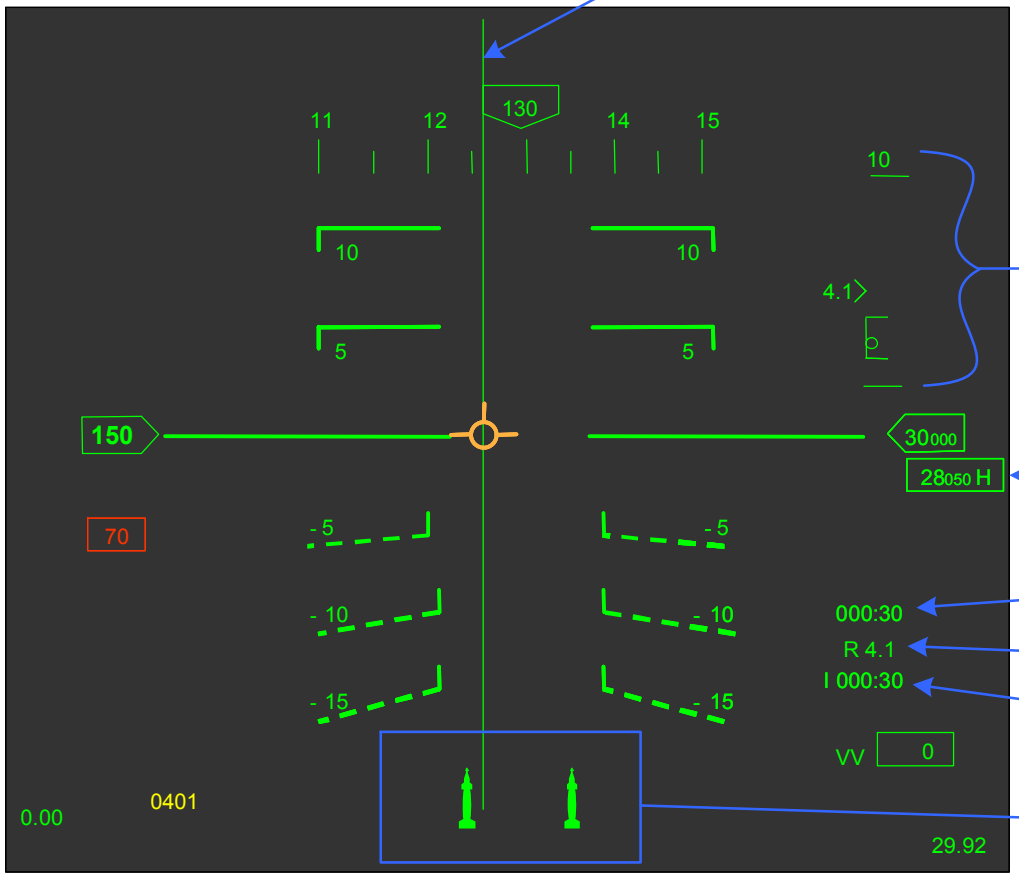
Munition Length	**129 in**
Munition Diameter	**11 in**
Munition Weight	**609 lb**
Fuze	**FMU-81**
Booster	**FZU-2**

BRU-15 Bomb Rack

- **BRU-15/A Bomb Rack**
  - Electro-mechanical gravity rack
    - No pyrotechnics or pneumatic actuation
  - Release via 28 v electrical impulse
- **Currently fielded on the P-3B and P-3C Orion aircraft**

Rack Length	**23.5 in**
Rack Height	**5.4 in**
Rack Weight	**16 lb**
Standard Suspension	**14 in**
Aero 1A Adapter Suspension	**30 in**

Human Machine Interface



GBU-12 and Hellfire Test Program

- **Standard test program for weapons integration**
  - Ground:
    - Ground vibration tests
    - Drop test
    - System Integration Lab (SIL) test
  - Flight
    - Separation tests
    - Handling qualities
    - Guided inert drops/launches
    - Guided live drops/launches

GBU-12 Separation Testing

GBU-12 Live Drop

MQ-9 With Hellfire and GBU-12

MQ-9 Hellfire Flight Test

Summary

- **MQ-1 and MQ-9 are well suited for precision weapons delivery**
  - Designs allow easy mission role expansion
  - Man-in-the-loop allows for positive control of weapons employment
  - Satellite control and persistence allows weapons to be in the right place at the right time to engage time sensitive targets
- **MQ-1 continues to be a vital weapon systems in the GWOT**
- **MQ-9 will bring significant additional capability to the fight**

Unmanned Combat Air Systems
26 July 2006

Dyke D. Weatherington
OUSD(AT&L)/PSA/Air Warfare

#06-S-2070

2006 QDR Guidance

- The 2006 Quadrennial Defense Review Report emphasizes the importance of Unmanned Aircraft Systems
  - Department will also increase procurement of unmanned aerial vehicles to increase persistent surveillance, nearly doubling today's capacity
  - Approximately 45% of the future long-range strike force will be unmanned
  - Establish a SOF unmanned aircraft systems squadron
  - Maritime aviation will include unmanned aircraft for both surveillance and strike
  - Restructure the Joint Unmanned Combat Air System (J-UCAS) program and develop an unmanned longer-range carrier-based aircraft capable of being air-refueled to provide greater standoff capability,
  - Increase investment in unmanned aerial vehicles to provide more flexible capabilities to identify and track moving targets in denied areas
  - Nearly double UAV coverage capacity by accelerating the acquisition of Predator UAVs and Global Hawk

Persistent Surveillance

- The Department will also increase procurement of unmanned aerial vehicles to increase persistent surveillance, nearly doubling today's capacity. It also will begin development of the next generation long-range strike systems, accelerating projected initial operational capability by almost two decades. Page-6
- Nearly double UAV coverage capacity by accelerating the acquisition of Predator UAVs and Global Hawk. Page-46

Unmanned Aircraft (UA)
2006

Theater & Tactical (>10lbs)	
• Buster	20
• Pioneer	34
• Shadow 200	140
• Neptune	15
• Tern	15
• Mako	14
• Tigershark	6
• SnowGoose	25
• Hunter	32
• I-Gnat	4
• Predator	70
• Predator B	6
• Global Hawk(GH) - ACTD	4
• Global Hawk - Prod	5
• GH Maritime Demo	2
• Sub-total	392

309% Increase from 2002

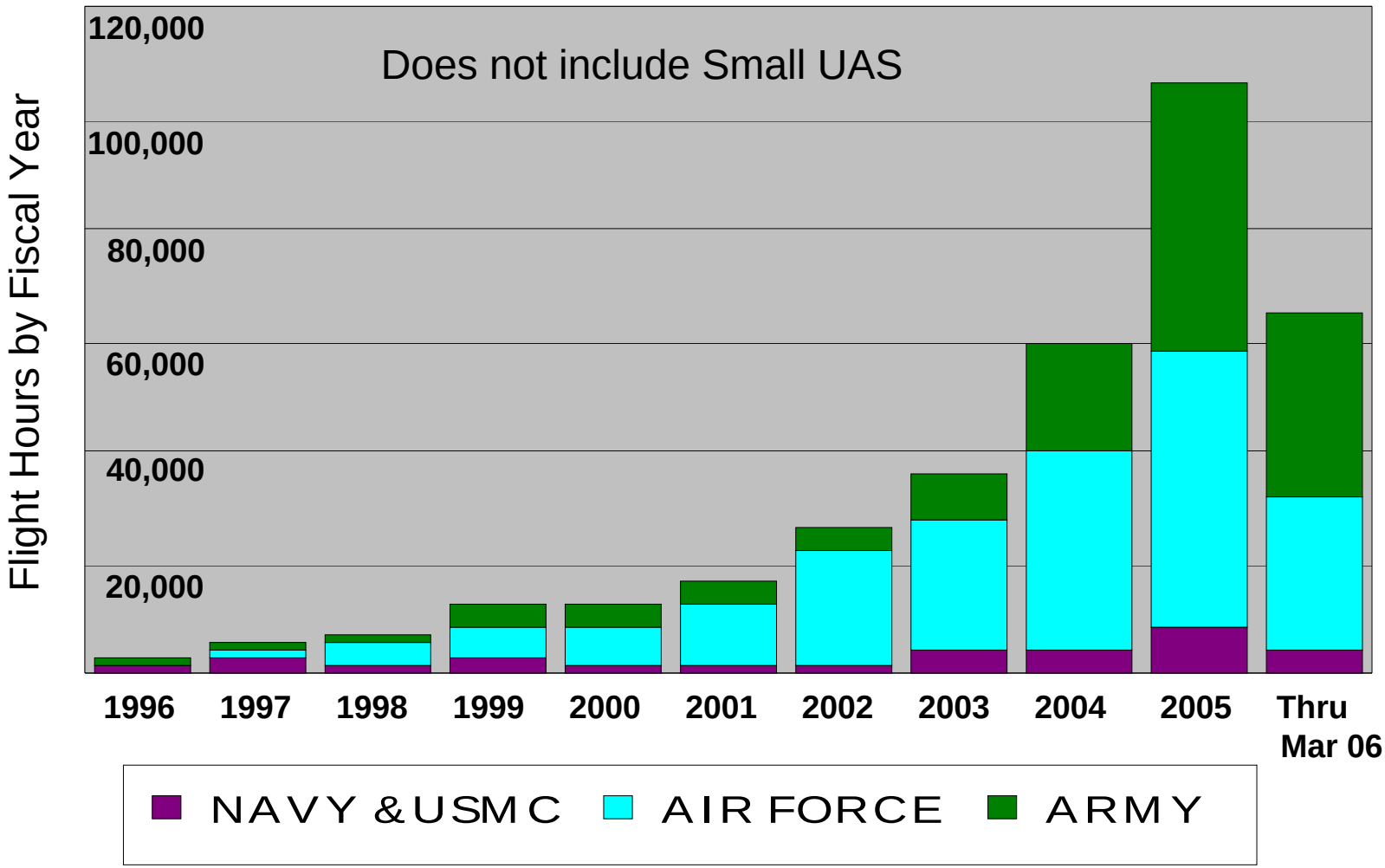
Small (<10lbs)	
• Pointer	126
• Raven	1776
• Dragon Eye	402
• Desert Hawk	126
• BATCAM	54
• Swift	212
• Sub-total	2570

1,773% Increase from 2002

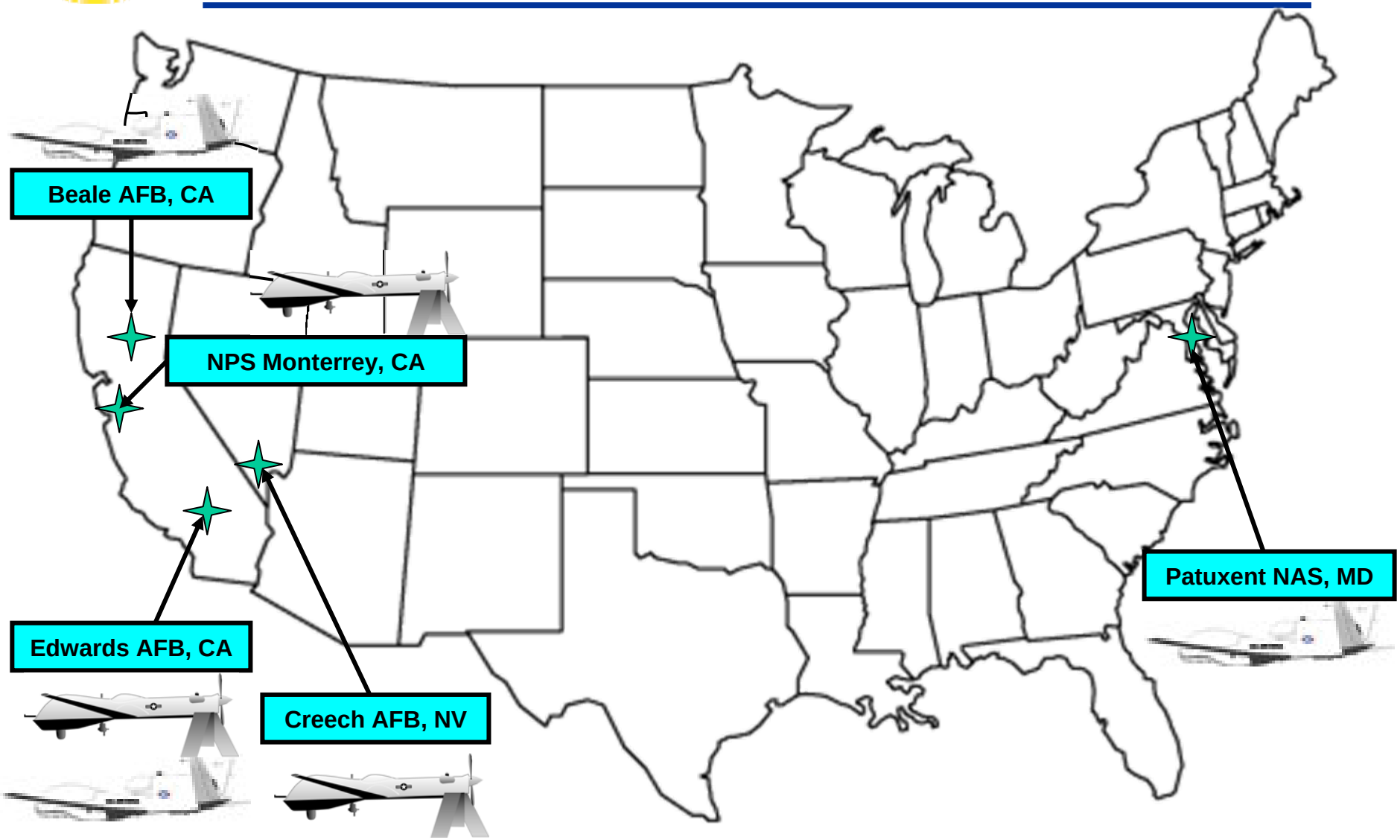
2002	167 Aircraft	$ 763M
2004	727 Aircraft	$1,631M
2006	2,962 Aircraft	$1,627M

Total R&D and Procurement costs per year

DoD UAS Flight Hours



Current Predator & Global Hawk Operations



Persistent Surveillance

RQ-4 Global Hawk

Attributes:

- Ceiling – 65,000 ft
- Endurance – 32 hours
- Radius – 5,400 nm
- Sensors – EO/IR, SIGINT, SAR/MTI
- Payload – 1,950 lbs
- Data Link (s) – BLOS (SATCOM)/ LOS

MQ-1 Predator

Attributes:

- Ceiling – 25,000 ft
- Endurance – 14 hours (armed)
  24 hours (unarmed)
- Radius – 500 nm
- Sensors – EO/IR, SAR
- Payload – 450 lbs
- Data Link (s) – BLOS/ LOS

Future Long-Range Strike

- The Air Force has set a goal of increasing its long-range strike capabilities by 50% and the penetrating component of long-range strike by a factor of five by 2025. Approximately 45% of the future long-range strike force will be unmanned. Page-46

Air Force Long Range Strike
Way Ahead

3-Phased Approach

- **Phase 1 – Continues modernization of legacy bombers to upgrade combat effectiveness**
- **Phase 2 (Next Generation Long Range Strike) – Leverages near-term technologies to start development of long range strike capability to augment current fleet**
  - **Technology maturity a key consideration to meet QDR-directed 2018 IOC**
  - **Analysis of Alternatives being conducted, results due Spring 2007**
- **Phase 3 – Cutting edge *producible* technology in the 2035+ timeframe**
  - **Directed energy, hypersonics, exo-atmospheric**
  - **Speed, range, accuracy, connectivity & survivability improvements**

Air Force Long Range Strike
(Phase 2) AoA Desired Capabilities

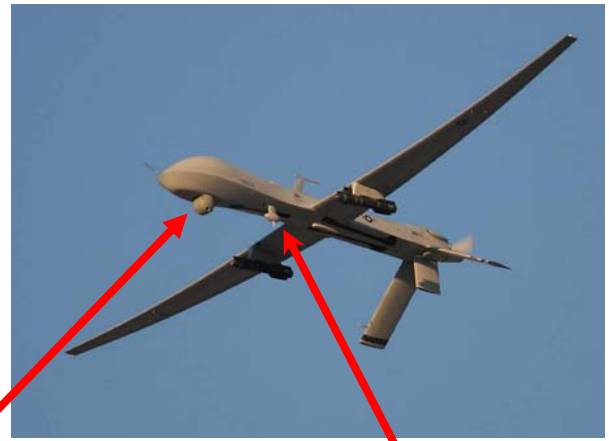
- **Long-range** – Global from CONUS or forward operating bases
- **Persistent** – 24/7 capability in anti-access environment
- **Responsive** – Respond globally within hours to minutes
- **Flexible, precise weapons payload** – Mixed load, nuclear capable
- **Highly survivable – Self-defending** – reduces support
  - Low observable, standoff weapons, speed, altitude
  - Manned, unmanned, or optionally manned
- **Global situational awareness**
  - Robust, fused sensor suites
- **Real-time, robust beyond line of site connectivity** – Fully netted
- **Autonomous operations** – Onboard sensors, offensive, defensive, non-traditional ISR
- **Flexibility /adaptability** – easily incorporate new capabilities, open architecture – "plug and play"

Joint Tactical Air Control

- Expand the Air Force Joint Tactical Air Control program by jointly training personnel for air/ground operations and use of Unmanned Aerial Vehicles. Page-43

Tactical Air Control Party

A TACP is generally a two-airman team, working in an Army ground unit and directing close air support firepower toward enemy targets on the ground in close proximity to friendly forces.



Special Operations UAS Squadron

- The Air Force will establish an Unmanned Aerial Vehicle Squadron under U.S. SOCOM. Page-5
- Establish a SOF unmanned aerial vehicle squadron to provide organic capabilities to locate and target enemy capabilities in denied or contested areas. Page-45

Special Operations UAS Squadron

The Air Force is currently standing up a special operations Predator UAV squadron at Creech Air Force Base, NV. The squadron will initially consist of 24 MQ-1 aircraft but could eventually add the larger MQ-9 Predator B when the aircraft completes development. The Air Force has not announced a specific timetable for the completion of the stand up of the AFSOC Predator squadron.

MQ-9 Predator B

Naval Aviation

- Maritime aviation will include unmanned aircraft for both surveillance and strike. Page-45
- Restructure the Joint Unmanned Combat Air System (J-UCAS) program and develop an unmanned longer-range carrier-based aircraft capable of being air-refueled to provide greater standoff capability, to expand payload and launch options, and to increase naval reach and persistence. Page-46

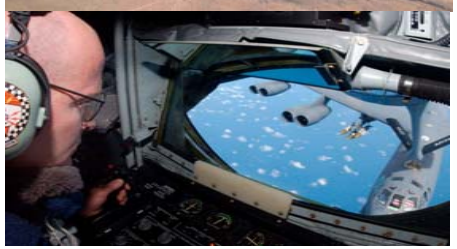
Navy Unmanned Combat Air System

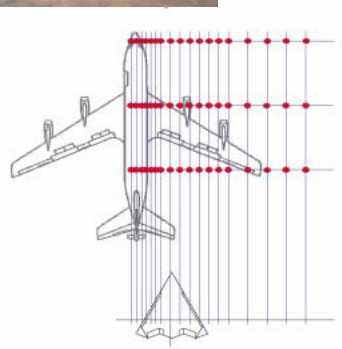
Restructure the Joint Unmanned Combat Air System (J-UCAS) program and develop an unmanned longer-range carrier-based aircraft capable of being air-refueled to provide greater standoff capability, to expand payload and launch options, and to increase naval reach and persistence.

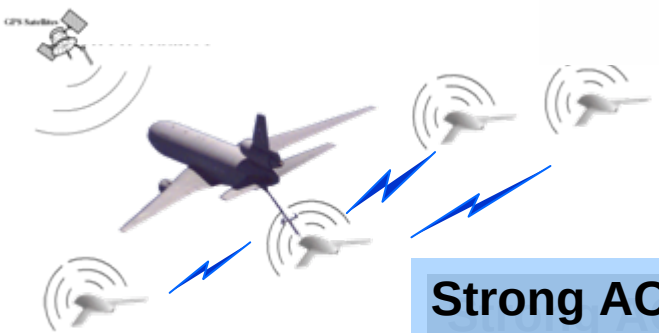
	FY07	FY08	FY09	FY10	FY11	FY07-11
RDT&E-Navy ($M)	**+239**	**+310**	**+369.4**	**+491.1**	**+421.1**	**+1,830.5**

CAT/TRAP Demonstration planned for FY11

Automated Aerial Refueling







Goal: Develop and Flight Demonstrate Initial AAR Capability

Initial User/TAD: J-UCAS, FY07

Technology Challenges:

- **Rendezvous**
- **UAS Operations near tanker**
  - **Precise relative position**
  - **Collision avoidance**
- **C2: MCS supervised, Boomer breakaway**
- **Systems integration**

Strong ACC & AMC participation in effort - Includes desire to minimize impact to existing tanker fleet and con-ops

Reserve Component

- The Air Force is optimizing Reserve Component personnel for new missions that can be performed from the United States, including unmanned aerial vehicle (UAV) operations and ISR reach-back, leveraging the core competencies of the reserves while reducing stress on the force. Page-45

Reserve Component

- Grand Forks initially is scheduled to receive Predators in 2009 and Global Hawks in 2010, North Dakota Senator Kent Conrad
- The details of the Grand Forks and Fargo missions were embedded in the Air Force's Total Force Integration program, which lays the ground rules for military strategies and acquisitions. Under this program, the North Dakota Air National Guard's 119th Wing was assigned two missions at Hector International Airport. Those missions are flying an unidentified joint cargo aircraft and operating a Predator UAV ground control station.
- The Guard will create a new maintenance unit at Grand Forks Air Force Base that will support Predator launch and recovery operations. The new maintenance squadron also may be asked to support Global Hawk UAV operations once those aircraft arrive on base, Senator Conrad said.

UNMANNED AERIAL VEHICLES : 'Victory for North Dakota' Air Force, National Guard work out additional details of Predator mission
By Elisa L. Rineheart Herald Staff Writer 28Jun2006

Reserve Component

- Air National Guards units will conduct Predator unmanned aircraft systems missions in a reachback capacity over long distances from their home states.
- Air Force Reserve members will participate in all mission areas at the Air Warfare Center at Nellis Air Force Base, Nev. The first new reserve-component mission will be Predator unmanned aircraft systems missions.

- 5 Predator Squadrons
  - Arizona – Davis-Monthan/ Fort Huachuca
  - California – March ARB
  - New York – Hancock Field Syracuse
  - North Dakota – Fargo/Grand Forks
  - Texas – Ellington Field
- Global Hawk Units
  - North Dakota - Grand Forks
- United States Air Force Warfare Center
  - Reserve & Guard augmentation

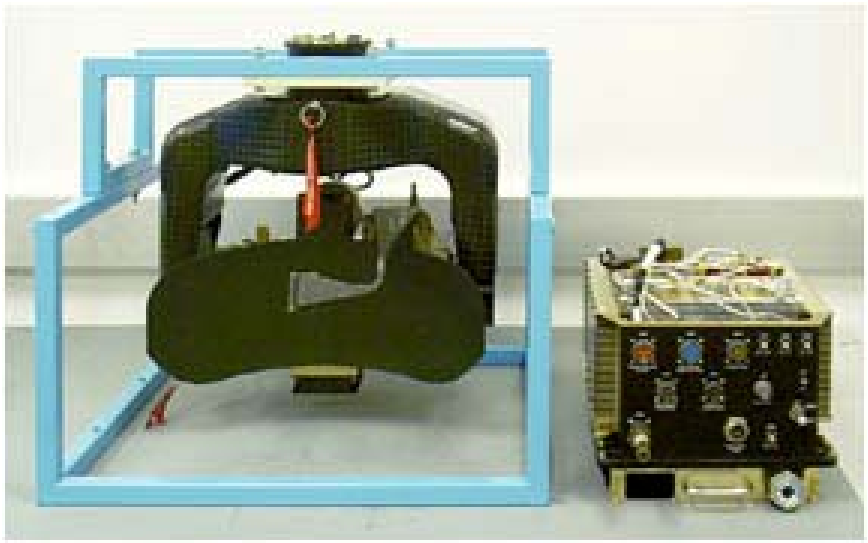
Proposed Guard and Reserve Predator and Global Hawk Locations

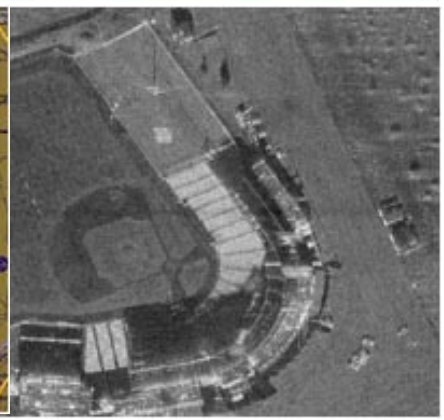
#06-S-2070

Moving Targets

- Increase investment in unmanned aerial vehicles to provide more flexible capabilities to identify and track moving targets in denied areas. Page-57

Lynx II Synthetic Aperture Radar/Ground Moving Target Indicator (SAR/GMTI)





- Mission
  The Lynx II SAR/GMTI is a multi-function radar that operates in Synthetic Aperture Radar (SAR) and Ground Moving Target Indicator (GMTI) modes. High-resolution SAR and GMTI data is processed on-board and is data-linked to a Ground Station for exploitation.
- Description
  The *Lynx II* consists of a Radar Electronics Assembly (REA) and an Antenna/Gimbal Assembly. SAR modes operate in 0.1 m to 3.0 m resolution. In the GMTI mode, the radar detects moving targets at speeds of 10-70 kph and overlays their locations on a digital map. The *Lynx II* is slated for production in FY07 and is sized for operations on the UA Class IV, ER/MP and Hunter UAVs.
- Applications
- **All-condition RSTA of moving and stationary targets**
- **Battle Damage Assessment (BDA)**
- **Wide area surveillance**
- **Brigade/Division intelligence operations**
- **Multi-mode cueing**

Office of the Secretary of Defense
Unmanned *Systems* Roadmap ***2007-2032***

- **Focus**
  - **Interoperability of air, ground, and sea systems**
  - **Remains on customer, technology and industry**
- **Adds**
  - **Unmanned Ground Systems**
  - **Unmanned Surface Systems**
  - **Unmanned Underwater Systems**
- **New Format**
- **Long term plan is to publish an integrated Unmanned Systems Roadmap in 2009**
- **The goal is for the 2009 Road map to influence the FY 2010 POM**

Unmanned Systems Roadmap, 2007

Very Rough **Format Straw Man**

- **Executive Summary**
- **Chapter 1 – Introduction**
- **Chapter 2 – Strategic Planning, Policy, Guidance, & Organization**
- **Chapter 3 – Capabilities**
- **Chapter 4 – Joint Mission Areas**
- **Chapter 5 – Technology Application (appendices in current version of the roadmap)**
- **Chapter 6 – Experimentation and Test**
- **Chapter 7 – Roadmap – programs/capabilities/timeline**
- **Annex A – Unmanned Aircraft Systems**
- **Annex B – Unmanned Ground Systems**
- **Annex C – Unmanned Sea Systems**
- **Annex D – Standards Listing**

- **Separate volume with detailed appendices...?**

- **Targeting completion Fall FY07**


Questions?

Headquarters Air Combat Command

ACC/C2ISR Delivering Desired Effects on the Battlefield

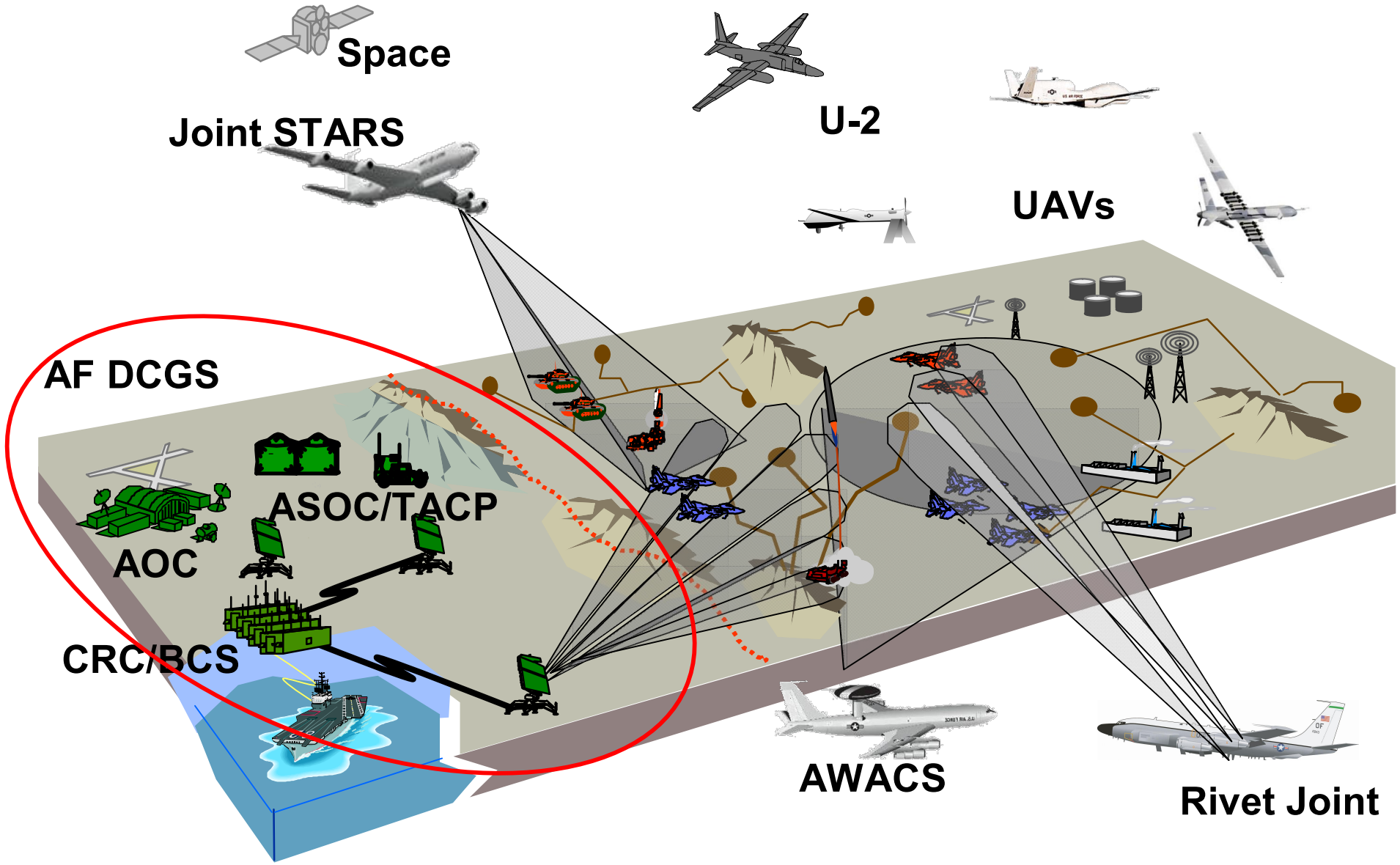
Col Tom Wozniak
ACC/A8C
25 July 2006

This Briefing is:
UNCLASSIFIED

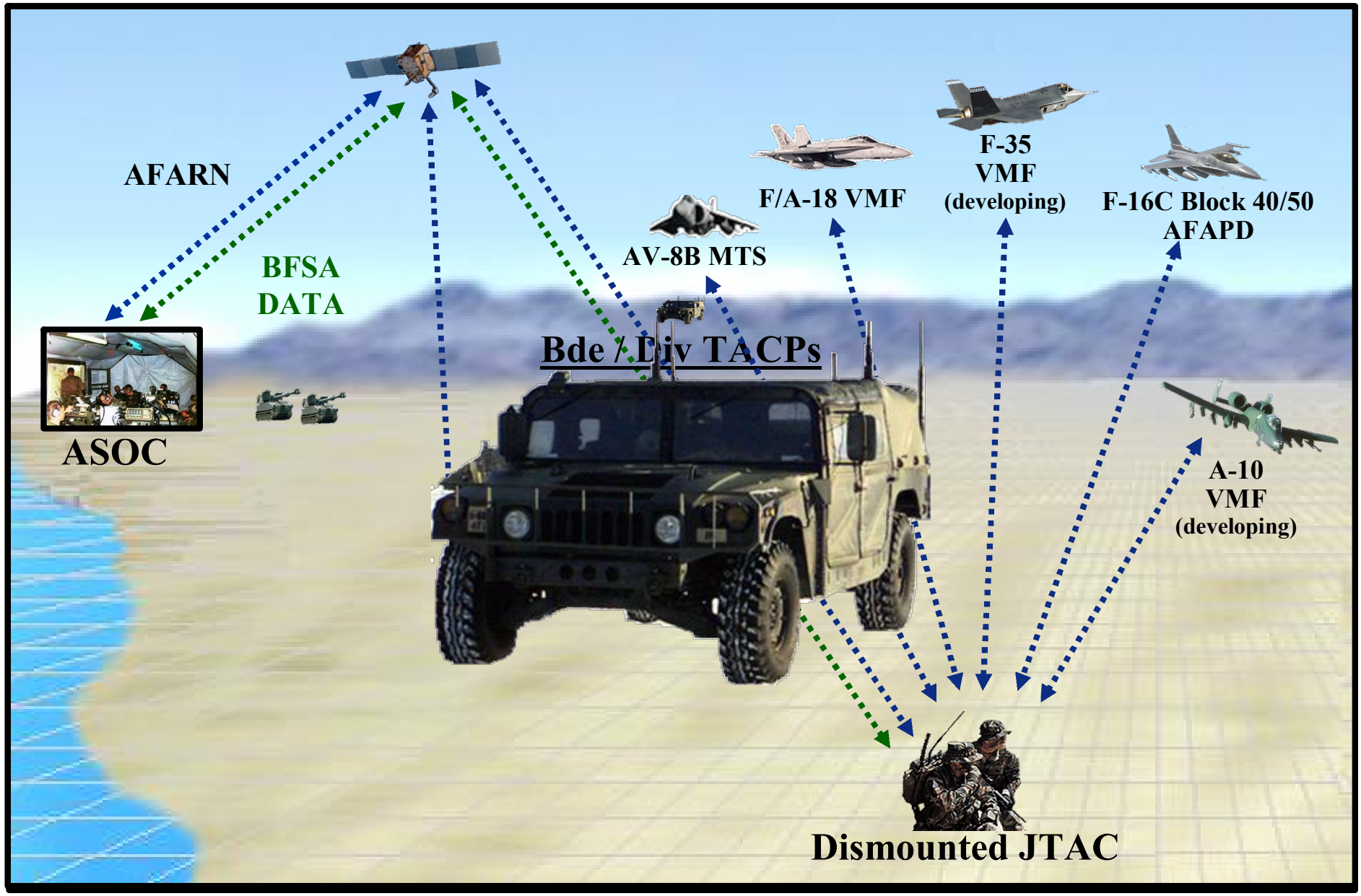
Overview

- **Tactical Level Programs**
  - **TTNT, TACP, ICAN**
- **Operational Level Programs**
  - **NCCT, BACN, AMSTE**
- **C2ISR Integration**
  - **Future, HMI**
- **Force Structure Challenge**

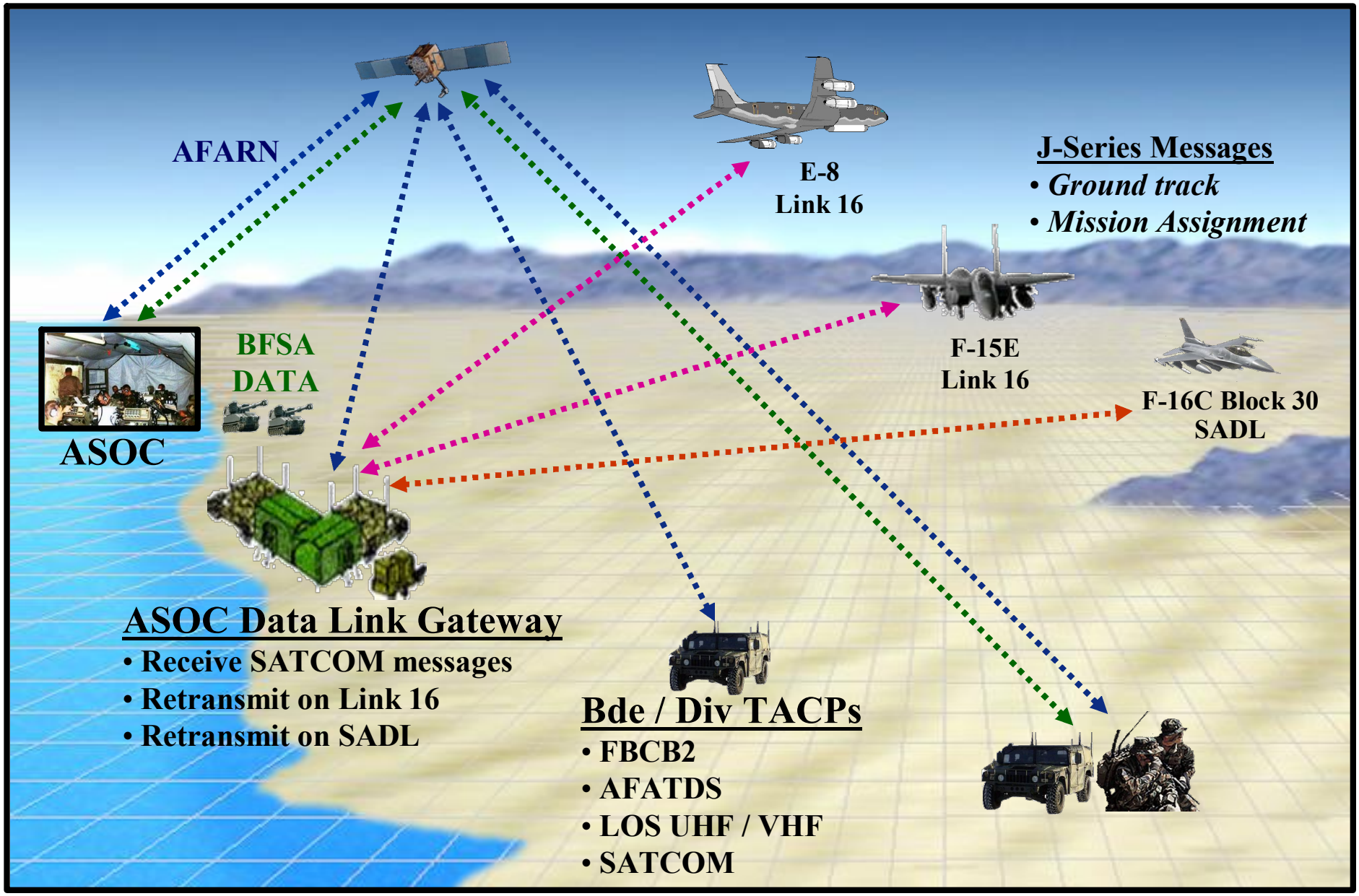
Tactical Level Programs



TACP-CASS S/W v1.2 – Fielded



TACP-CASS S/W v1.3.1 – Fall 06

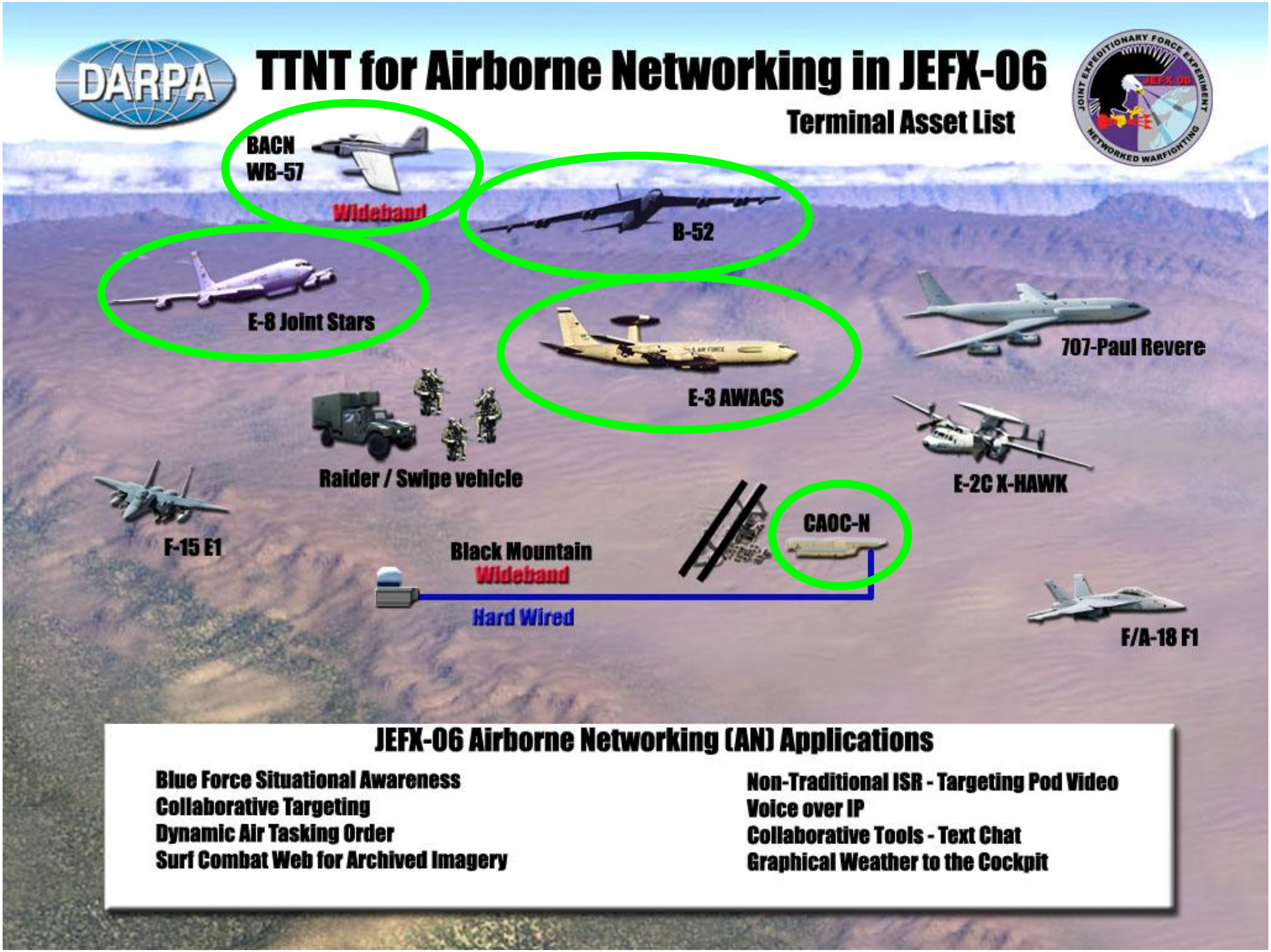


Tactical Targeting Network Technology

(TTNT)

TTNT for Airborne Networking in JEFX-06

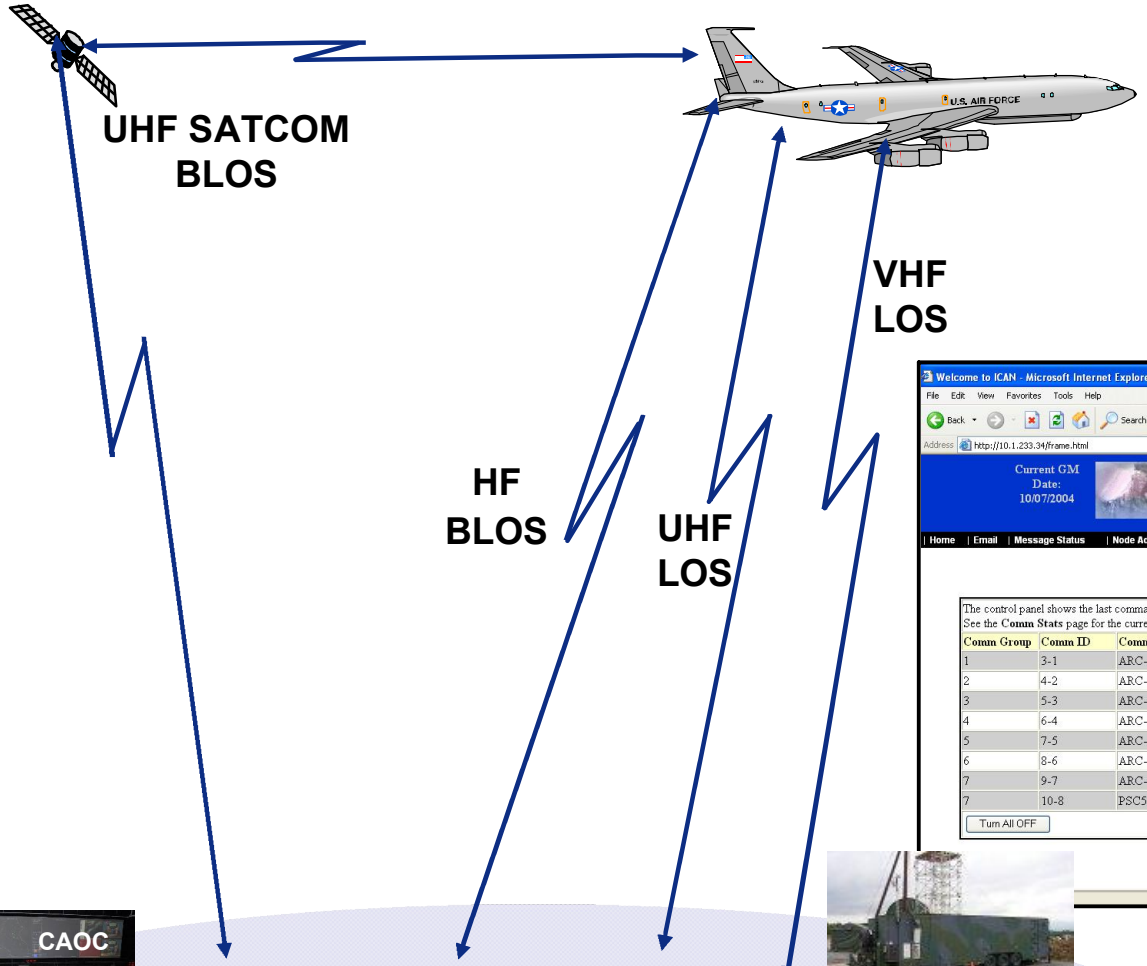
Terminal Asset List

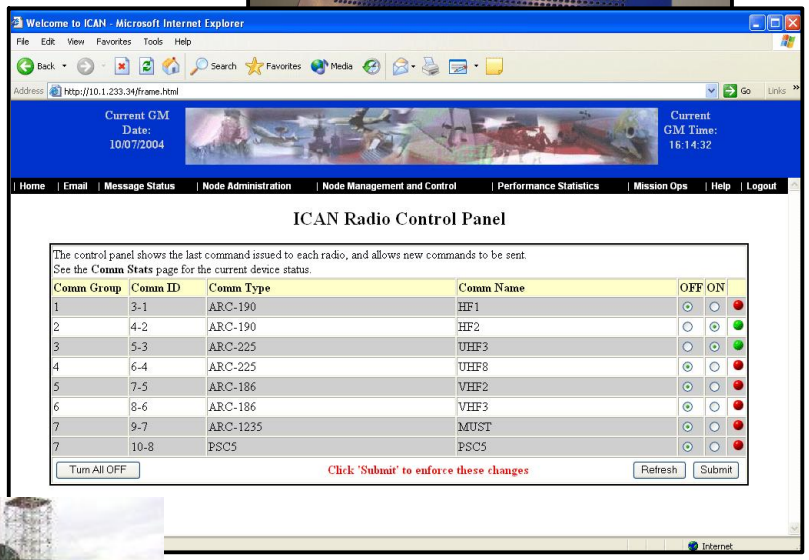


JEFX-06 Airborne Networking (AN) Applications

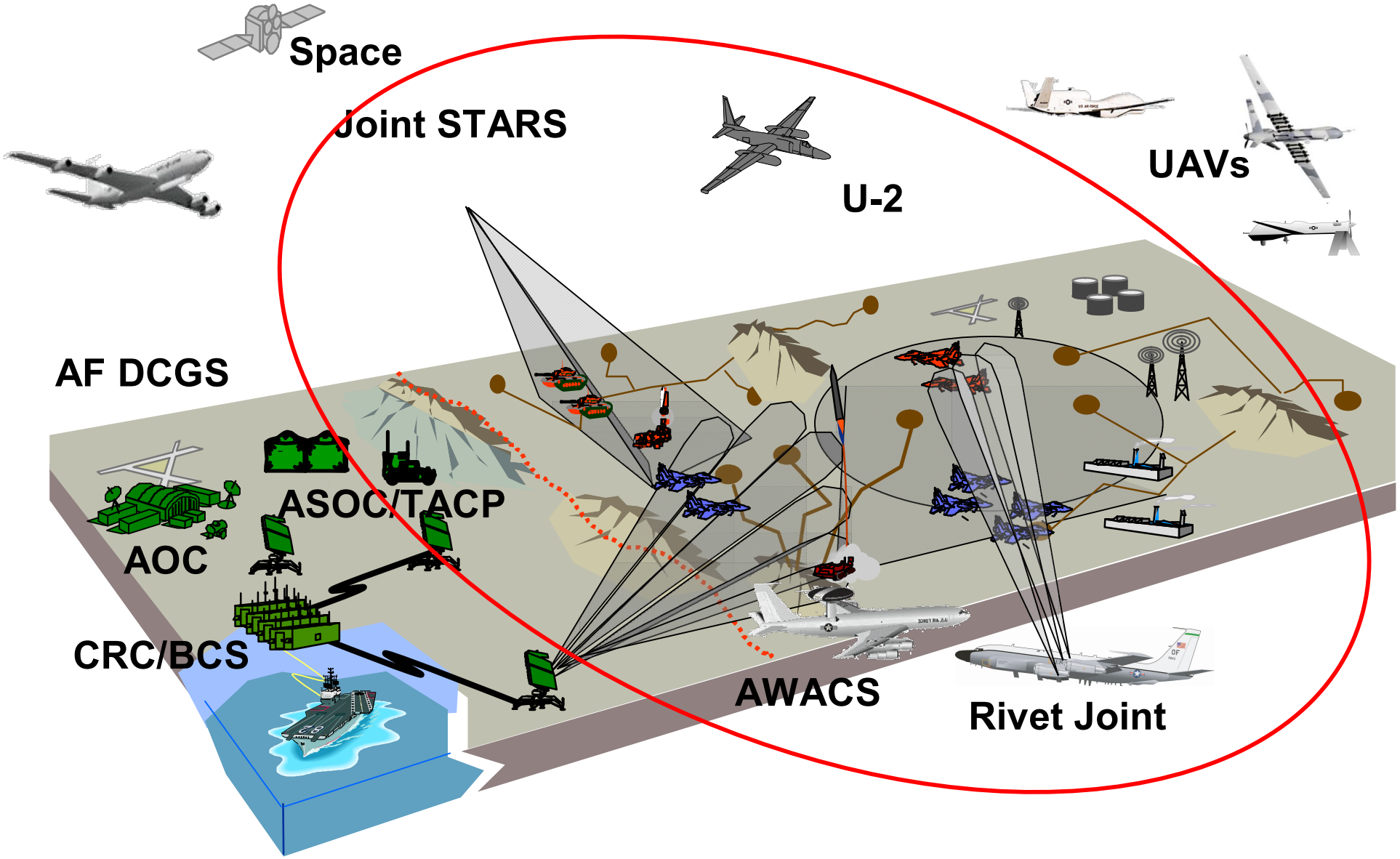
- Blue Force Situational Awareness
- Collaborative Targeting
- Dynamic Air Tasking Order
- Surf Combat Web for Archived Imagery
- Non-Traditional ISR - Targeting Pod Video
- Voice over IP
- Collaborative Tools - Text Chat
- Graphical Weather to the Cockpit

ICAN Deployment CONOPS

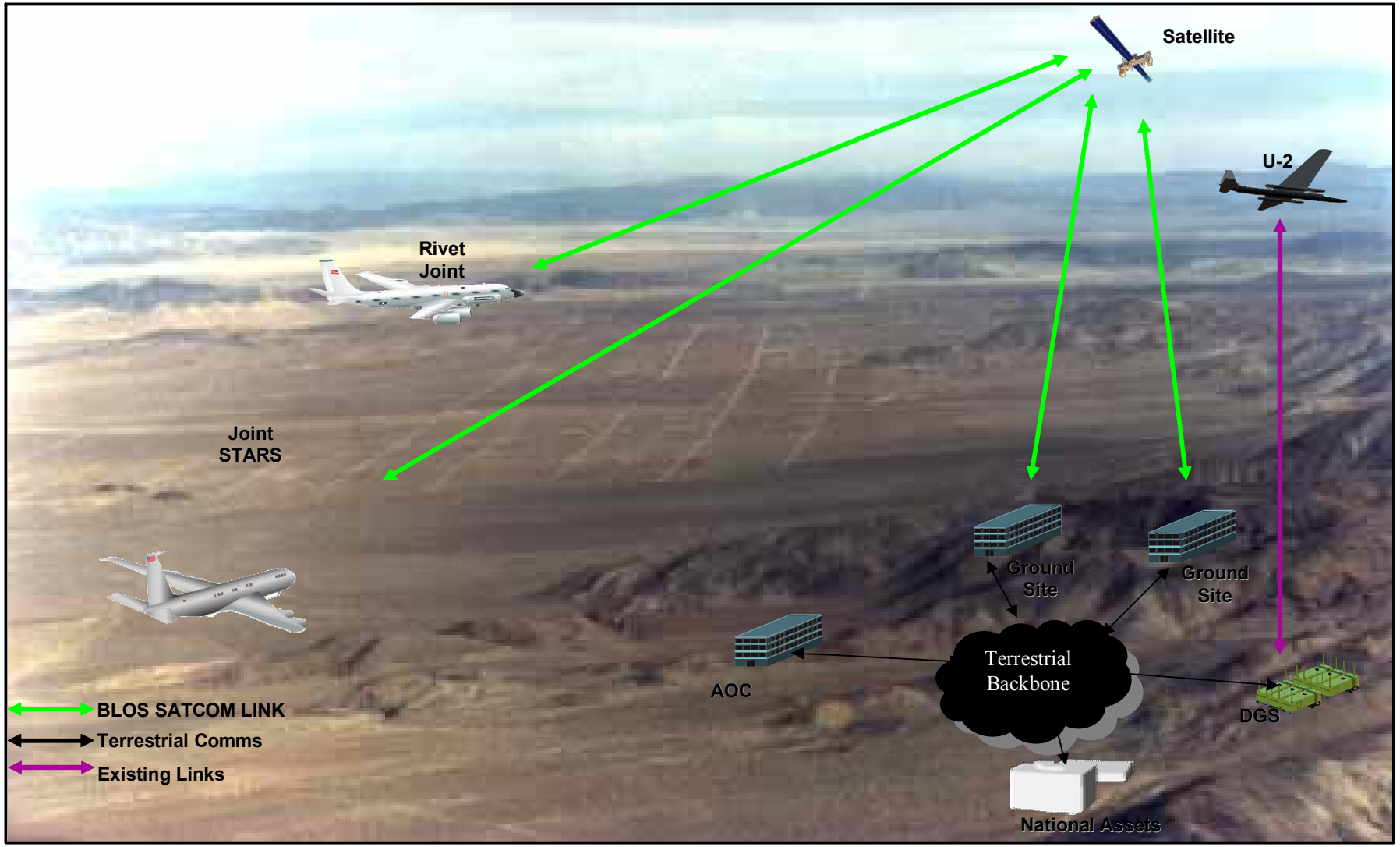




Operational Level Programs

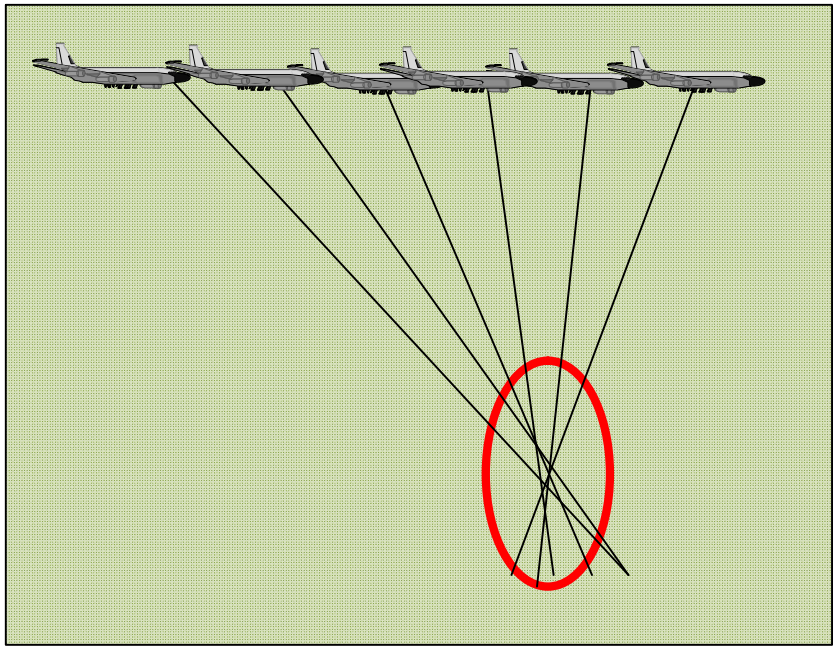


NCCT


Satellite
U-2
Rivet
Joint
Joint
STARS
Ground
Site
Ground
Site
AOC
Terrestrial
Backbone
DGS
National Assets
BLOS SATCOM LINK
Terrestrial Comms
Existing Links

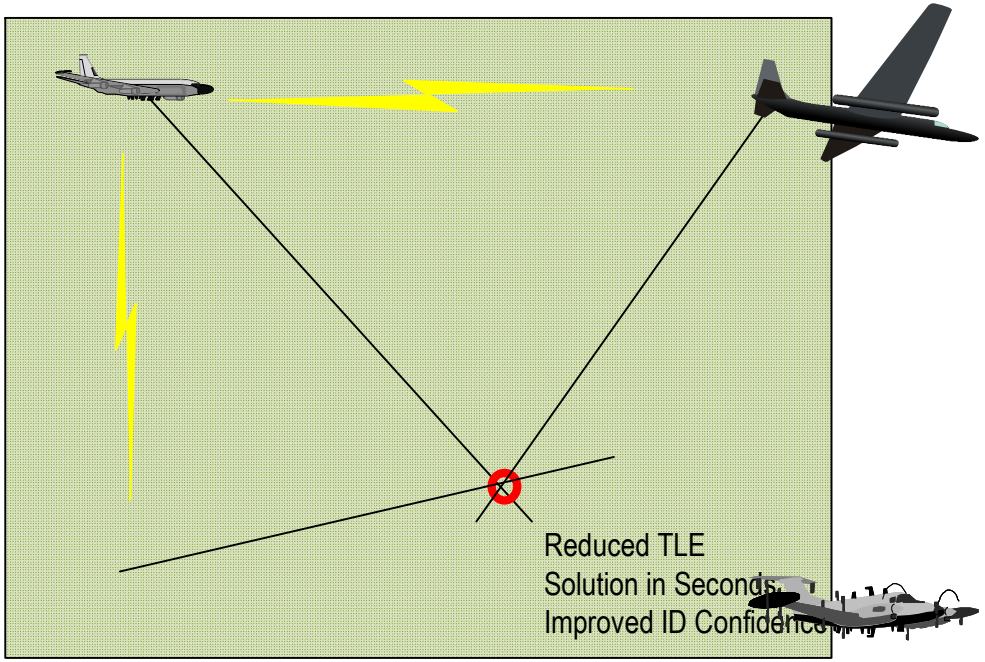
NCCT: The Payoff

Stand Alone Platform



- Stand alone platforms
- Single-Int
- Tens of minutes
- Coarse location, if target stays on the air

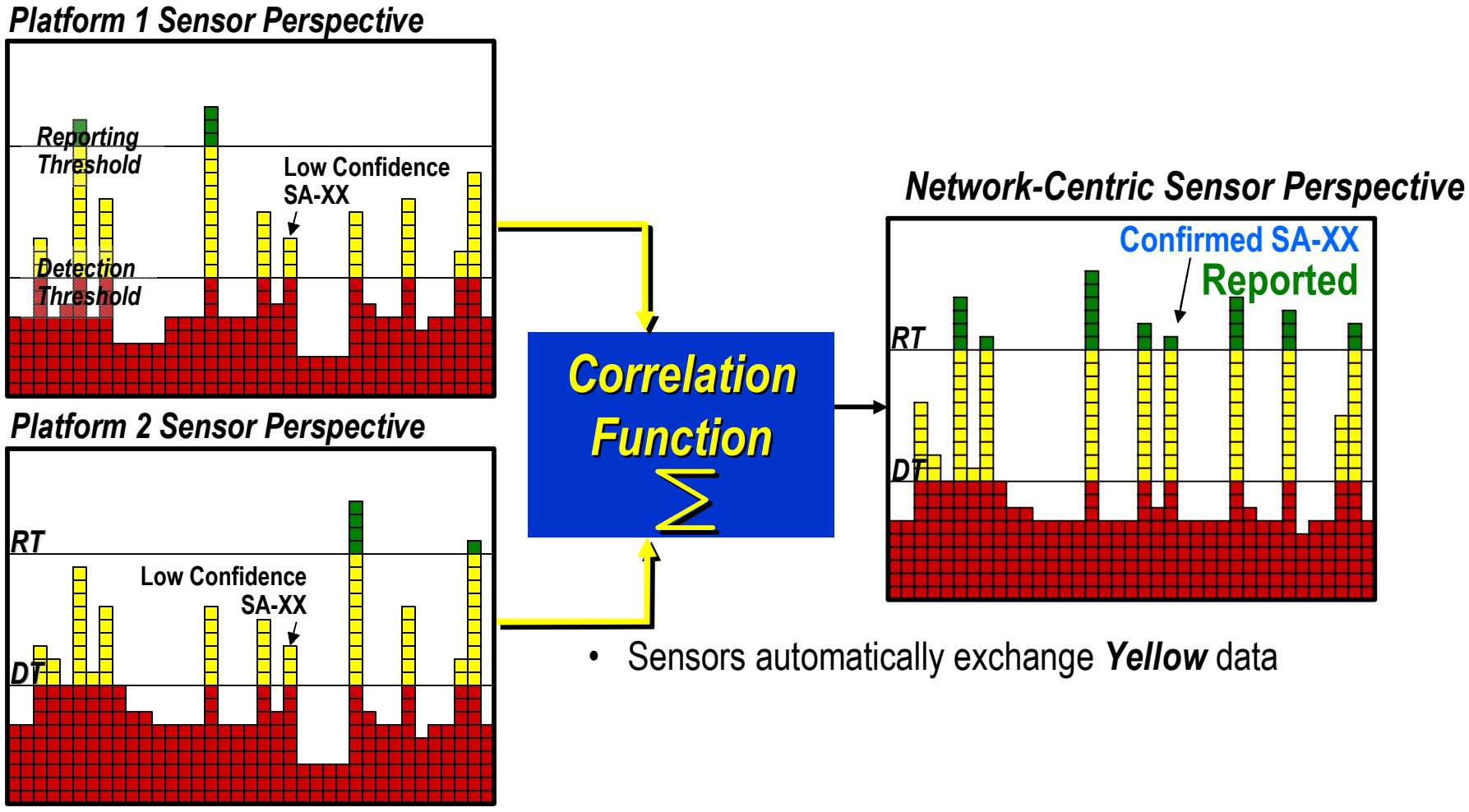
NCCT Networked Platforms



- Networked platforms
- Diverse Sensors / Multi-Int
- Seconds to a few minutes
- Accurate location, even if target is short up-time

NCCT Process Example

Network-Centric Sensing

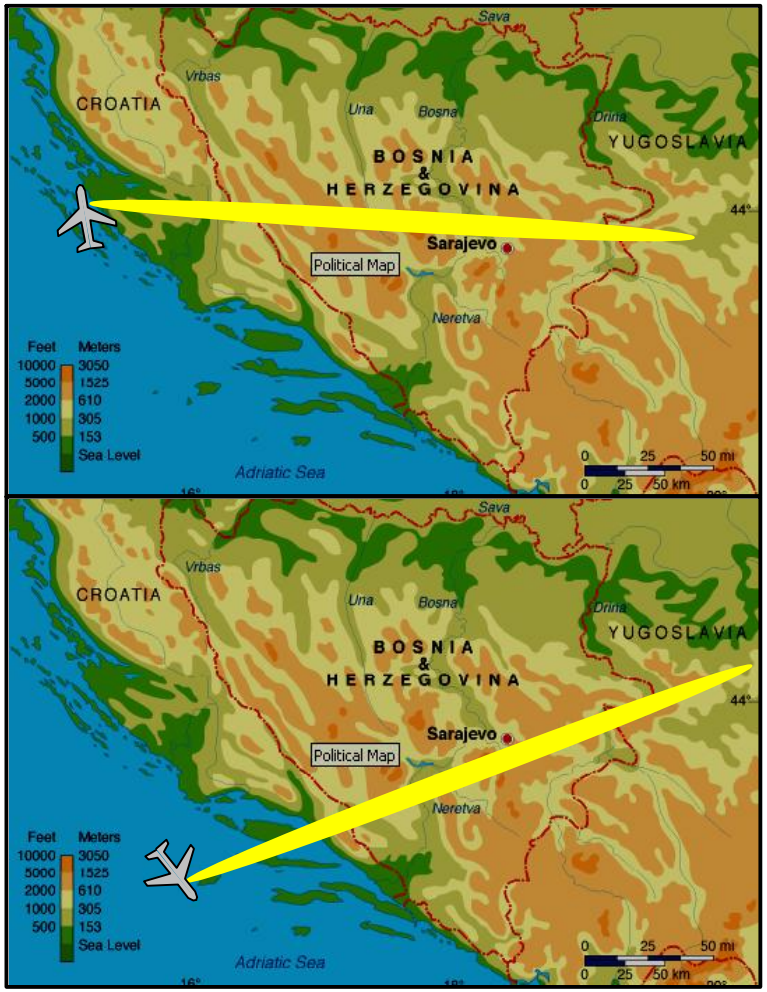


- Sensors automatically exchange ***Yellow*** data

NCCT Creates New Information via Machine-to-machine Ops

NCCT Process Example

Network-Centric Sensing



Both assets work in isolation and each have low confidence data

-Target Never Reported

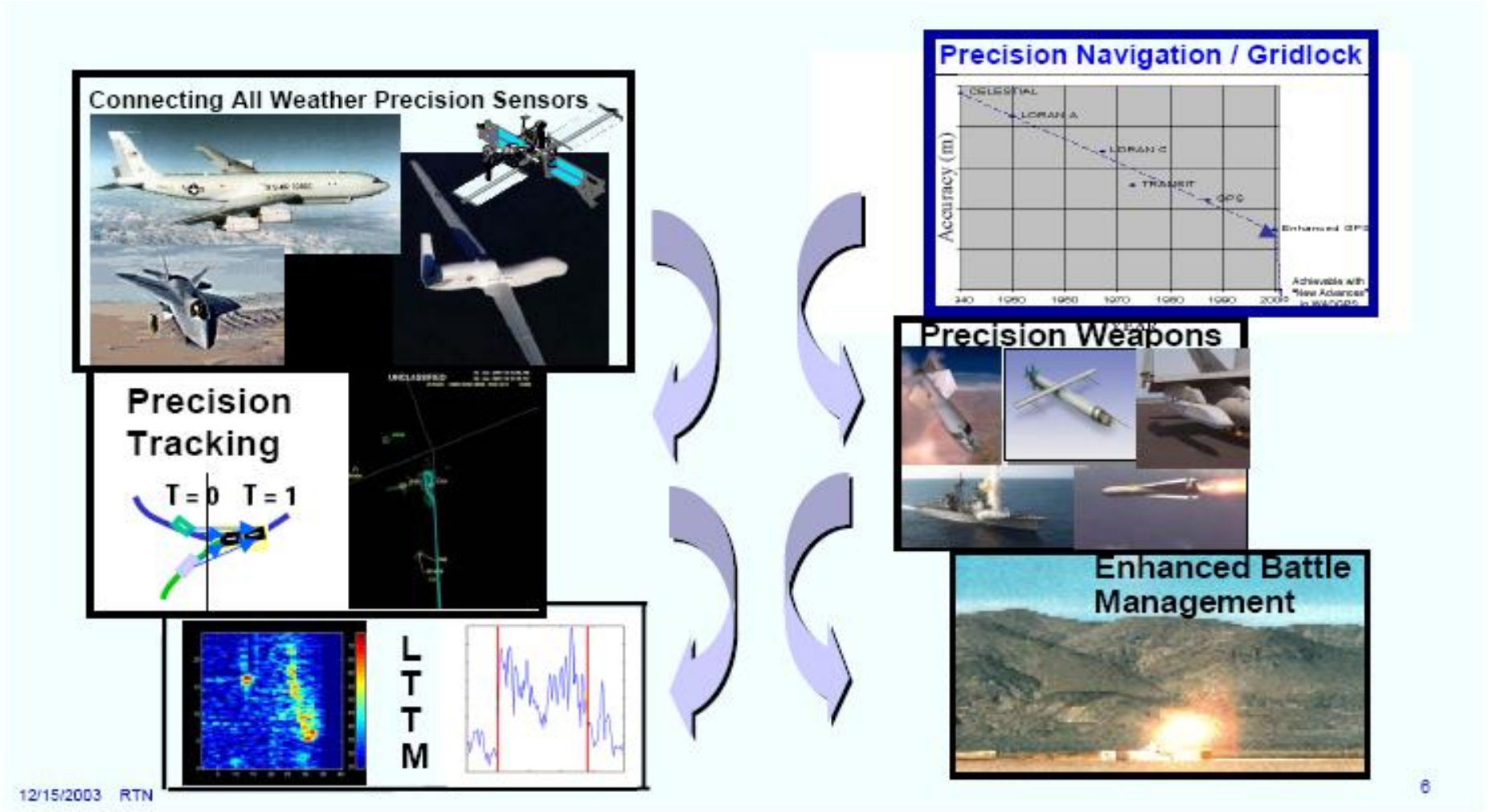
Assets networked jointly collecting

- Shared data focuses & cues collection efforts of all assets
- All new data is correlated
- Low threshold targets no longer slip through the cracks

-Targets are created and reported

AMSTE Program

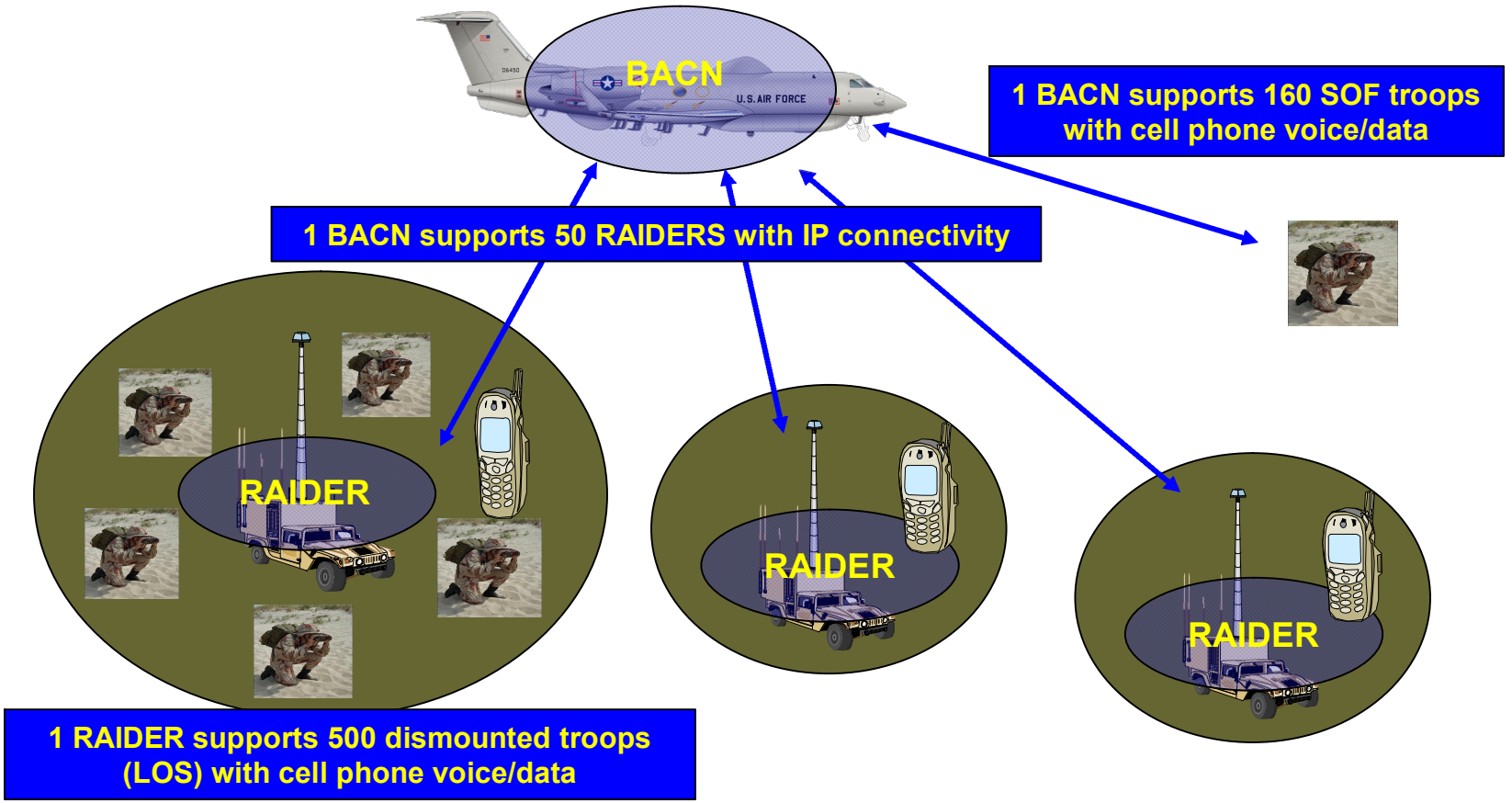
- **Key AMSTE Technology Advancement**



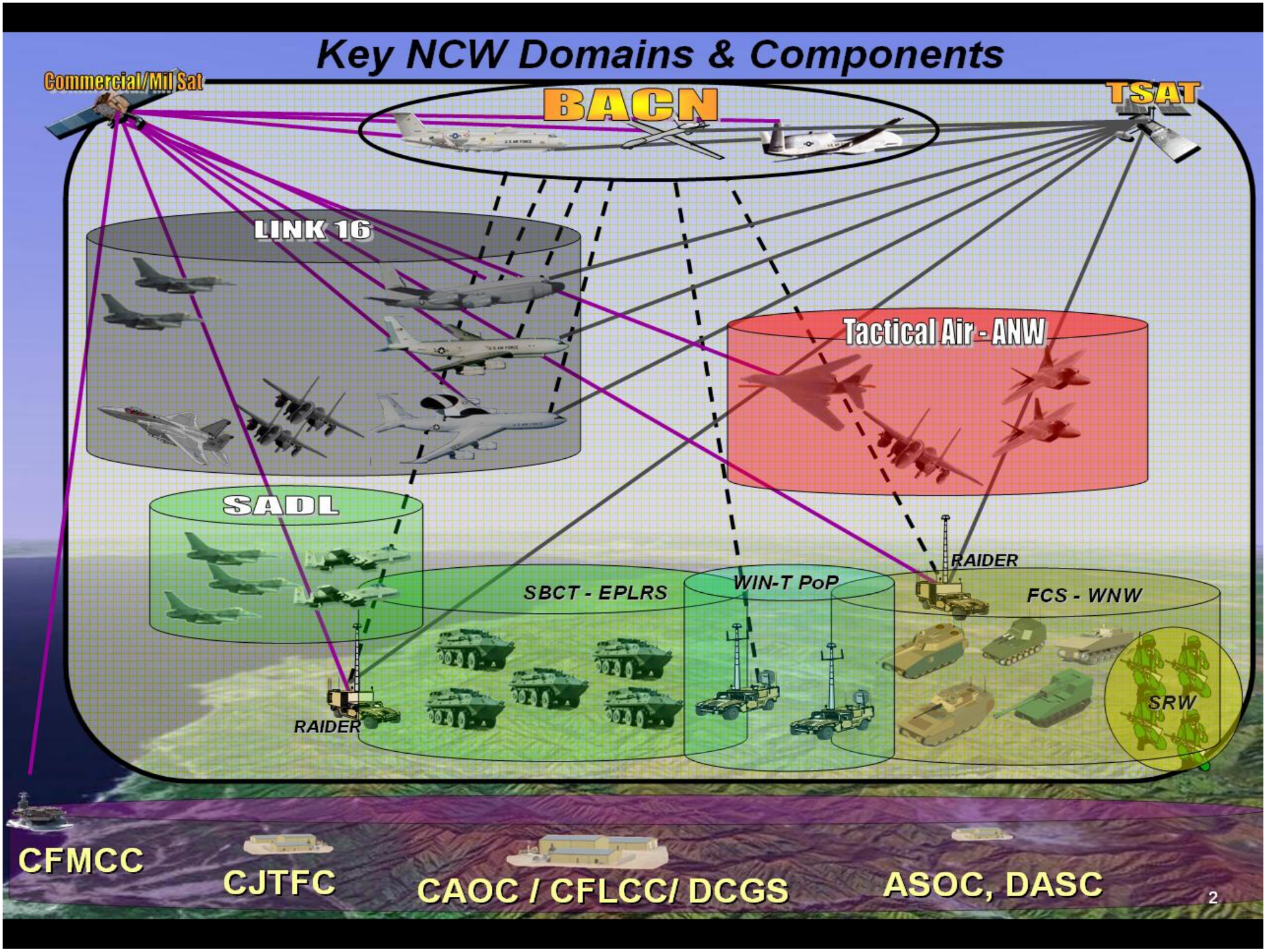
Resultant Fury

BACN & RAIDER…Communications

'Spine'
AF contribution to edge connectivity

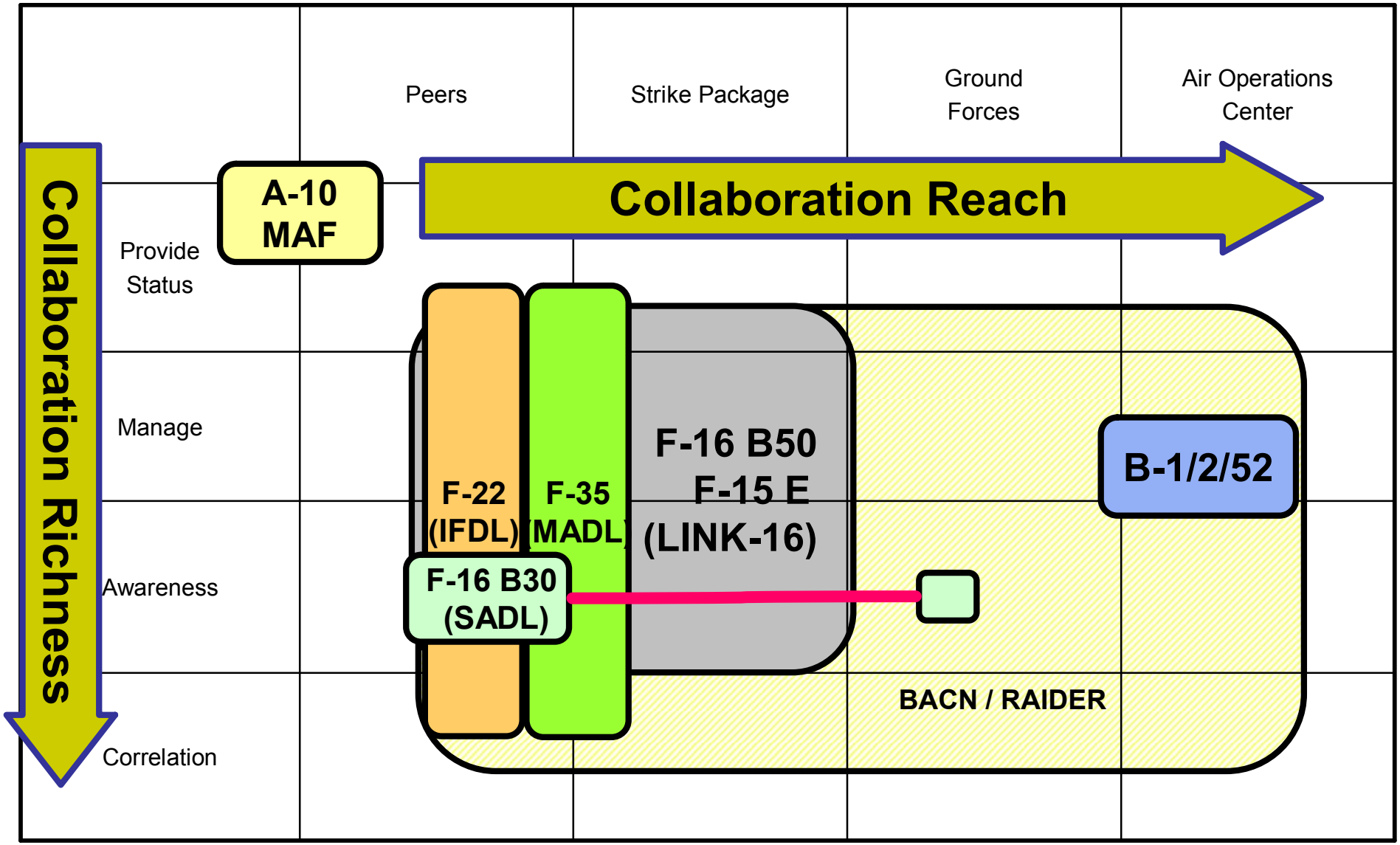


Connect Soldiers, Marines & Battlefield Airmen to GIG

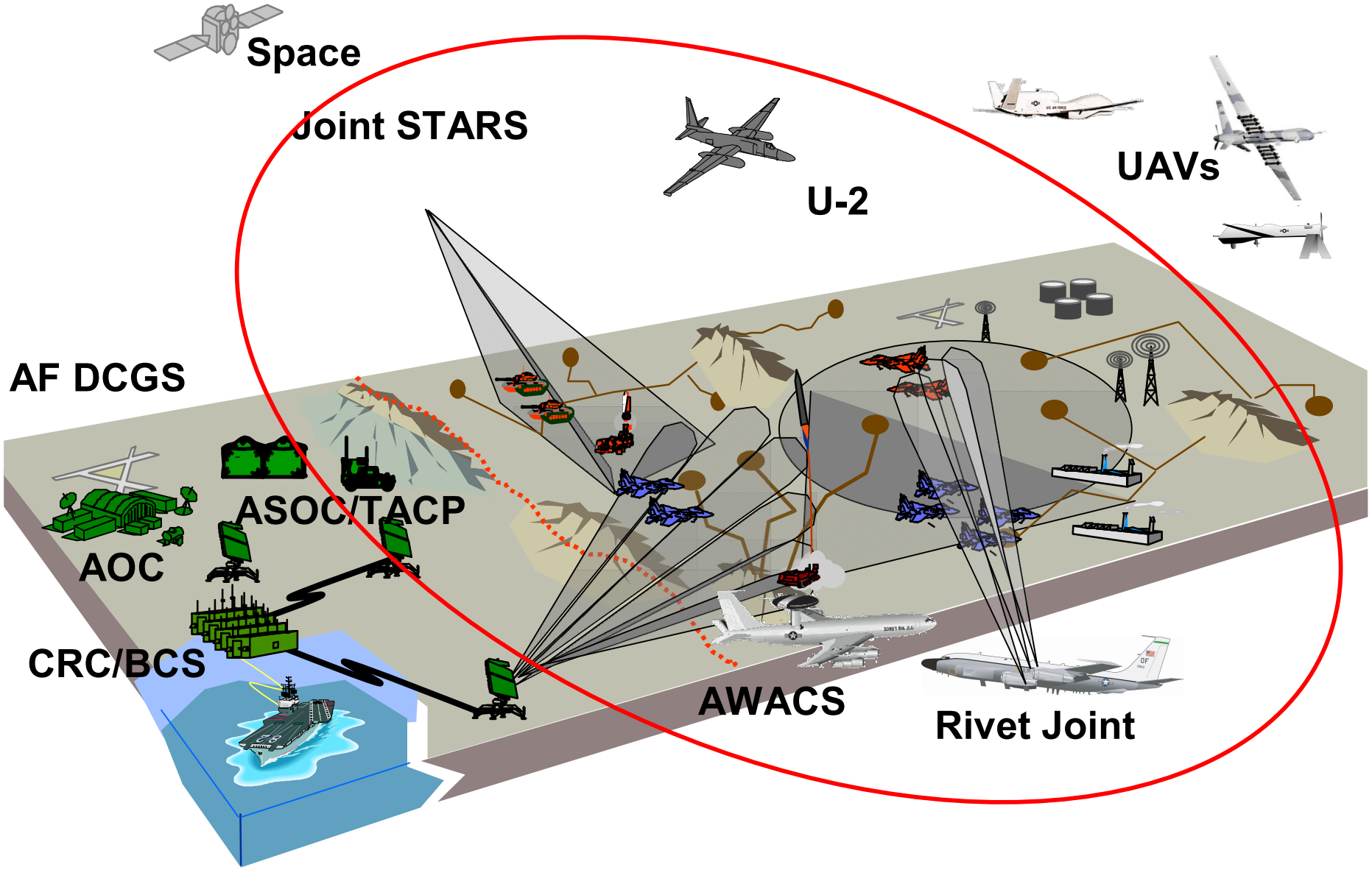

Key NCW Domains & Components
Commercial/Mil Sat
BACN
TSAT
LINK 16
Tactical Air - ANW
SADL
SBCT - EPLRS
WIN-T PoP
RAIDER
FCS - WNW
RAIDER
SRW
CFMCC
CJTFC
CAOC / CFLCC/ DCGS
ASOC, DASC

Current Collaboration Capability

Strike Platforms BACN & RAIDER Allow Better Platform Options



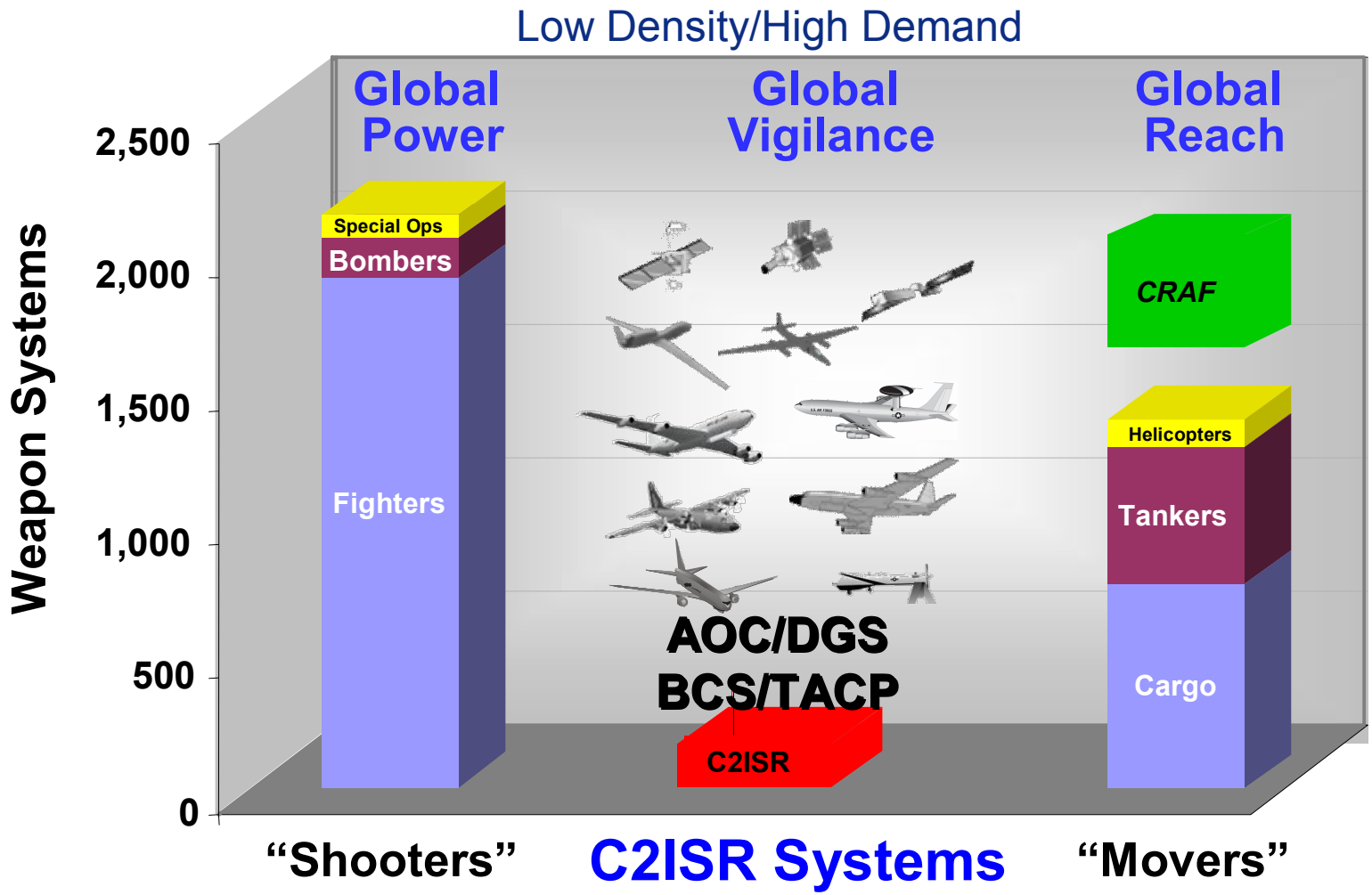
C2ISR Integration



Air Force C2ISR Common HMI

- Enables information sharing across battlespace
- Provides critical battle management functionality
- Enhances operator's situational awareness

C2ISR -- Integral Player for a Winning Team

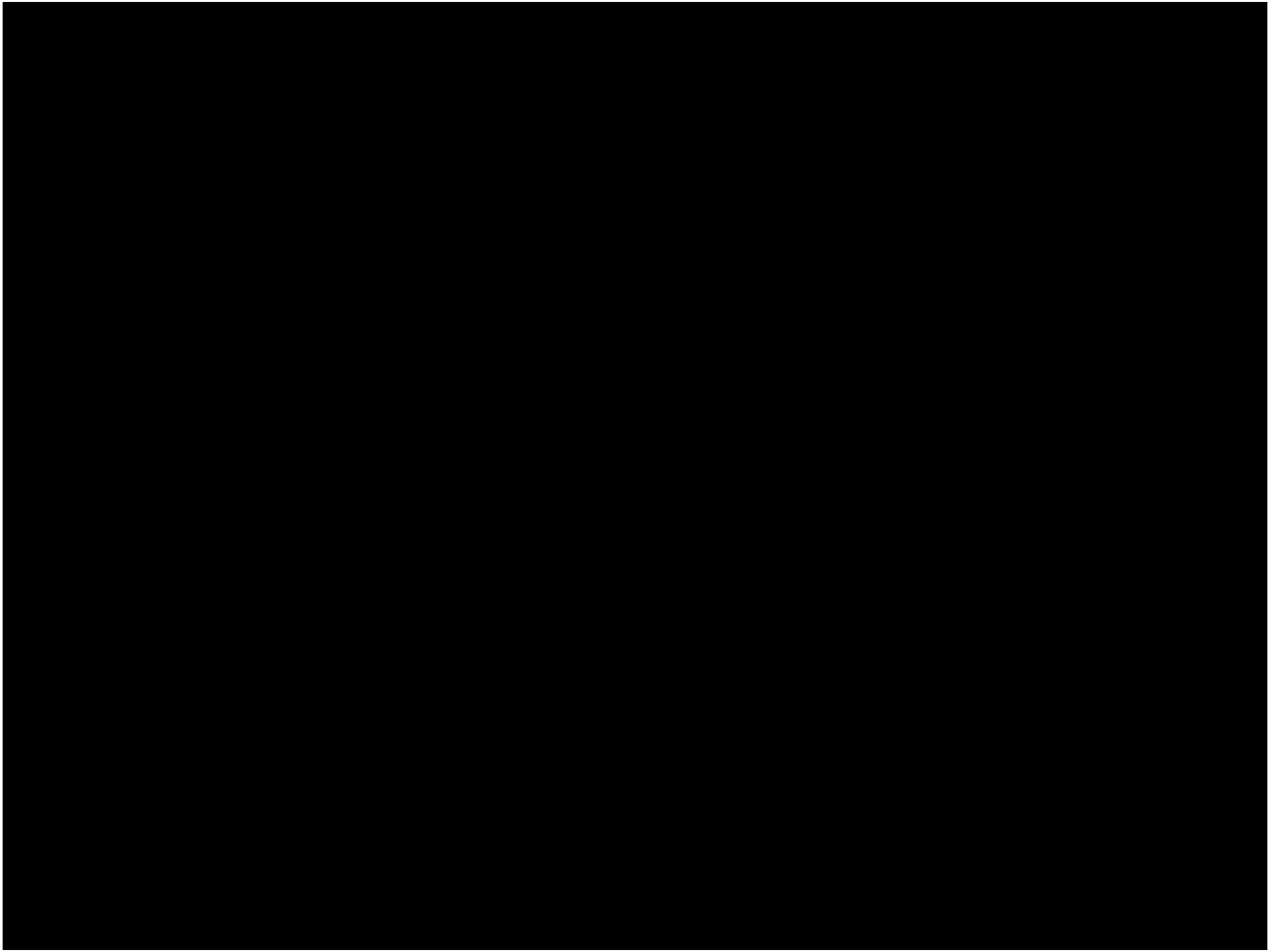


Combatant Commanders Want More Persistent ISR Coverage

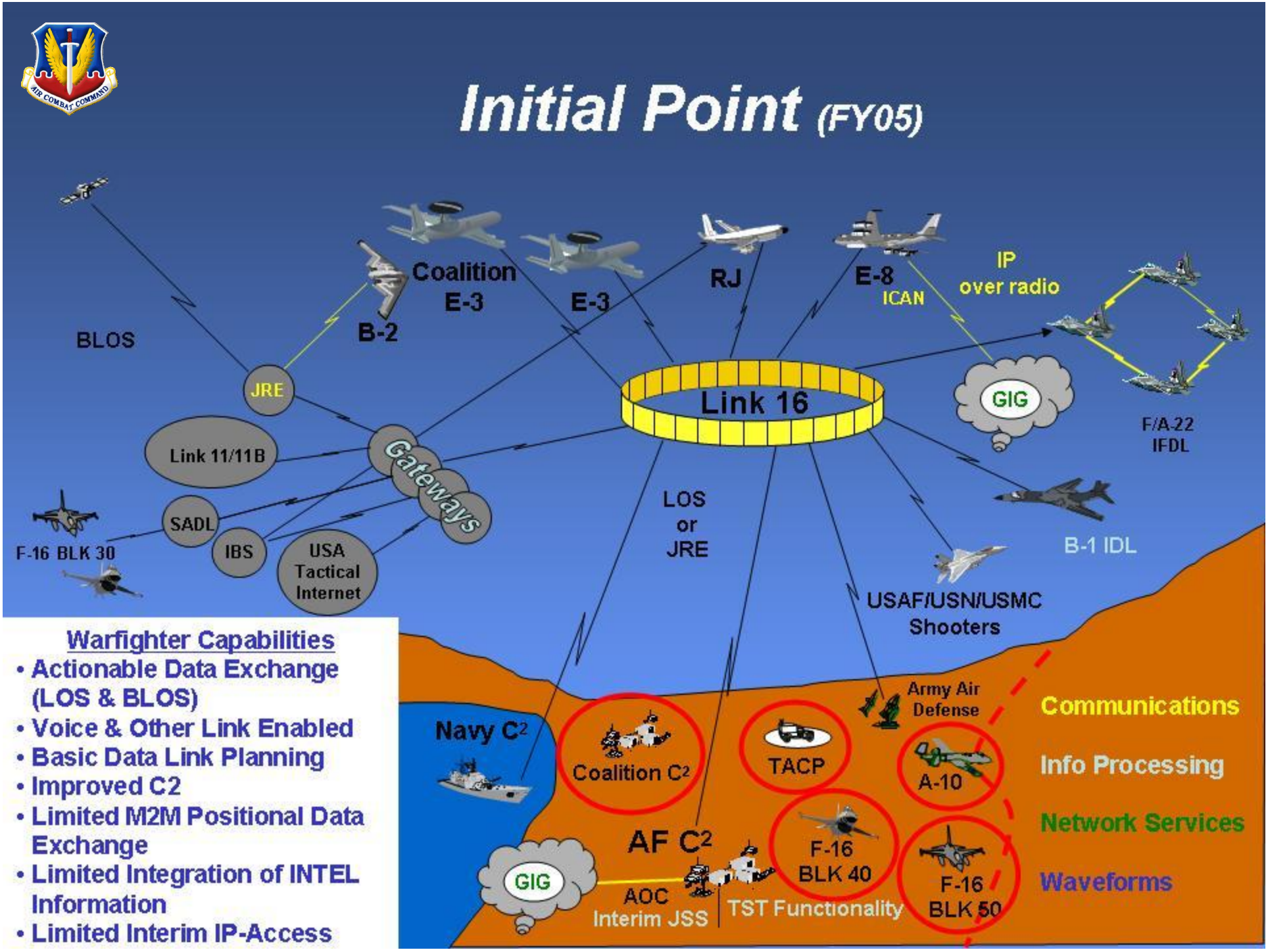
Video

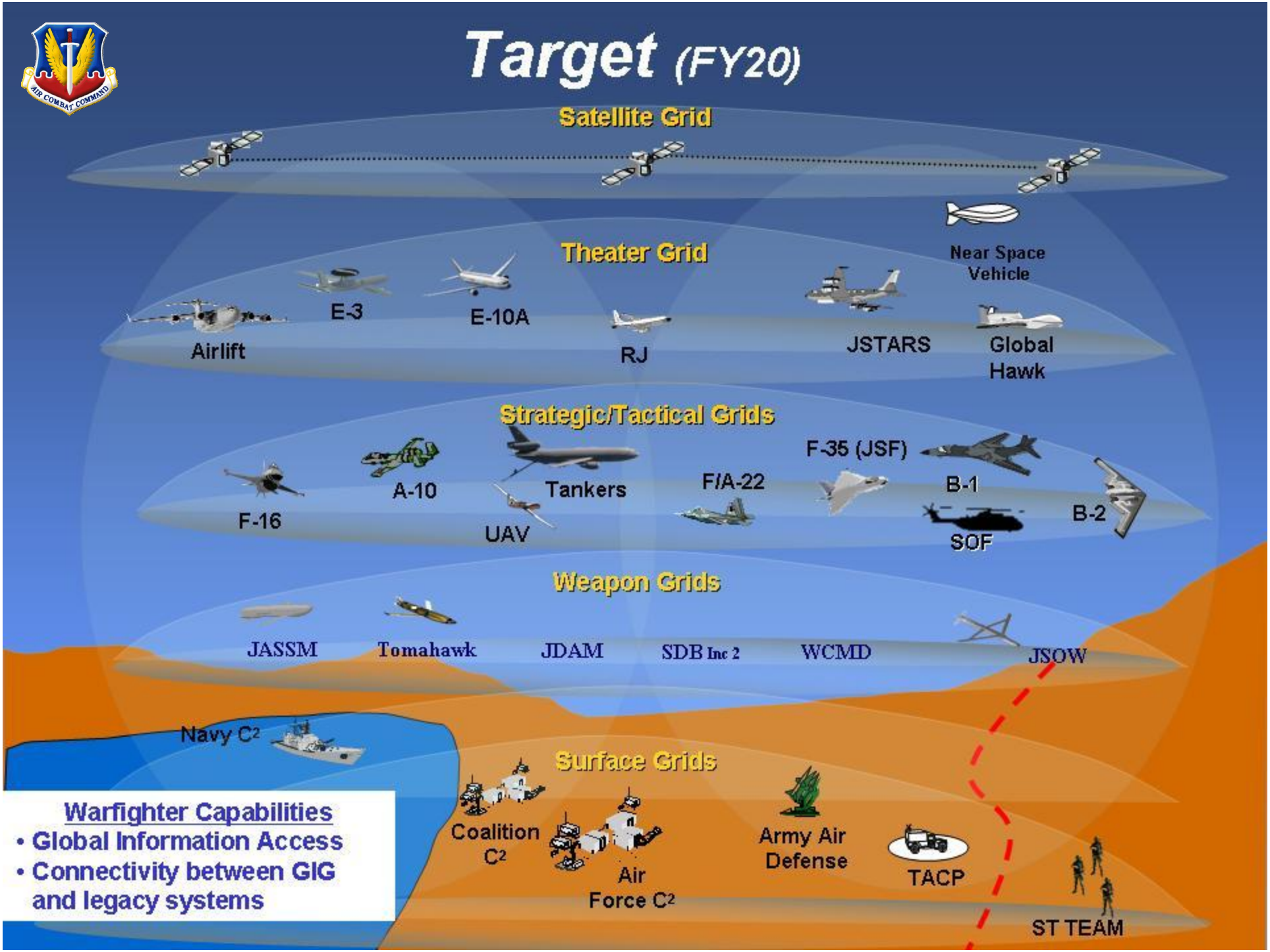
Questions

?



BACK UP SLIDES


Initial Point (FY05)
BLOS
Coalition E-3
B-2
E-3
RJ
E-8
ICAN
IP over radio
JRE
Link 16
GIG
F/A-22 IFDL
Link 11/11B
Gateways
SADL
IBS
USA Tactical Internet
F-16 BLK 30
LOS or JRE
B-1 IDL
USAF/USN/USMC Shooters
Warfighter Capabilities
• Actionable Data Exchange (LOS & BLOS)
• Voice & Other Link Enabled
• Basic Data Link Planning
• Improved C2
• Limited M2M Positional Data Exchange
• Limited Integration of INTEL Information
• Limited Interim IP-Access
Navy C2
Coalition C2
TACP
Army Air Defense
A-10
AF C2
F-16 BLK 40
F-16 BLK 50
GIG
AOC Interim JSS
TST Functionality
Communications
Info Processing
Network Services
Waveforms


Target (FY20)
Satellite Grid
Theater Grid
Near Space Vehicle
E-3
E-10A
Airlift
RJ
JSTARS
Global Hawk
Strategic/Tactical Grids
F-35 (JSF)
A-10
Tankers
F/A-22
B-1
F-16
UAV
SOF
B-2
Weapon Grids
JASSM
Tomahawk
JDAM
SDB Inc 2
WCMD
JSOW
Navy C2
Surface Grids
Coalition C2
Air Force C2
Army Air Defense
TACP
ST TEAM
Warfighter Capabilities
• Global Information Access
• Connectivity between GIG and legacy systems

NCCT Program Overview

- NCCT applies common software applications to change how sensors gather information
  - Software application provides machine-to-machine rules to operate as a collaborative sensor network
  - NCCT rapidly focuses several sensors on common targets simultaneously to get very accurate target information in near-real-time
- Initial Military Utility Assessment (MUA) Completed in JEFX04
- Final MUA Results from Trident Warrior 05 (TW05) Pending
- IOC in 2009 based on Joint STARS Funding in FY08 POM
  - IOC = 5 x RJ, Joint STARS, DCGS, AOC, AOIO
- Prime Integrator: L-3 ComCept, Rockwall, TX

What ICAN Provides

- Provides IP-based Network-Centric connectivity
  - mIRC chat
  - SIPRNET email
  - Joint STARS is the only aircraft with true Mobile IP connectivity in theater
- Seamless extension of Global Grid to weapons and ISR platforms, providing Net-centric capabilities. A standards-based capability that transforms legacy and commercial radio links into an IP network
- Prioritizes all Traffic and Smartly Manages Bandwidth through end-to-end Mission-based QoS

What ICAN Provides

- **A Pathfinder for JTRS and Net-centric warfare. Risk Reduction to Strengthen JTRS Capability; will shorten path to integration, saving Engineering & Development costs**
  - **Move from Voice to a Data Environment**

- **ICAN is an Intelligent Information Manager, Super Smart Router and a Comm Manager.**

- **ICAN will only be as good as the comm it manages but it is surprising the number of "good" things that can be done even with "dial-up rate" links…**

Phase 3 Test – Sep 05 (China Lake)

First TTNT Flight Tests Validated Extensive Analyses, Simulations and Laboratory Tests

No Interference W/ Link-16

Mobile Installation

Fixed Installation

Low Latency < 2msecs

Net Form < 5 Secs.

Missile Control Messages with SLAM-ER Lab Unit Via IP

2 Video-Over-IP Streams

IP YAHOO Chat T-39 Screen

2.25Mbps Data Rate

Network Awareness

T-39 Installation

Video