Unmanned Aircraft Systems

20 April 2010
Mr. Dyke Weatherington
Deputy Director, Unmanned Warfare
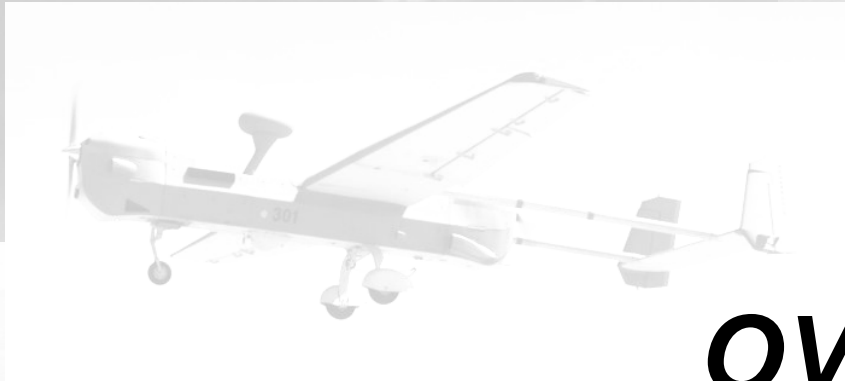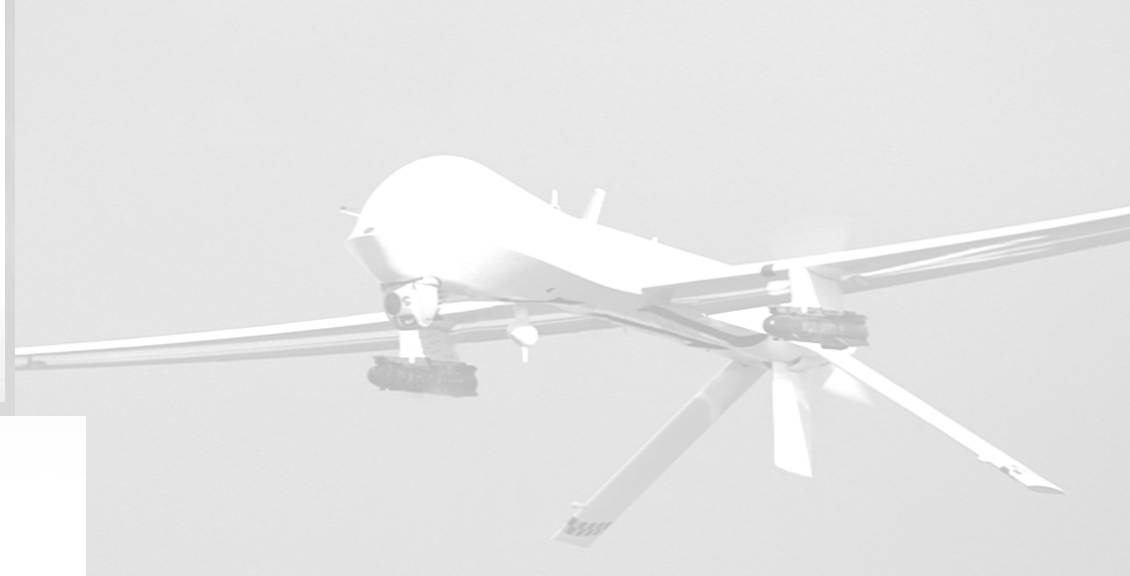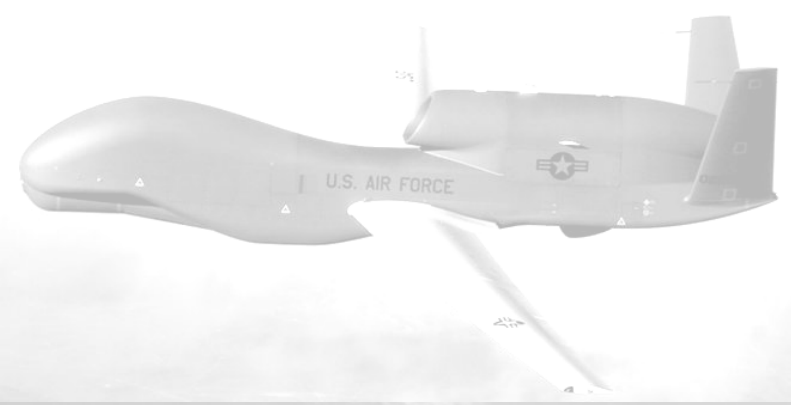*OUSD(AT&L)/PSA*

Outline

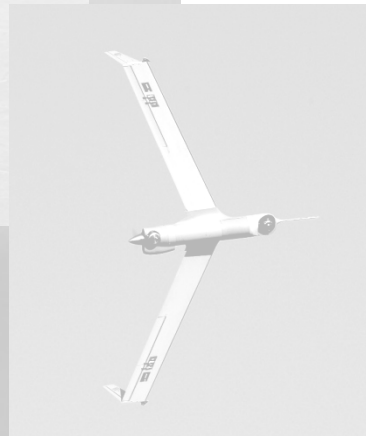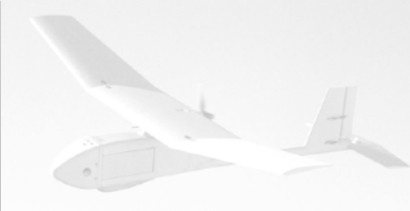- **DoD UAS Overview**
- **Acquisition Issues**
  - Rapid Acquisition in the Defense Acquisition System
  - Defense Science Board Recommendations
- **Operational Issues**
  - Airspace Integration
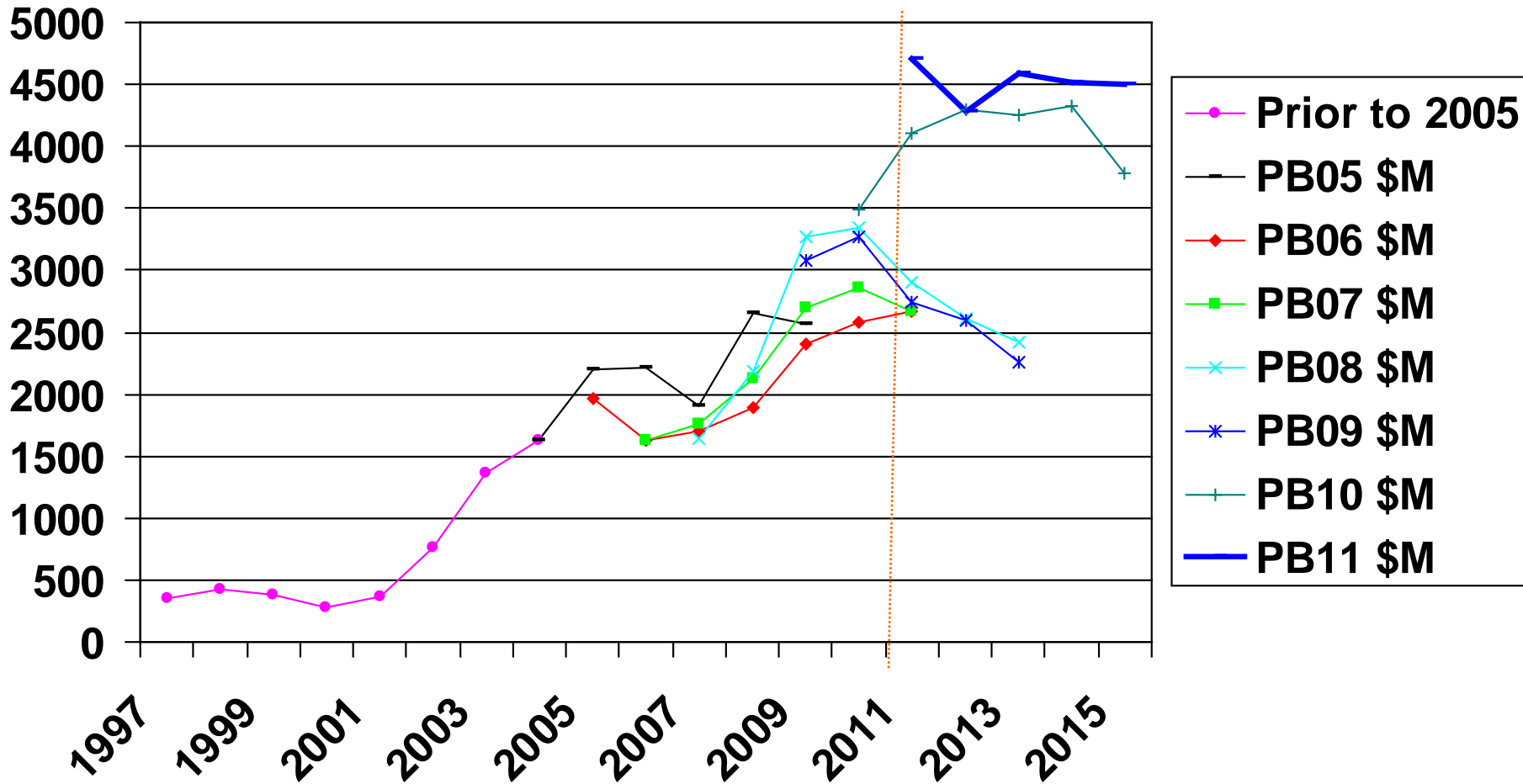 - Data Link Encryption
  - Commonality
  - Interoperability

OVERVIEW

DoD UAS Funding
(RDT&E and Procurement)

PB 10 included $189M through the FYDP for UAS Airspace Integration

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UAS Group Categorization

UAS Categories by Payload and Radius
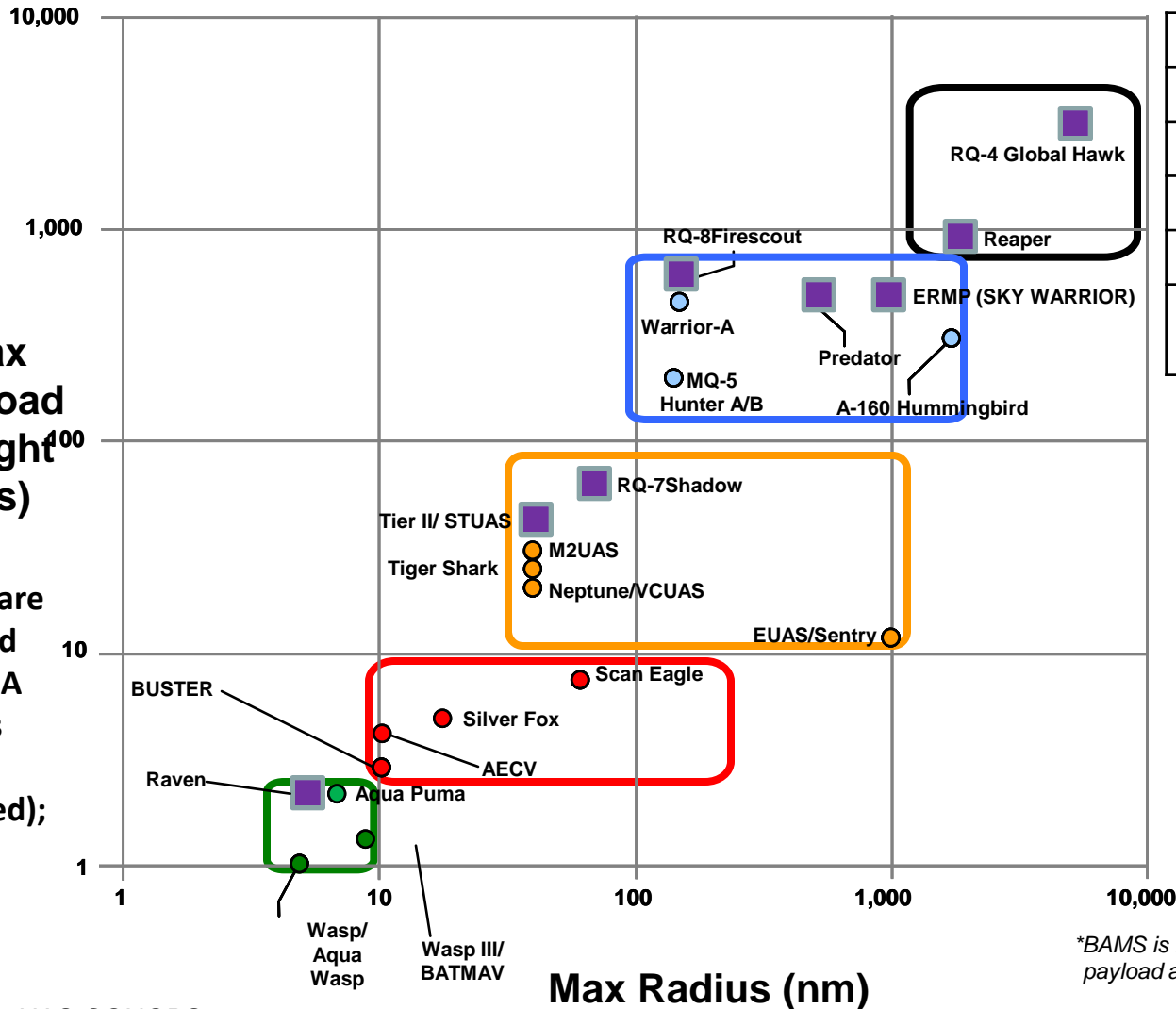
Group	Flight Hours	
2	67551	15%
3	100,831	22%
4	254,412	55%
5	39,269	8%
FY09 Total	462064	100%

Max Payload Weight (lbs)

Max Radius (nm)

UAS Groups are constructed based on UA attributes (Altitude, Weight, Speed);

Chart labels: RQ-4 Global Hawk, RQ-8 Firescout, Reaper, Warrior-A, ERMP (SKY WARRIOR), Predator, MQ-5 Hunter A/B, A-160 Hummingbird, RQ-7 Shadow, Tier II/ STUAS, Tiger Shark, M2UAS, Neptune/VCUAS, EUAS/Sentry, Scan Eagle, BUSTER, Silver Fox, AECV, Raven, Aqua Puma, Wasp/Aqua Wasp, Wasp III/BATMAV

Legend:
- ■ - Program of Record (planned Program of Record)
- □ - Group 5 UAS
- □ - Group 4 UAS
- □ - Group 3 UAS
- □ - Group 2 UAS
- □ - Group 1 UAS

BAMS is not shown as final threshold max payload and mission radius are still TBD.

Ref: Joint UAS CONOPS, ver. 2

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DoD UAS Flight Hours
(By Department, By Fiscal Year)
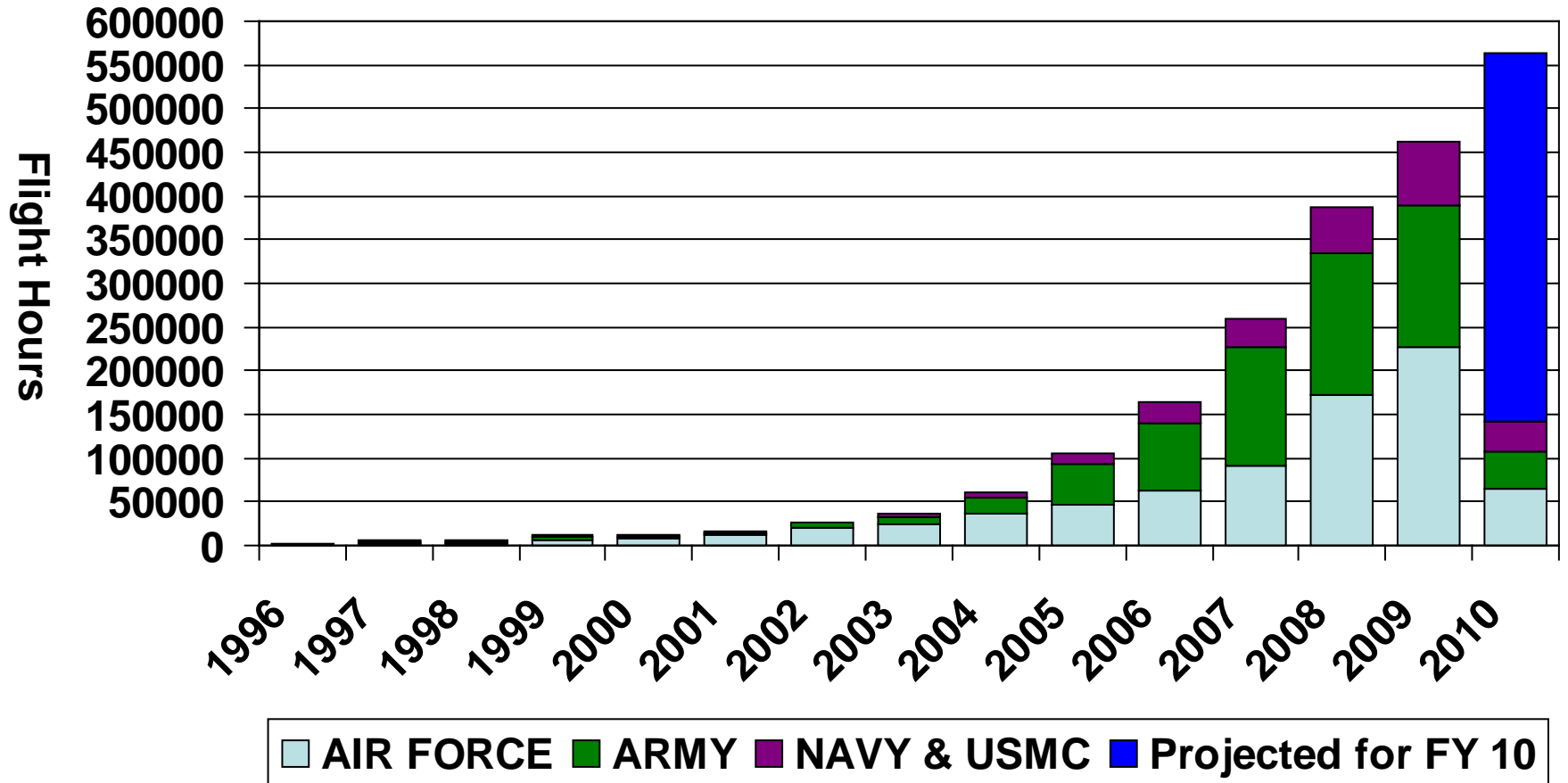
Does not include Group 1-2 UAS

DoD UAS Activities
Current and Projected Through FY11

Status
● Current UAS Activities
● Future UAS Activities

ARMY
AIR FORCE
NAVY/MARINES
USSOCOM

McChord (W,R)
Ft Lewis (S,W,R)
Arlington, OR (SE)
Portland (W,R)
Limestone Hills (W,R)
Grand Forks AFB (P,GH)
Camp Ripley (S)
Mt Washington (W,R)
Ft Drum (S,P)
Lake Oneida (Rascal)
Syracuse (Reaper)
Beale AFB (GH)
Camp Williams (W,R)
Moffett (RMAX)
Dugway (H,S)
Vandenberg (W,R)
Ft Ord (RMAX)
Creech AFB (P, Reaper)
Ft Carson (S,W,R)
USAFA (V_3,S)
Ft Riley (S)
Indiantown Gap(S)
Lakehurst (Spyder)
Camp Atterbury (T)
Camp Dawson (W,R)
NAS Pax River (GH-B)
Kenova (W,R)
A.P.Hill (RMAX,W,)
Ft Story (W,R,Pu,S)
Louisville (W,R)
Ft Eustis (Vigilante)
Fentress (R,W,Pu)
Pinon (R)
Blue Grass Station (W,R)
Ft Knox (S,W,R)
Camp Roberts (W,R)
El Mirage (War)
Ft Irwin
Santa Fe (R)
Blackstone (S)
MCAS Cherry Point (S,W,R)
Simi (R)
Victorville (A160, R)
Pope (W,R)
Ft Campbell (S,W,R)
Patriot (W,R,Pu,S)
Ft Bragg (R)
NAS Pt. Mugu (GH-B)
Camp Pendleton (W,R)
Laguna (gMAV)
Cannon AFB (P, Reaper)
29 Palms (S,R)
Redstone (S,W,R)
Shaw (W,R)
Silver Strand (W,R,Pu)
Camp Morena (W,R)
Holloman AFB (P, Reaper)
Robbins AFB (P)
Ft McClellan (W,R)
Palmdale (GH)
Imperial Beach(W,R)
Ft Worth (R)
Camp Shelby (W,R,S)
Benning (S)
Evans (S)
Cochise (H-1/3)
Choctaw (W,R,Pu,S)
Wright (H)
Huachuca (War-1)
Ft Polk (R)
Eglin (W,R)
Robert Gray (H)
Stennis (W,R,Pu)
Hurlburt (W,R)
Camp Blanding (W,R)
Trent Lott (Fire Scout)
Camp Bullis (W,R)
Okeechobee (R)
Homestead (W,R)
Key West (W,R)

B-BAMS
H-Hunter
R- Raven
S-Shadow
GH –Global Hawk
P- Predator
War- Warrior
W – Wasp
Pu - Puma-AE
SE – Scan Eagle
T – Tiger Moth
V_3 - Viking 300

SUA
Restricted
Waning

0 50 100   200   300   400   500   Nautical Miles

7

UAS Airspace Integration Department-Wide Teaming Efforts

NORTHCOM
- Plans, organizes and executes HD and DSCA
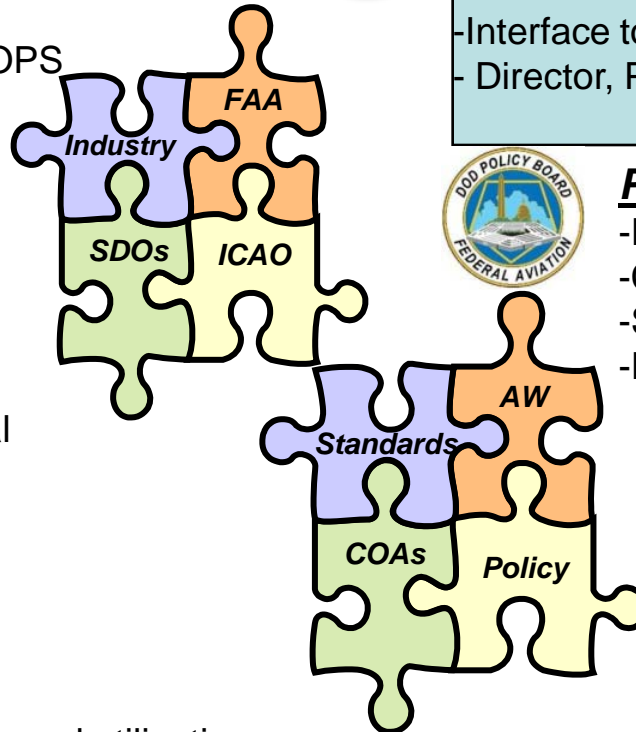- Consolidate interagency CONOPS

OUSD (AT&L) / UAS TF
- Sets objectives
- Coordinate/integrate activities
- Provide funding for Department-wide activities
- Interface to UAS development activities
- Director, PSA is UAS Executive Committee Principal

JFCOM
- Provides joint-capable forces
- Develop and integrate joint, interagency, and multinational capabilities

PBFA
- Primary OPR for policy/procedural issues
- Coordinates DoD policy with FAA
- Serves as DoD liaison with DoT
- Executive Director is UAS Executive Committee Principal

Services/SOCOM
- Engaged in all phases of development, operations, sustainment
- Airworthiness certification
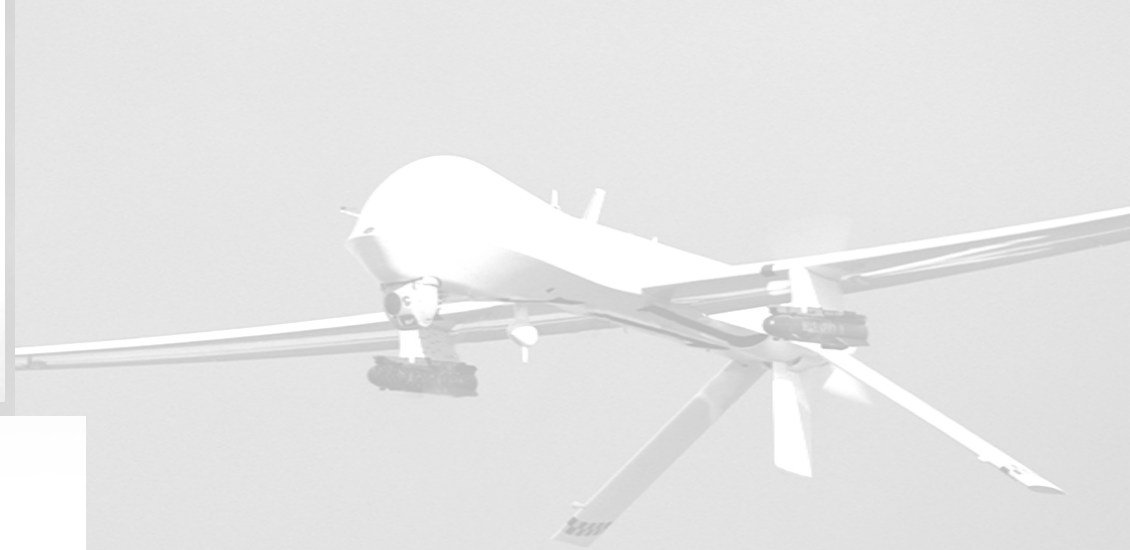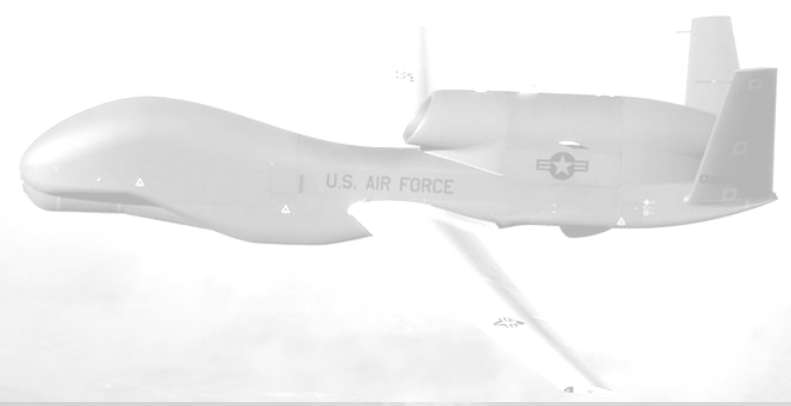- Aircrew training

JCOE
- Optimize UAS capabilities and utilization
- Develop and integrate common UAS operating standards, capabilities, concepts, technologies, doctrine, tactics, techniques, procedures, and training
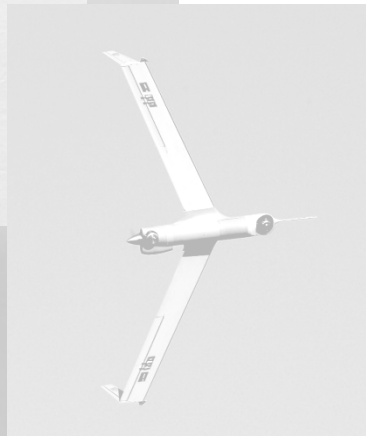
Puzzle pieces: Industry, FAA, SDOs, ICAO, Standards, AW, COAs, Policy

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ACQUISITION ISSUES

DoDI 5000.02p
The Defense Acquisition System

Myths

- *"The 5000-process is too slow"*

- *"The 5000-process requires competition… that will only slow us down."*
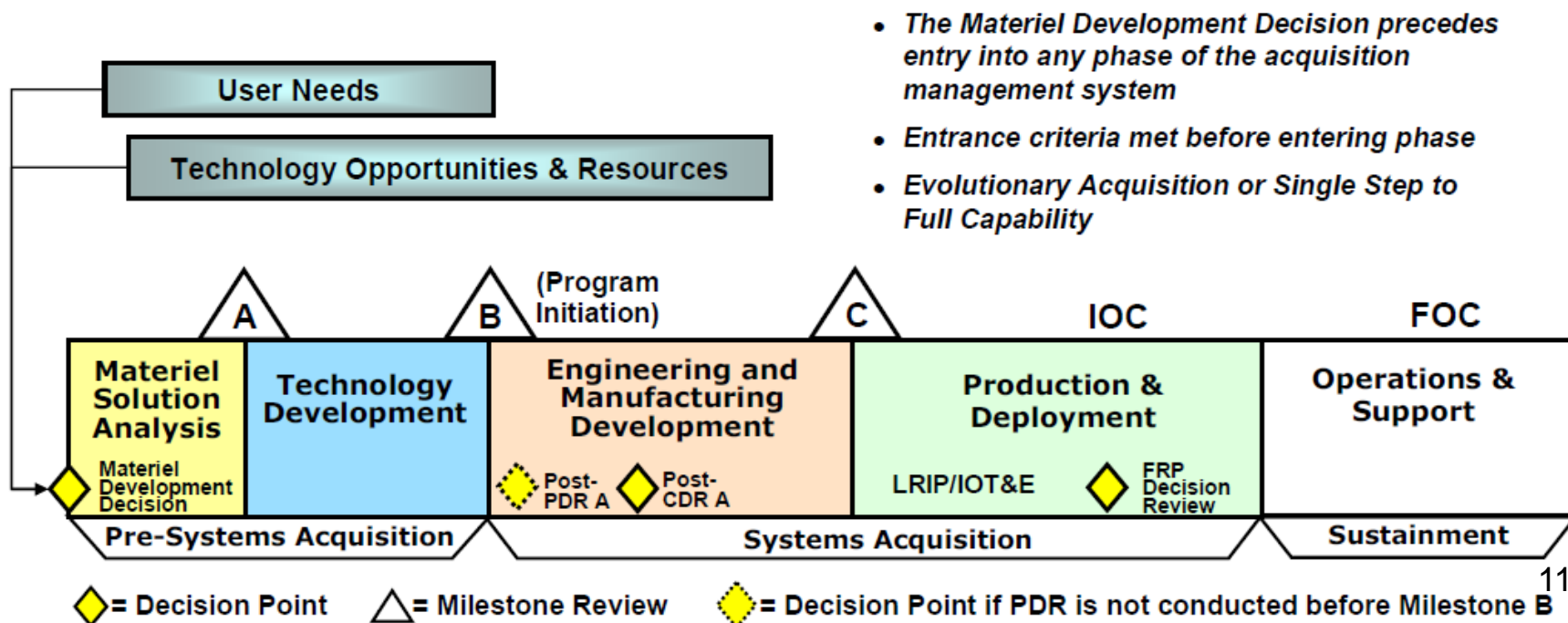
Realities

- All regulatory steps (not mandated by law) are tailorable in the DoD 5000 process.

- Based on maturity of the system/technology, the system can enter the process at any phase.

- Often, timelines are driven more by funding and requirements generation than acquisition.

- Requirement for a sole-source justification for acquisitions is driven by law, in the CFAR.

Challenges to Normalizing Rapid Acquisition

- Funding sources not indentified across the FYDP

- Requirements are subjective and may change significantly

- Absence of a rigorous sustainment plan

- The Materiel Development Decision precedes entry into any phase of the acquisition management system
- Entrance criteria met before entering phase
- Evolutionary Acquisition or Single Step to Full Capability

User Needs

Technology Opportunities & Resources

A   B (Program Initiation)   C   IOC   FOC

| Materiel Solution Analysis | Technology Development | Engineering and Manufacturing Development | Production & Deployment | Operations & Support |

Materiel Development Decision

Post-PDR A   Post-CDR A   LRIP/IOT&E   FRP Decision Review

Pre-Systems Acquisition   Systems Acquisition   Sustainment

◆ = Decision Point   △ = Milestone Review   ◆ = Decision Point if PDR is not conducted before Milestone B

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Defense Science Board Report Terms of Reference

Report of the
Defense Science Board
Task Force on the

Fulfillment of Urgent Operational Needs

July 2009

Office of the Under Secretary of Defense
For Acquisition, Technology, and Logistics
Washington, D.C. 20301-3140

- Evaluate effectiveness of the procedures to generate, validate and fulfill warfighter requirements through the urgent operational need processes (UON/JUON)

- Evaluate extent JUONs are used to avoid Service-specific UONs and acquisition processes or to document non-urgent capability

- Evaluate extent joint acquisition entities maintain oversight once a Military Department of Defense Agency has been designated to execute and field the capability

Defense Science Board Report Findings

- All DoD needs can not be met by the same acquisition processes.

- Rapid is countercultural and will be under supported in traditional organizations.

- Any response must be based on proven technology and robust manufacturing processes.

- Current approaches to implement rapid responses to urgent needs are not sustainable.

- An integrated triage process is needed.

- Institutional barriers – people, funding, and processes – are powerful inhibitors to successful rapid acquisition and fielding of new capabilities.
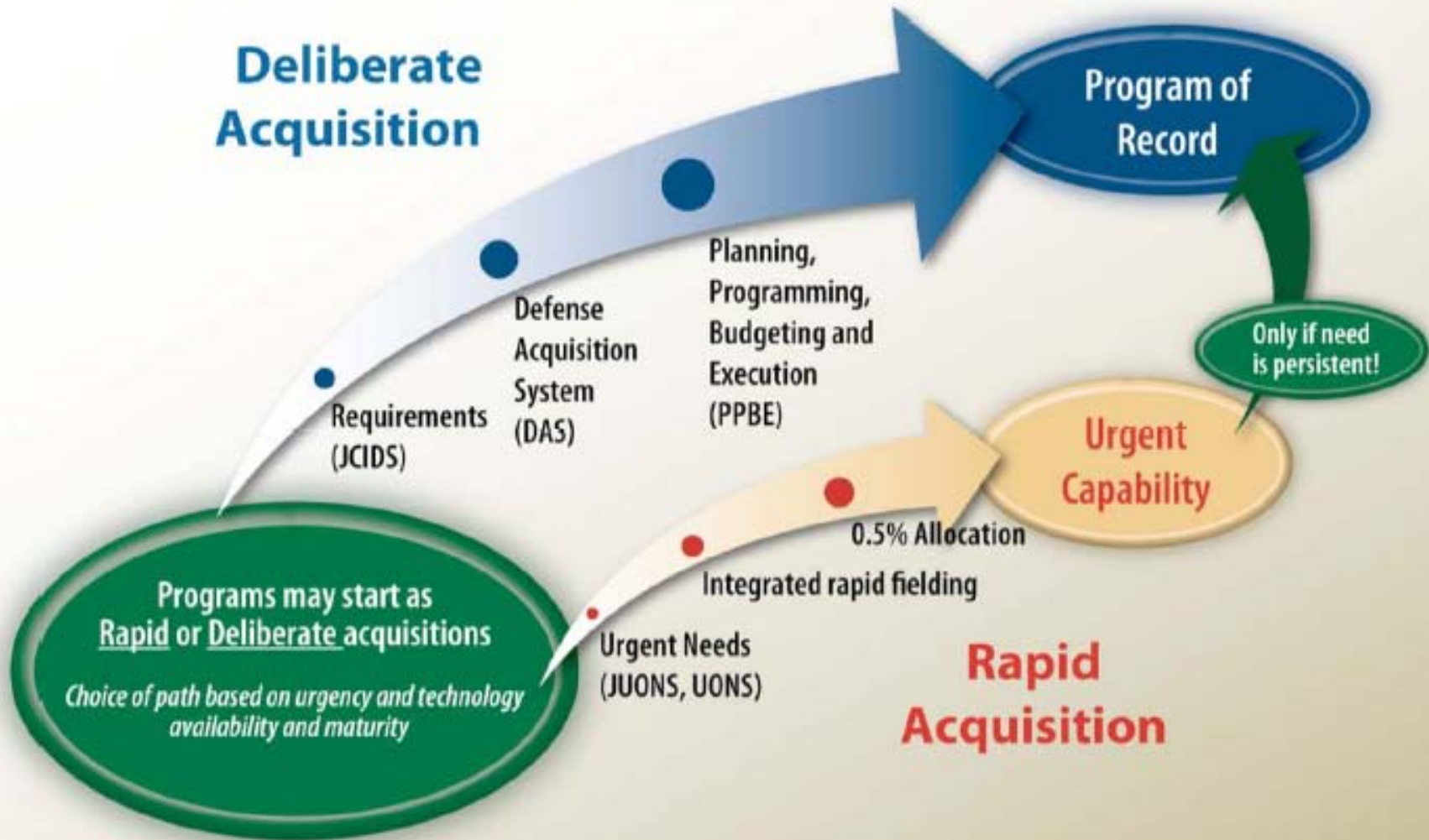
Defense Science Board Report Recommendations

- Formalize a dual acquisition path.

- Establish a fund for rapid acquisition.

- Establish a new agency: the Rapid Acquisition and Fielding Agency within OUSD(AT&L).

- Establish a streamlined, integrated approach for rapid acquisition.

# *Defense Science Board Report Proposed Dual Acquisition Path*

Deliberate Acquisition

Program of Record

Requirements (JCIDS)

Defense Acquisition System (DAS)

Planning, Programming, Budgeting and Execution (PPBE)

Only if need is persistent!

Urgent Capability

0.5% Allocation

Integrated rapid fielding

Programs may start as Rapid or Deliberate acquisitions

Choice of path based on urgency and technology availability and maturity

Urgent Needs (JUONS, UONS)

Rapid Acquisition

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USD(AT&L) Rapid Acquisition Initiatives

- ## Draft Decision Type Memorandum (DTM):
    - Develops policy and procedures governing rapid acquisition process
    - Establishes necessary Service and COCOM actions and limits to resolve UONs
    - Establishes a Rapid Acquisition Fund and management responsibilities
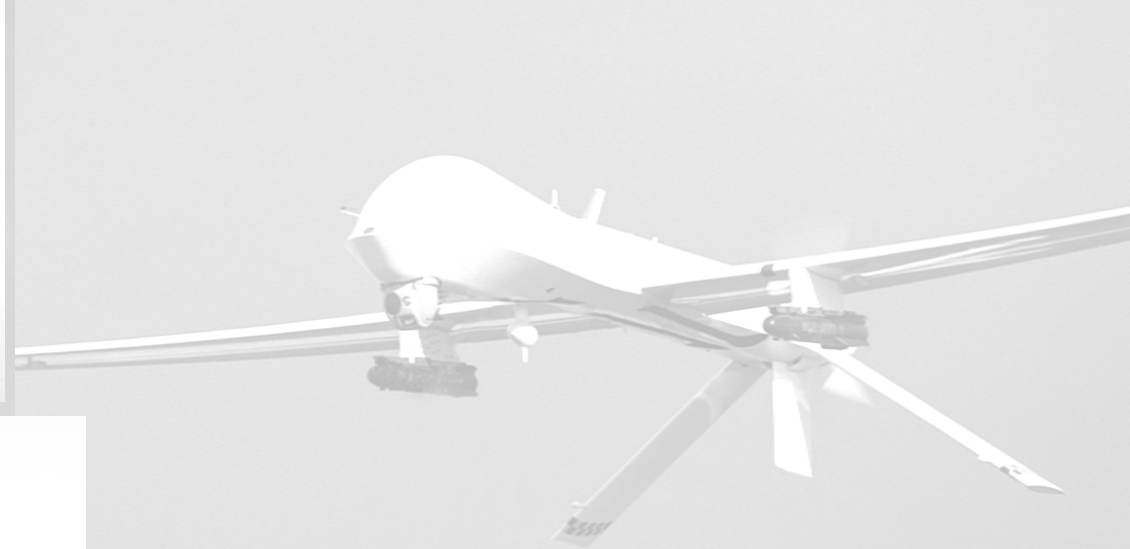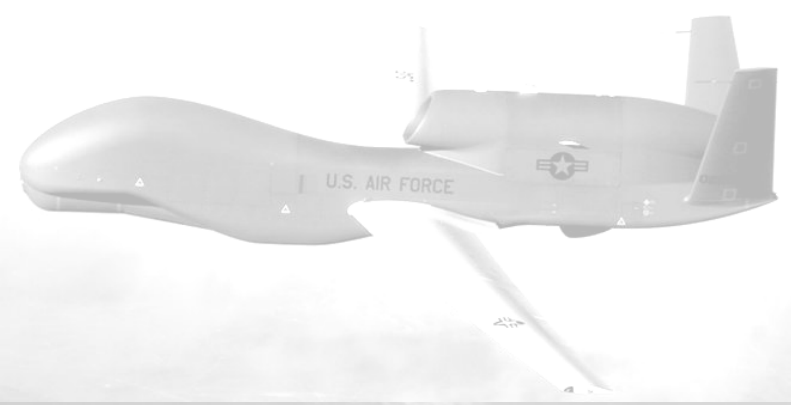
OPERATIONAL ISSUES
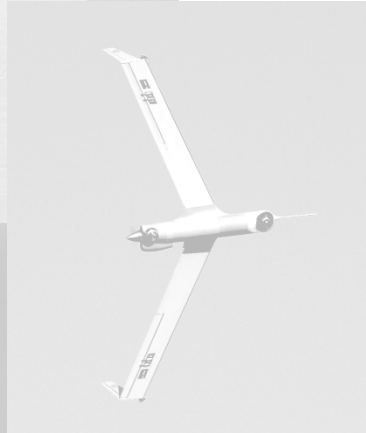
Airspace Integration Foundational Activities Overview

- **Airworthiness**
  - Update MIL-HDBK-516 to address gaps for DoD UAS certification

- **Pilot/Operator Qualifications**
  - Military Departments develop/implement training syllabi/standards
  - DoD instruction (CJCS3711) provides qualification targets
 - Service validation activities evaluate effectiveness and adjust curriculum

- **Regulatory Compliance**
  - Procedural
    - Class D/G operational procedures
    - Blanket Certificates of Authorization (COAs) / COA Reform
    - ATC standard phraseology/terminology
    - Lost link / Divert / Recovery guidelines
    - Self Separation / Collision Avoidance criteria
    - Operating area rules
  - Materiel
    - Ground Based Sense and Avoid (GBSAA)
    - Airborne Sense and Avoid (ABSAA)
    - SAA Displays
    - Maneuver algorithms
    - Weather Avoidance
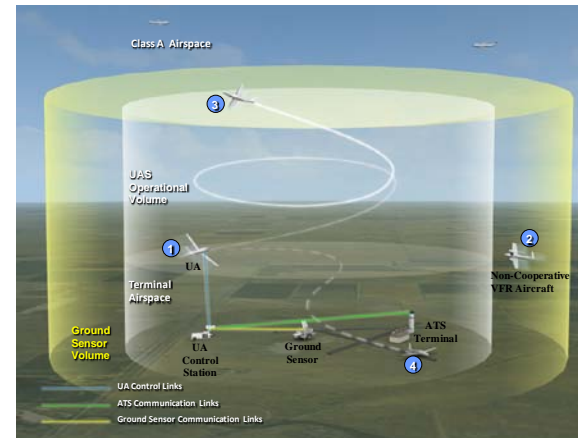   - Auto-Takeoff / Auto-Land
    - Other

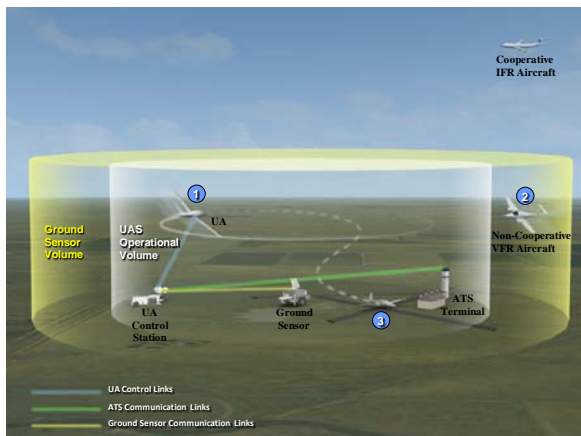# *Incremental DoD NAS Access Strategy*
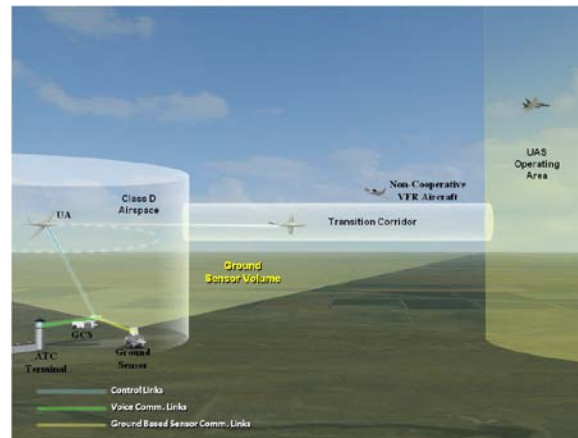## *UAS Access Profiles*

Line-of-Sight Operations
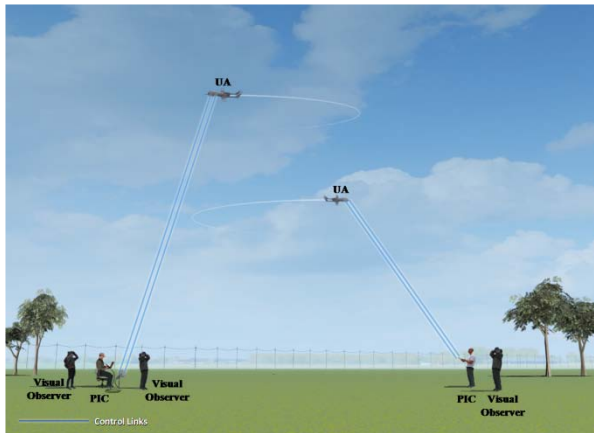
Terminal Area Operations

Vertical Transit Operations

Lateral Transit Operations

Dynamic Operations

19
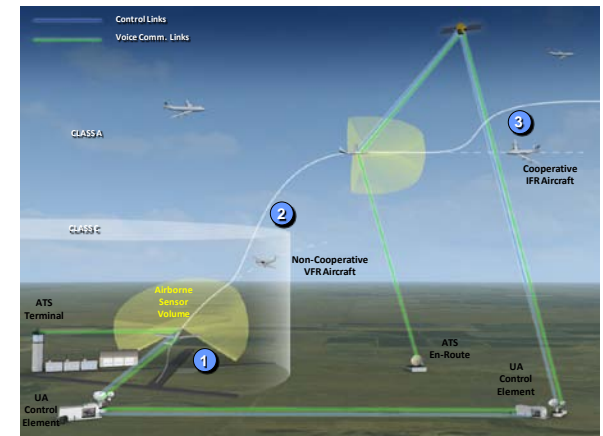
UAS Data Link Protection / Encryption

Video
Metadata
Platform Control
Sensor Control
Platform Control
Sensor Control
Video
Metadata

Remote Ground Control Station

BLOS

Deny Access

Digital Links vs Analog Signals

Protect vs Encrypt

Smaller Tactical Systems

Global Hawk
MQ-1
MQ-9
Warrior-Alpha
Analog
Shadow
Analog
Hunter
ScanEagle

PTP
Directional Signal

LOS

Analog
Omni Broadcast
Most Vulnerable

Video
Metadata
Platform Control
Sensor Control
Video
Metadata

OSRVT
Rover II, III, IV, V
Video Scout

FWD Ground Control Station

Risk of enemy assuming control or disrupting platform and sensors

Risk of interception and exploitation of metadata and video from unprotected down links
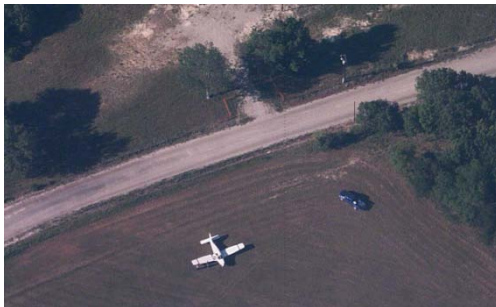
20

Common EO/IR Sensor Payloads

TODAY

- EO/IR/I^2 imagery
- Laser Designator
- Eye-safe Laser Rangefinder
- Laser Target Marker
- Laser Spot Tracker

- Multi-Target Track
- EOCC M
- In-flight boresight
- Blended/fused Imagery
- Wide Area Search/Step Stare
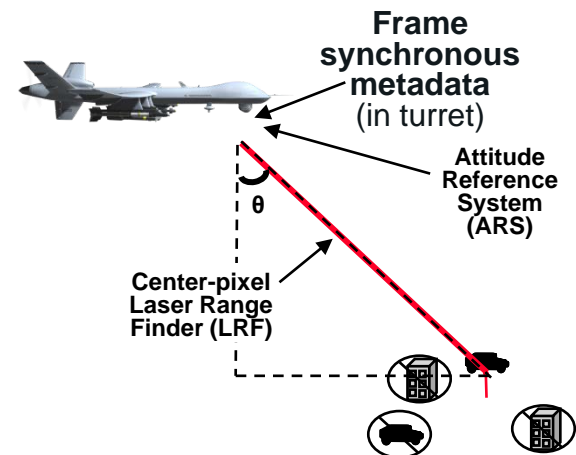
720p HD EO/IR

JDAM Targeting Accuracy

2012

Frame synchronous metadata (in turret)

Attitude Reference System (ARS)

θ

Center-pixel Laser Range Finder (LRF)

IMU on sensor   **Digital video**   **DGPS**

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Weapon-Capable Unmanned Systems

* - Total load-out

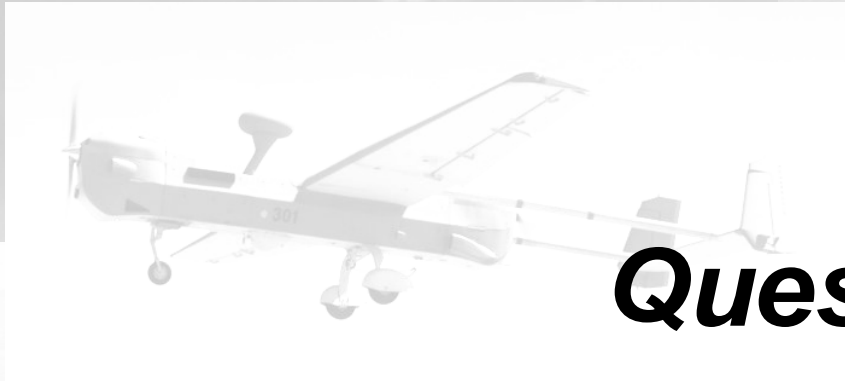| Unmanned	Platform	Weapon Types	Weapon Load-outs*	ISR Systems
MQ-1B PREDATOR ACAT 1D Post MS C		AGM-114 Hellfire	Up to 2 - Hellfire	Multi-Spectral Targeting Sys (EO/IR, LD, IR & IR Illuminator
MQ-1C ER/MP ACAT 1D LRIP2 4QFY10		AGM-114	Up to 4 – AGM-114 2-250lb and 2-500lb wing hdpts	EO/IR, SAR/MTI
MQ-9 Reaper		GBU-12 LGB GBU-38 JDAM AGM-114 Hellfire	Various configurations 3K lbs wing hdpts 750 lbs internal	EO/IR, LRF, LD
RQ-7 Shadow (USMC) Pre-MDAP		Under consideration by the USMC	No current capability	EO/IR w/ LD and IR Illuminator
MQ-5B Hunter		Viper Strike Weapon System	Up to 2 – VIPERS (Brilliant Anti-Tank munition derivative) <100 lbs ea	EO/IR

Interoperability and Commonality Across UAS

- Analyzed and identified common capability across existing tactical control stations.
- Pulling common functions outside of the control stations and structured them into service packages.
- Leveraging UxS development and acquisition are taking place outside of PORs and PEOs/Program Offices to reduce program costs through software re-use.
- Will conduct incremental demonstrations in FY10 showing SOA based functionality within the tactical systems.

- Demonstration in FY10, 3rd party integration in existing tactical stations at JSIL.
- Creating and venting an Open Business Model (OBM) for UAS.
- Building common integration tools for unmanned systems interoperability.
  - Common Tools: Auto-generate SOA based interfaces, behaviors, and documentation

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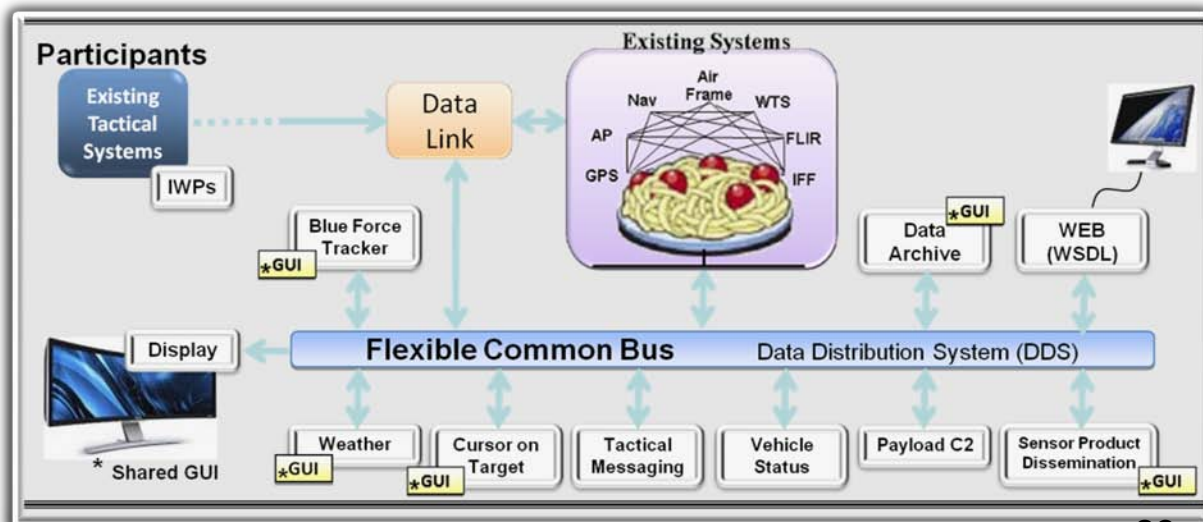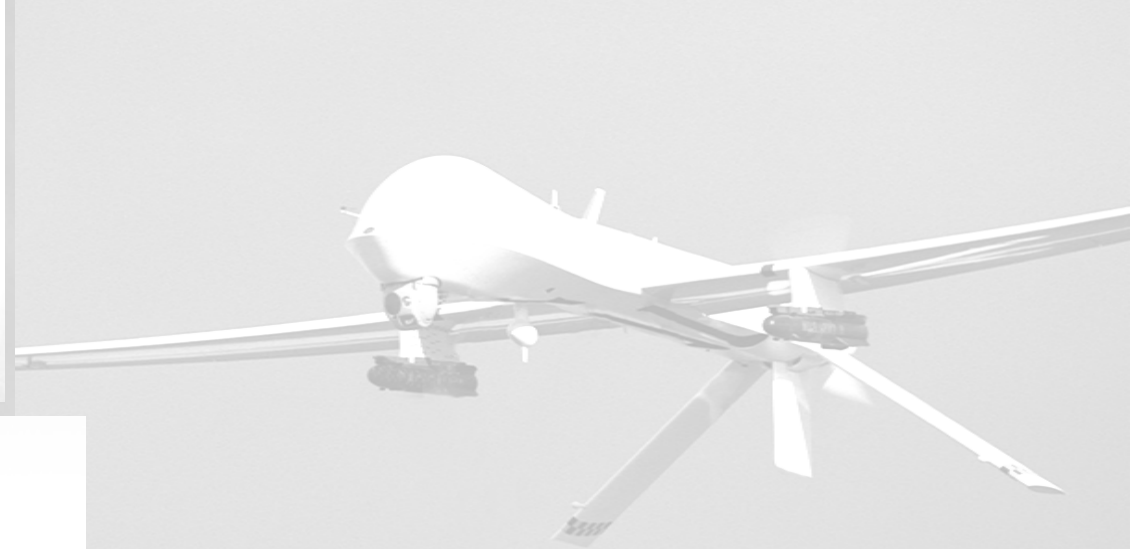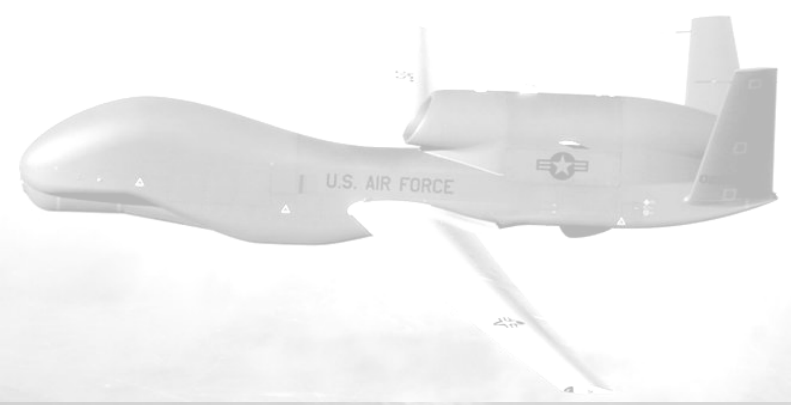
Questions?
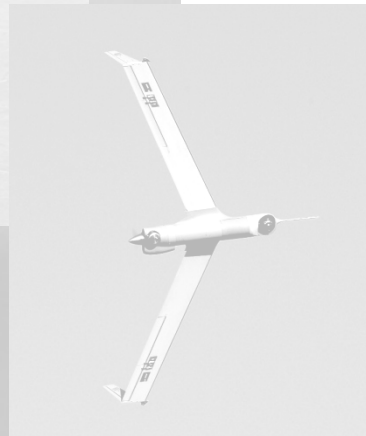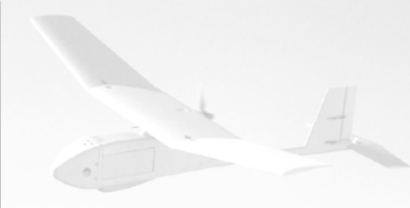
BACK UPS

DoD UAS Activities
Projected Operations Through FY16

- ● Current UAS Activities
- ○ Future UAS Activities
- ● Future ARNG Fielding

ARMY
AIR FORCE
NAVY/MARINES
USSOCOM

McChord (W,R)
Ft Lewis (S,W,R)
Arlington, OR (SE)
Portland (W,R)
ARNG (S)
Limestone Hills (W,R)
Grand Forks AFB (P,GH)
Mt Washington (W,R)
Ft Drum (S,P,)
ARNG (S)
Camp Ripley (S)
ARNG (S)
ARNG (S)
Lake Oneida (Rascal)
Syracuse (Reaper)
ARNG (S)
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Dugway (H,S)
Camp Atterbury (T)
Camp Dawson (W,R)
NAS Pax River (GH-B, S)
Vandenberg (W,R)
ARNG (S)
ARNG (S)
Kenova (W,R)
Ft Ord (RMAX)
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USAFA (V₃,S)
Ft Riley (S,E)
Louisville (W,R)
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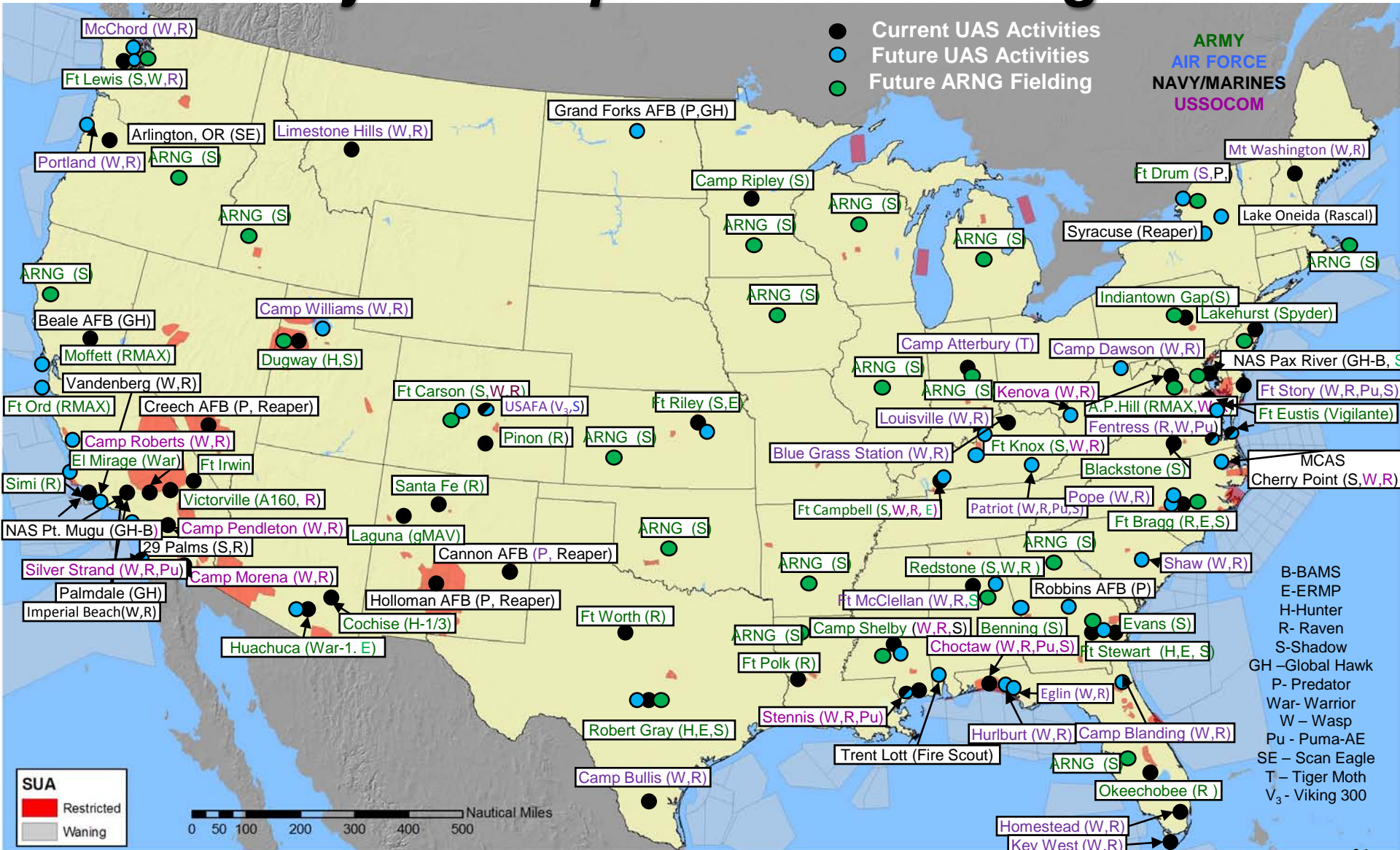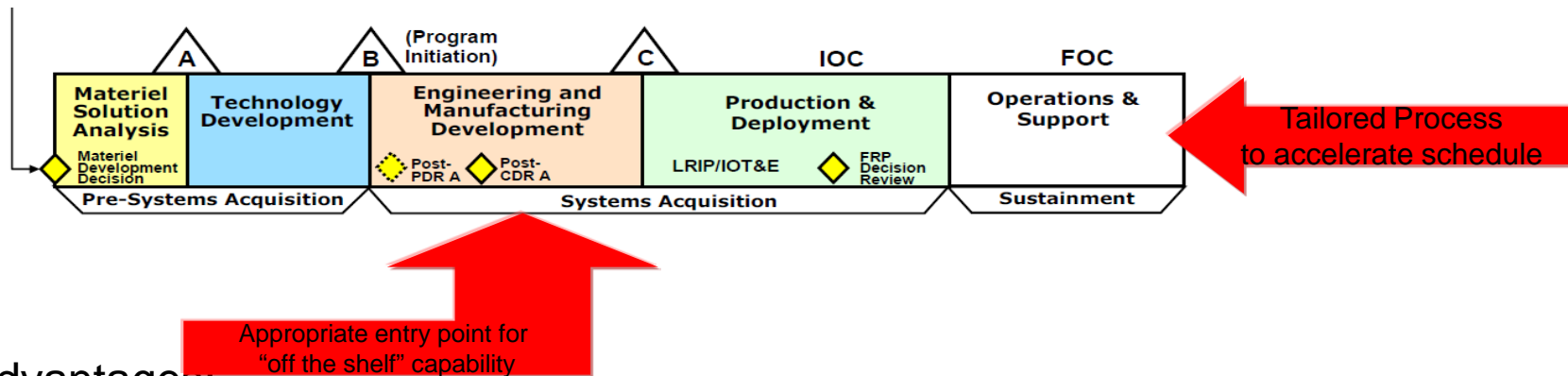Ft Story (W,R,Pu,S)
Creech AFB (P, Reaper)
Pinon (R)
ARNG (S)
Blue Grass Station (W,R)
Ft Knox (S,W,R)
Fentress (R,W,Pu)
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Ft Polk (R)
Eglin (W,R)
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Stennis (W,R,Pu)
Hurlburt (W,R)
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ARNG (S)
Camp Bullis (W,R)
Okeechobee (R)
Homestead (W,R)
Key West (W,R)

B-BAMS
E-ERMP
H-Hunter
R- Raven
S-Shadow
GH –Global Hawk
P- Predator
War- Warrior
W – Wasp
Pu - Puma-AE
SE – Scan Eagle
T – Tiger Moth
V₃ - Viking 300

SUA
- ■ Restricted
- ■ Waning

0 50 100   200   300   400   500   Nautical Miles

As of 26 Oct 09

Two Paths for Rapid Acquisition

- Option #1: Accelerate the process

- Advantages:
  - Produces a "complete" product (training, logistics support, etc)
  - Smoother transition to acquisition program
  - Better able to complete integration often required by new systems/techs
  - Better supports interoperability requirements
- Cons:
  - Takes longer to develop training & "ilities"
  - Capability traded for schedule
- Example: ERMP QRC

Success requires a clear understanding and articulation of the warfighter's capability need

Two Paths for Rapid Acquisition

- Option #2: Go Around the Process

Procure and Field
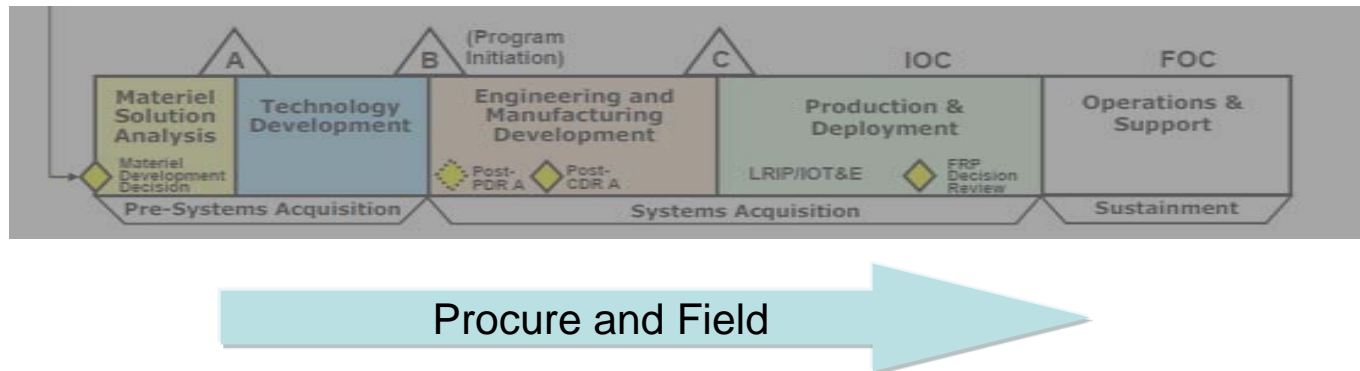
- Advantages:
  - Can be faster
- Cons:
  - Still must follow contracting process
  - No provisions for development of training, "ilities"
  - Not optimum for maturing technologies or completing integration
  - Little to no interoperability with existing systems
- Examples:
  - MC-12, LEMV

Success requires a clear understanding and articulation of the warfighter's capability need
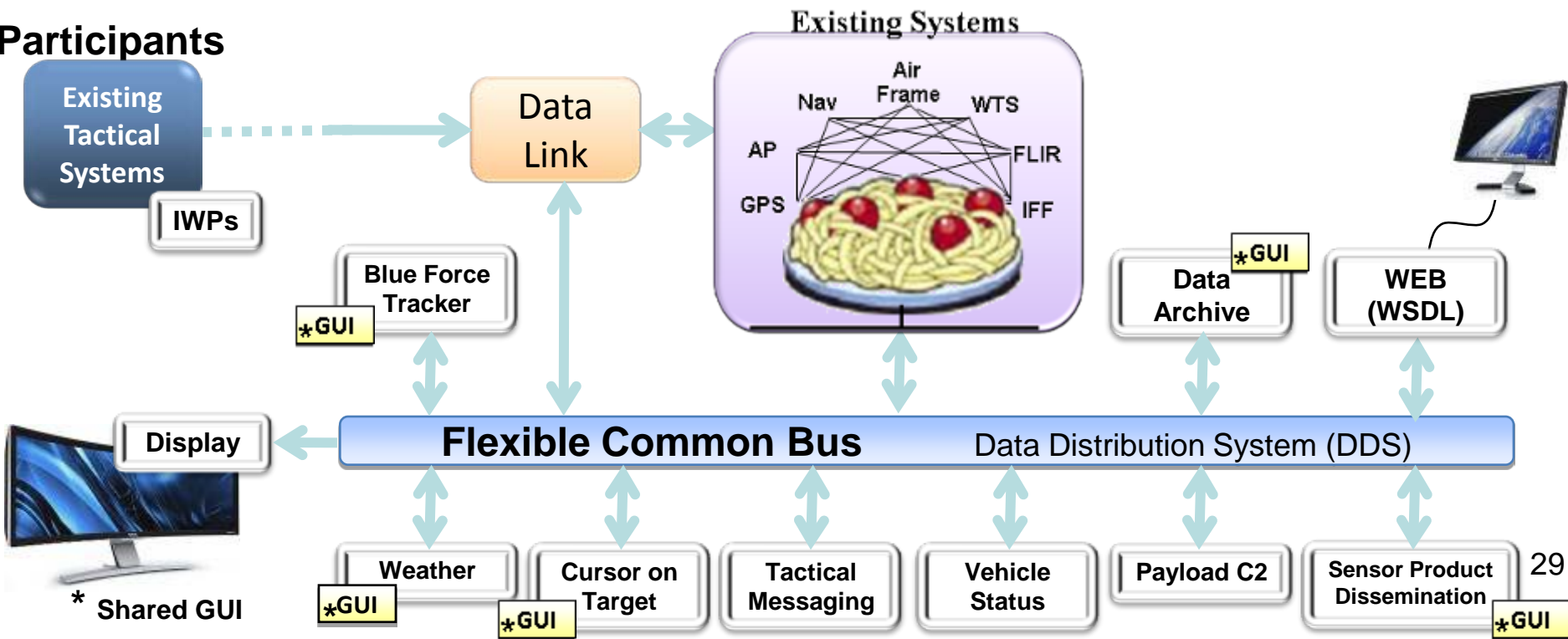
Current Work Packages - Shared SW Services across Tactical Stations
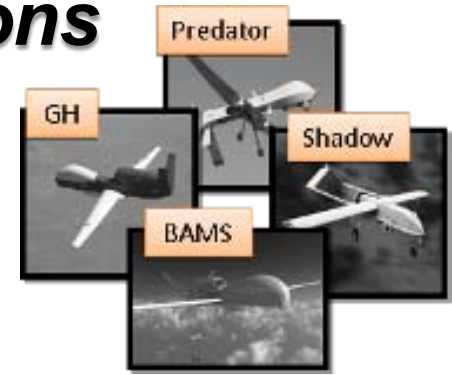
- Analyzed and identified common capability across existing tactical control stations. (Bus)
- Pulled common functions outside of the control stations and structured them into service packages.
- Demonstrate functionality and prepare tactical systems for 3rd party integration.

Participants

Existing Tactical Systems

IWPs

Data Link

Existing Systems

Nav — Air Frame — WTS

AP — FLIR

GPS — IFF

Blue Force Tracker

*GUI

Data Archive

*GUI

WEB (WSDL)

Display

Flexible Common Bus — Data Distribution System (DDS)

* Shared GUI

Weather
*GUI

Cursor on Target
*GUI

Tactical Messaging

Vehicle Status

Payload C2

Sensor Product Dissemination
*GUI

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What We Can Do Today

Objective: Rapid Insertion of Common Services into Existing Systems

- Reduction in Proprietary Capabilities

- Decompose existing systems into common behaviors

- Lateral replacement of functionality

Increase Formal Re-Use on New Programs

Increasing Integration of Common Services

| Service |
| Service |
| Service |
| Service |
| Service |
| Service |
| Service |

Vehicle Status

Bus | SOAP

Cursor on Target | Data Archive

Payload C2

Weather | Blue Force Tracker | WEB (WSDL) | Tactical Messaging | Sensor Product Dissemination

Leverage and Extend Toolset Development Efforts Over Time

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