UNMANNED AIRCRAFT SYSTEMS ROADMAP

2005 - 2030

Office of the
Secretary of Defense

Presented by
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Special Assistant
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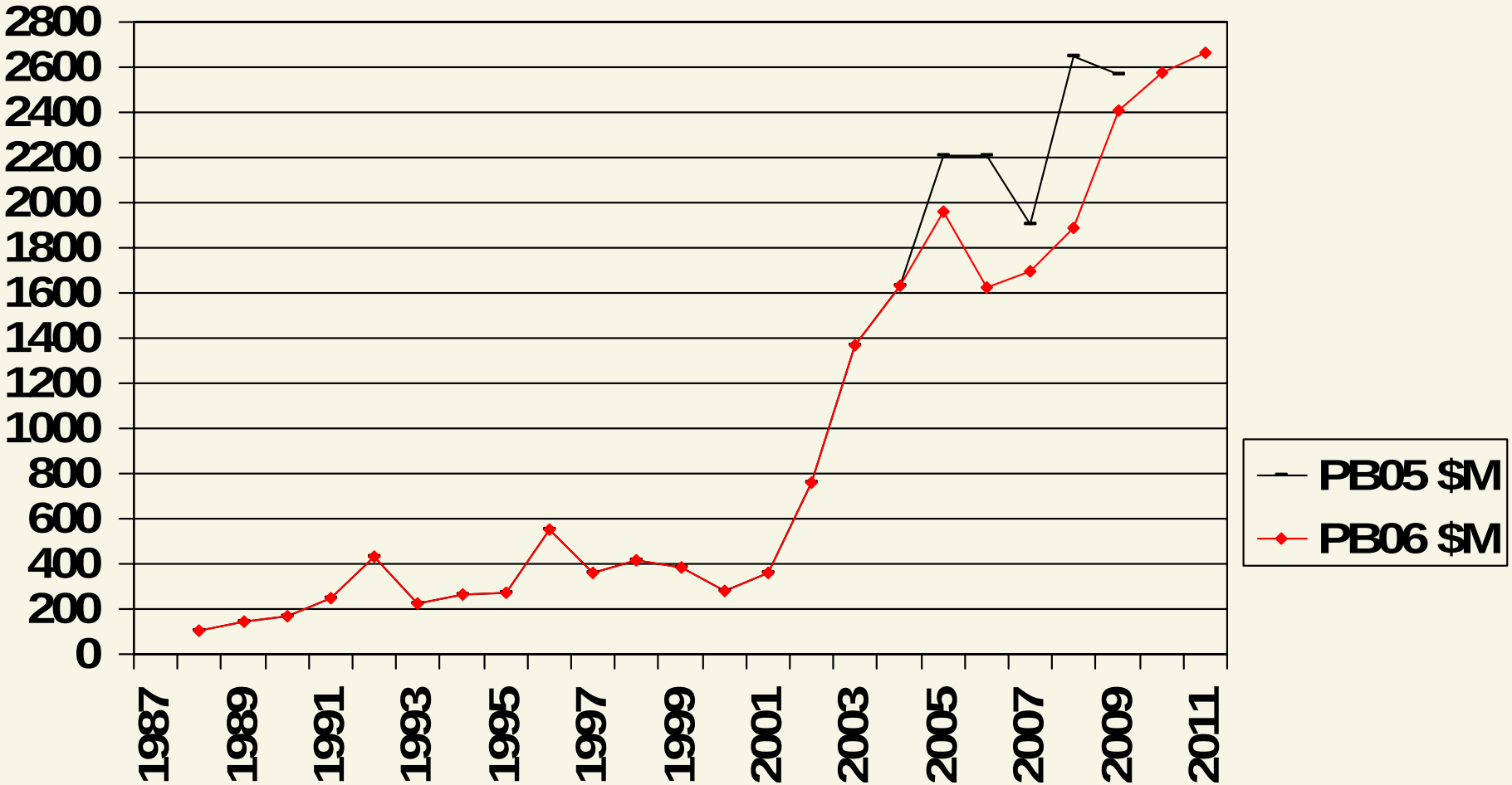
Outline

- Top Level Thoughts
- UAS Roadmap, 2005 – 2030
- Summary

UAS vs. UAV

- The term “Unmanned Aircraft System (UAS)” describes the entire weapon system that DoD has historically referred to as an “Unmanned Aerial Vehicle (UAV)”
- The weapon system includes the aircraft (UA), surface components, and architecture elements
- “UAS” is the emerging DoD term

UAS Funding (RDT&E and Procurement)



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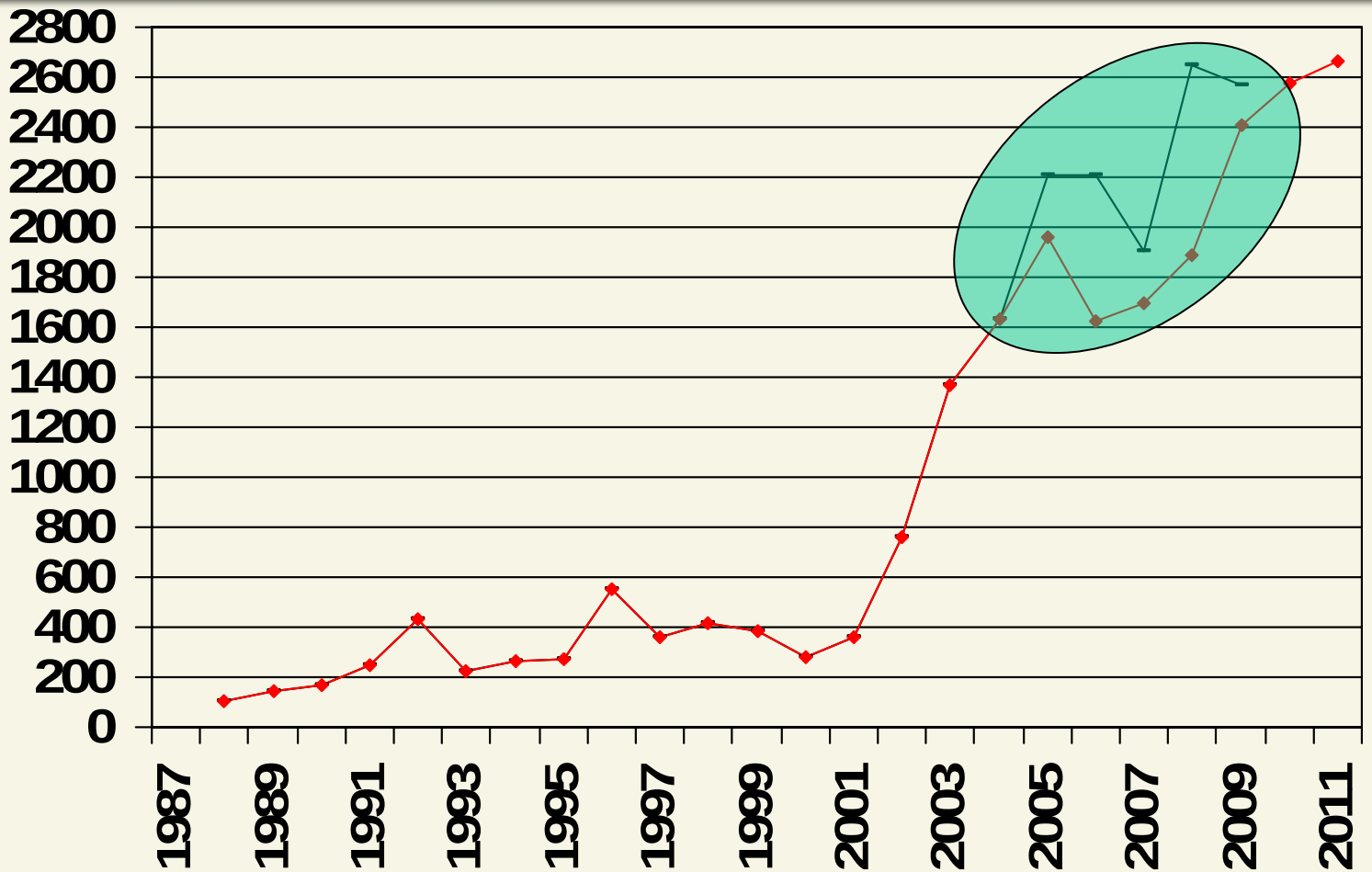

PB:	05	06	07	08	09
J-UCAS:	0	-395	+20	-489	-207
BAMS:	-28	-142	-287	-241	-106
PB06 Reductions:	-28	-537	-267	-730	-313

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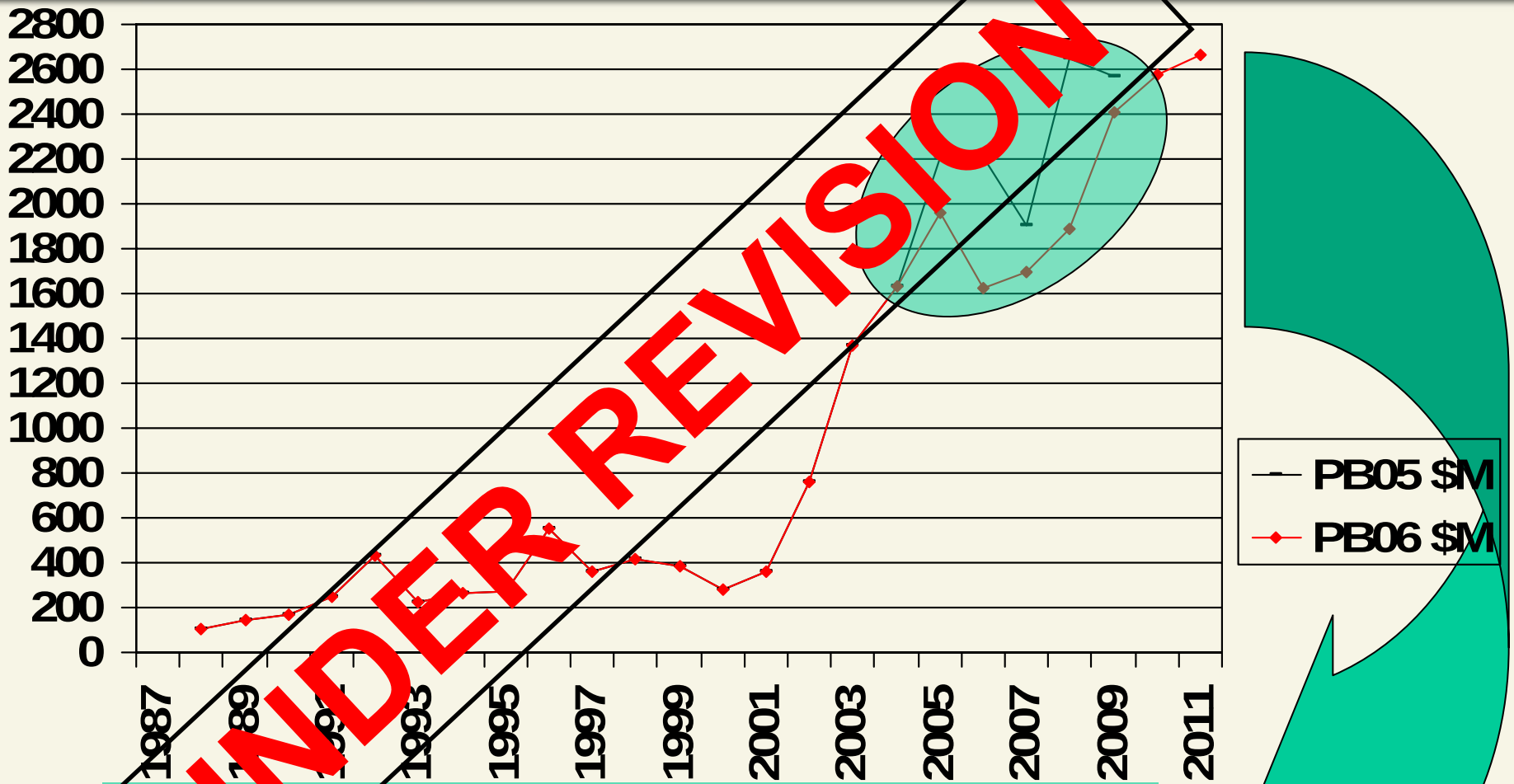

UNDER REVISION

PB:	05	06	07	08	09
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UAS Roadmap, 2005 – 2030

UAS Roadmap Update

Purpose

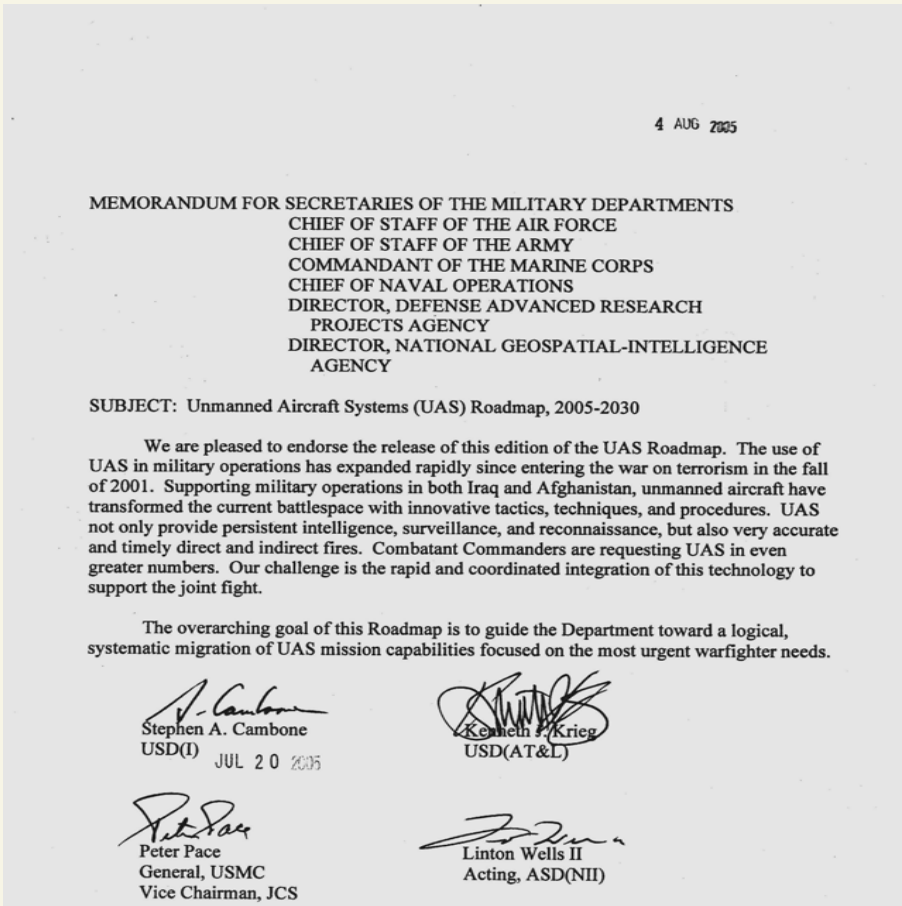
- **To stimulate the planning process for U.S. military UAS development over the period 2005-2030**
- **To assist DoD decision makers in developing a long-range strategy for UAS development and acquisition**
- **To contribute UAS vectors to the Strategic Planning Guidance and Quadrennial Defense Review**
- **To identify highest value areas for industry investment and areas for international cooperation**

OSD Application

- **The Roadmap is *guidance* for the systematic migration of mission capabilities to UAS while addressing the most urgent mission needs that are supported both technologically and operationally**

- **Roadmap *is* ***not*** *a* budgetary document and does not *direct* funding of UAS and UAS-related technology**
  - **But it *is* the document we use to evaluate how well the services and components have implemented the OSD UAS vision …**

Roadmap Release



4 AUG 2005

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHIEF OF STAFF OF THE AIR FORCE
CHIEF OF STAFF OF THE ARMY
COMMANDANT OF THE MARINE CORPS
CHIEF OF NAVAL OPERATIONS
DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
DIRECTOR, NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

SUBJECT: Unmanned Aircraft Systems (UAS) Roadmap, 2005-2030

We are pleased to endorse the release of this edition of the UAS Roadmap. The use of UAS in military operations has expanded rapidly since entering the war on terrorism in the fall of 2001. Supporting military operations in both Iraq and Afghanistan, unmanned aircraft have transformed the current battlespace with innovative tactics, techniques, and procedures. UAS not only provide persistent intelligence, surveillance, and reconnaissance, but also very accurate and timely direct and indirect fires. Combatant Commanders are requesting UAS in even greater numbers. Our challenge is the rapid and coordinated integration of this technology to support the joint fight.

The overarching goal of this Roadmap is to guide the Department toward a logical, systematic migration of UAS mission capabilities focused on the most urgent warfighter needs.

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JUL 20 2005

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- **Endorsed by**
  - **USD (AT&L)**
  - **USD (I)**
  - **ASD (NII)**
  - **VCJCS**
- **Released Aug 4, 2005**

The *Unmanned Aircraft Systems Roadmap, 2005 – 2030* is available at: www.acq.osd.mil/uas

Changes

- **Deletions**
  - Small UAV and Weapons appendices incorporated into appropriate chapters
- **Additions**
  - Airships
  - Department of Homeland Security appendix
  - UAS Support to Military Operations (classified) Appendix
- **Major Revisions**
  - Communications
  - Sensors
  - Standards
  - Airspace Integration Plan for Unmanned Aviation
  - Survivability

Contents

- Roadmap
  1. Introduction
  2. Current UAS
  3. Requirements
  4. Technologies
  5. Operations
  6. Roadmap

- Appendices

Appendices

A. Missions
B. Sensors
C. Communications
D. Technologies
E. Standards
F. Airspace
G. Task, Post, Process and Use Considerations
H. Reliability
I. Department of Homeland Security
J. Unmanned Ground Vehicles
K. Survivability
L. UAS Support to Military Operations (Classified)

UAS Roadmap Goals (1 - 4)

1. Develop and operationally assess a joint unmanned combat aircraft system

2. Field secure Common Data Link (CDL) compatible communications for aircraft control and sensor product data distribution for all tactical and larger UA, with improved capability to prevent interception, interference, jamming, and hijacking

3. Comply with the existing National Geospatial-Intelligence Agency (NGA) metadata standards for all full motion video-capable UA, and fielding of a near real-time UAS metadata derived targeting capability

4. Foster the development of policies, standards, and procedures that enable safe, timely, routine access by UA to controlled and uncontrolled airspace

UAS Roadmap Goals (5 - 9)

5. Improve Combatant Commander UAS effectiveness through improved joint service collaboration

6. Develop and field reliable propulsion alternatives to gasoline-powered, internal combustion engines on UA

7. Improve adverse-weather UA capabilities to provide higher mission availability and mission effectiveness rates

8. Ensure standardized and protected positive control of weapons carried on UA. Develop a standard UAS architecture including weapons interface for all appropriate UA

9. Support rapid integration of validated combat capability in fielded/deployed systems through a more flexible test and logistical support process

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Communications Appendix

- **UAS need to interface to and be an integral part of the Global Information Grid (GIG)**
- **Provide guidance on the UAS network migration path to industry and to the Services**
  - **Acquisition Functions**
    - Migrate to Common Data Link (CDL) based communications
      - FY06 Appropriations Bill Mandate
    - Procure Joint Tactical Radio System/Software Configuration Architecture compliant systems when available
    - Meet spectrum guidelines
  - **Operators**
    - Networking enables new operational constructs: research, demos, CONOP development and exercises needed to flesh out
    - Mitigate/eliminate spectrum related deployment/employment issues
  - **Industry**
    - Know up front what is expected/accepted
    - Focus development/product lines to meet commercial and DoD needs
- **Provide reference of standards and implementation dates**

Communications Appendix Continued

- **Addresses key UAS functional interfaces that should be accessible through the GIG**
  - **Situational Awareness**
  - **Vehicle Control – Everything but payloads and weapons**
  - **Payload**
    - Product
    - Control
  - **Weapons**
    - Kinetic (bombs, missiles, etc.)
    - Non-kinetic (electronic warfare, directed energy, etc.)

- **Establishes minimum communications interoperability standards required of all DoD UAS programs**
  - **Examples:**
    - Weapons security, air vehicle security, payload security, ATC interface
    - Allowing machine to machine sensor tasking, while precluding inadvertent automatic weapons employment

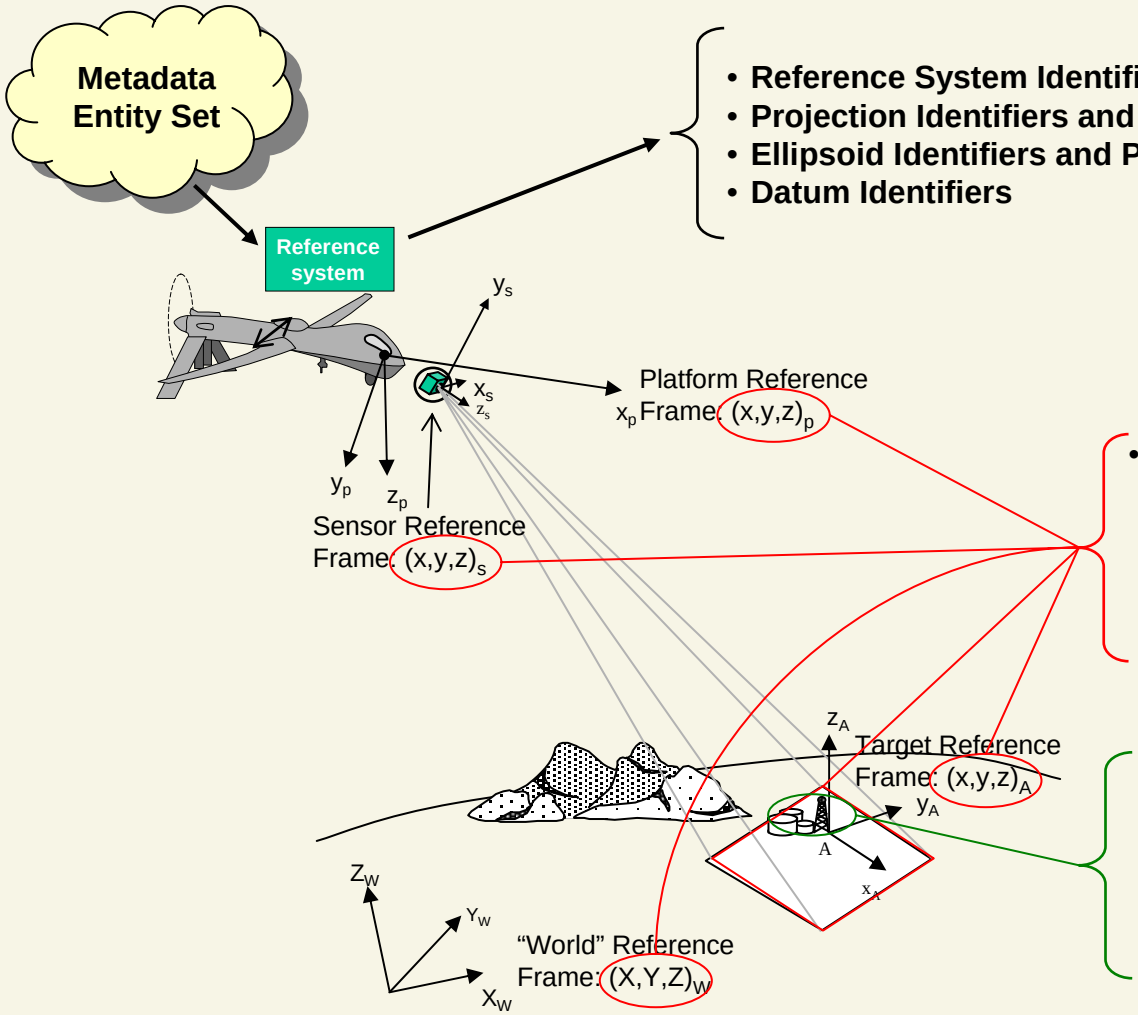
Sensors Appendix

- **Minor revisions**
  - **Refinements based upon OEF/OIF experiences**

- **Focus on metadata and applications**
  - **NGA Motion Video Metadata (KLV) allows derivation of PGM-grade coordinates in near real-time from video**
    - GRIDLOCK ACTD
  - **Critical component of GIG integration**
    - Makes integration/fusion of product and use by others easier
    - Machine to machine capability

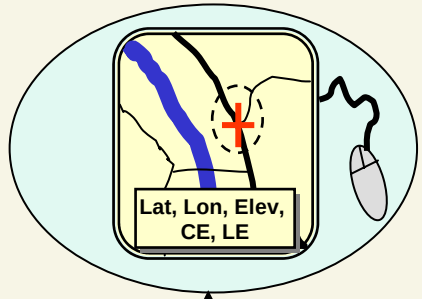
- **Discussion of next generation of sensors**
  - **Synthetic Aperture Radar (SAR)**
    - Migration to operational level systems (Extended Range/Multi Purpose)
    - Advanced Technology migration path (Foliage Penetration, Inverse SAR, Air-to-Air)
  - **Digital video/metric sensor**
    - Migration to all digital, full metadata capability (High Definition TV)
  - **Multi/Hyper spectral**
    - Cueing and target confirmation
  - **Signals Intelligence (SIGINT)**

Tactical ISR Metadata



GRIDLOCK Approach

- Core Image Science / Photogrammetric Processes Required to Generate Smart Image
  - Auto-correspondence between mission and reference imagery
  - Auto-generation of DEM on-the-fly
  - Rigorous photogrammetric resection to update the initial support data of mission image
  - Complete and rigorous error propagation to yield reliable target CE/LE



GRIDLOCK SMART Image

GRIDLOCK "Photogrammetric" Engine

Controlled Images

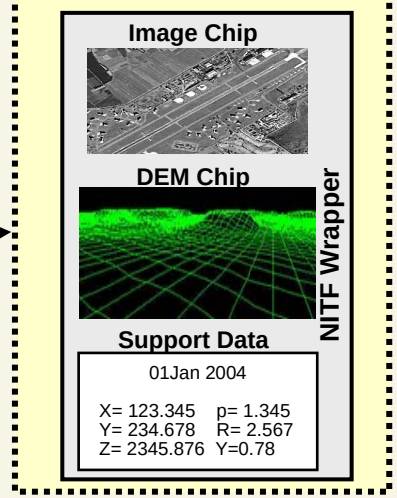
Mission Image

DEM and Error Prop

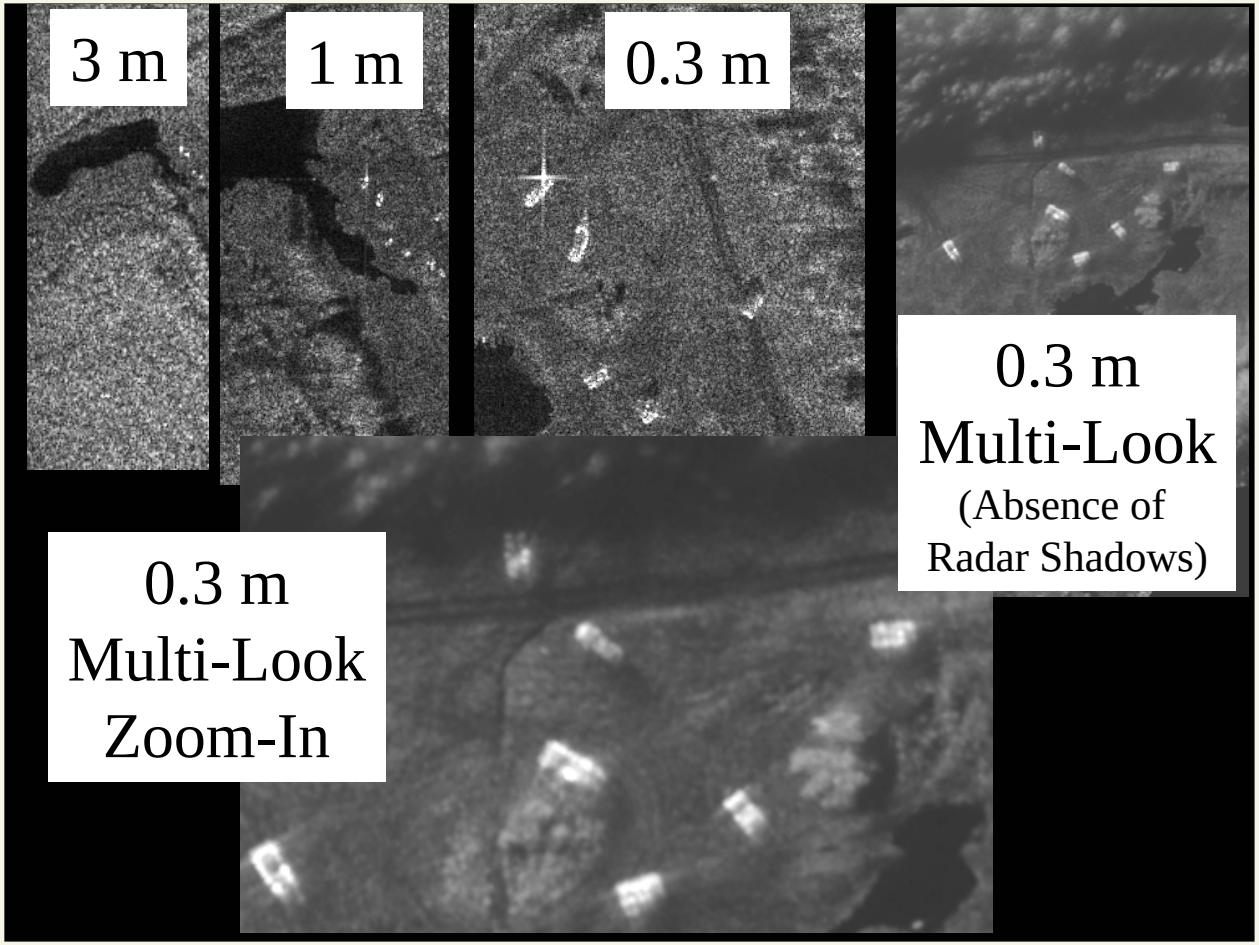
Rigorous Math Model

Auto-Correspondence

Resection, Replacement Model, and Error Prop



LYNX SAR

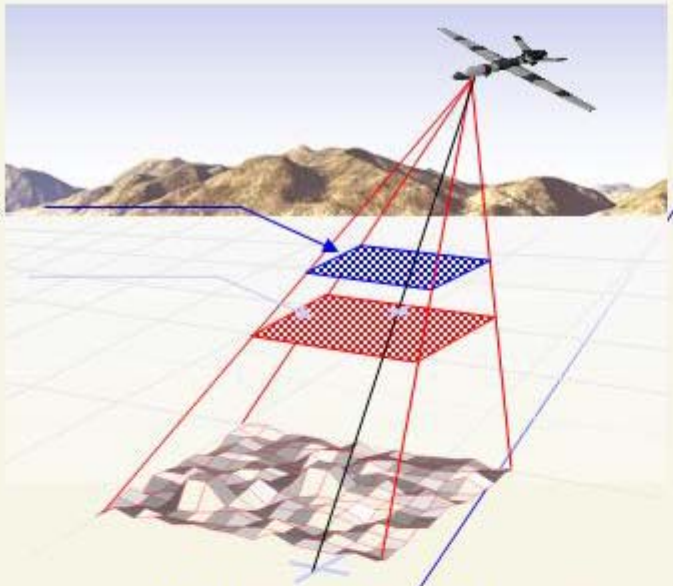


Convoy Search Ft Dix: 2 x Cargo Trucks / 6 x Hummers

Metric Sensor
(Precision View Approach)

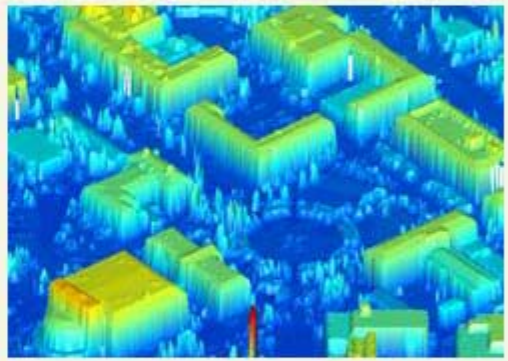
Image

DEM



Broad Area Search (BAS)

High-Resolution Terrain Information (HRTI)



High-Resolution Point Target

UAS Roadmap Summary

- **Roadmap reflects influence of GWOT**
- **Focus on standards and integration**
- **OSD UAS development reference document**

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