Unmanned Aircraft Systems
Present & Future Capabilities

Major General Blair Hansen
23 October 2009
Overview

- Why Unmanned Aircraft Systems
- Evolution of Capabilities
- Growing Demand
- Emerging Missions
- Challenges
- Vision
Why Unmanned Aircraft Systems?

- Persistence - ability to loiter over a target for long time periods for ISR and/or opportunity to strike enemy target
- Undetected penetration / operation
- Operations in dangerous environments
- Can be operated remotely, so fewer personnel in combat zones - projects power without projecting vulnerability
- Integrates “find, fix, finish” sensor and shooter capabilities on one platform

RQ-11 Raven

RQ-8 Fire Scout

Reaper
# Evolution of Capabilities

<table>
<thead>
<tr>
<th></th>
<th>WWII</th>
<th>Vietnam</th>
<th>Gulf War</th>
<th>OIF/OEF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planes</strong></td>
<td>![1,000 planes (B-17)]</td>
<td>![30 planes (F-4)]</td>
<td>![1 plane (F-117)]</td>
<td>![1 plane (F-16)]</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td><img src="1024x1024" alt="60 crew" /></td>
<td><img src="1024x1024" alt="1 crew" /></td>
<td><img src="1024x1024" alt="1 crew" /></td>
<td><img src="1024x1024" alt="1 crew" /></td>
</tr>
<tr>
<td><strong>Targets</strong></td>
<td><img src="1024x1024" alt="1 Target" /></td>
<td><img src="1024x1024" alt="1 Target" /></td>
<td><img src="1024x1024" alt="2 Targets" /></td>
<td><img src="1024x1024" alt="6 Targets" /></td>
</tr>
<tr>
<td><strong>Tech</strong></td>
<td>Mass Aircraft</td>
<td>Tactical Strike</td>
<td>Laser Munitions</td>
<td>GPS Munitions</td>
</tr>
<tr>
<td><strong>C2</strong></td>
<td>In-the-Loop</td>
<td>In-the-Loop</td>
<td>In-the-Loop</td>
<td>In-the-Loop</td>
</tr>
<tr>
<td><strong>Mgmt</strong></td>
<td>Active</td>
<td>Active</td>
<td>Active</td>
<td>Active</td>
</tr>
</tbody>
</table>

**Near Future**
- 4 planes (MQ-X)

**Distant Future**
- Swarm (Autonomous UAS)
- Mission Commander

**Tech**
- Collaboration

**C2**
- On-the-Loop

**Mgmt**
- Responsive

**Future**
- Past

**Future**
- Near

**Future**
- Distant
...We must take a joint approach to:

Get the **most** out of UAS to **increase** joint warfighting capability, while promoting service interdependency and the wisest use of tax dollars

**Requires:**

- Optimal joint concept of operations (CONOPS)
- Airspace control resulting in safe / effective UAS operations
- Air defense architecture to achieve security w/o fratricide
- Acquisition effectiveness, efficiency, standardization
Principles of UAS Evolution

- Automation is key
- Modularity = flexibility
- UAS is compelling where the human is a limitation to mission success
- Seamless manned and unmanned systems integration
- “Integrated Systems” approach
- Robust, agile, redundant C2 enables supervisory control (“man on the loop”)
- Solutions are linked and must be synchronized
Autonomy

Conventional Harbor
- 4 operators per crane
- Manpower-centric system
  - Legacy system
  - Manpower dependant
  - Manual Operation

“Multi-Crane Control”
- 1 operator per 6 cranes
- 24x increase in efficiency
- Tech-centric system
- Multi-crane Control
- Automation (cranes and AGV)
  - DGPS
  - Algorithms
Autonomy – Multi-Aircraft Control
Potential Manpower Savings

2011
(Current system)

- 50 CAPs
  - 50 MQ-9 CAPs
  - + 7 a/c in constant transit
- 10 pilots per CAP
  - 500 pilots required
  - + 70 pilots to transit a/c

570 Total Pilots

2012
(MAC)

- 50 CAPs
  - 50 MQ-9 CAPs
  - 2 CAPs per MAC GCS
  - 1 transit per MAC GCS
- 5 pilots per CAP
  - 250 Pilots required
  - + 0 to transit aircraft

250 Total Pilots

56% Manpower Savings

TBD
(MAC + 50% auto)

- 50 CAPs
  - 50 MQ-9 CAPs on orbit
- 25 CAPs automated
- 25 CAPs in MAC (5 pilots/CAP)
  - 125 pilots required
  - + 25 auto-msn monitor pilots
  - + 0 to transit aircraft

150 Total Pilots

64% Manpower Savings

MAC = 1 pilot can fly up to 4 a/c
Unmanned Aerial Systems Growth

- Overwhelming demand for persistent ISR has driven significant DoD investment in UAS
  - Over 2,000 UAS aircraft deployed to Iraq and Afghanistan
  - $3.5B investment in PB10
  - Over 450K flight hours in FY09
  - Light-weight, low altitude UAS account for preponderance of growth

**UAS Investment**

**DoD UAS Flight Hours**

Does not include Overseas Contingency Operations funding

Does not include man-portable UAS

- AIR FORCE
- ARMY
- NAVY & USMC
- Projected for FY09
Anticipated growth within CONUS

Planned 2013 DOD UAS bed down

- 113 CONUS locations
- 1.1 million UAS flight hrs for initial/continuation training
- 91% of airspace is Class E&G
Emerging UAS Missions - Advanced ISR Capabilities

Open architecture allowing modular sensors to be integrated quickly and inexpensively

Open Sensor Bus

- WAAS
- LADAR
- Hyperspectral
- SIGINT
- SAR
- DAS

Hyperspectral

Situational Awareness

Multi-stream Wide Area Sensor

DAS Provides All Functions Simultaneously
Wide Area Airborne Surveillance (WAAS)

- As new capabilities are developed, warfighters innovate to meet mission needs
- New and developing payloads create opportunities and challenges

**Today**

- **MQ-1**
  - Observe single target
  - Single ROVER / OSRVT

**IOC 2nd Qtr FY10**

- **MQ-9**
  - 4x4 km coverage area
  - 12 independent ROVER queries growing to 30

**4th Qtr FY11**

- **MQ-9**
  - 10x10 km coverage area
  - As many as 30 ROVER queries and potentially 65 clips to the Tactical Operations Center

**FMV – 30 fps**

**Gorgon Stare – 2 fps**

**Gorgon Stare + ARGUS**
Analytical Challenges – Data ≠ Knowledge

- Tasking Processing, Exploitation and Dissemination (TPED)
  - Capabilities have not kept pace with platform growth
- Data Standards and Interoperability
  - Sufficient interoperability does not exist between platforms and TPED architectures
- Communications Architectures
  - Growth of UAS platforms and intelligence capabilities has driven significant frequency spectrum demand
Vision for an unmanned future

- Automated control and modular “plug-and-play” payloads
- Airspace integration/deconfliction – addressing both cultural and technical challenges
- Joint UAS solutions and teaming
- Automated exploitation capabilities
- Technology to address bandwidth concerns
- An informed industry and academia – knowing where we are going and what technologies to invest in ….
Today's UAS deliver a game-changing capability
A single air vehicle provides the ability to find, fix, and finish targets!
Unmanned Aircraft Systems
Present & Future Capabilities

Major General Blair Hansen
23 October 2009
Back up slides
The Operational Demand by Airspace Class

Percent of 1.1M Hours

- **Class G** -- 76%
- **Class E** -- 15%
- **Class D** -- 2%
- **Class C** -- 0%
- **Class B** -- 0%
- **Class A** -- 5%
- **Restricted** -- 2%

**Jet Routes**

- **60,000’ MSL**
  - Global Observer

- **45,000’ MSL**
  - Global Hawk
  - Reaper

- **18,000’ MSL**
  - Sky Warrior
  - Predator

- **10,000’ MSL**
  - Shadow
  - Hunter

- **SFC-10,000’ MSL**
  - Class B

- **SFC-4,000’ AGL**
  - Class C

- **SFC-2,500’ AGL**
  - Class D

- **SFC-14,500’ MSL**
  - Class G

- **SFC-700’ or 1,200’ AGL**
  - Class G
  - SFC-14,500’ MSL
  - Class G
UAS Classification

- Joint Classification scheme developed to facilitate consensus on regulations, standards and certification
- Utilized at all echelons and levels within combat theaters

<table>
<thead>
<tr>
<th>UAS Category</th>
<th>Maximum Weight (lbs) (MGTOW)</th>
<th>Normal Operating Altitude</th>
<th>Speed (KIAS)</th>
<th>Current/Future Representative UAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>0-20</td>
<td>&lt;1,200 AGL</td>
<td></td>
<td>WASP III, BATCAM, Raven, Dragon Eye</td>
</tr>
<tr>
<td>Group 2</td>
<td>21-55</td>
<td>&lt;3,500 AGL</td>
<td>&lt;250</td>
<td>Scan Eagle</td>
</tr>
<tr>
<td>Group 3</td>
<td>&lt;1320</td>
<td></td>
<td></td>
<td>Silver Fox, Shadow, Neptune,</td>
</tr>
<tr>
<td>Group 4</td>
<td>&gt;1320</td>
<td>&lt;18,000 MSL</td>
<td>Any Airspeed</td>
<td>Predator, Sky Warrior, Hunter, Fire Scout</td>
</tr>
<tr>
<td>Group 5</td>
<td></td>
<td>&gt;18,000 MSL</td>
<td></td>
<td>Global Hawk, Reaper, BAMS, Global Observer, N-UCAS</td>
</tr>
</tbody>
</table>
UAS – an alternative to a range of traditionally manned systems

- Deeply modular and upgradable
  - Support future roles and mission needs
- Size, Weight and Power
  - Maximize sensor & weapons flexibility
- High subsonic dash
  - Force packaging and responsiveness
- Target area persistence
- Survivable in contested environment