Approved for Public Release. This presentation does not contain technical data per ITAR 22 CFR parts 120-130.
Agenda

• General Atomics Aeronautical Systems
• Putting the change in context
• The future
• Recommendations
GA-ASI Family of Aircraft

- 720+ aircraft delivered
- 310+ GCS delivered
- 322+ Lynx Radar delivered
- 3,200,000+ flight hours
  - 90% combat hours
- Capabilities include
  - Direct control
  - Autopilot control
  - Auto takeoff / auto land available
- Voice and data communications
  - Line-of-sight and remote operations
  - Direct down link to ground forces
  - Radios for air-to-air & air-to-ground communications
  - Robust aircraft comm/nav systems
- Long endurance performance

Predator B/ MQ-9 Reaper/ Guardian
Maritime Surveillance/ Hunter-Killer

Avenger
Armed Reconnaissance
Multi-Mission, Quick Response

Gray Eagle
U.S. Army Ground Troop Support

Predator/ Predator XP
Regional Surveillance
Growth and Evolution

- 1990: GNAT-750
- 1991: Prowler I
- 1994: Predator 1995
- 1996: Altus
- 1997: I-GNAT
- 1998: Prowler II
- 1999: Armed Predator
- 2000: ER/MP Prototype
- 2001: Altair
- 2003: Production Predator B
- 2005: Army I-GNAT ER
- 2007: Gray Eagle Block 0
- 2008: Prototype 2003
- 2009: Gray Eagle ER/MP
- 2009: Maritime Predator B
- 2009: Mariner 2007
- 2010: Improved Gray Eagle
- 2013: Predator C
- 2013: Avenger
- 2013: ER/MP Prototype
- 2014: MQ-9 Block 5
- 2014: Gray Eagle Block 0
- 2014: Improved Gray Eagle

- **20 variants developed in the last 20 years**

- **20,000 hours**
- **50,000 hours**
- **1M hours**
- **3 M+ hours**
## Predator B

### CHARACTERISTICS
- **Wing Span:** 66 ft
- **Length:** 36 ft
- **Powerplant:** Honeywell TPE 331-10
- **Max Gross Takeoff Weight:** 10,500 lb
- **Fuel Capacity:** 3,900 lb
- **Payload Capacity:**
  - 850 lb int.
  - 3,000 lb across 6 wing hard points
  - 750 lb external on centerline
- **Weapons:**
  - Hellfire missiles
  - GBU-12 laser-guided bombs
  - GBU-38 JDAM
- **Payloads:**
  - MTS EO/IR,
  - Lynx Multi-mode Radar,
  - 360° digital multi-mode maritime radar,
  - Automated Identification System (AIS),
  - SIGINT/ESM, Communications relay

### PERFORMANCE
- **Max Altitude:** 50,000+ ft
- **Max Endurance:** 27 hr
- **Max Air Speed:** 240 KTAS

### FEATURES
- Triple-redundant flight control system
- Redundant flight control surfaces
- Remotely piloted or fully autonomous
- MIL-STD-1760 Stores Management System
- Seven external stations for carriage of payloads
- C-Band line-of-sight data link control
- Ku-Band beyond line-of-sight/SATCOM data link control
- Over 90% system operational availability
- C-130 transportable (or self deploys)
The Guardian is the same aircraft as Predator B but with maritime sensors.
Advanced Cockpit Enhances Situational Awareness

- Increased mission effectiveness
- Reduced training
- Successfully flown on Predator-series UAS, 3rd party UAS
- Significantly improved Human-Machine Interface (HMI)
The World’s Benchmark

Every second of every day, nearly 70 Predator/Gray Eagle-series aircraft are airborne worldwide.

3.2 Million total flight hours
2014 - Approximately 500,000 flight hours
Over 37,000 flight hours per month

Long Endurance  Mission Flexibility  Best Value
“Twenty years ago my brother and I thought that its use would be principally scouting in warfare, carrying mail, and other light loads to places inaccessible by rail or water, and sport.

But the wildest stretch of the imagination of that time would not have permitted us to believe that within the space of fifteen years actually thousands of these machines would be in the air engaged in deadly combat.”

- Orville Wright on 20th year anniversary of first flight
We are now at a place where what, where, when, and how we fly should be a significant factor in determining the appropriate rules, regulations, and levels of certitude.
Can We Treat These the Same?

12,500 lb, 45K ft, 250 KTAS

18 lb, 6K ft, 40 KTAS

14 lb, 5-29K ft, 50 KTAS
• What are these things? Airplanes, RC aircraft, small UAS, or “something else?”
• Can parsing by category simplify or expedite progression into safe integration?
• How and who should regulate these “things,” keep them safe, and permit commerce to thrive?
• Does this new “mode” of flight merit any accommodation of the other established NAS users?
• What existing laws (such as rights to privacy,) aviation regulations, or other codes already exist that we can leverage?
• What is the right balance of technological vs. procedural solutions?
Putting the Change Into Context

- Not in my backyard?
- Safety and Security
- Is this navigable airspace?
- Reasonable expectation to privacy?
• **Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:**
  
  – **Anywhere**
    - An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface
  
  – **Over congested areas**
    - Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft
  
  – **Over other than congested areas**
    - An altitude of 500 feet above the surface, except over open water or sparsely populated areas; in those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure
Putting the Change into Context – Examples

- **Agree on Categories, for example**
  - Radio Controlled Aircraft Rules, sUAS rules, RPAS rules

- **sUAS (other than model aircraft hobbyist)**
  - Operator Registration
    - Put the burden on the operator to operate safely and responsibly, maintain in AW condition, and carry liability insurance; report incidents or accidents on-line
    - Require appropriate basic training in equipment, aeronautics, safety and privacy
    - Require registration and marking of sUAS and perhaps RFID or other system

- **sUAS**
  - Commercial or Private Operations by Permit and Airman Registration
    - Over congested areas limit operations to 1,000 feet above buildings and persons and 2,000 feet laterally with permission of property owners
    - Over other than congested areas, limit sUAS flights over persons or property to not less than 500 feet without the property owner’s permission
    - Do not allow flights over people or property without a special permit
  - Commercial or Private Operations with Registered Operator but does not require a permit
    - Allow property owners (or with their permission) flights up to 400 feet LOS and BLOS as long as sUAS stay contained in the property boundaries for commercial or other purposes (Others should not be “bamstoming” your crops, houses, fences, or property anyway)
Is there gold in them thar hills?
### DHS' Predator B Flew Nearly 700 Times for a Variety of Customers (2010-2012)

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<thead>
<tr>
<th>Customer</th>
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<tbody>
<tr>
<td>ICE</td>
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<td>NOAA</td>
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<td><strong>All organizations (combined)</strong></td>
<td>~700 Total Flights **</td>
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An Example — Forest Fire Support
Other Emerging Applications for Large UAS

- ISR for land-use base-lining, monitoring, planning
- ISR for disaster response and search and rescue
- ISR for infrastructure monitoring
- ISR for environmental stewardship
- ISR for security monitoring
- Emergency communications node
Investment and Funding

- **The following areas are desperately in need of government and private sector investment**
  1. Sense and Avoid systems, certified algorithms, and testing
  2. Command and communications secure aviation spectrum allocations
  3. GCS to ATC ground-based communications
  4. Policy and rulemaking
Like most change projects, the following 10 phases seem to apply:

1. Putting together the initial change planning team (experts)
2. Definition of vision statement
3. Definition of goals and objectives
4. Information build-up
5. Brainstorming solutions
6. Assigning organizations, responsibilities, funding, and resources
7. Testing, down-selection, and identification of solutions
8. Implementation planning
9. Conducting the implementation
10. Monitoring the change – correct as necessary