General Atomics Aeronautical Systems, Inc.

Presented By:

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GENERAL ATOMICS AERONAUTICAL

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**

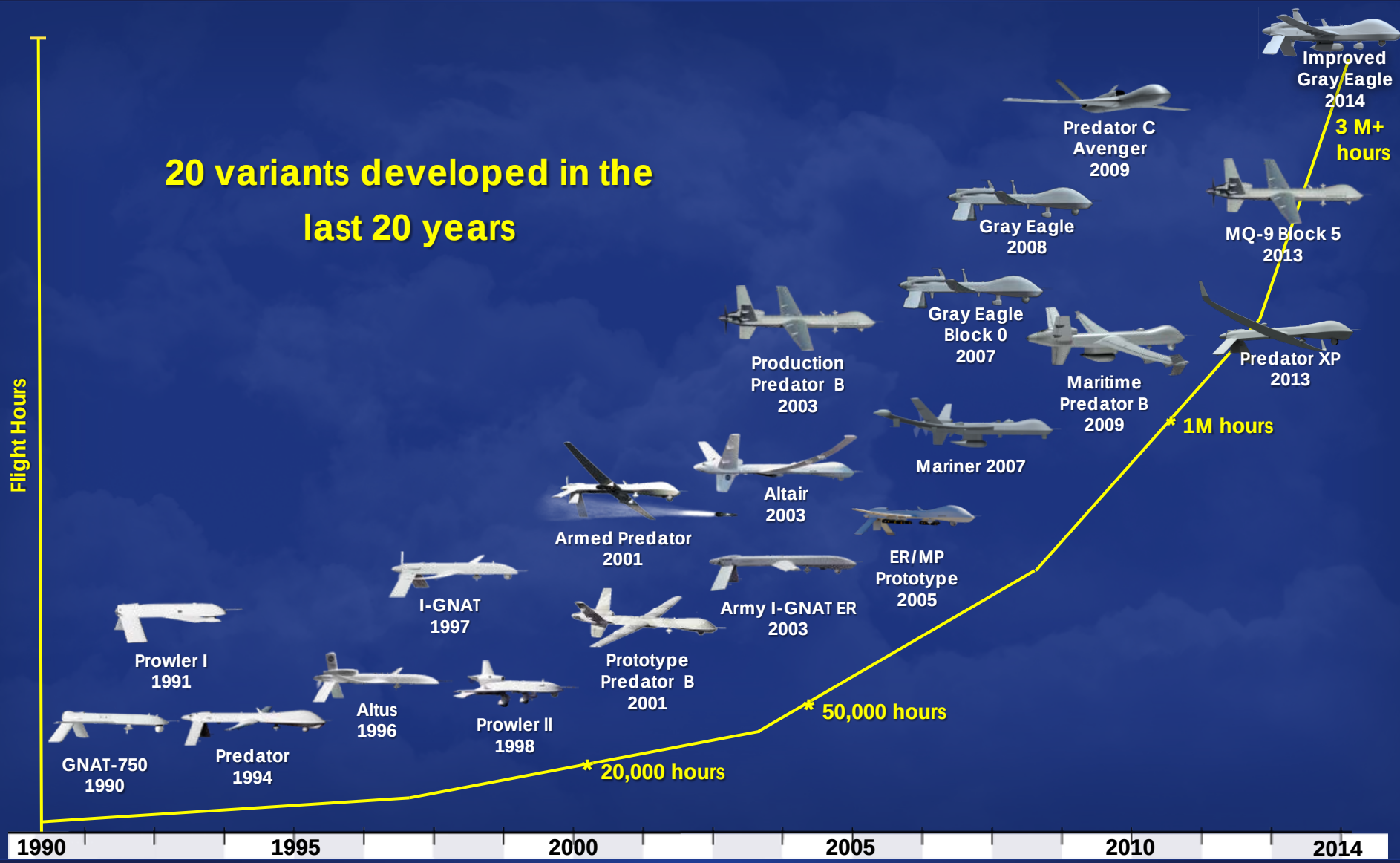
Avenger
Armed Reconnaissance
Multi-Mission, Quick Response

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

Gray Eagle
U.S. Army Ground Troop Support

Predator/Predator XP
Regional Surveillance

Growth and Evolution



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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)

Guardian

The Guardian is the same aircraft as Predator B but with maritime sensors

CHARACTERISTICS

Wing Span:	66 ft
Length:	36 ft
Powerplant:	Honeywell TPE331-10
Max Gross Takeoff Weight:	10,500 lb
Fuel Capacity:	3,900 lb
Payload Capacity:	850 lb int. 3,000 lb ext.
Payloads:	AIS, ESM , EO/IR camera system, 360º Multi-mode Maritime Radar

PERFORMANCE

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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

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

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

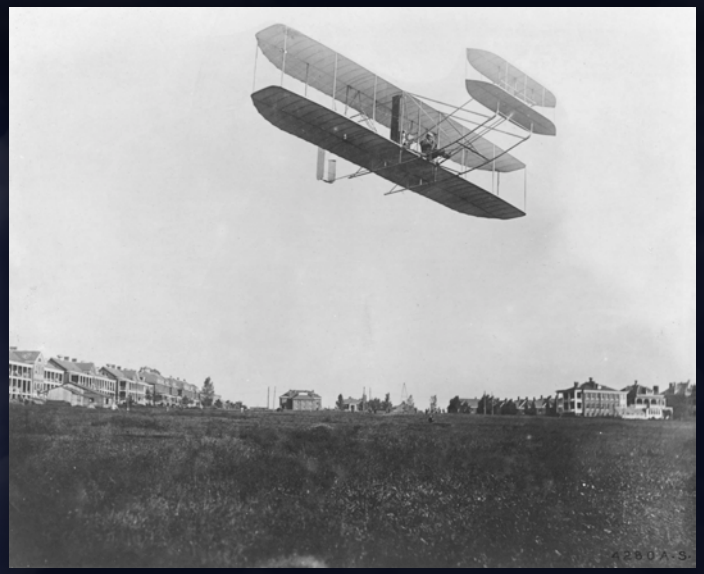
Long Endurance **Mission Flexibility** **Best Value**

Pace of Change

"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



Putting the Change Into Context

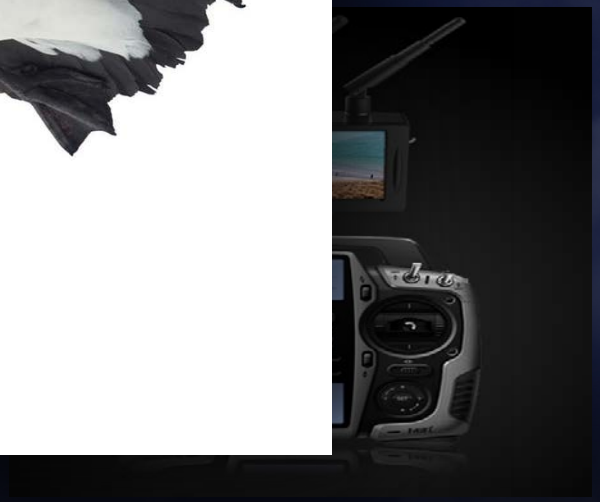
We are now at a place where what, where, when, and how we fly should be a significant factor in determining the appropriate rules, regulations, and levels of certitude.

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



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Putting the Change into Context

- 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?

FAR 91.119 Minimum Safe Altitudes: General

- **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 "barnstorming" your crops, houses, fences, or property anyway)

The Future

Is there gold in them thar hills?

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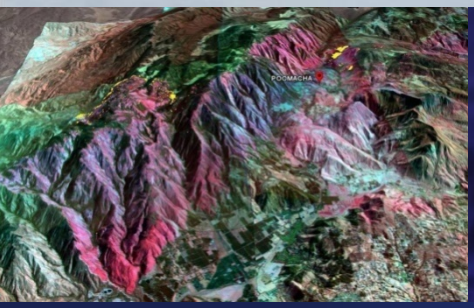
DHS' Predator B Flew Nearly 700 Times for a Variety of Customers (2010-2012)

Customer	Flights
ICE	183
USCG	134
DEA	106
State/local law enforcement	64
FEMA	20
DOJ	19
Bureau of Land Management	16
U.S. military	15
U.S. Forest Service	13
FAA	11
NOAA	6
All organizations (combined)	**~700 Total Flights**

An Example — Forest Fire Support



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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

What Should Be Done Next?

- **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