

# Predator Precision Weapons Integration and Testing

Precision Strike PEO Forum  
July 2006

# Overview

- **Predator mission**
- **Predator weapons integration objective**
- **MQ-1B Predator weapons integration and test**
  - Hellfire
  - Stinger
- **MQ-9 Predator B weapons integration and test**
  - GBU-12
  - Hellfire
- **Summary**

# Predator Mission

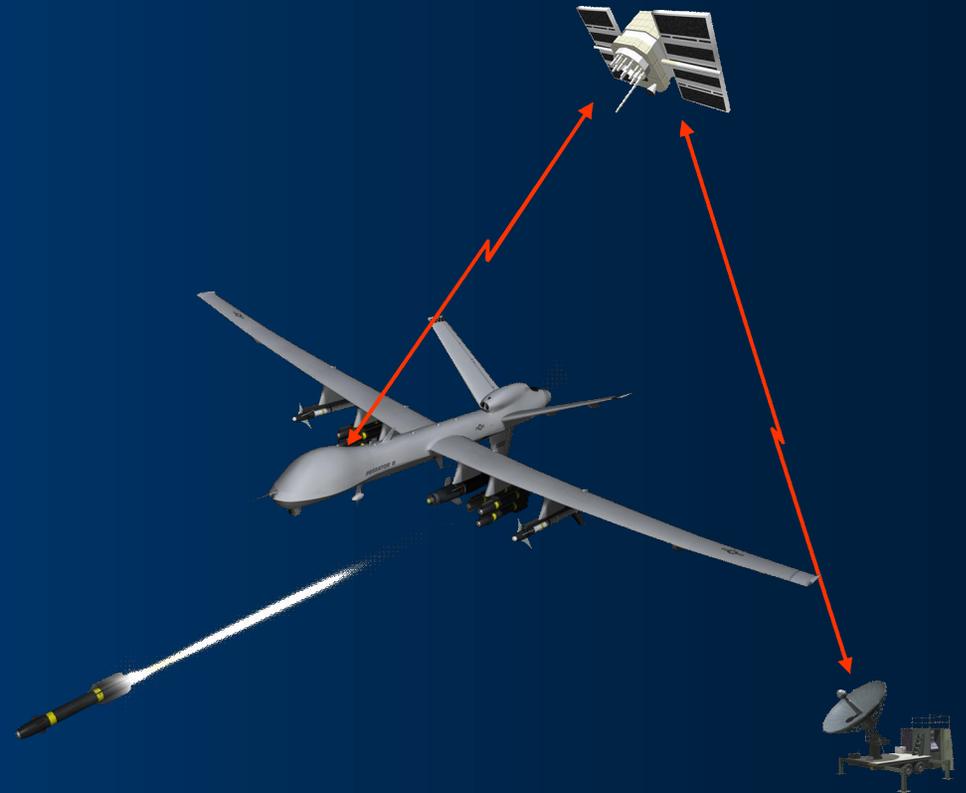


- **Interdiction and armed reconnaissance against critical, perishable targets**
- **Reconnaissance, surveillance and target acquisition in support of the Joint Forces commander**

# Mission

## Armed

- Is what it has always been
- Weapons coming off airplanes
- But now with precision accuracy



# Mission

- **Reconnaissance is now accomplished with:**
  - Persistent airborne platform
  - Day and night streaming video
  - Synthetic aperture radar to image through clouds
  - Near instantaneous distribution world wide

# Mission

- **Long Endurance Armed Reconnaissance**
  - 30-50 hr flight times
  - Camera and radar sensors to detect
  - Precision weapons to destroy
- **To make it routine**
  - The pilot/crew had to come out of the airplane
  - The airplane had to be reliable enough to run for 30 – 50 hr per flight
  - A control scheme had to be developed in order to fly the airplane anywhere
  - Unique distribution and reception systems

# Ground Control Station (GCS)



- **C-Band Line-of-Sight (LOS) data link for take off, landing**
- **K<sub>u</sub>-Band satellite link for missions over the horizon**

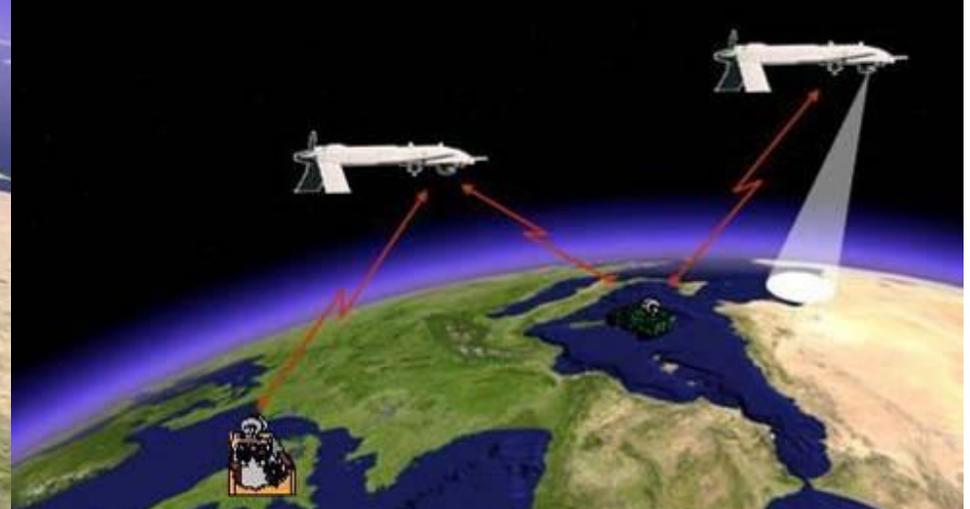
# Multi-Aircraft Control GCS



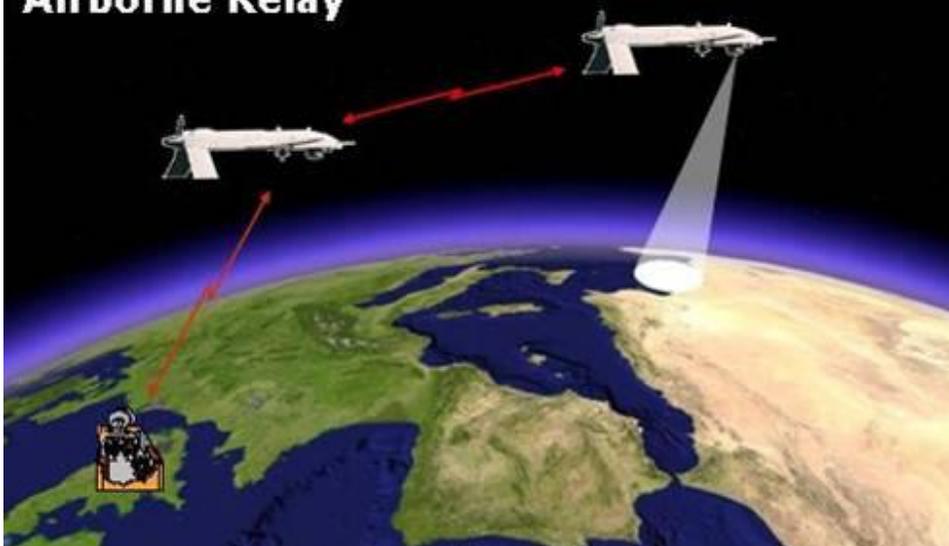
### Line of Sight



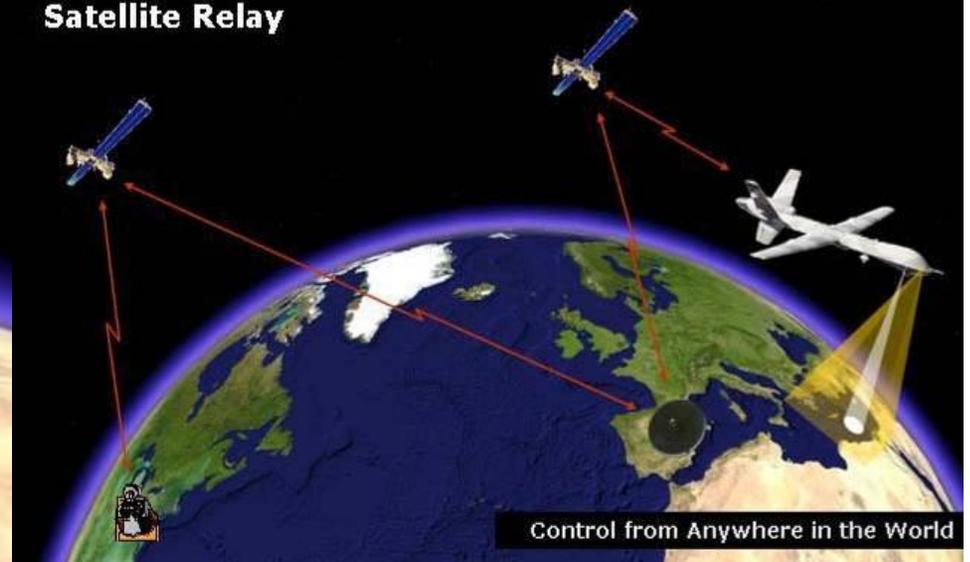
### Forward Pass



### Airborne Relay



### Satellite Relay



# Weapons Integration Objective

- **Overall objective of Predator precision weapons integration:**
  - Provide persistent ability to hold time sensitive targets at risk any time, any place
  - Enable compression of end-to-end kill chain

# Predator History

- **First flown 1994, deployed to the Balkans 1995**
- **Modified to carry Hellfire 2001**
- **Fleet hours now over 215,000, 2/3 in combat**

# Hellfire



## HELLFIRE AGM-114C

Weight	98 lb
Length	64 in
Min range	0.5 km
Max range	8.0 km
Velocity	Mach 1.3



## M-299 Hellfire Launcher

Weight (4 rail)	145 lb
Weight (2 rail)	96 lb
Standard	14'' lugs
Built-in safe arm switch	

# MQ-1 Hellfire Testing



- **Incremental build-up**
  - Ground static live fire
  - Phase 1 flight test: AGM-114C at low altitude
  - Phase 2 flight test: AGM-114K/M at higher operational altitudes
  - AGM-114 P flight test: AGM-114P designed specifically for Predator to allow high off boresight shots

# Hellfire Static Ground Launch



# Static Ground Launch (Cont.)



# Hellfire Phase 2 Flight Test





# Air-to-Air Stinger Weapon System

- **Accurate and lethal system**
  - Fire and forget missile
  - Two color IR/UV seeker
  - Effective against all known countermeasures
- **Currently fielded on OH-58C, OH-58D, and MH-60 helicopters**



Missile Length	58 in
Missile Diameter	2.75 in
Missile Weight	23 lbs
Missile Speed	Up to Mach 2
Air-to-Air Carriage System	Two per launcher

# Predator Stinger Flight Test Program

- **Contract award 25 Sep 02, completed in 56 days**
- **Captive Carry Tests**
  - Functional air-to-ground tests
  - CONOPs development
    - Cessna 206 engagements
    - F-16 engagements
- **Live-Fire Tests**
  - All air-to-ground launches
  - Operations based from China Lake NAWC
  - Varied aircraft communications
    - C-band LOS
    - Ku-band SATCOM
  - Eight missile launches
    - Four Blast Test Vehicles
    - Four Full-up Rounds



# Predator Stinger Flight Test Program

- **Captive Carry Test Results**
  - Robust air-to-ground capability
  - Initial air-to-air CONOPs developed
- **Live Fire Demonstration Results**
  - Safe separation from all eight missile shots
  - Four Full-up Rounds
    - Shot 1: Impact between ground targets
    - Shot 2: Timed self-destruct prior to target
    - Shot 3: Timed self-destruct prior to target
    - Shot 4: No self-destruct – potential missile failure
  - Set world record for highest Stinger Missile launch (20,000' MSL)



# Stinger Operational Use



# MQ-9 Predator B System Description



- **Mission:**
  - Hunter-Killer: Prosecute critical emerging time sensitive targets as a radar-based attack asset with organic hard-kill capability
  - ISR and target acquisition
- **History**
  - First flown 2001
  - Currently integrating GBU-12, GBU-38 and Hellfire under the MQ-9 System Development and Demonstration (SDD) program

# MQ-9 Predator B System Description (cont)



Predator

Predator B

	Predator	Predator B	Factor
GTOW	2,250 lb (1022 kg)	10,500 lb (4772 kg)	4.6
HP	105	900	8.6
Maximum Altitude	25,000	50,000+	2
Maximum Speed	120 KTAS	240 KTAS	2
Fuel	600 lb	4,000 lb	6.6
Payload Nose	450 lb (204 kg)	800 lb (363 kg)	1.8
Payload Wing	250 lb (113 kg)	3,000 lb (1363 kg)	12
Endurance	40 hr	30 hr+	.75

# MTS-B EO/IR Payload



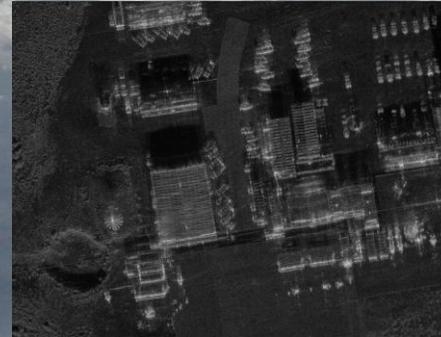
# Lynx SAR



1m resolution



0.3m resolution



Dwell spot 0.1m

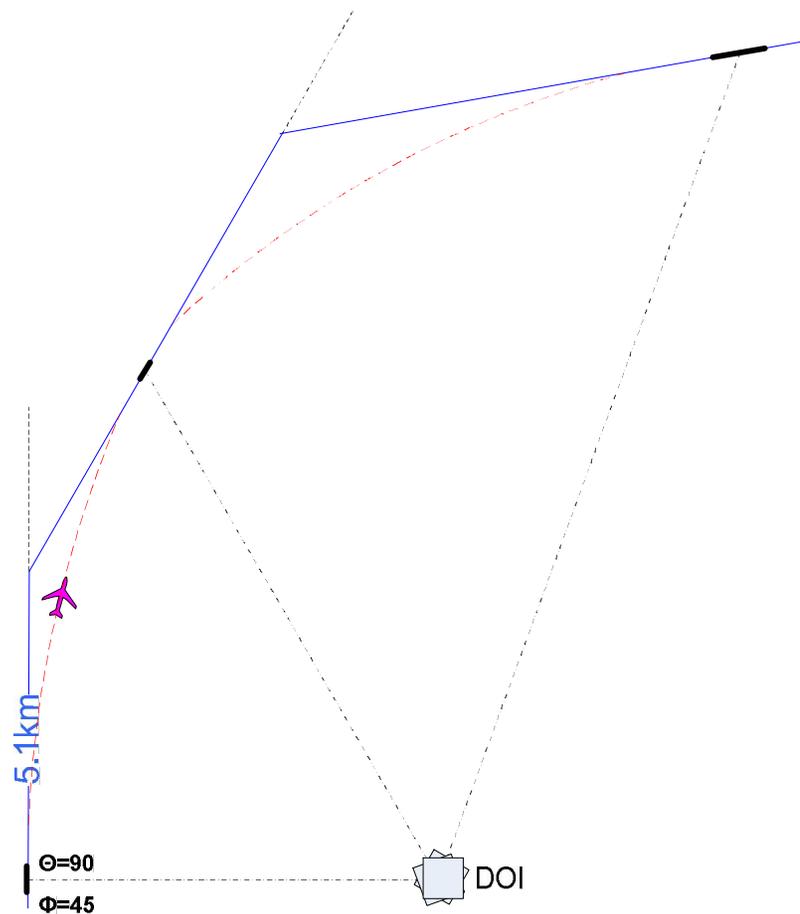


Drill-down zoom sequence with SAR and EO-imagery

# Lynx 3D Targeting

- Spot images collected at three (3) points
- Ability to cue EO/IR sensor or pass target coordinates to weapons

Example 30 Kft Flight Path



# GBU-12 Munition

- **GBU-12 Munition**
  - 500 lb class weapon
  - Part of the Paveway II family of munitions
  - Semi-active laser guidance
  - Bang-bang autopilot control
  - No electrical connection to the host aircraft
- **Currently in service with the US Air Force and US Navy**



<b>Munition Length</b>	<b>129 in</b>
<b>Munition Diameter</b>	<b>11 in</b>
<b>Munition Weight</b>	<b>609 lb</b>
<b>Fuze</b>	<b>FMU-81</b>
<b>Booster</b>	<b>FZU-2</b>

# BRU-15 Bomb Rack

- **BRU-15/A Bomb Rack**
  - Electro-mechanical gravity rack
    - No pyrotechnics or pneumatic actuation
  - Release via 28 v electrical impulse
- **Currently fielded on the P-3B and P-3C Orion aircraft**



<b>Rack Length</b>	<b>23.5 in</b>
<b>Rack Height</b>	<b>5.4 in</b>
<b>Rack Weight</b>	<b>16 lb</b>
<b>Standard Suspension</b>	<b>14 in</b>
<b>Aero 1A Adapter Suspension</b>	<b>30 in</b>

# Human Machine Interface



# GBU-12 and Hellfire Test Program

- **Standard test program for weapons integration**
  - Ground:
    - Ground vibration tests
    - Drop test
    - System Integration Lab (SIL) test
  - Flight
    - Separation tests
    - Handling qualities
    - Guided inert drops/launches
    - Guided live drops/launches



# GBU-12 Separation Testing



# GBU-12 Live Drop



# MQ-9 With Hellfire and GBU-12



# MQ-9 Hellfire Flight Test



# Summary

- **MQ-1 and MQ-9 are well suited for precision weapons delivery**
  - Designs allow easy mission role expansion
  - Man-in-the-loop allows for positive control of weapons employment
  - Satellite control and persistence allows weapons to be in the right place at the right time to engage time sensitive targets
- **MQ-1 continues to be a vital weapon systems in the GWOT**
- **MQ-9 will bring significant additional capability to the fight**

