



U.S. AIR FORCE

Air Force Materiel Command



Dominant Air Power: Design For Tomorrow...Deliver Today

Developing, Fielding, and Sustaining America's Aerospace Force



U.S. AIR FORCE

The Predator Unmanned System

From Advanced Concept
Demonstrator to Transformational
Weapon System

Frank Grimsley
303d AESW/EN

Integrity - Service - Excellence

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE SEP 2008		2. REPORT TYPE		3. DATES COVERED 00-00-2008 to 00-00-2008	
4. TITLE AND SUBTITLE The Predator Unmanned System From Advanced Concept Demonstrator to Transformational Weapon System				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) 303rd Aerospace Wing, 2640 Loop Rd West, Wright Patterson AFB, OH, 45433				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM002183. Presented at the Technology Maturity Conference held in Virginia Beach, Virginia on 9-12 September 2008.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



U.S. AIR FORCE

Why UAS? Operator Pull



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Advances in Sensor Technology**
 - **Reduced Size & Weight**
 - **High Resolution**
 - **Permit Detection of Fixed and Moving Targets**
- **Pressure to Minimize Casualties both Civilian and Military**
- **Requirement for Persistent Surveillance of the Battle space**
 - **Taxes or Exceeds the Limits of Human Endurance**
- **High Marks from Combatant Commanders in Serbia, Afghanistan and Iraq**



U.S. AIR FORCE

Technology Transition Resistance



Dominant Air Power: Design For Tomorrow...Deliver Today

- 1. Culture And Policy**
 - **Long Standing, Large Organizational Bias Against New, Unproven Technology Or Concepts**
- 2. Competition With Legacy And Other Programs For Funds**
- 3. Program Start Stop Syndrome –**
 - **Uncertain Requirements**
 - **Stop Production In Favor Of Next Best UAS**
- 4. Greater Than Expected Costs, Mishap Rates, Survivability Concerns**
- 5. Radio Frequency Bandwidth Concerns And Interoperability**

Ref: *OSD UAS Roadmap*

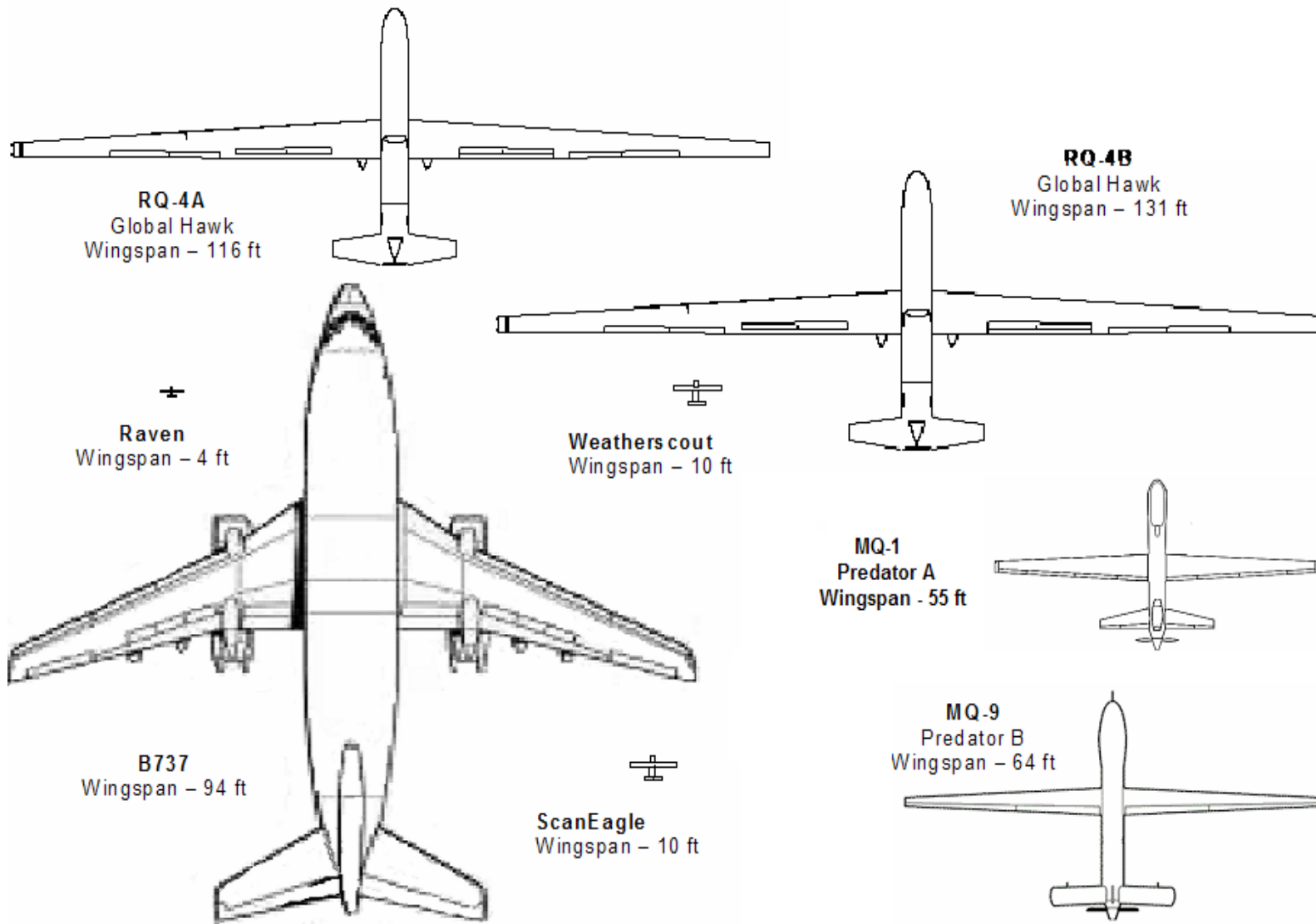


U.S. AIR FORCE

RSW UAS Size Comparison



Dominant Air Power: Design For Tomorrow... Deliver Today





U.S. AIR FORCE

MQ-9A Program Description



Dominant Air Power: Design For Tomorrow...Deliver Today

•Hunter-killer (*Reaper*)

- Find, Fix, Track, Target, Engage And Assess
- Prosecute Critical Emerging Time Sensitive Targets
- Radar-based Targeting With Organic Hard-kill Capability
- Secondary Role Of Intelligence, Surveillance, Reconnaissance

Wingspan: 66 FT
Length: 36 FT
Max Speed: 240 KTAS
Max Endurance: 24 hr
Max Fuel: 4,000 lb
Max Altitude: 50,000 ft
GTOW: 10,500 lbs
External Payload: 3000 lbs (6 wing hard points)





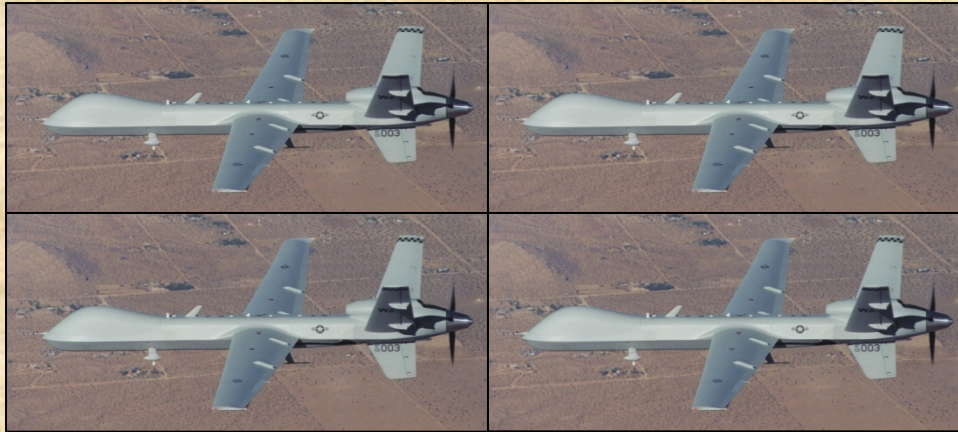
U.S. AIR FORCE

MQ-9A System Description



Dominant Air Power: Design For Tomorrow...Deliver Today

Forward Operating Base



MQ-9A Air Vehicles



Launch & Recovery
Ground Control
Station



Ground Data Terminal
(Line of Sight Link)



Support Equipment
& Ready Spare Parts

Intermediate OL



Primary Predator Satellite Link
(SATCOM / Beyond Line of Sight)

Main Operating Base



Fixed Ground Control Station

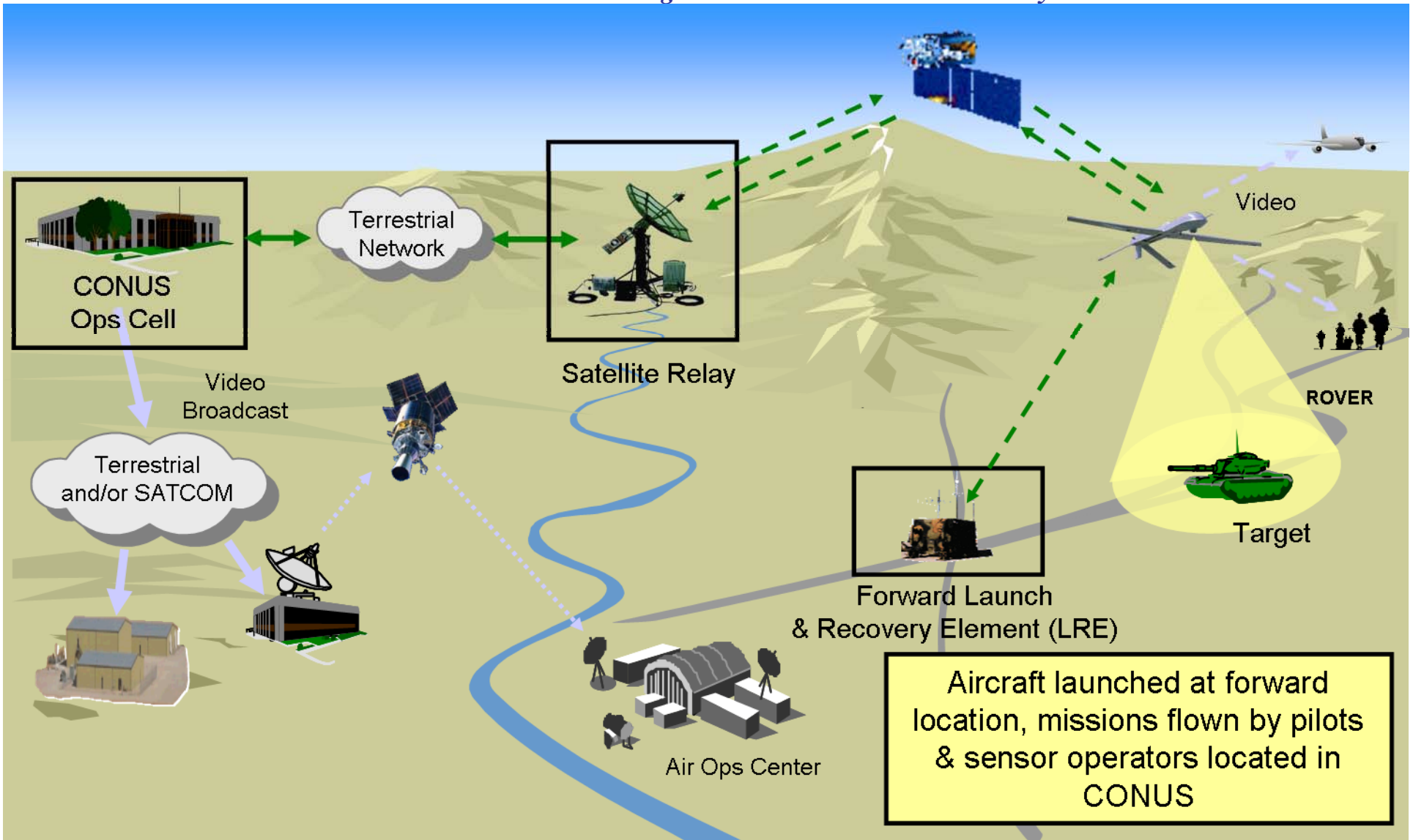


U.S. AIR FORCE

Remote Split Operations (RSO)



Dominant Air Power: Design For Tomorrow...Deliver Today





U.S. AIR FORCE

Critical Enablers



Dominant Air Power: Design For Tomorrow...Deliver Today

- **MQ-1 Predator With Hellfire (FY2001)**
 - Required CSAF Gen Jumper Top Down Leadership
 - Familiar With System Since Bosnia
 - Drove The Weaponization Effort
- **Rover (FY 2001)**
 - Developed As An Urgent Warfighter Need For AC-130 Gunship (FY 2001)
 - Transitioned To Ground Forces (FY2002)
- **These Two Technologies Combined To Create The Perfect Tool For Iraq And Afghanistan**
 - Broke Down A Large Number Of Stovepipes



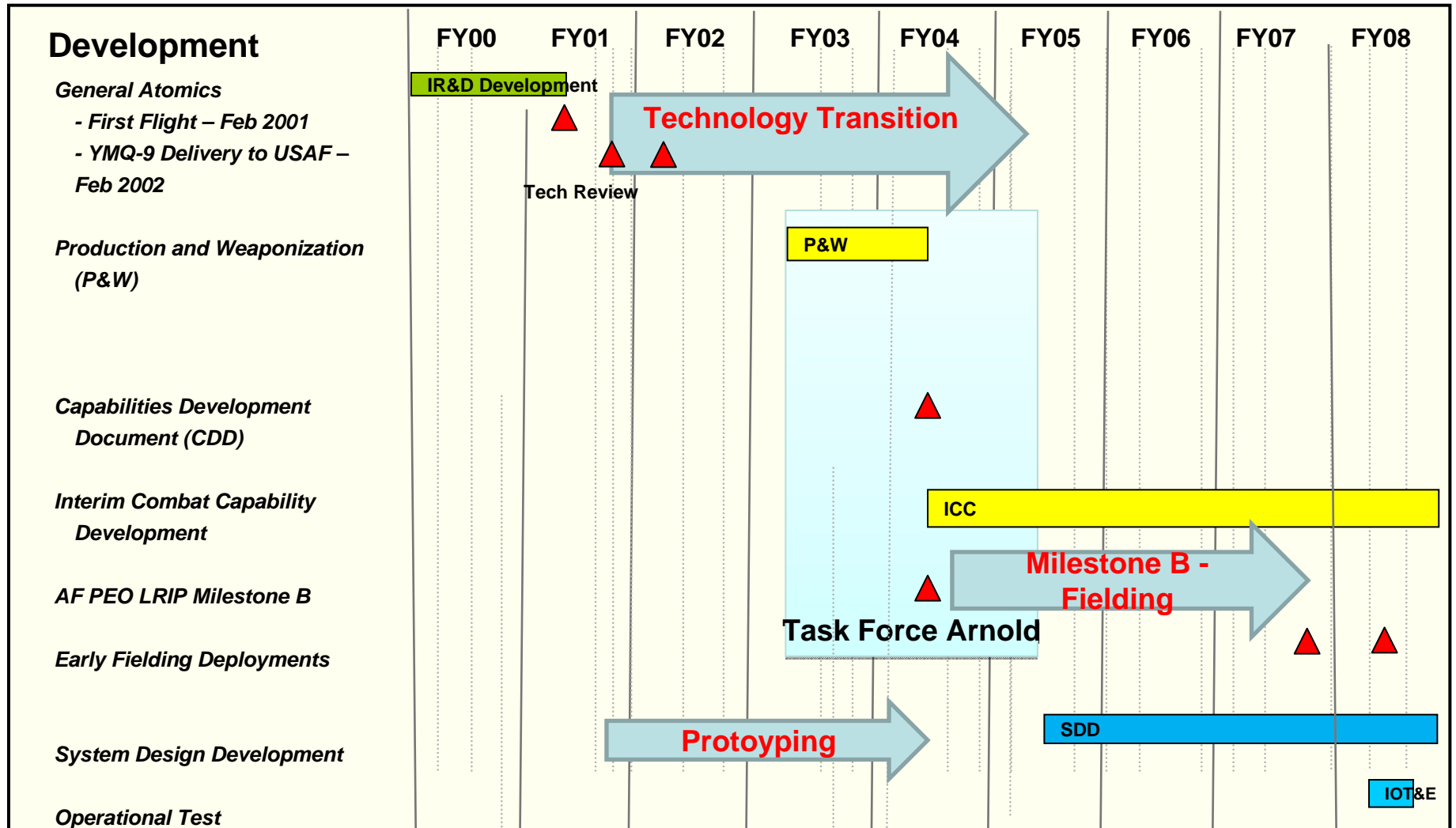


Schedule



U.S. AIR FORCE

Dominant Air Power: Design For Tomorrow...Deliver Today





U.S. AIR FORCE

Technical Transition Phase Prototyping



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Originated As Industrial Research And Development (IRAD) Program By GA-ASI In 2000**

- **First Flight in Feb 2001**



- **Post 9-11-01 Accelerated Purchase Of First Two YMQ-9 “Predator B” – Support War On Terror**

- **Delivered First “As Is” Configuration To USAF In Feb 02**

- **Used DERF (Defense Emergency Response Funding)**

- **Expanded Envelope And Payload Capacity (Beyond MQ-1)**

- **Early Focus On Agile, Quick Reaction Development/Test**



U.S. AIR FORCE

Technical Transition Phase Prototyping



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Predator B Tech Review (Dec 2001) Held Prior To Purchasing Two Prototypes**
- **Findings**
 - **A/C #1 And #2 - “Development” Aircraft - Not FAR 23 Compliant**
 - **Limited Flight Testing To Date (Approx. 90 Flight Hrs)**
 - **Performance Estimates Available - GA Analytical Numbers**
 - **High Altitude Endurance Flight Test In Progress (Up To 50 K-ft)**
 - **A/C Capability -- “Fall-out” Of Current Configuration**
 - **Structural Limitations - Landing Gear & Wing Structure (A/C#1)**
 - **Both Less Than 10,000 lbs GTOW**
 - **Similar Electronic System Reliability To Predator A - Single Thread Flight Controls**



U.S. AIR FORCE

Technical Transition Phase Task Force Arnold



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Task Force Arnold (TFA) Created To Increase Oversight**
 - Senior USAF Leadership (Secretary Of The Air Force, Chief Of Staff Of The Air Force, Commander Of Air Combat Command)
 - Conducted From Feb 03 Thru Jun 05
 - Focused On Warfighter Capabilities And Priorities
 - Provided Stable Vector, Direction And Objectives
- **Oversaw Multi-phase Transitional Efforts**
 - Productionization And Weaponization (P&W) – Jul 03
 - Strengthened Structural Integrity (Expand Payload Capacity)
 - Improved Avionics And Flight Controls (Fully Redundant)
 - Improved Communication, Radar (Lynx SAR) And EO/IR Sensor
 - Interim Combat Capability (ICC) – Apr 04 Basic Weapons Capability
 - GBU-12 / AGM-114 HELLFIRE / GBU-38 JDAM (FY08)
 - 45kVA High Capacity Starter-Generator System
 - FAA Certified 1-Box Digital Electronic Engine Control (DEEC)



U.S. AIR FORCE

Technology Transition Phase Results



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Air Combat Command Program Direction Approved By JROC (Joint Requirements Oversight Council)**
 - Capability Development Document (Inc I) – Dec 04
- **Air Force Program Executive Officer Approved Milestone B (LRIP I) – Feb 04**
 - Approved 10 Pre-production Prototypes
 - Approved 4 A/C For First Low-rate Initial Production (LRIP I)
 - Continue R&D Efforts To Improve Capabilities
- **Congress Added 7 More A/C (FY04)**





U.S. AIR FORCE

System Development And Demonstration (SDD) – Mar 05



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Improved Weapons Capability**
 - GBU-12 / AGM-114 HELLFIRE / GBU-38
 - Improved BRU-46(SL) Bomb Rack Development/Integration
 - Stores Management System (SMS) Improvements
- **Lynx SAR Improvements**
- **Blue Suit Technical Order Development**
- **Logistics Management Information (LMI)**
- **Electromagnetic Interference / Environmental Testing**
- **Airworthiness Certification**

“Normalize But Don’t Slow Down”



U.S. AIR FORCE

Conclusions



Dominant Air Power: Design For Tomorrow...Deliver Today

- **MQ-9 Was Able To Overcome Technology Transition Resistance**
 - ✓ **Culture And Policy - Long Standing, Large Organizational Bias Against New, Unproven Technology Or Concepts**
 - **Followed MQ-1/Rover Success**
 - ✓ **Competition With Legacy And Other Programs For Funds**
 - **Aircraft System Is Inexpensive Relative To Other Weapon Systems**
 - ✓ **Program Start Stop Syndrome –**
 - **Uncertain Requirements**
 - **Stop Production In Favor Of Next Best UAS**
 - **High Level Champion In Task Force Arnold**
 - **Consistent Funding, Requirements**
 - **Over 22,700 Flight Hours**



U.S. AIR FORCE

Conclusions



Dominant Air Power: Design For Tomorrow...Deliver Today

- ✓ **Greater Than Expected Costs, Mishap Rates, Survivability Concerns**
 - **MQ-1 Mishap Rates Have Improved Dramatically**
 - **MQ-9 Leverages MQ-1 Lessons Learned (Ex. Redundant Flight Systems, Planned A/W Certification)**
- ✓ **Radio Frequency Bandwidth Concerns And Interoperability**
 - **Interoperability With MQ-1 Ground Stations, Rover, Video Exploitation, Etc**



U.S. AIR FORCE

Summary



Dominant Air Power: Design For Tomorrow...Deliver Today

- **Successful Transitions Require:**
 1. **High Level Champion**
 2. **Needs To Integrate With Existing Operator Infrastructure**
 3. **Early Successes**
 4. **Operator Needs To Be Involved Early**
 - **Willingness To Experiment**
 - **Requirements**