Air Force Aerial Targets

“Preparing for the New Threat”

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40th Annual NDIA Air Targets,
UAVs Range Operations Symposium

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Director, Aerial Targets SPO
Eglin AFB, FL

Overall Classification of This Briefing is Unclassified
Overview

• Background
• Product Groups
  – Full Scale Aerial Targets
  – Subscale Aerial Targets
  – Target Control Systems
  – Target Payloads
• The Way Ahead
Aerial Targets Program Management Directive:

- “Aerial targets are required for both development and operational testing of weapons systems. Title 10 United States Code 2366 requires all new or improved weapon systems demonstrate their lethality prior to production. Aerial targets and the missile scoring systems carried on-board are the mechanism to demonstrate that lethality. In addition, fielded weapons systems undergo continual evaluation under the USAF Air-to-Air Weapon System Evaluation Program (WSEP).”

Aerial targets are also used for evaluation/training exercises such as WILLIAM TELL.
• The entire Air Force Aerial Targets team provides
  – Realistic threat-representative aircraft “presentations”
    • The target itself
    • The ability to control the target in the air
    • Launch, recovery, maintenance, repair

• The Aerial Targets System Program Office
  – Develops, procures and sustains aerial targets and related systems
Program Description

- We support:
  - Developmental test
  - Operational test
  - Operational evaluation
  - Exercises (e.g., WILLIAM TELL)
  - Training

- We operate at:
  - Tyndall AFB, FL
    - Eglin Gulf Range
  - Holloman AFB, NM
    - White Sands Missile Range (WSMR)
Who Are Our Customers?

Missile development programs .... and testers !!!

AMRAAM

ASRAAM

SPECIAL PROGRAMS

AERIAL TARGETS

Shooters... Operators... Maintainers...
Overview

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  – Target Payloads

• Long-term View
Program Manager: 1Lt Gabe Hiley
Lead Engineer: Mr. Glenn Ragsdale

Full Scale Aerial Targets (FSAT)
Description: - Retired F-4E/G Aircraft Reinstated by AMARC
- Converted to Remote-Controlled Target
- Large Payload Capability for ECM
- Supports Live Fire / Lethality Testing (Title X)

Contractor: BAE Systems, Mojave CA

Contract Type: FFP

Acquisition Phase: Production / Sustainment

Joint: Air Force / Army / FMS

Operating Ranges: Eglin Gulf Range & White Sands Missile Range (WSMR)
QF-4 Limitations

- Not representative of 4th- or projected 5th-generation threats (fighters)
- QF-4s are not interoperable across multiple Service T&E ranges
- Expect increasing supportability issues in the 2007-2010 timeframe
FSAT – Where Are We Going?

• Air Superiority Target (AST)
  – Follow-on to QF-4, first true tri-service FSAT
  – IOC required FY 10 (draft ORD)
  – Will better represent 4th or 5th generation fighter aircraft
  – Cost estimate provided to ACC for FY04 POM
AST Requirements

• Draft “joint interest” ORD:
  – Produce sufficient targets to support DoD requirements from FY11 through FY25
  – Annual kill rate of 25 ASTs
  – Total anticipated buy of 375 drones

• Must operate at multiple locations:
  – Tyndall AFB, FL / Eglin Gulf Range
  – Holloman AFB, NM / White Sands Missile Range
  – NAWC China Lake, CA
  – Point Mugu, CA
• PRDA released to Industry – Jul 01
• Contractors to identify solutions to meet AST ORD requirements
  – Airframe
    • Retired Military Aircraft
    • Foreign Aircraft
    • UAVs
    • Other than Existing Aircraft
  – Manned or Unmanned
  – Presentations
  – Mobile Range Concept
  – Ground and/or air launch
  – Re-configurable vehicles
AST TMI Concept Studies

• Three contracts awarded in Sep 01:
  – Lockheed Martin Corporation
    Palmdale CA
  – Lockheed Martin Corporation
    Fort Worth TX
  – The Boeing Company
    Military Aircraft and Missile Systems
    St Louis MO
## Notional AST Schedule

<table>
<thead>
<tr>
<th>FY02</th>
<th>FY03</th>
<th>FY04</th>
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- **FY03 Gov Analysis**
- **Acquisition Program Planning / Study**
- **Contract Award / EMD**
- **Production Decision**
- **Prod Lead Time**
- **First Prod Deliveries**

- 24 months
- 48 months
Overview

• Background

• Product Groups
  – Full Scale Aerial Targets
  – Subscale Aerial Targets
  – Target Control Systems
  – Target Payloads

• Long-term View
**MQM 107**
Program Manager: Lt Paul Claveloux
Lead Engineer: Mr. John Goleta

**AFSAT**
Program Manager: Elaine Farrington
Lead Engineer: Mr. Joel Knight

**BQM 34-A**
Program Manager: 2Lt Keith Larson
Lead Engineer: Mr. John Goleta

**Subscale Aerial Targets**
BQM-34

Program Manager: Lt Keith Larson
Systems Engineer: Mr. John Goleta
BQM-34A
Where Are We Now?

Description:
- More survivable (than QF-4)
- Less expensive
- High-G maneuvers (vs MQM-107)
- Highly maneuverable
- High-altitude flight
- Transonic speeds
- Carry heavy EA/ECM
- Proportional control (-53)
- Advanced maneuvers (-53)
- Operation down to 50 feet (-53) w/ RALACS
- Factory-installed scoring subsystem/hardware for payloads

- **Contractor:** Northop-Grumman Ryan Aeronautical Center
- **Acquisition Phase:** Production/Deployment/Sustainment
- **Used by:** Army/Navy/Air Force
MQM-107 SUSTAINMENT

Program Manager: Lt Paul Claveloue
Systems Engineer: Mr. John Goleta
MQM-107 Program
Sustainment Effort

Description: Subscale aerial target
- More survivable (than full scales)
- Less expensive
- Highly maneuverable frequently augmented with IR pods

Target Inventory: MQM-107D (Raytheon)
MQM-107E (BAE)

Sustainment Contractor: BAE Flight Systems

Contract Type: Fixed price--time and materials

Acquisition Phase: Sustainment

Used by: Army/Air Force
Air Force Subscale Aerial Target (AFSAT)

Program Manager: Elaine Farrington
Systems Engineer: Mr. Joel Knight
AFSAT

- What We Need
- AFSAT Direction
- AFSAT Contract Award
- Operational Benefits
- Unique Features
- Top Level AFSAT Schedule
- Potential AFSAT Future
What We Need

- Single multi-mission subscale aerial target to satisfy infrared and electronic attack missions.
- Affordable multi-mission capability
- Fix shortfall in subscale inventories (FY06)
- Provide capability for future growth
AFSAT Key Requirements

Threshold/Objective

- **Payload weight (lbs)**
  - Total (wings) 300/500
  - Internal 100/350

- **Endurance/Mission time (min)**
  - Total 60/75
  - Mil Power 30 of 60 (@ 15k ft) / 45 of 75 (@ 500 ft)

- **Airspeed (@15kft)**
  - Minimum 250 KCAS/200 KCAS
  - Maximum 0.90M / 1.5M

- **Formation flights** 2, 3, and 4 targets
AFSAT Contract Award

• Contract awarded 12 July 02 to Composite Engineering Inc (CEi)
  – CEi name for new target: “Skeeter”
  – Herley Vega - avionics
  – MicroTurbo - engine
  – Boeing - guidance and control
  – Irvin – recovery system
  – ATK - RATO
Operational Benefits

• Design meets/exceeds payload objectives
  – Internal Weight Capacity = 350 lbs (350 lbs)
  – Wing (each) Weight Capacity = 300 lbs (250 lbs)

• Meets low airspeed objective; 200 KCAS @ 15,000 ft

• Meets/exceeds all key performance parameters (KPP)
Unique Features

• New airframe design—all composite
  – High strength and stiffness to weight ratio
  – Corrosion resistant
  – Airframe can support growth initiatives for KPPs

• Repairs and Maintenance
  – 44% reduction in number of exterior parts
  – Internal parts reduced by over 1000
  – Minor damage is field repairable
  – Modular design offers easy access
Unique Features (cont)

- 44% reduction in number of exterior parts
- Internal parts reduced by over 1000
AFSAT Schedule

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<td>Contract award: 12 Jul 02</td>
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Potential AFSAT Future

• Meets Air Force requirements and potential multi-service use

• Improvements to address:
  – Multi-service Target Control System (MSTCS)
  – Enhanced engine for speed/endurance
  – Signature
  – Internalized Electronic Attack systems
  – Air launch capable
Overview

• **Background**

• **Product Groups**
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• **Long-term View**
Target Control Systems

- Gulf Range Drone Control System (GRDCS)
- Multi Service Target Control System (MSTCS)
GRDCS

- Current range system, used to track/control targets, weapons, other airborne assets
- Functional at the Eglin Gulf Range (includes Eglin AFB and Tyndall AFB)
- Slightly different version also functional at White Sands Missile Range (WSMR)
- Operational since early 80’s
GRDCS Description

Capability to Track

- Control 4 drones, any mix of: QF-4, BQM-34A, MQM-107D/E
- 4 shooters
- Terminate 4 missiles
- 4 high fliers
- 2 other aircraft

Assets

- 8 consoles
- 14 ground stations
- 15 tracking pods plus spares
- 2 GRDCS Mobile Control Systems (Tyndall & Holloman)
GRDCS Limitations

• Access and reliability of 915 MHz data-link
  – Commercial interference
  – Spectrum sell-off
• Not deployable
  – No GPS
  – Requires multi-lateration
• Lack of secure operations
MSTCS Program Description

Provide an interoperable suite of equipment and software for use within the Department of Defense for command and control of the various target systems.
MSTCS Demonstration

- OSD-funded CTEIP program to upgrade system
- MSTCS concept demo, managed by 46th TW
  - Develop / build transponder and control software interface
  - Create new software and hardware vehicle interface
  - Demo completed by FY 05
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  – Target Payload Systems
• Long-term View
Target Payload Systems

Program Manager: MSgt Wes Fenton
Lead Engineer: Mr. Ernest Finney
**Mission:** Enhance combat readiness through use of electronic attack (EA) simulators that enable aerial targets to better represent real-world threats

**Key Players:**
- **Naval Air Warfare Center (NAWC)**
  - Provide LRUs for DLQ-9s and ALQ-188s
  - Builds DLQ-9s
- **WR-ALC/LNXB**
  - Sustainment support for ALQ-188s
- **Quick Reaction Capability (QRC)--Northrop Grumman--Rolling Meadows IL**
  - Pod integration, sustainment

**Existing Systems:** AN/ALQ-188B, DLQ-9
Payloads – Where are we now?

DLQ-9

AN/ALQ-188B
Payloads—
Where are we now?
Payloads - Where are we going?

• Miniaturization
  – Integrate current EA payload LRUs for internal carriage on subscales
  – Encourage miniaturization of EA radar into AFSAT production at earliest opportunity

• Other EA enhancements
  – Keep pace with ability to represent threats
  – Analog / digital signal processing enhancements
    • Threat-driven and non-threat-driven

• Internalized chaff/flare on AFSAT
  – Integration of ALE-47
Scoring Systems

Program Manager: 2Lt Joseph Pugliese
Lead Engineer: Mr. John Goleta
Vector Doppler Scorer (VDOPS)

**Description:**
- Commercial Off-the-Shelf (COTS) system for non-cooperative missile scoring requirements
- Supports air-to-air missile testing (DT & OT) and training programs

**Prime Contractor:** Cartwright Electronics

**Contract Type(s):** Firm-fixed price (Hardware, Spares, Logistics Support, Sustaining Engineering)

**Phase:** Production / Sustainment (full contractor logistics support)

**Initiatives:** “Shrink” VDOPS for AFSAT; QF-4 antenna re-design

**Issues:** - Radio frequency spectrum encroachment
## Key Performance Parameters

<table>
<thead>
<tr>
<th>KPPs</th>
<th>Threshold Baseline</th>
<th>Actual Estimate</th>
<th>Variance</th>
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<tbody>
<tr>
<td>Max Position Error</td>
<td>2.0 ft</td>
<td>&lt;2.0 ft</td>
<td>Meets ORD</td>
</tr>
<tr>
<td>Max Velocity Error</td>
<td>5%</td>
<td>&lt;1%</td>
<td>Exceeds ORD</td>
</tr>
<tr>
<td>Max Attitude Error</td>
<td>5 deg.</td>
<td>&lt;5 deg.</td>
<td>Meets ORD</td>
</tr>
<tr>
<td>Timing Correlation</td>
<td>± .1 ms</td>
<td>± .02 ms</td>
<td>Exceeds ORD</td>
</tr>
</tbody>
</table>
• VDOPS antenna pattern coverage
  – QF-4 pattern coverage concern for modeling/simulation of missile performance
  – No concern with subscale targets

• Telemetry RF encroachment
  – Current VDOPS TM bandwidth sold
  – New user starting ops (2310-2350 MHz)
  – Temporarily able to work “around” new user; need new RF band
  – Options limited, potentially costly
    • L-band: No E-9 TM relay capabilities
    • Lower S-band: Crowded; Hardware mod required
VDOPS
Enhanced Antenna Array

- Prototype QF-4 antenna array
  - Designed to mitigate current full-scale scoring reliability issues
  - In-line Transmit-Receive Interface Module (TRIM)
    - Boosts signal / filters “noise”
    - Redesigned antennas to maximize coverage
VDOPS
Enhanced Antenna Array

Current Nose Antenna Pattern

Redesigned Nose Antenna Pattern

Not to scale
VDOPS
Enhanced Antenna Array

Current Tail Antenna Pattern
Redesigned Tail Antenna Pattern

Not to scale
VDOPS
Enhanced Antenna Array

Old Wing
- 120 feet
- 80 feet
- 18 feet
- 24 feet
- 5 feet

Current Wing Antenna Readings

New Wing
- 130 feet
- 110 feet
- 90 feet
- 80 feet

Redesigned Wing Antenna Readings
VDOPS
Enhanced Antenna Array

Current Nose Antenna Readings

Redesigned Nose Antenna Readings
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Future Challenges

• The Days of a “Vanilla” Target are Gone
  – Advanced aircraft and cruise missile threats
    • Performance
    • Signature
    • Electronic Attack Countermeasures
    • Chaff & Flares
## Common Service Pod TMI

### Description
- Design Target Control System (TCS) interface card
- Generate required TCS software changes
- Generate engineering and production drawings
  -- Must be suitable for competitive procurements
- Construct prototype
- Ground test
  -- Obtain appropriate flight test approvals (SEEK EAGLE, Safety, etc.)
- Flight test
- Document test results vs. requirements

### FY 03 Scheduled Effort
- Requirements Review
- Basic Concept Design
- Structural & Aero Analysis
- Basic Electrical Design
- Preliminary Design Review

### “Key” Performance Parameters
- Enable aerial targets to simulate evasion techniques employed by threat fighter aircraft
- Ability to dispense USAF & USN & foreign CM at threat representative rates & numbers from a common design
- Provide this realistic threat capability to a full scale drone
- Integrate existing ALE-47 dispenser system into a stretched Mongoose pod

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**Common Service Pod TMI**

**Mongoose**

**Common Service Pod (AF version)**

**Common Service Pod (Navy Version)**
**Subscale IR / IRCM TMI’s**

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th><strong>FY03 Scheduled Effort</strong></th>
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</table>
| - IR Enhancement TMI will allow use of cheaper subscale for potential full-scale missions  
  -- Spatially / spectrally similar IR target signature  
- IR Countermeasures TMI will replicate threat representative IRCM, including  
  -- Spectral Intensity  
  -- Dispense rates  
  -- Dispense angles | - Develop/fabricate prototype hardware  
- Perform static tests  
-- Determine functionality of the prototypes  
- Additional effort scheduled in FY04 |

**“Key” Performance Parameters**

- Better enable subscale targets to emulate enemy threat fighter aircraft in the IR spectrum, far-field
Lt Col Jeffery S. Robertson
Director, Aerial Targets SPO
Eglin AFB, FL

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