48th Annual NDIA Conference
Targets, UAVs & Range Operations
Symposium & Exhibition

Boeing QF-16 Program

QF-16 Full Scale Aerial Target
Boeing Global Services and Support
Maintenance, Modifications, & Upgrades
Aircraft Sustainment & Maintenance

Mr. Robert Insinna
QF-16 Program Manager
October 21, 2010

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Boeing Targets / Decoys

- Cost Effectively Converting Highly Reliable, NDI Air Vehicles
- Providing Foundation for New Development Programs
- Boeing’s Systems Integration Expertise and Teaming
- Application of Boeing Critical Technologies
- Synergy Among Our Targets, Unmanned Systems, and Weapons Programs
Demonstrated Performance on Non-OEM Platforms

- **T-38 Avionics Upgrade Program**
  - Cockpit digital conversion on Non-Boeing platform
  - 100% on-time production delivery (465 units)
  - System Design Exceeding Mean Time Between Failure Key Performance Metric

- **C-130 Avionics Modernization Program**
  - Cockpit digital conversion design and installation on Non-Boeing platform

- **A-10 Wing Replacement Program**
  - Structural Design and Interface to Non-Boeing Platform
  - Experience Working with Non-Boeing Engineering Documentation

- **MA-31 Target System**
  - Russian KH31 Missile Conversion to US Target System
  - Upgraded to Precision Guidance with Boeing Developed Hardware/Software
QF-16 Overview

Key Features

- Follow on for QF-4 Program: Supersonic, High-G, Heavy Payload Capability
- Satisfies Title 10 "Live Fire/Lethality"
- Provides 4th Generation Threat Representation
QF-16 Program Key Sites

QF-16 Program Office and Engineering
St. Louis, MO

BAE SYSTEMS
Johnson City, NY
Automatic Flight Control Computer

Cecil Field
Jacksonville, FL
Aircraft Modifications, Ground and Flight Test

Tyndall AFB
Contractor Flight Testing
USG DT&E, IOT&E, Operations

Davis-Monthan AFB
AMARG

White Sands Missile Range
USG IOT&E, Operations

Program Management Support and Logistics IPT
Boeing Fort Walton Beach, FL

Eglin AFB
691 ARSS
Program Office

Leveraging the Best of Industry to meet Customer needs
QF-16 FSAT Roadmap Meets All Government Milestones

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Government Roadmap

- 2009: A/C Deliveries (6 F-16)
- 2010: DT/OT IOT&E Tyndall WSMR
- 2011: RAA IOC
- 2012: Ground Tests
- 2013: Flight Tests
- 2014: Build Develop
- 2015: CDR SRR
- 2016: SVR1
- 2017: SVR2
- 2018: Pre-EMD EMD LRIP
- 2019: Lot 2 Lot 3 Lot 4 Lot 5 FRP/Deployment/Sustainment
- 2020: SPS 6 QF-16 A/C

Contractor IMS

- 2009: MS A
- 2010: MS B
- 2011: MS C

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**Functional Baseline - DPE**

- **Drone Peculiar Equipment (DPE)** refers to the unique airborne equipment developed to remotely command and control the QF-16 aircraft and provide scoring data for end game mission analysis.
  - Target Control System integration
  - Launch and Recovery
  - Full F-16 flight envelope performance and maneuvers
  - Payload control and deployment
  - Commanded or Automatic Flight Termination
  - Visual Augmentation
  - End game scoring

- **DPE consists of multiple subsystems with Top Level functions:**
  - Automatic Flight Control System (AFCS)
    - Take-off and Landing
    - Programmed Maneuvers & Automatic Sequences
    - Throttle Control
    - Air vehicle command and control
  - Command Telemetry System (CTS)
    - Target Control System to AFCS interface
  - Payload Control System (PCS)
    - Payload control and deployment
  - Flight Termination System (FTS)
    - Commanded or automatic immediate termination of aerodynamic flight
  - Vector Scoring System (VSS)
    - End game projectile miss distance
  - Visual Augmentation System (VAS)
    - Commanded Pulsed smoke trail for visual acquisition
Peculiar Support Equipment (PSE) refers to the unique support equipment developed to test and troubleshoot the QF-16 Drone Peculiar Equipment (DPE)
  – Acceptance test of QF-16 modifications at Cecil Field
  – Pre-Mission Test of QF-16s at Tyndall and Holloman AFB
  – Diagnosis and Isolation of DPE anomalies

PSE consists of an Automated System Test Set (ASTS) and a Portable Flight Line (PFLT) Tester.
  – ASTS Top Level Functions
    - Perform full QF-16 system level Acceptance Test Procedures (ATP) to verify that the DPE drone modifications are installed correctly
    - Perform NULLO (Not Under Live Local Operation) Pre-Mission system level validation Test (PMT)
    - Fault isolate to the QF-16 DPE major Line Replaceable Unit (LRU) level
  – PFLT Top Level Functions
    - Test and troubleshoot the QF-16 system to the DPE LRU level
    - Load Operation Flight Programs (OFPs) for DPE systems with flight-line loadable OFPs
    - Program levels for payloads signals
QF-16 Architecture Block Diagram

Ground Systems
- GRDCS/DFCS
- VSS Ground Terminal
- FTS Cmd/Cntrl

PSE
- ASTS
- PFLT

Airborne Systems
- DPE
- CTS
- AFCS
- VSS
- VAS
- FTS
- PCS

F-16
Synthesis and Integration

- Architecture has been defined and the suppliers selected
  - Alternative concepts defined and analyzed
  - Physical interface definition started

Drone Peculiar Equipment (DPE)

- PCS – Payload Control System
- AFCS – Automatic Flight Control System
- VAS – Visual Augmentation System
- VSS – Vector Scoring System w/ Encryption
- CTS – Command Telemetry System
- FTS – Flight Termination System
- ASTS
- PFLT
Advanced Engineering Applied to QF-16

- Use of X-ray and Laser Scanning Technology
  - Rapid prototyping of risk reduction articles
  - 3D modeling of equipment installation

Rapid Prototype of FTS Pallet Installation on Block 25 F-16

3D Modeling of Equipment Installation in Gun Ammo Bay

- Rapid Prototype of F-16 Structure for Visual Augmentation Equipment Installation
Static Destruct Test

- Testing supports QF-16 Flight Termination System Warhead Placement
- Static Destruct Test Successfully Completed at Eglin AFB - August 2010
- Test Results show FTS warhead detonation will terminate QF-16 flight
Antenna Testing

- Completed Testing in Boeing Near Field Test Facility
  - Determined RCS contribution of QF-16 unique antennas
  - Antennas installed on F-16 Test Asset
- Antenna Pattern Testing at Boeing’s Antenna Test Range, planned for January 2011.

Near Field Testing

Antenna Pattern Testing
Test and Evaluation

- A dedicated QF-16 System Integration Lab (SIL) will be used to support integration of DPE/PSE, to develop SW for DPE, and to support Flight Testing
  - Hardware in loop testing, GRDCS Simulations and GRDCS Data Link Testing (GDLT)
- Contractor Aircraft Ground and Flight Testing - Cecil Field
  - Mobile GRDCS and GRDCS Portable Towers

- EMD Phase - DT/OT at Tyndall and at Holloman (White Sands Missile Range)
Ready to Support Drone Conversions

- Cecil Field  Recovery of first F-16
  - On time readiness
  - Trained and experienced support personnel

**Lean cellular production supports affordable, high quality, on time performance**
Program Summary

• The Boeing QF-16 Program leverages QF-4 supply base and maximizes the use of existing hardware and software capabilities to provide a low risk drone peculiar equipment solution.

• The program has progressed through the startup phase, completed a system requirements review (SRR), the integrated baseline review (IBR), and the system functional review (SFR). PDR is on schedule for October 2010.

• Boeing systems engineering processes and program management best practices are in place to provide successful execution of the program requirements.