



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

Boeing QF-16 Program



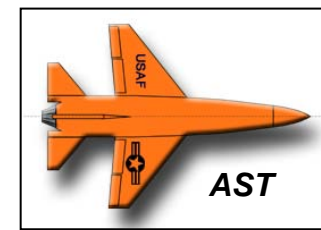
QF-16 Full Scale Aerial Target
Boeing Global Services and Support
Maintenance, Modifications, & Upgrades
Aircraft Sustainment & Maintenance

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

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



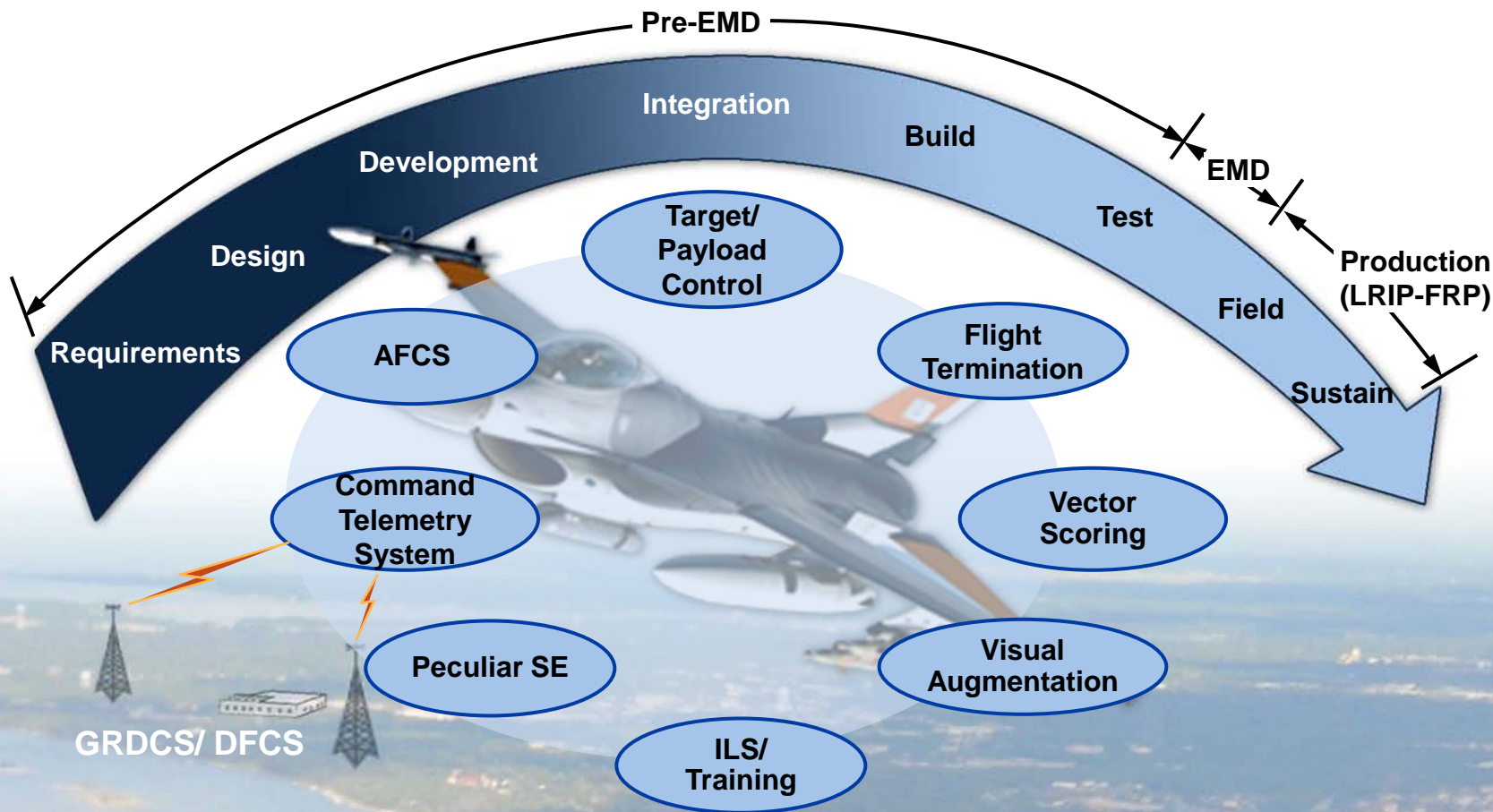
Demonstrated Performance on Non-OEM Platforms



- **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



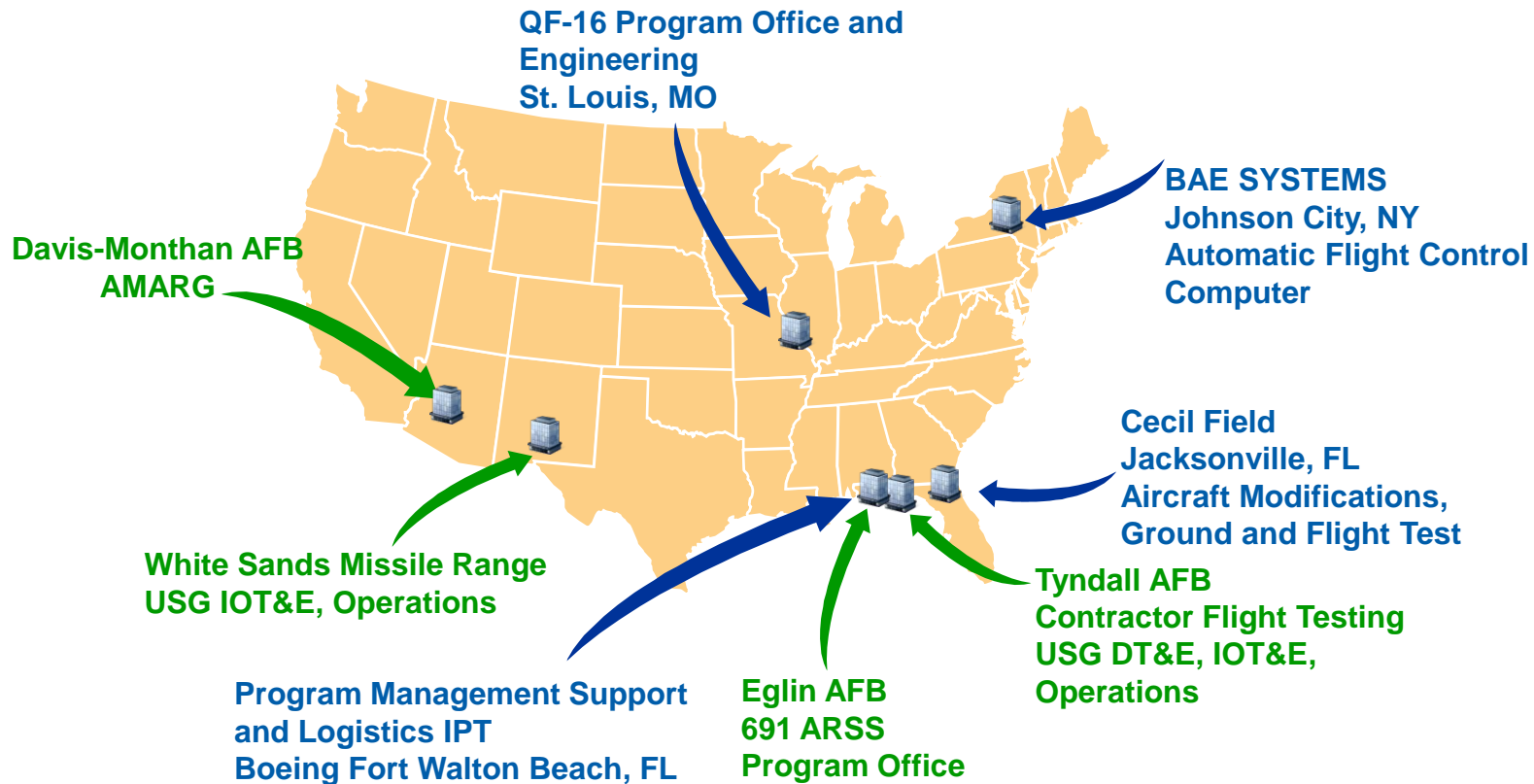
QF-16 Overview



Key Features

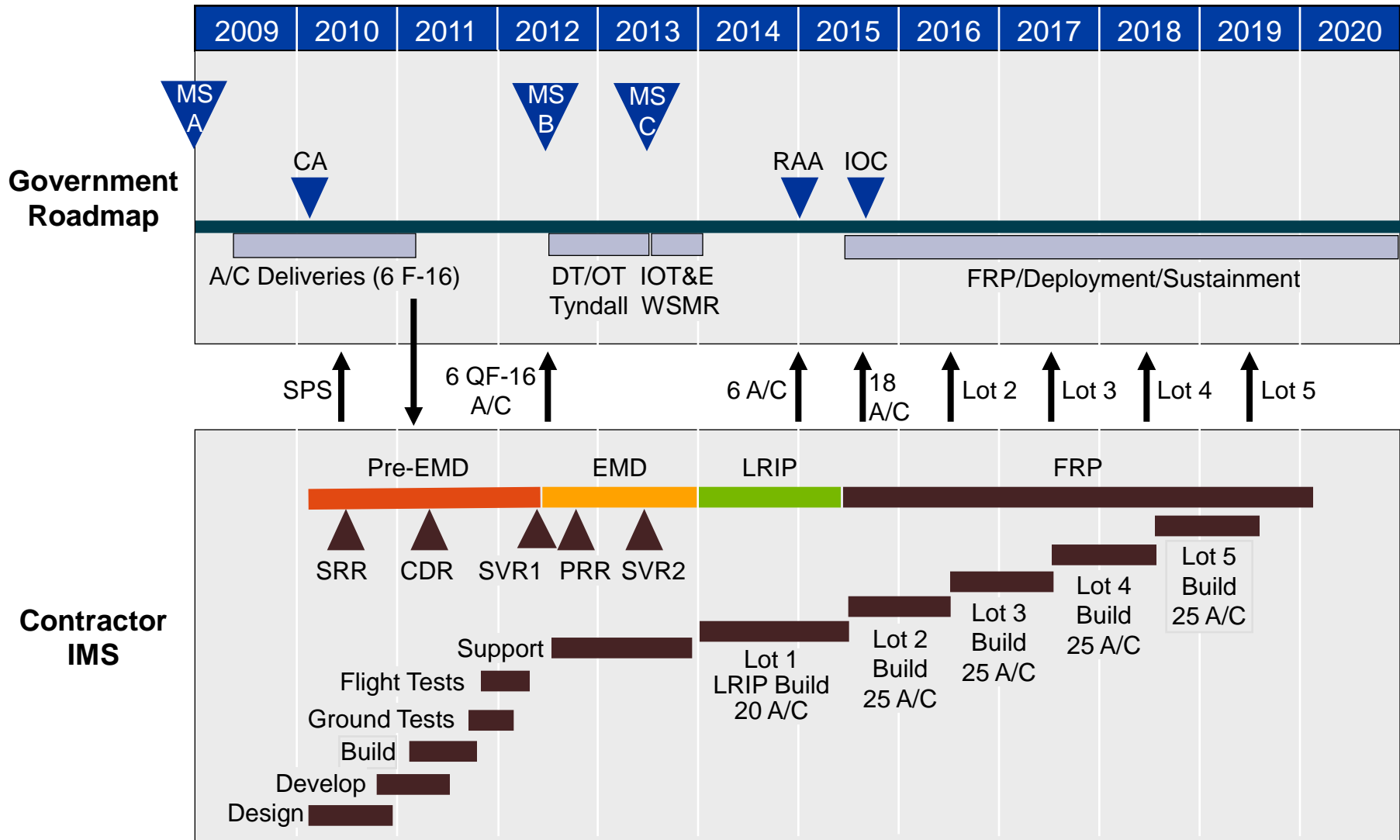
- Follow on for QF-4 Program: Supersonic, High-G, Heavy Payload Capability
- Satisfies Title 10 "Live Fire/Lethality"
- Provides 4th Generation Threat Representation

QF-16 Program Key Sites



Leveraging the Best of Industry to meet Customer needs

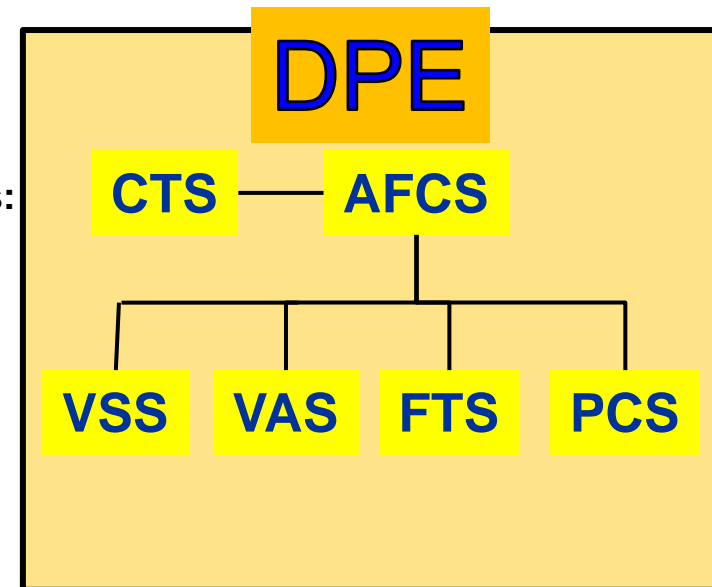
QF-16 FSAT Roadmap Meets All Government Milestones



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



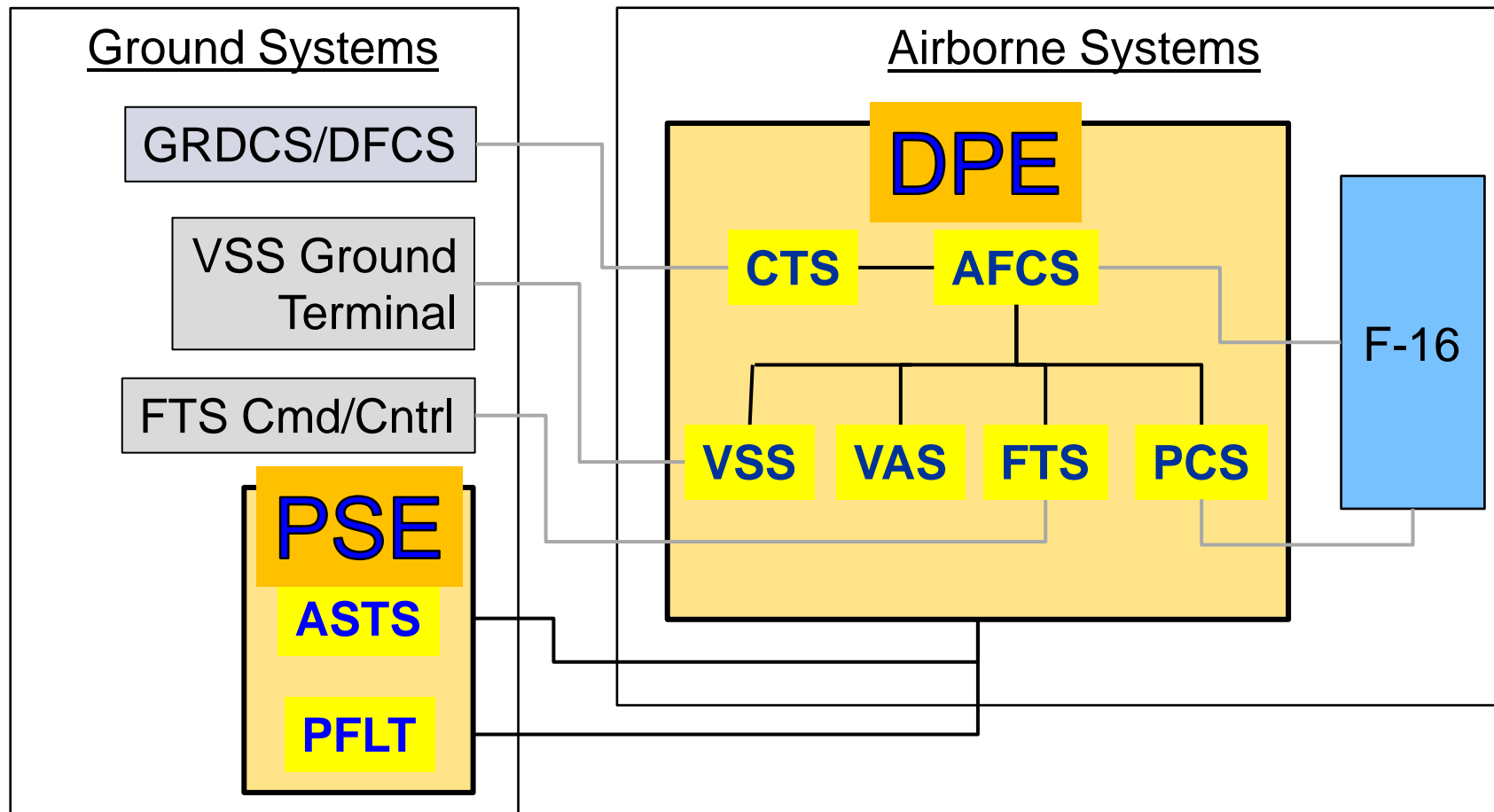
Functional Baseline - PSE



- **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



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

Peculiar Support Equipment (PSE)

ASTS



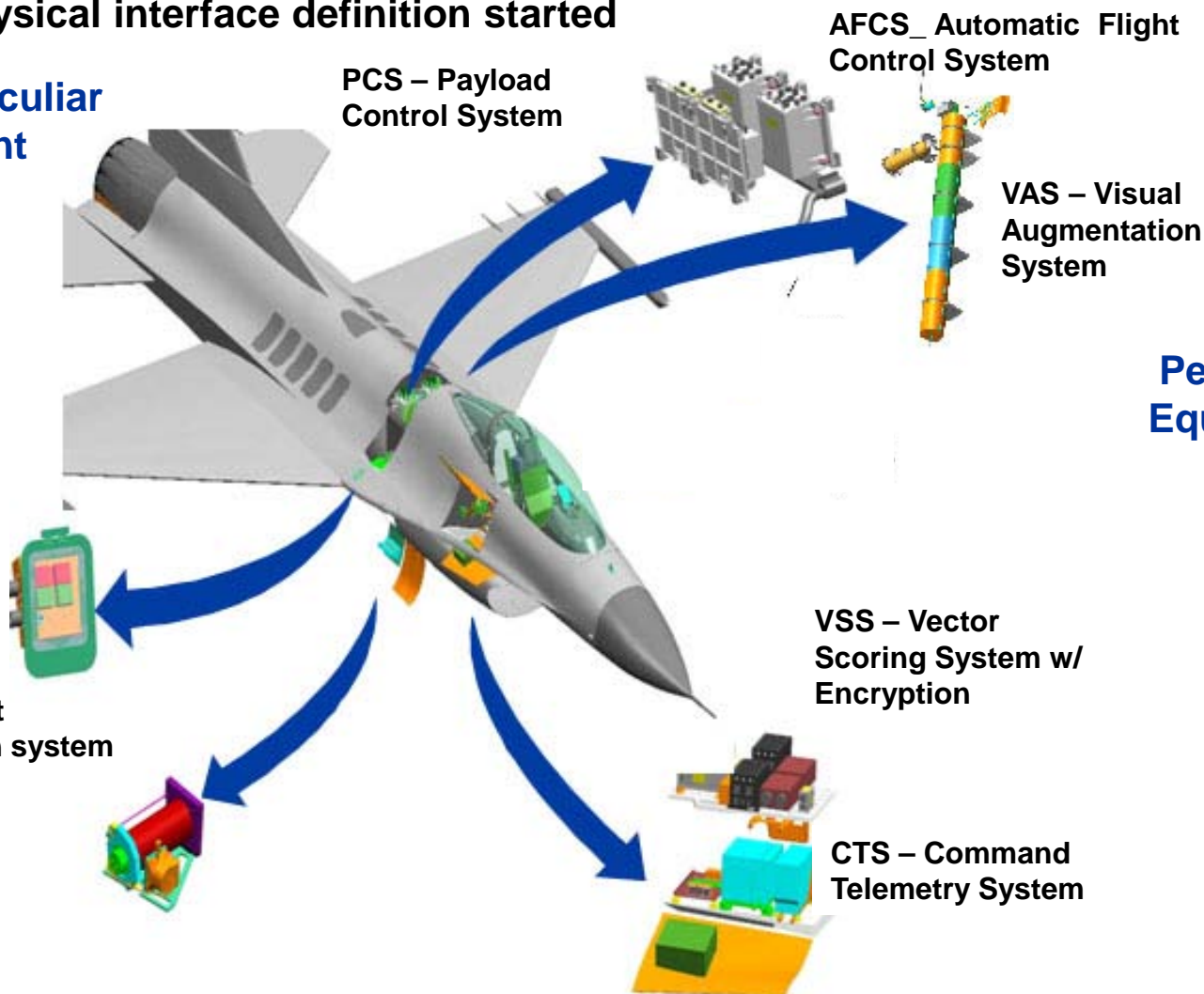
VSS – Vector Scoring System w/ Encryption

PFLT

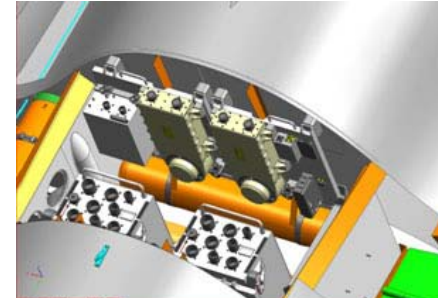


FTS – Flight Termination system

CTS – Command Telemetry System



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



3D Modeling of Equipment Installation in Gun Ammo Bay



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



- 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



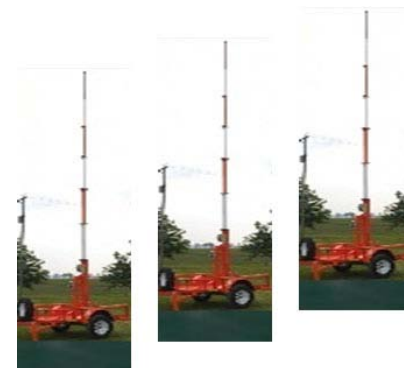
GDLT



SIL



Mobile GRDCS

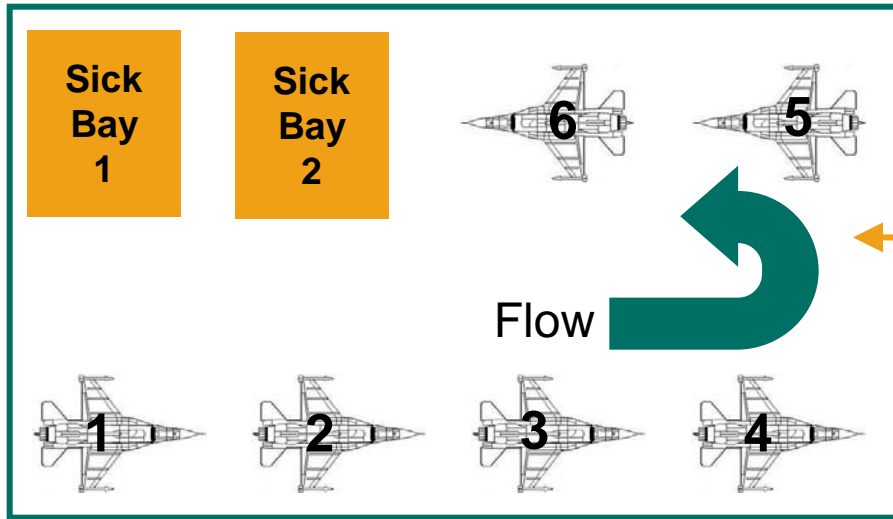


GRDCS Portable Towers

- 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.

Non-OEM Experience



System Integration Experience



Unmanned Experience



