DARPA/USAF/USN J-UCAS X-45A

System Demonstration Program

A Review of Flight Test Site Processes and Personnel

Gary B. Cosentino
Aeronautics Mission Directorate

Mar 12, 2008
DoD, Boeing, and NASA Partnerships

UCAV Program

Dryden Flight Research Center
Flight Test Expertise and Support
Unique Facilities and Airspace

Air Force Flight Test Center
Airfield and Airspace Management
Flight Test Infrastructure

Ames Research Center
Computational Fluid Dynamics

Wind Tunnel Tests

Langley Research Center
Transonic Wind Tunnel Testing

UCAV X-45
Roles & Responsibilities – Program Wide

DARPA/Program Office
• Government oversight/insight and approval authority
• SEIT IPT Lead
• Flight Test IPT Lead
• On-Site Rep – Gary Cosentino (Government Flight Representative)

Boeing
• Responsible Test Organization (RTO) for UCAV-ATD Flight Test Program, Per 845 OTA: MDA972-99-9-0003
  – System Integration & Test: “The contractor shall provide a disciplined, controlled process for system integration/test and demonstration flight tests”.
  – Owns the Flight vehicles and ground stations
  – Ultimately responsible for System Safety, Flight Safety, and Airworthiness
• System Test Director
• Test Ops and Planning
• Site manager
Roles and Responsibilities - NASA DFRC

- NASA Project Manager
- Range and Ground Safety
  - Range and Ground Safety Plans and Hazard Analyses
  - FTS Hardware (GFE), Design and Testing Reviews & Analyses
  - Operating and Support Hazards and Analyses, Procedures Review
- Flight Test Support and Infrastructure
  - Provide Hangar, Ground Station, and Office Space
  - Integrate Range Assets (Radars, Telemetry, Control Rooms)
  - Coordinate Assets and Flight Test Support with AFFTC
  - Chase Aircraft and In-Flight Photography
  - Ground Photography
  - Meteorology
- Technical and Engineering Tasks
  - Autonomous Ground Operations Software, Auto Taxi Control Laws
  - Contingency Management for Autonomous Vehicles (Ground Ops)
  - Assist with Air Data Calibrations and Parameter Identification
DFRC Engineering Contributions

Autonomous Ground Taxi Control Development:

GPRA Milestone: Demonstrate robust taxi capability with contingency planning for an autonomous vehicle (UCAV)

→ Demonstrated October 24, 2001

Structural Dynamics Testing and Analysis:

Ground Vibration Testing: Utilized three 50 lb. shakers for excitation input and 176 accelerometers to measure aircraft response

Other Flight Test Support:

Range Facilities, Telemetry Data, Tracking Radars Communications and Control Support Equipment and Infrastructure Lakebed Runways
Roles and Responsibilities - Air Force Flight Test Center

- AFFTC UCAV Deputy Project Manager

- 452nd FLTS
  - Currently providing 7 maintainers (2 crew chiefs and 3 weapons loaders)
  - 2 UAV Operators; 1 Mission Planner w/weapons drop experience
  - 1 Operations engineer, 1 Flight Test Engineer
    - JON established between DFRC and 452nd for flight test support

- System Safety Support from “day one”
  - AFFTC Safety/System Safety Office

- Spectrum Management Office support for concurrent radiation from “Trundy” Tower between Global Hawk and UCAV programs

- Propulsion support in Hush House

- Airfield management and air traffic control services
System Test Organization - Government (X-45A)

Program Director
Capt.(s) R. Alderson

SEIT IPT SYS A
Andrew Gutierrez

Flight Test IPT Lead
(Test Management/Planning)
Michael Schlabach

Flight Test On-site Representative
(Test Execution)
Gary B. Cosentino

AFFTC Support
Capt. Nichole Williams (Ops Engr)
Lt. Norman Dimalaluan (FTE)
Capt. Thomas McMasters (Mission)
Victor Martinez (Lead Engineer)

USAF MCS Operators
Maj Mike Marston (452nd FLTS)
Capt Kent Tiffany (452nd FLTS)

USAF Maintainers
MSgt. Ron Neuschwanger
SSgt. Troy Altevers
TSgt. Waylon Nez
TSgt. Michael Cook
TSgt. Fernando Batista
SSgt. Michael Fountain
SSgt. Chris Harsh

Project Management
Gary S. Martin (DFRC)
Lt. Devon Christiansen (AFFTC)
Tom O’Meara (Tybrin)
T-33 J-UCAS Surrogate Aircraft

Overview:

- Aircraft Nose Bay contains the UDS Flight Control and Communications Avionics Pallet
- UDS Pallet integrated with T-33 Autopilot; T-33 Controlled by the MCS operator during “up and away” flight (T-33 pilot cued for taxi ops)
- Flight Characteristics of T-33 Similar to X-45A, 0.7 Mach at 35,000 ft

Surrogate Serves as Significant Risk Reduction Resource:

- Guidance And Navigation (up & away)
- Contingency Management
- Mission Planning verification
- Comm Link and coverage testing
- Software checkout
- Team training and proficiency
- Range safety mission assessment
Test Site Layout
Vehicles in Test Bay 6
TOSC and Annex
Program assets:
- X-45A vehicles
- T-33 Surrogate
- UMCS
- TOSC
- TM & C2 antennas

Range assets:
- Remote antennas and communication sites
- NASA/DFRC Mission Control Centers
- NASA/DFRC Mobile Operations Facility
- Flight Termination Hardware (ground & airborne systems)
- C-Band Tracking Radars & Optics

Interdependence of Range Assets
Dish Locations

ATF-1 Site:
- TriPlex – 23’ diam (C- & L-band)
- Radar 34 & 38

ATF-2 Site:
- MFTS – 23’ diam (C- & L-band)
- ATF-2 – 6’ diam (L-band; C-band mod in planning)

Hill A-7 Site:
- Hill A7 – 6’ diam (C- & L-band)

Pad 21 Site:
- MOF – 6’ diam (C- & L-band)
Command and Control/TM Antenna Locations at AFFTC

- NASA MOF
  - L-Band
  - C-Band Video

- RAIF
  - UHF Secondary

- Hill Antennas
  - L-Band
  - C-Band Video

- Trundy Tower
  - UHF Primary
X-45A Inert GPS-Guided Bomb Demo
18 April 2004

UCAV X-45
X-45A AV-1 & AV-2 Multi-Vehicle Ops Demo
1August 2004