AARD - Autonomous Airborne Refueling Demonstration

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DARPA
- Approval of test objectives
- Project funding to primes involved in the demonstration program
- Program Oversight

DFRC
- Responsible Test organization
- Lead system integrator
- Responsible for system airworthiness
- Responsible for flight safety

SNC Development Team
- Overall test leader
- AARD Controller development
- Responsible for mission success
- Responsible for contracting Omega tanker activities.
- Support integration, airworthiness and flight test activities.
Program Goals

- **Primary Objective**
  - To make one **fully automatic** probe-to-drogue engagement using the AARD system.

- **Success Criteria**
  - One successful automatic engagement from the trail position (planned 100 ft from drogue) to basket connection
  - Hold connected to simulate a complete refueling sequence (planned for 5 minutes) then automatically disconnect and return to trail
  - Record on video – (with Pilot’s hands in the air!!)
• The Basket Can Strike Back
System Design

- **Tanker System**
  - GPS Pallet Transmitting Position & Velocity
  - **No** Modifications to Drogue Refuel System

- **F/A-18 System**
  - GPS & Receiver; “Rel-Nav” Solution
  - Optical Tracker; Basket Capture Solution
  - AARD Computer to Replace Pilot Inputs
  - PVI Panel
Pictorial View

Modes: Hold, Pre-contact 1&2, Trail

Capture, Closure
AARD Controller
Rear Cockpit PVI
PVI Controller

- Eight active push tiles with information

- Stndby
- Close

- X: xxx
- Y: xxx
- Z: xxx

- Forcef
- Off

- Manual

- AARD
- OK

- Trail
Front Cockpit

- Canopy bow status lights
- Optical tracker camera
- Video selector
- DDI RFCS control
Validation Flights

- 4 Flights with Sabreliner Surrogate Tanker: 16 – 29 June 2006
- 3 Flights with Sabreliner in second phase: Nov 2006 – Mar 2007
Omega Tanker Flights

- 9 Flights with Omega tanker:
  - 11 July ‘06: Optical tracker problems
  - 27 July ‘06: Optical tracker problems
  - 17 Aug ‘06: Data Link problems, Optical tracker OK
  - 30 Aug ‘06: SUCCESS
  - 13 Dec ’07: Plugs
  - 22 Feb ’07: Plugs in a turn
  - 23 Mar ’07: Plugs in turbulence
  - 16 Apr ’07: Plugs in turbulence
  - 17 Apr ’07: Plugs in turns
Turbulence
“Stick” Measurements
Lessons Learned

- Early Pilot Involvement
- Computers Remove “Human” Problems
- Shortcuts Seldom Work
- “SHIT” Happens: (Software / Hardware Induced Trauma)
Possible Users
Questions???
PSFCC’s
Front Cockpit Glareshield
AARD Test Program

- Background
- Participants
- Design
- Simulation and Ground testing
- Test Flights:
  - With surrogate tanker
  - With Omega tanker
    - Optical system problems
    - Rel-Nav problems
- 30 August 2006