

NASA Dryden Status

**Aerospace Control & Guidance Sub-committee
Meeting 105
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IRAC F-18 #853 Testbed

- ! **Dedicated Ghz processor for experiment**
- ! **Shell & process for Simulink autocode (or c-code)**
- ! **Can control commands to:**
 - All aero surfaces (except speed brake)**
 - All pilot inputs**
 - Both engine throttles independently**
- ! **Limit checks done by Class A software in RFCS**
- ! **Potential for Class A experiment (dual ARTS IV or in quad RFCS) – take to landing?**
- ! **Tons of research instrumentation parameters (mostly related to structures)**
- ! **Simulated A-Matrix and B-Matrix failures**



NASA Dryden Flight Research Center Photo Collection
<http://www.dfrc.nasa.gov/Gallery/Photo/index.html>

NASA Photo: EC04-0361-16 Date: December 15, 2004 Photo By: Carla Thomas

NASA's flexible-wing F/A-18 maneuvers through a test point during the second phase of the NASA/Air Force Active Aeroelastic Wing flight research program.



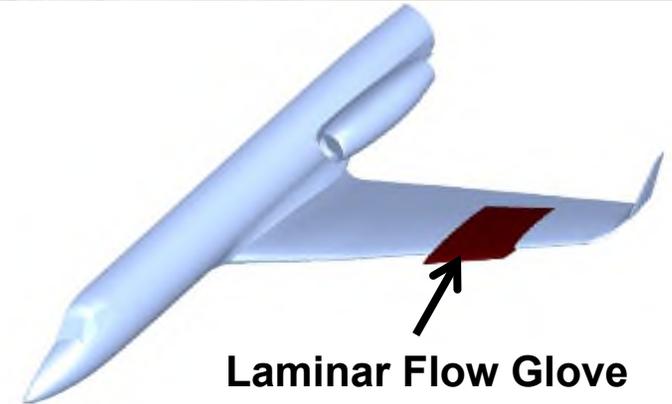
IRAC F-18 #853 Testbed - Current Status

- ! **Completed Hardware-in-the-loop testing (August)**
 - ! **First flight of new hardware** – **March 2010 – ON SCHEDULE**
 - ! **Dynamic Inverse controller** – **June 2010**
 - ! **Simplified Model Ref Adaptive Control** – **August 2010**
- ! **Evaluating simplified adaptive control approaches**
 - ! **Dynamic Inversion Baseline**
 - ! **Simplified MRAC**
 - ! **Benefit vs. complexity trade studies on extensions to basic MRAC**
 - ! **Interaction between adaptive controller and aircraft structure**
- ! **Investigating ways for pilot to control learning rates**
- ! **Planning to fly cross-coupling handling qualities metric development test with AFFTC test pilot school**
- ! **Future planned work**
 - ! **Adaptive controller implemented in redundant system**



NASA G-III Research Aircraft

- ! NASA DFRC is acquiring a Gulfstream III (G-III) to serve as a flying testbed for aeronautics experiments
- ! The aircraft will be instrumented and modified to accommodate a range of flight test-experiments
- ! Laminar Flow Glove
 - ! NASA's ERA program is funding a flight-test of a wing glove with a natural laminar airflow airfoil. Discrete Roughness Elements (DRE)s will be placed on the glove for passive laminar flow control. Texas A&M and Dryden will be developing the glove.
- ! Adaptive Compliant Trailing Edge (ACTE)
 - ! AFRL is funding development and flight test of an adaptive, compliant flap. The port inboard flap of the G-III will be replaced with a compliant design. The flight test will examine ACTE suitability as a lift control device (flap), control surface (ailerons), and trim device (trim tabs).
- ! Aircraft acquisition planned for early CY 2010.



Adaptive Compliant Trailing Edge



X-48 Blended Wing Body

- ! **74 flights completed on X-48B**
 - ! **Slats extended and slats retracted stall onset has been characterized**
 - ! **Flight results providing data for aerodynamic model and simulation updates**
 - ! **Currently flight testing departure limiter assault**
- ! **Peak seeking control to optimize in-flight drag reduction in 2010**



- ! **X48C completed wing tunnel testing**
- ! **Preparation work on X-48C for flight**
 - **FEM, simulation, engine integration, and control law development**
 - **Design and build flight weight parts**
 - **Complete modifications and prepare for flight**



SOFIA

- ! **Stratospheric Observatory For Infrared Astronomy**
 - ! 2.5 m diameter German built infrared telescope
 - ! Open port cavity
 - »! ~24°-57° viewable elevation range
 - ! Platform is Boeing 747 SP
 - »! Capable of 6+ hours of observation time
- ! **On going open door envelope expansion flights through 2010**
 - ! Concurrent with mission system build up and limited science missions
 - ! Completed two open door straight and level flights at 10% and 100% open in December 2009
 - ! Completed two expansion flights at 10% and 40% open up to 15Kft and 225 kias January 2010



- ! Completed one shortened 70% open expansion flight February 2010
- ! Envelope clearance with a cavity acoustics focus
 - »! All test points show sound pressure levels are below expected levels thus far
- ! Autopilot interface development to support science mission navigation requirements is ongoing



Orion CEV Launch Abort Systems Tests

- ! **Dryden is leading the test activities for the Launch abort systems test. Tests will be conducted at White Sands, NM**
 - ! **Pad Abort 1 (PA-1): Tests the basic functionality of the launch abort system from the pad in its preliminary design configuration.**
 - »! **Current launch date is late April – early May 2010**
 - ! **Ascent Abort 2 (AA-2): Tests the ability of the launch abort system to function as the spacecraft approaches the region of maximum drag.**
- ! **Current program status is to continue with the abort flight tests as planned through Sept 2010 (PA-1)**
- ! **AA-2 is also still currently in the plans as a technology demonstration**
- ! **Plans in work for everything after PA-1 test**
- ! **Current activities**
 - ! **Hardware testing and integration of the PA-1 crew module at White Sands, NM**
 - ! **Preparation for Flight Test Readiness Review**
 - ! **Planning for future flight tests (eg. AA-2)**



