

NASA Dryden Status

**Aerospace Control & Guidance Sub-committee
Meeting 106
La Jolla, CA
October 2010**

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ACGSC Meeting 106, Oct 2010

F-18 FAST

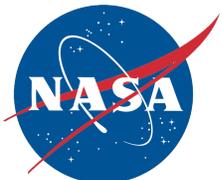
- Full-scale Advanced Systems Testbed (FAST)
- First Flight March 2010
 - RFCS hardware
 - Replication Control Laws
 - PID inputs
 - Simulated Failures
 - Including Propulsion Only
- ARTS IV first flight July 2010
 - Pass-through mode
 - Simple ARTS PID experiment
 - Ethernet research data output
 - Nonlinear Dynamic Inversion baseline controller (Sept 2010)



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

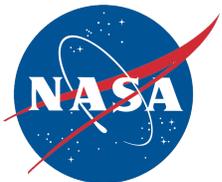
NASA's flexible-wing F/A-18 maneuvers through a test point during the second phase of the NASA/Air Force Active Aeroelastic Wing flight research program.



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IRAC F-18 #853 Testbed - Current Status

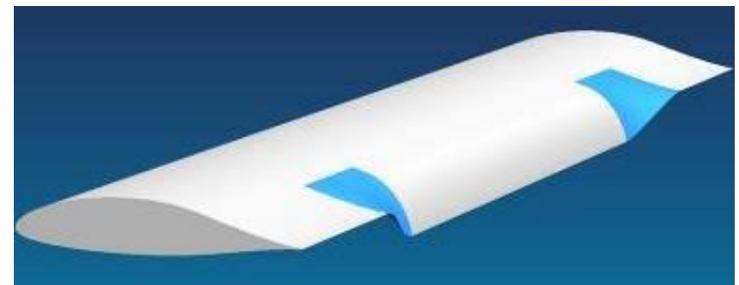
Video



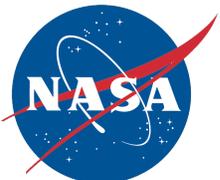
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NASA G-III Research Aircraft

- **NASA DFRC has acquired 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 are developing the glove.
- **Adaptive Compliant Trailing Edge (ACTE)**
 - AFRL is funding development and flight test of an adaptive, compliant flap.
 - Both aircraft flaps on 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).



Adaptive Compliant Trailing Edge



X-48 Blended Wing Body

- Phase 1 (80 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
 - Flight testing of departure limiter assault complete
- NASA PID flights (Phase 1.5)
 - 3 flights completed as of 09.29.2010
 - 648 planned excitations
- Moment of Inertia swing testing planning on-going. Testing will begin after completion of PID flights
- Intelligent Control for Performance to optimize in-flight drag reduction (X-48C)
- Engine Yaw Control (X-48C)

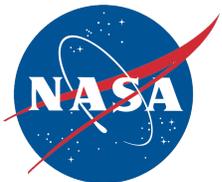
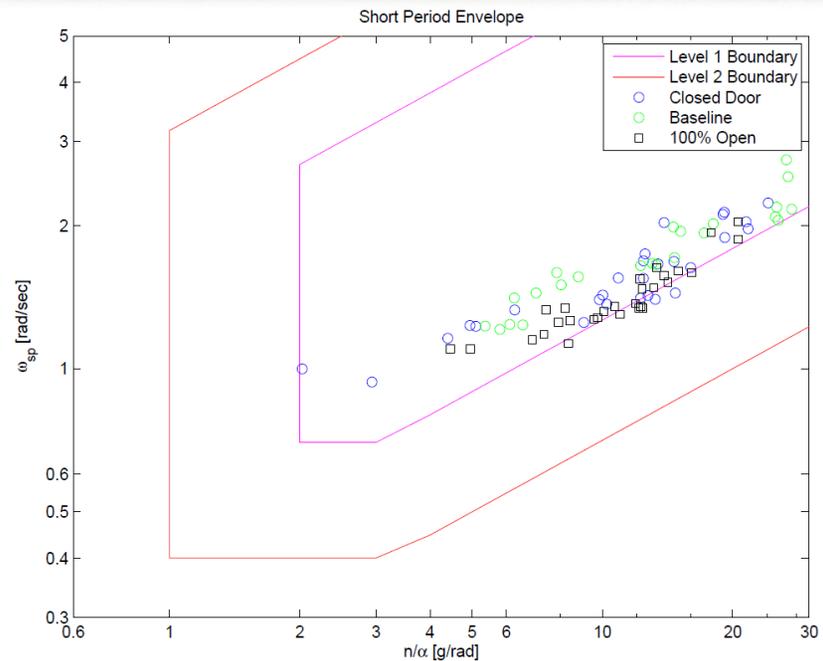


- X-48C completed wing tunnel testing
- Preparation work on X-48C for flight
 - FEM, simulation, engine integration, and control law development
 - Design and build flight weight parts
 - Complete modifications and prepare for flight



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
- **Completed open door envelope expansion**
 - Aircraft dynamics similar to unmodified 747
 - No resonant acoustics found in flight envelope
- **Autopilot controller development in work**
 - Science missions require heading tracking performance with less than 0.5 degree error



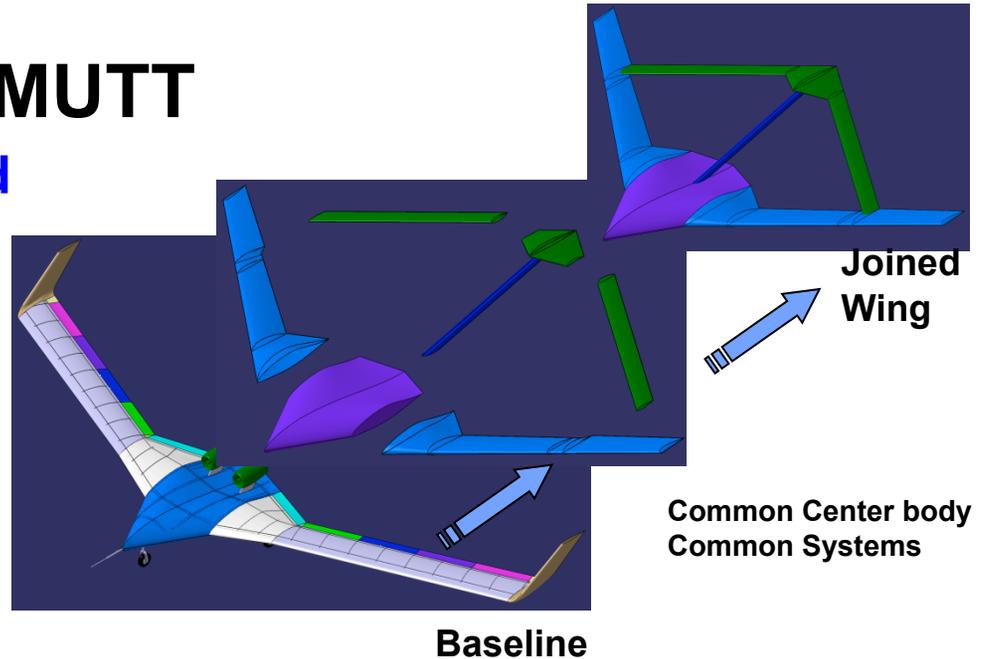
MUTT

- **Multi-Utility Technology Testbed**

- AFRL and Lockheed Martin partnership
- Demonstrate active flutter suppression and gust load alleviation
- Reconfigurable aircraft

- **Planned NASA involvement**

- Develop design guidelines
 - » Guarantee vehicle control and structural stability simultaneously
 - » Evaluate existing criteria for gust loads (FAR 25.341) for active gust load alleviation
- Develop analysis methodology
 - » Closed-loop robust stability margin guidelines for active structurally controlled aircraft
- Release aircraft models
- Design, analyze, and evaluate control laws for flutter suppression and gust load alleviation



- **Aircraft summary**

- Wingspan: 28 ft
- Gross weight: 480 lbs
- 10 trailing edge control surfaces
- Hot film, accelerometer, airdata, and IMU sensors
- Flexible and stiff wing sets

- **First flight October 2012**



Orion CEV Launch Abort System Tests

- Dryden successfully led the test activities for the Launch abort system tests at White Sands, NM
 - Pad Abort 1 (PA-1): PA-1 Launch on 6 May 2010 was very successful
 - » Tested the basic functionality of the launch abort system from the pad in its preliminary design configuration.
 - 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
 - Assisting production team with OFT-1 flight test (this is an uncrewed LEO flight test that tests entry, descent & landing)
 - OFT-1 Launch date is currently June 2013
- AA-2 is also still currently in the plans as a technology demonstration
 - Would occur 6 months after OFT-1 has flown
- Current activities
 - Support of PTR-1 (SRR) for OFT-1
 - Limited AA-2 support
 - » Launch site trade study
 - » Alternative flight test booster trade studies

