NASA Dryden Status

Aerospace Control & Guidance Sub-committee
Meeting 106
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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)
IRAC F-18 #853 Testbed - Current Status

Video
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).
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 ongoing. 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

ACGSC Meeting 106, Oct 2010
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
• 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
To Fly What Others Imagine …