

NASA Dryden Status

Aerospace Control & Guidance Sub-committee
Williamsburg, VA
October 2006

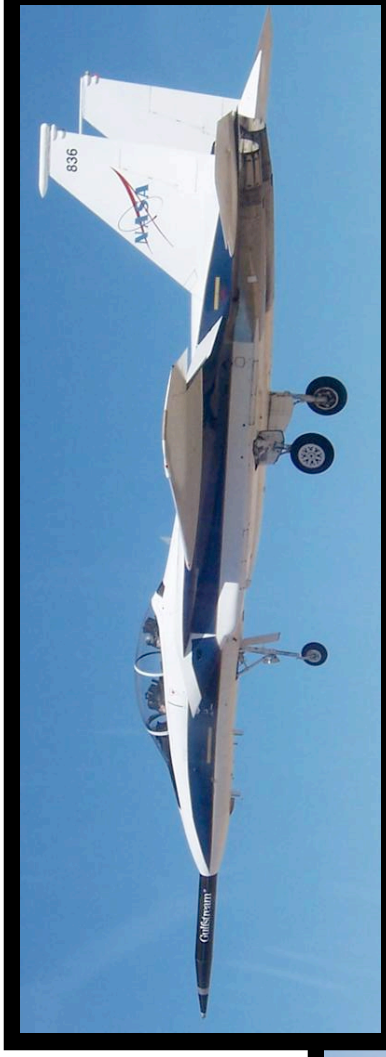
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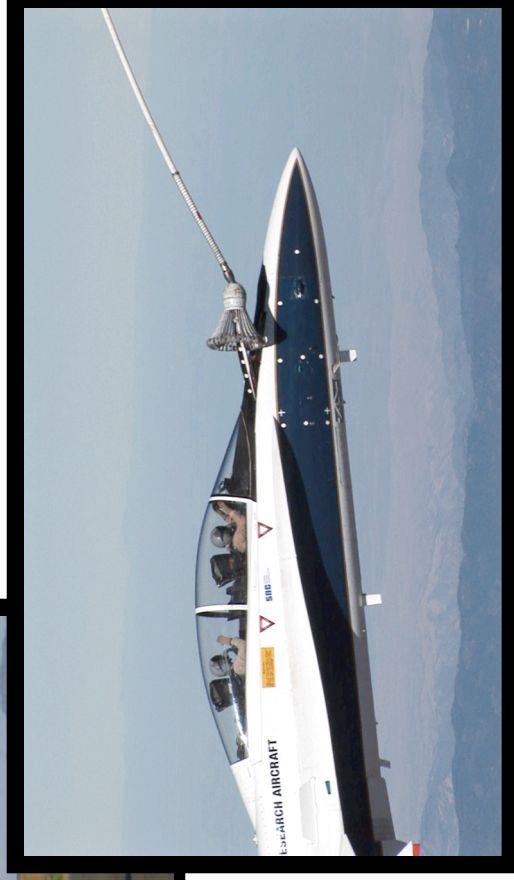
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Recent Activities

Ikhana Delivered



Quiet Spike



AARD



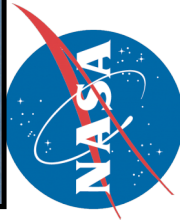
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Autonomous Airborne Refueling Demonstration (AARD)

- Program started 4/30/2005
- DARPA, Sierra Nevada Corporation, NASA Dryden
- Successfully plugged the basket in 2 out of 6 attempts on 8/30/2006
- Possible follow-on activities



- Autonomous probe and drogue airborne refueling
- F/A-18 configured as autonomous testbed
- Pallet on tanker, otherwise unmodified
- Relative GPS/INS navigation
- Monocular camera tracking system



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Ikhana Project Overview



Mission

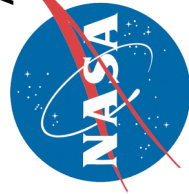
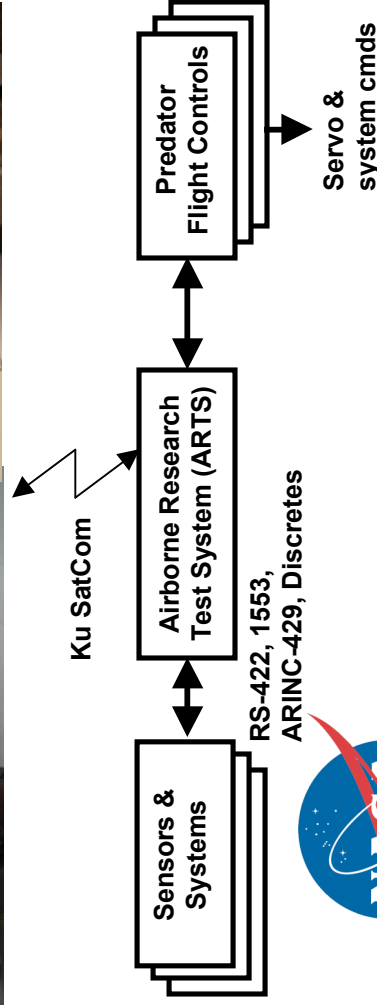
- Platform to conduct Earth Science Missions
 - Fire detection mapping with USFS 7/07
 - UAV AVE satellite validation 9/07
- Testbed for UAS technology development
 - Collision Avoidance (advocacy)
- Fundamental Aeronautics Research Validation Platform
 - Fiber-optic Wing Shape Sensing (FY07-FY09 proposed)

Assets/Capabilities

- Standard MQ-9 w/ digital engine control (9/06)
- Mobile ground control station (10/06)
 - Ku Satcom for over the horizon missions
 - 6 engineering monitoring stations
- Ground Support Equipment / Spares
- 2 pilots in training (complete 1/07)
- External Pods able to carry sensors

Airborne Research Test System (ARTS)

- 3 processor research flight control and/or mission computer
- Able to autonomously control the aircraft and some systems (waypoint commands, autopilot commands, or pilot stick/rudder commands)
- Able to host research control laws (autonomous mission management, collision avoidance, precision trajectory, autonomous refueling, etc)



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Quiet Spike

- **Objective: Extendable boom to reduce sonic boom signature**
 - Structural load / ASE validation of boom to 1.8 Mach
 - Limited sonic boom probing
- **Pre-Flight Analysis**
 - SMI ground tests show little to no margin with boom retracted
 - Worse with Nz feedback via CAS
 - Worse case deterministic aero uncertainty cases
 - Low high speed stability margins
 - Low Dutch roll, short period damping

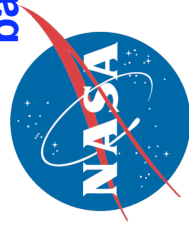


- **Program Status**

- **First Flight: Aug, 2006**
 - Gear down: no Nz feedback
 - Boom retracted
 - **Second flight scheduled 9/29**
 - Subsonic / Supersonic Phases
 - Envelope expansion approach
- balanced between ASE, S&C, Flutter



F-15B with Quiet Spike Retracted



ARM D Implementation Planning



Subsonic Fixed Wing



Computer Enhanced Picture of Proposed Platform.

Hypersonics



Supersonics



Integrated Resilient Aircraft



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C-20A Precision Autopilot Development

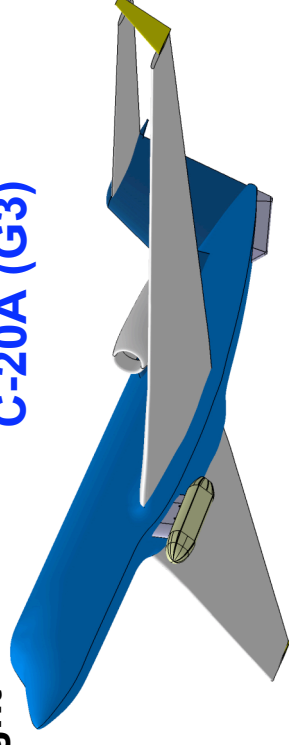
Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR)

- Fly for up to 200 km within a 20 meter tube with light turbulence

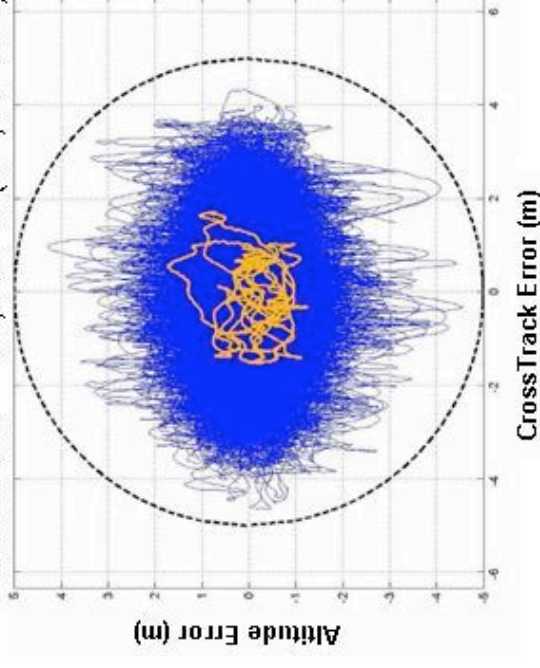
- Status

- Critical Design Review completed in April 2006
- Controller design refined to enhance performance and robustness
- Hardware in the loop simulation developed
 - » Conducting V&V testing
- Flight Readiness Review planned for Oct 2006
- Precision Autopilot Demonstration flight late 2006 or early 2007

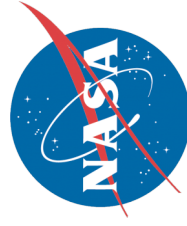
C-20A (G3)



Mach 0.8 – 40,000 ft (12,192 m.)



Monte Carlo Simulation Results



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Crew Exploration Vehicle (CEV)

- Dryden responsible for Flight Test of Launch Abort System
 - Pad Abort tests (2)
 - Government furnished CM
 - Prime Contractor furnished CM
 - Ascent Abort tests (4)
 - Transonic
 - Max q – nominal & off-nominal
 - High Altitude
- SRR for Abort Flight Test project completed in July 2006
- PDR scheduled for October 2006
- CDR scheduled for February 2007
- Controls Group working on independent simulation of Abort Flight Test
 - Sensitivity analysis
 - Monte Carlo runs
 - Trajectory analysis
 - Abort flight test conditions



Crew Exploration Vehicle

