Dryden Flight Research Center

Center Overview
Dryden Flight Research Center
Edwards Air Force Base

Rogers and Rosamond Dry Lakes as seen from space

You are here!
Dryden Flight Research Center
Edwards Air Force Base

- Remote Location
- Varied Topography
- 350 Testable Days Per Year
- Extensive Range Airspace
- 29,000 Ft Concrete Runways
- 68 Miles of Lakebed Runways
- 301,000 Acres
- Supersonic Corridor
Dryden Aircraft Operations Facility
Palmdale, CA

• Palmdale Site 9 Complex
  – Ready access to USAF Plant 42 runway and facilities
  – 40 miles from NASA Dryden Flight Research Center
The NASA Dryden Flight Research Center was named after Dr. Hugh L. Dryden, the final Administrator of NACA and the first Deputy Administrator of NASA. The following is his explanation as to why there is a need for flight research,

“...to separate the real from the imagined and to make known the overlooked and the unexpected...”
To Fly What Others Only Imagine
Advancing Technology and Science Through Flight

• Mission Elements
  – Perform flight research and technology integration to revolutionize aviation and pioneer aerospace technology
  – Validate space exploration concepts
  – Conduct airborne remote sensing and science observations
  – Support operations of the Space Shuttle and the ISS
  … for NASA and the Nation
Summary of Dryden Capabilities

• Core Competencies
  – Atmospheric Flight Research and Test
    • Flight Safety and Risk Management
    • Flight Project and Mission Management
    • Flight Research Technology
    • Flight Test Operations
    • Experimental Aircraft - piloted and unpiloted

• Facility Capability
  – Flight Operations & Engineering Staff
  – Experimental and Testbed Aircraft
  – Unmanned Aircraft Systems
    • Extensive experience in securing Certificates of Authorization (COA) for UAS flights
  – Airborne Science Platforms
  – Range and Aircraft Test Facilities
    • Western Aeronautical Test Range
    • Research Aircraft Integration Facility
    • Flight Loads Laboratory

FY09 Vital Statistics:
Civil Servant Staff
~ 560
On-site Contractors
~ 650
Budget
~ $247M
DFRC/AFFTC/AFRL Alliance Activities

- DFRC/AFFTC/AFRL Alliance
- Co-Chaired council meets quarterly
- 8 integrated product teams
- 33 active Memorandum of Agreements
- Over $86M in cost avoidance/savings to date

Test and Evaluation

Preserves Unique Missions

Air Force

NASA

New Emphasis Areas
- Program Collaboration
  - X-51, UAS, C-17, ACAT,
  ...
- Sharing Staffing Resources
  - Technicians and Shops
  - Engineering
  - Administrative

Common Infrastructure
- Airfield Operations
- Range and Flight Safety
- Shared Aircraft and Equipment
- Frequency Management
- Health and Welfare
- Emergency Response
- Security

Fully integrated infrastructure with EAFB

Research and Technology

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Strategic Partnerships

• DoD Partnerships:
  – USAF, AFFTC Alliance, AFRL,
  – USN, NAVAIR,
  – US Army, CERDEC
  – DARPA

• International
  – DLR Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center), Cranfield (UK), …

• Industry
  – Boeing, Lockheed Martin, Gulfstream, Northrop Grumman, AeroVironment, General Atomics, Scaled Composites, …

• Academia
  – AERO Institute
  – Multiple university grants

• NASA Centers
  – ARC, GRC, GSFC, JPL, JSC, KSC, LaRC, MSFC

• Airborne Science
  – Departments of Agriculture, Energy, Homeland Security, and Interior
  – NOAA, EPA
Mission Activity
Exploration Systems
Orion Launch Abort Flight Test

- Orion crew exploration vehicle includes a launch abort system (LAS) that assures crew escape after failure
- Lead Flight Test Vehicle Development and Test
  - Systems Engineering & Integration
  - Safety and Quality Assurance
  - Development Flight Instrumentation
  - Abort Test Booster Procurement Lead
  - Crew Module Integration and Test
  - Launch Facilities & Ground Support
  - Equipment Lead Flight, Ground, & Range Operations
Aeronautics Research

- Fundamental Aeronautics Program
  - Subsonic Fixed Wing
  - Supersonics
  - Hypersonics

- Aviation Safety Program
  - Integrated Resilient Aircraft Control
  - Integrated Vehicle Health Management

- Airspace Systems Program
  - UAS in the National Airspace System in support of JPDO

- Reimbursable/Partnerships (2011 SPG 1.4.4)
  - Technology Development
  - Systems Integration
  - Systems Validation
Airborne Science Program

- Aligned with the Science Mission Directorate’s Airborne Science Program
  - Program Objectives
    - Satellite Calibration and Validation
    - New Sensor and Algorithm Development
    - Process Studies
    - Next Generation NASA Scientist and Engineer Development

- Platforms
  - DC-8
    - Heavy lift
    - Long Range
    - Shirt-sleeve environment
  - ER-2
    - Very High Altitude
    - Long Range
  - G-III UAVSAR
    - Synthetic Aperture Radar
    - Repeat pass interferometry
  - Global Hawk
    - Unmanned
    - Extreme range and endurance
NASA Space Operations

- Primary alternate landing site
- On-orbit communications support for International Space Station (ISS) and Shuttle Orbiter
- Telemetry support
- Shuttle Carrier Aircraft (SCA) maintenance and support
Current Research: Ikhana

- Modified Predator-B UAV
- Environmental Research and Sensor Technology (ERAST) program
- Long-endurance/high-altitude: 32 hours @ 52,000 ft
- Over-the-horizon control, AI collision-avoidance demonstrator
- Observation, climate monitoring, search and rescue, wildfire support
- 700 lbf instruments long endurance or 3,000 lbf science payload short endurance

Partners: General Atomics Aeronautical Systems, USFS
Current Research: X-48B

- 8.5% scale remotely piloted technology demonstrator
- Advanced nacelle placement and design
- Supercritical airfoil shape
- Currently in flight test for validation and verification
- Advanced aerodynamic design could provide huge improvements in efficiency

Partner: Boeing Phantom Works, Cranfield Aerospace
Current Research: ER-2

• High altitude civil U2 derivative, 410 kt at 75,000 ft.

• Can reach 65,000 ft in 20 min, range 6,000+ nm, endurance 10 hrs.

• Earth resources, celestial observations, atmospheric chemistry and dynamics, oceanic processes, electronic sensor R/D, satellite calibration / data validation, hurricane prediction, cloud formation, etc, etc, …

• Numerous spectral and atmospheric measurement partnerships with other NASA centers, USAF, NOAA, EPA, private industry, and universities
Current Research: F-15B IFCS

- Artificially intelligent direct-adaptive neural network controller
- Aviation safety, damaged airframe recovery, pilot augmentation, AI systems research
- Modified pre-production F-15B, canards + thrust vectoring
- Digital failure logic via ARTS-II research controller
- Soon to move to F/A-18 aircraft due to F-15B #837 retirement

Partners: NASA ARC / ISR / Boeing
Current Research: F-15B Testbed

• “The Flying Wind Tunnel”
• Aerodynamic component testing and flight research
• Flight systems research
• Full, scale, and component level testing of propulsion systems coming soon

Partners: Various
Current Research: Global Hawk

- Demilitarized combat UAV
- Long endurance earth science missions
- Measuring, monitoring, and observing remote areas of the earth not easily accessible by other aircraft
- 30-hour endurance
- 2000 lbf payload
- 11,000 NM range

Partners: Northrop Grumman
Current Research: DC-8 Flying Lab

- advanced on-board lab equipment and scientific instruments
- variety of Earth Science mission support
- climate monitoring and atmospheric research
- Arctic and polar research
- crop yields and agricultural studies
- air quality

Partners: NOAA, EPA, USFS, other various
SOFIA
Stratospheric Observatory for Infrared Astronomy

- SOFIA will provide astronomers with a key infrared window to the Universe
  - Energetics of Luminous Galaxies
  - Origin of Stars and Planetary systems
  - Gas and Grain Chemistry of the Interstellar Medium
  - Structure of our Solar System

- Joint program by NASA and DLR (Deutsches Zentrum für Luft und Raumfahrt)
- Science Mission Operations - Universities Space Research Association (USRA), Deutsches SOFIA Institut (DSI)

- Major aircraft modifications:
  - German-built 100-inch (2.5 meter) diameter far-infrared telescope weighing 20 tons mounted in the rear fuselage
  - Mission and support systems
    - Mission Control and Communications System (MCCS)
    - Education and Public Outreach work stations Flight test operations

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Testbed Aircraft

• Testbed aircraft augmenting Dryden’s one-of-a-kind research aircraft are available to support a wide variety of research missions.
  – Dragon Lady (ER-2)
  – Eagle (F-15)
  – Global Hawk (RQ-4)
  – Gulfstream (G-III)
  – Hornet (F/A-18)
  – Ikhana (MQ-9)
  – King Air (B-200)
  – Mentor (T-34)
  – Talon (T-38)

• Testbeds provide platforms for sensor validation, aerodynamic, system, and propulsion research and test.
VSE / Constellation / Orion
**Education and Public Outreach**

- NASA Robotics Education Project (REP)
- Math Odyssey
- Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)
- Teacher Training
- NASA Explorer School (NES)
  - G.C. Cole Middle School, CA
  - Black Mountain Middle School, AZ
  - Edwards Middle School, CA
  - Flagstaff Middle School, AZ
  - Kennedy Elementary School, CA
  - Westwind Intermediate School, AZ
  - Arrowhead Elementary School, AZ
- Educator Resource Center
- NASA Aerospace Exploration Gallery
- NASA Aerospace Education, Research and Operations (AERO) Institute
  - Serves as innovator, facilitator and integrator for joint NASA, University and Industry projects
    - Leverages the assets of NASA, other government agencies, academia and industry
    - Creates strategic private/public partnerships