



Airborne Science Annual Review

NASA Headquarters

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Dryden Flight Research Center

Bob Curry



ER-2

Core Aircraft for Very High Altitude

Capabilities

- Ceiling > 70,000 ft
- Duration > 10 hours
- Range > 4,000 nautical miles
- Payload 2,600 lbs
(700 lbs in each wing pod)

Mission Support Features

- Multiple locations for payload instruments
- Pressurized and un-pressurized compartments
- Standardized cockpit control panel for activation and control of payload instruments
- World-wide deployment experience



Background and Status

- U-2 and ER-2 aircraft have been a mainstay of NASA airborne sciences since 1971
- Over 100 science instruments integrated
- Two aircraft



ER-2, cont



2007 Activity (231 Hours)

- **NASA science missions**
 - TC-4 (Costa Rica)
 - Local AVIRIS and MAS
 - Large Area Collectors
- **DOE CLASIC (Ellington Field)**
- **Non-science users**
 - DHS
 - MDA

Outlook

- **Seeking to reduce operational costs to SMD**
 - Project re-structuring , greater workforce sharing
 - Continued interest from non-Science government agencies
- **Re-location to the Dryden Aircraft Operations Facility in Palmdale in Summer**



DC-8

Core Aircraft for Medium Altitude, Heavy Lift

Capabilities

- Ceiling 42,000 ft.
- Duration 12 hours
- Range > 5,400 nautical miles
- Payload 30,000 lbs

Mission Support Features

- Shirtsleeve environment for up to 30 scientist/investigators
- worldwide deployment experience
- Extensive modifications to support in-situ and remote sensing instruments
 - zenith and nadir viewports
 - wing pylons
 - modified power systems
 - 19 inch rack mounting



Background

- **Acquired by NASA in 1986**
- **Long history of supporting studies in archaeology, astronomy, ecology, geology, hydrology, meteorology, oceanography, volcanology, atmospheric chemistry, soil science and biology**



DC-8, cont.

2007 Activity

- TC-4 (Costa Rica)
- C-Check
- Extensive facility improvements



Aircraft and Facility Upgrades

New 1-F Flight Management System
New Terrain Awareness Warning System to meet FAA requirements
New Digital Aircraft Flight Recorder to meet FAA requirements
New Navigation Units with FM Immunity to meet European Standards
New Digital COMM / NAV Control Panels
New IRIDIUM air/ground communications for Flight Crew
Wing tip probe upgrades

Data Acquisition and Display System Upgrades

REVEAL data acquisition system
IRIDIUM based satcom system
X-chat capability with ground
New gigabit ethernet based data display system
Backward compatibility with RS-232 data stream
High resolution LCD displays
Dedicated Mission scientist station
Digital video system



DC-8, cont.

Aircraft operations transferred to Dryden in August

- Aircraft re-located to Palmdale, CA
- University of North Dakota participation continuing through
 - Science management
 - Public outreach and education

Outlook, 2008 missions

- ARCTAS
 - Spring – Alaska, Greenland
 - Summer – California, Canada, Greenland
- AMISA
 - August - Sweden

5/15/2008



Arrival at the Dryden Aircraft
Operations Facility, Palmdale, CA



Suborbital Tele-Presence (REVEAL)

Objective:

Provide situational awareness and instrument interaction for the science team during flight

Goal:

Deliver V1.0 system architecture in 2010

Approach:

- Phased development
- Apply incremental systems to high value science campaigns



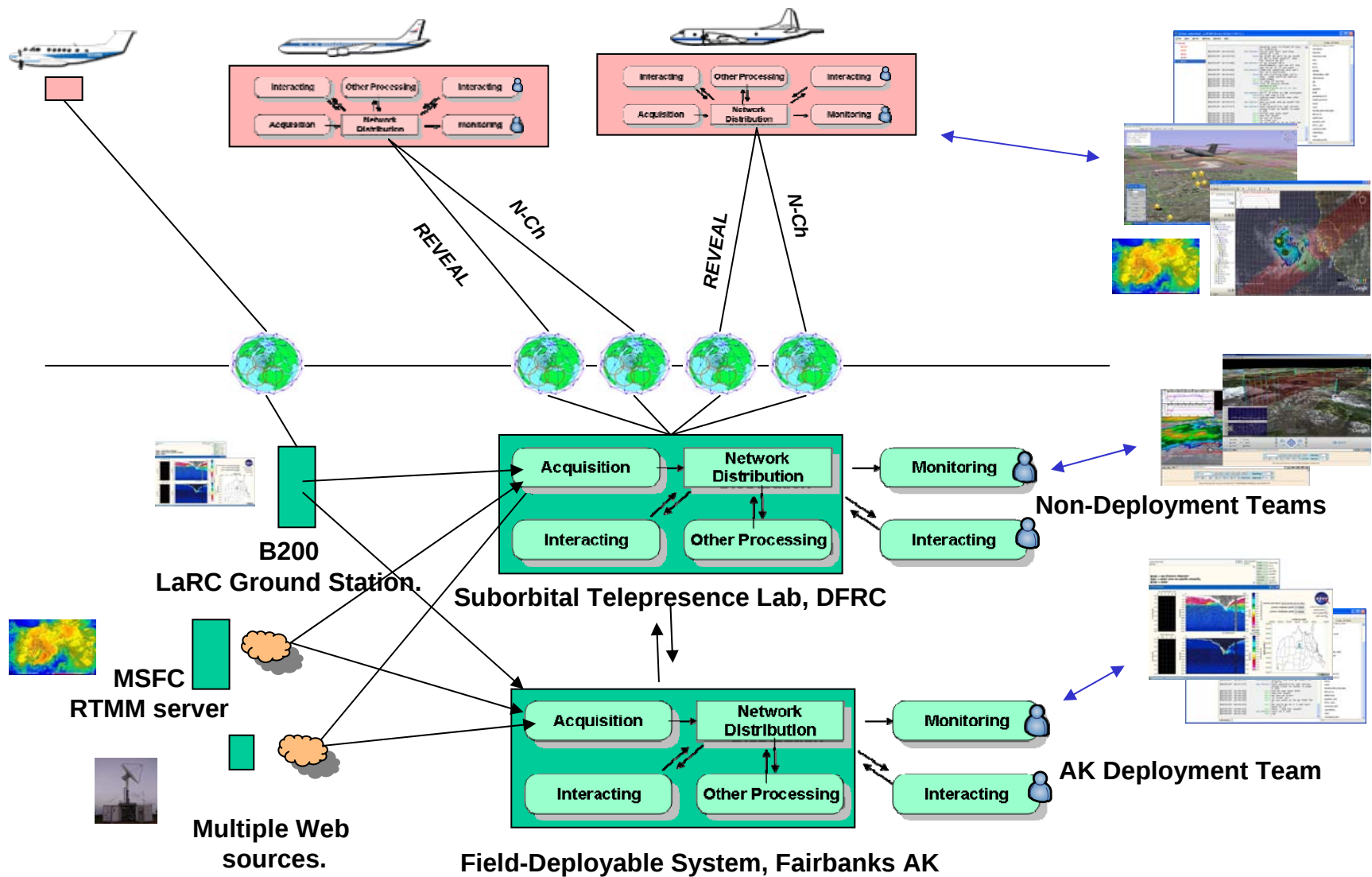
2007 Activities

REVEAL P-3
Field Deployable Ground Station
LINUX multi-link operations
DC-8 infrastructure upgrades

CLASIC / ER-2
TC-4 / WB-57, DC-8, ER-2
CARS / P-3



ARCTAS Notional Implementation



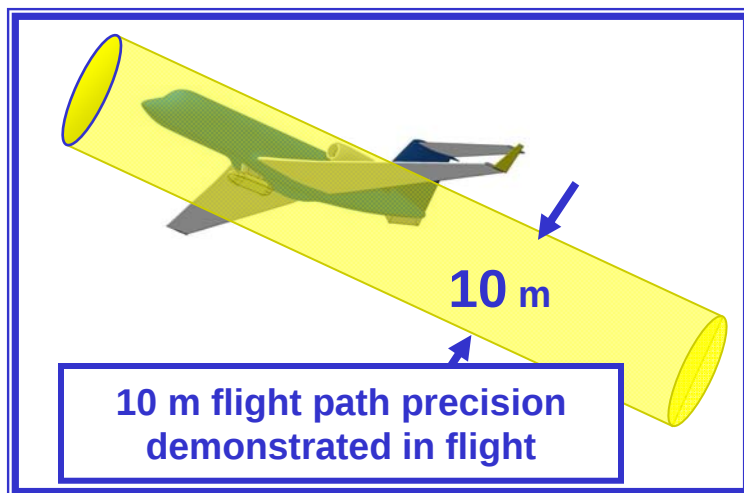


G-III UAVSAR (JPL Partnership)

Test-bed for UAS and Space Based Radar Technology

2007 Accomplishments

- Demonstration of precision autopilot
- Collection of first first images from a pod-mounted L-Band Synthetic Aperture RADAR
- Cruise envelope expansion (ventral fin removed)



Capability Development Activity

- Ka Band pod development – in work
- Pylon reduction – design complete
- Lidar integration – study
- REVEAL – study
- Automated formation flight - study



G-III UAVSAR Mission Development

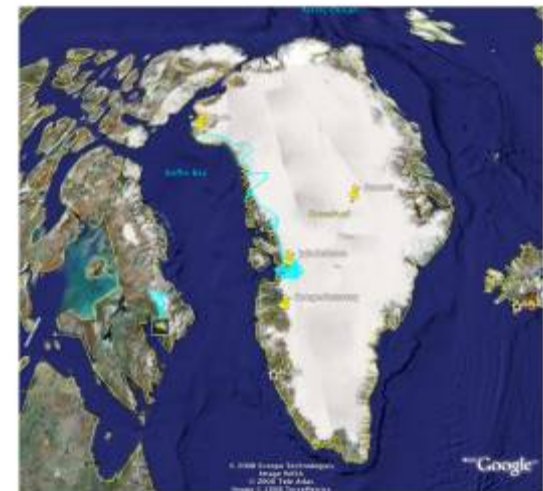
IPY – Greenland

- May, 2009
- Deployment to Thule
- L-Band and Ka-Band SAR, dual pods
- Coordinated flight with P-3

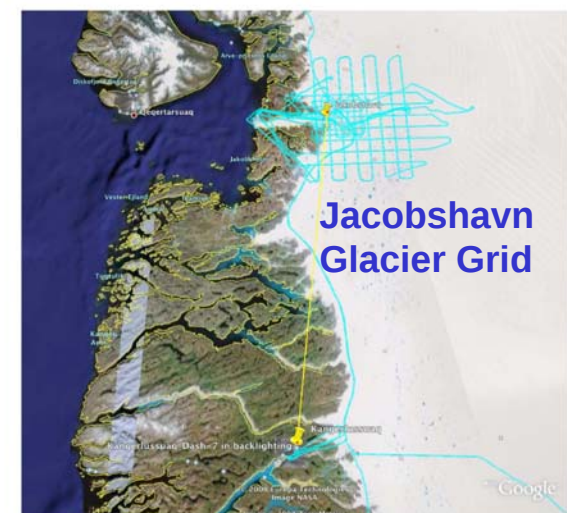
Other applications in study

- California fires
- Central America Archaeology
- Crustal Deformation
- Biomass/Forest Structure
- Decadal Survey Risk Reduction (Destiny, SCLP, . . .)

L-Band Repeat Pass



Ka -Band Bi-Static (Single Pass)





Ikhana

Medium Altitude, Very Long Endurance

Capabilities

- Duration > 24 hours
- Ceiling > 40,000 ft
- Payload 2,000 lbs, 750 lbs in wing pod
- Highly reliable UAS

Mission Support Features

- Deployment ready
 - Mobile ground station
 - High bandwidth science data link
 - Transport by land/sea/air
 - Ku Satcom for over the horizon missions
- External experiment pod with payload tray for parallel mission processing
- Internal payload compartments
- Experimenter network and data system
- Airborne Research Test System





Ikhana, Cont.

2007 Activity

- Stand-up of Dryden Operations
 - Received airframe and related equipment
 - Modified GCS for science support
 - Pilot and maintenance crew training
- Wing pod development and testing
- Western States Fire Mission
 - Extensive operations in NAS, close FAA interaction
 - Most complex COA to date
- SoCal emergency wildfire missions



Outlook

- Follow-on fire mission in 2008 season
- Integration and checkout of Ames' wing pod payload
- Science upgrades
 - Fuselage compartment windows
 - Data system improvement
 - Experimenter's Handbook
- Developing user base to reduce costs to Science

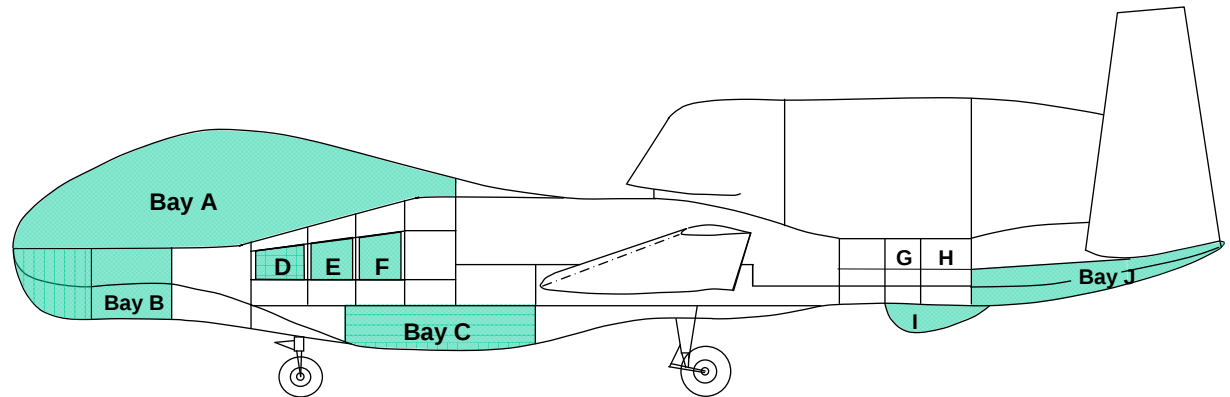


Global Hawk

New Capability for Very Long Endurance, High Altitude

Capabilities

- Endurance > 30 hours
- Range > 11,000 nmi
- Altitude 65,000 ft
- Payload > 1,500 lbs
- Highly reliable UAS



Mission Support Features

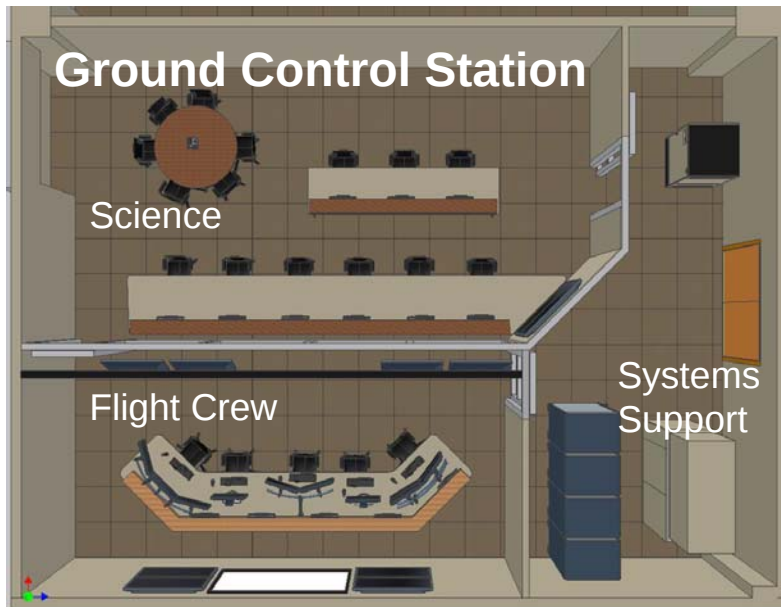
- Multiple payload locations.
 - Pressurized and un-pressurized.
 - Can accommodate wing pods (future).
- REVEAL system with ethernet network on the aircraft
- Fully autonomous control system, take-off to landing
- Experiment power
 - 2.0 KW DC
 - 8.3 KVA AC





Global Hawk - Status

- Both aircraft transferred to Dryden and located in Hangar 4801
- Dryden/Northrop Grumman partnership
 - Space Act Agreement
 - Stand-up and ops for over 5 yrs
- Ground station development underway



- Developing project team
- Experimenter's Handbook and other documentation in progress
- First flight expected by the end of 2008
- UAS-AVE is scheduled for Spring 2009
 - PI workshop in April 2008 at Dryden



Dryden Aircraft Operations Facility

Building 703:

SOFIA
DC-8
ER-2
G-3

Palmdale Site 9 complex will provide for :

- efficient consolidated operations of platform aircraft
- easy access for visiting science teams



DAOF

Science Integration Labs

