DataTurbine Activities at NASA

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Overview

  - Focus here on Earth science applications customers (~5 yrs)
- Brief look at DataTurbine-based systems at Dryden
- Status & Plans
- Show video clip of recent mission monitor application
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
• 4 CFM56-hi-bypass turbofan engines

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
  – extensive on-board data acquisition system and on-board experiment network

Background and Status
• 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
• Aircraft operations transferred to Dryden Flight Research in August, 2007

ER-2
Core Aircraft for Very High Altitude

Capabilities
• Ceiling > 65,000 ft
• Duration > 10 hours
• Range > 4,000 nautical miles
• Payload 2,600 lbs (700 lbs in each wing pod)
• GE F-118 Turbofan

Mission Support Features
• World-wide deployment experience
• Multiple locations for payload instruments
• Pressurized and un-pressurized compartments
• Standardized cockpit control panel for activation and control of payload instruments
• Iridium communications system with instrument interaction capabilities

Background and Status
• U-2 and ER-2 aircraft have been a mainstay of NASA airborne sciences since 1971
• Over 100 science instruments integrated
• Continuous capability improvements
• Two aircraft currently available for:
  –Remote sensing
  –Satellite calibration/validation
  –In-situ measurements and atmospheric sampling
  –Instrument demonstration, test and evaluation
P-3B Orion
Heavy Lift, Core Aircraft

**Capabilities**
- Ceiling 30,000 ft.
- Duration 12 hours
- Range 3,800 nautical miles
- Payload 16,000 lbs
- 4 Allison T56-14A turbo-prop engines

**Mission Support Features**
- Shirtsleeve environment, ≤ 18 scientists
- Worldwide deployment experience
- Extensive modifications to support in-situ and remote sensing instruments
  - Zenith and nadir viewports
  - Modified power systems
  - 19 inch rack mounting
- On-board data acquisition network

**Background and Status**
- Acquired by NASA in 1991, operational for science in 1993
- Long history of supporting studies in geology, hydrology, meteorology, biological oceanography, physical oceanography, atmospheric chemistry, and cryospheric sciences
- Frequently used by Instrument Incubator Program investigators

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
- DC Power 2.0 KW
- AC Power 8.3 KVA

**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
- Redundant LOS and BLOS aircraft command and control comm links
- Redundant BLOS ATC comm links
Network-Distributed Test/Measurement

Acquisition → Other Processing → Monitoring
Interacting
Network Distribution
Interacting

Location A

Location B

Global Test Range
Intelligent Network Data Server

- Prototype for operational infrastructure (< 2 yrs old)

Credit: Matt Miller
Credit: Creare, Inc.
Credit: Matt Miller
Credit: NASA
Sensor Web Notional Architecture

Year-at-a-Glance
Development Highlights and Milestones during 2007

Working toward a robust, operational capability by 2010 through:
- Incremental development
- Field deployment of incremental systems to high priority airborne science campaigns

- Inaugural flight of Linux Multi-Link
- DataTurbine Software Debuts Open Source
- Inaugural flight of REVEAL (WB-57)
- DC-8 Infrastructure Upgrade
- Field-Deployable Ground Station Construct; initial test
- NexGenNavRecorder Technical Interchanges
- Installation of P-3 antennas, REVEAL and servers
- Inaugural satcom data flow from P-3
- P-3: CARS
- ER-2: CHLOE
- ER-2: LAC
- ER-2: CLASiG
- WB-57/DC-8/ER-2: TC-4

IT Security Authorization to Operate

2007
- Feb
- Mar
- Apr
- May
- June
- July
- Aug
- Sept
- Oct
- Nov
- Dec

2008
- Jan
Typical Examples

July 2007 (TC4 – Central America):
• Three NASA aircraft in coordinated flight
• NASA-enabled displays for non-NASA instrument

October 2008 (SMAP-VEX – Eastern U.S.):
• Two aircraft in coordinated flight
• incl. non-NASA aircraft, web data source

Status and Plans

• DataTurbine-based INDS system comprise core data management in Dryden's ground station
• Two heavy–lift platforms also have DataTurbine servers to support onboard computing needs
• Five years of use in support of airborne science builds on DataTurbine involvement since inception 1995.
• Operational transition planning now in progress
  – New systems at DFRC (Global Hawk, emergency Ops, Data Center)
  – Redesign Global Test Range Development Lab (dev/production)
• Deploy first operational systems 2010
• Explore/advocate propagation across Agency.
  – Vehicle health management; space-related applications
(Show Video of Realtime Mission Monitor)