DataTurbine Activities at NASA

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Overview

• NASA Dryden Business: Flight Testing and Airborne Science
  – 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

Location A

Location B

Global Test Range
Intelligent Network Data Server

- Prototype for operational infrastructure (< 2 yrs old)
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 REVEAL (WB-57)
Inaugural flight of Linux Multi-Link
Inaugural satcom data flow from P-3
Installation of P-3 antennas, REVEAL and servers
NexGenNavRecorder Technical Interchanges
DataTurbine Software Debuts Open Source

2007
Feb Mar Apr May June July Aug Sept Oct Nov Dec 2008 Jan

ER-2: LAC
ER-2: CLASIG
ER-2: CHLOE
P-3: CARS
WB-57/DC-8/ER-2: TC-4

IT Security Authorization to Operate
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)