

NASA GRIP Aircraft



NASA DC-8



DC-8 Communications



REVEAL - Research Environment for Vehicle-Embedded Analysis on Linux

- Real-time aircraft position and data plotted on Google Earth
- X-Chat capability with science team members

Instrument Inter-communications

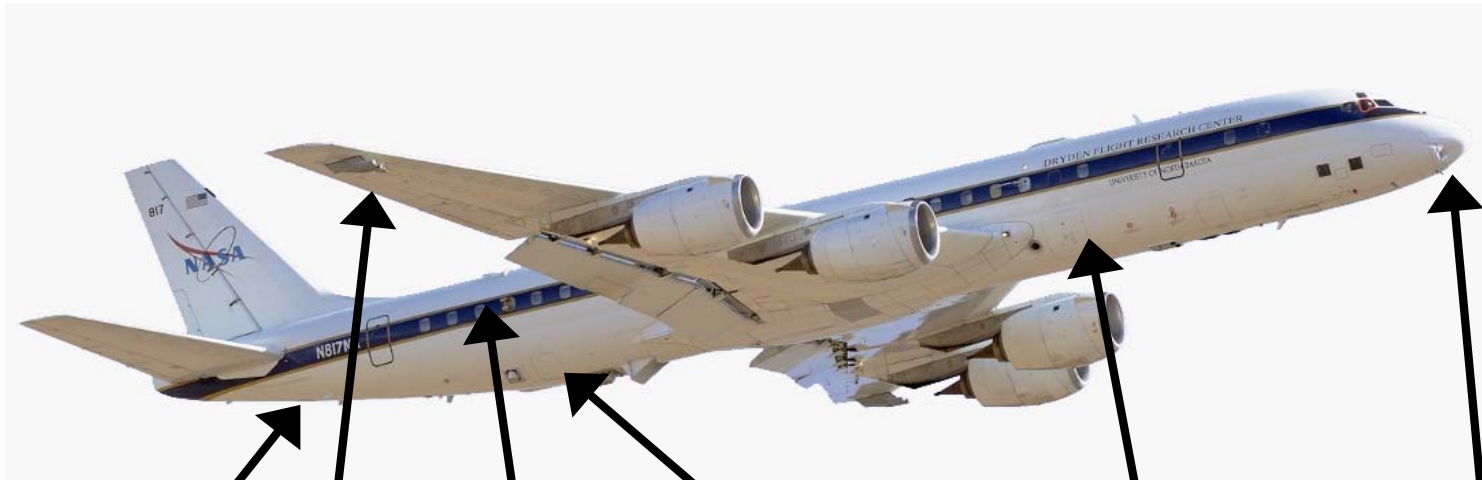
- Gigabit ethernet data system
- High Res. LCD displays

IRIDIUM and INMARSAT Satcom

- 9600 bps IRIDIUM
- 432kbps INMARSAT

Digital forward and Nadir video system

GRIP DC-8 Payload



Dropsondes
(Vertical Profiles of
Temp, Press, Humidity
and Winds)

CAPS, CVI, PIP
(Cloud Particle Size
distributions, Precip Rate,
Rain & Ice water content)

LASE
Lidar Atmospheric
Sensing Experiment
(H₂Ov, Aerosol
profiles and Cloud
distributions)

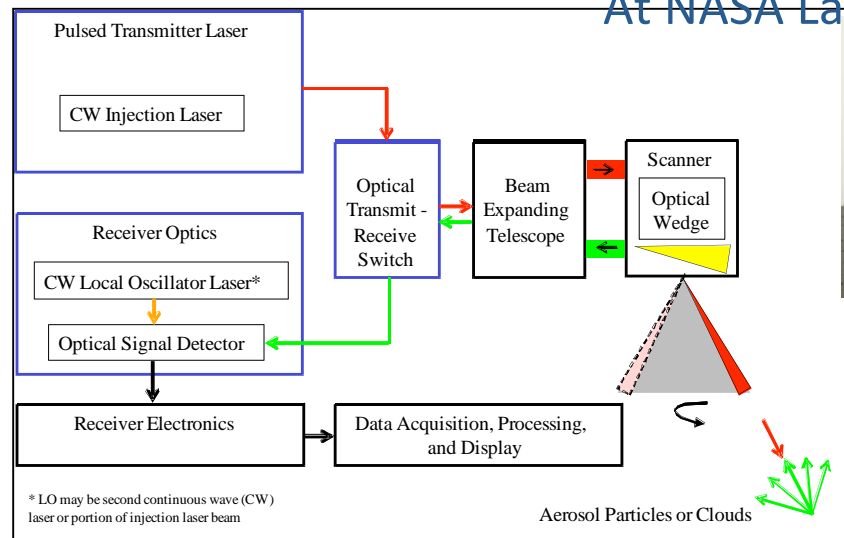
DAWN
Doppler Aerosol Wind
Lidar
(Vertical Profiles of
Vectored Horizontal
Winds)

APR-2
Airborne Precipitation
Radar Dual Frequency
(Vertical Structure Rain
Reflectivity and Cross
Winds)

MMS
Meteorological
Measurement System
(Insitu Press, Temp, 3D
Winds and Turbulence)

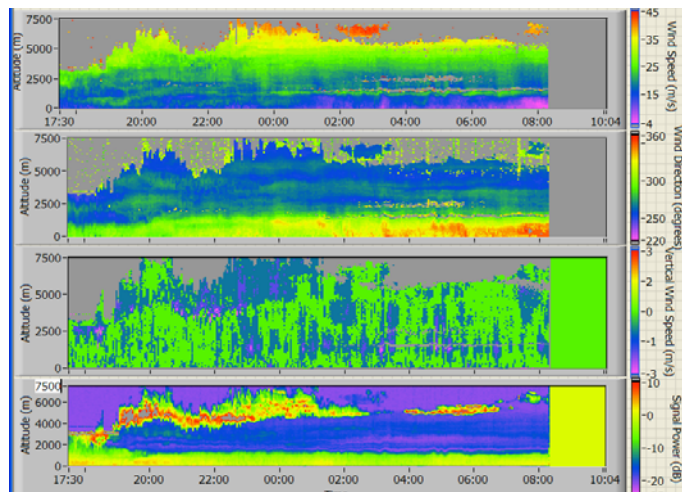
Pulsed 2-Micron Coherent-Detection Doppler Wind Profiling Lidar System

At NASA Langley Research Center



DAWN Transceiver
(Transmitter + Receiver)
250 mJ/pulse, 10 pulses/sec.
5.9" x 11.6" x 26.5", 75 lbs.
(no telescope or scanner)

Elements of Coherent (Heterodyne) Doppler Lidar



March 11-12, 2009, unattended autonomous operation, ~ 14 hrs, 3-minute shot integration times, 5 Hz

Tilted Beam - 45 deg elev.
2 Azimuths Horiz. Wind Speed
4 - 45 m/s

Horizontal Wind Direction
220 - 360 deg

Vertical Wind Speed
-3 - +3 m/s

Vertical Signal Power
~ 35 dB

Predicted DC-8 Performance

- Horizontal vector wind profile from 300 m below DC-8 to ground, thick clouds permitting, ~ 3 min. integration
- Line-of-sight velocity precision better than 1 m/s
- Line-of-sight velocity bias less than 0.1 m/s
- Deliver LOS and/or horizontal wind profiles
- Multiple integration times permitted on same data
- Multiple vertical resolutions permitted on same data
- On board real-time displays
- Archive all data

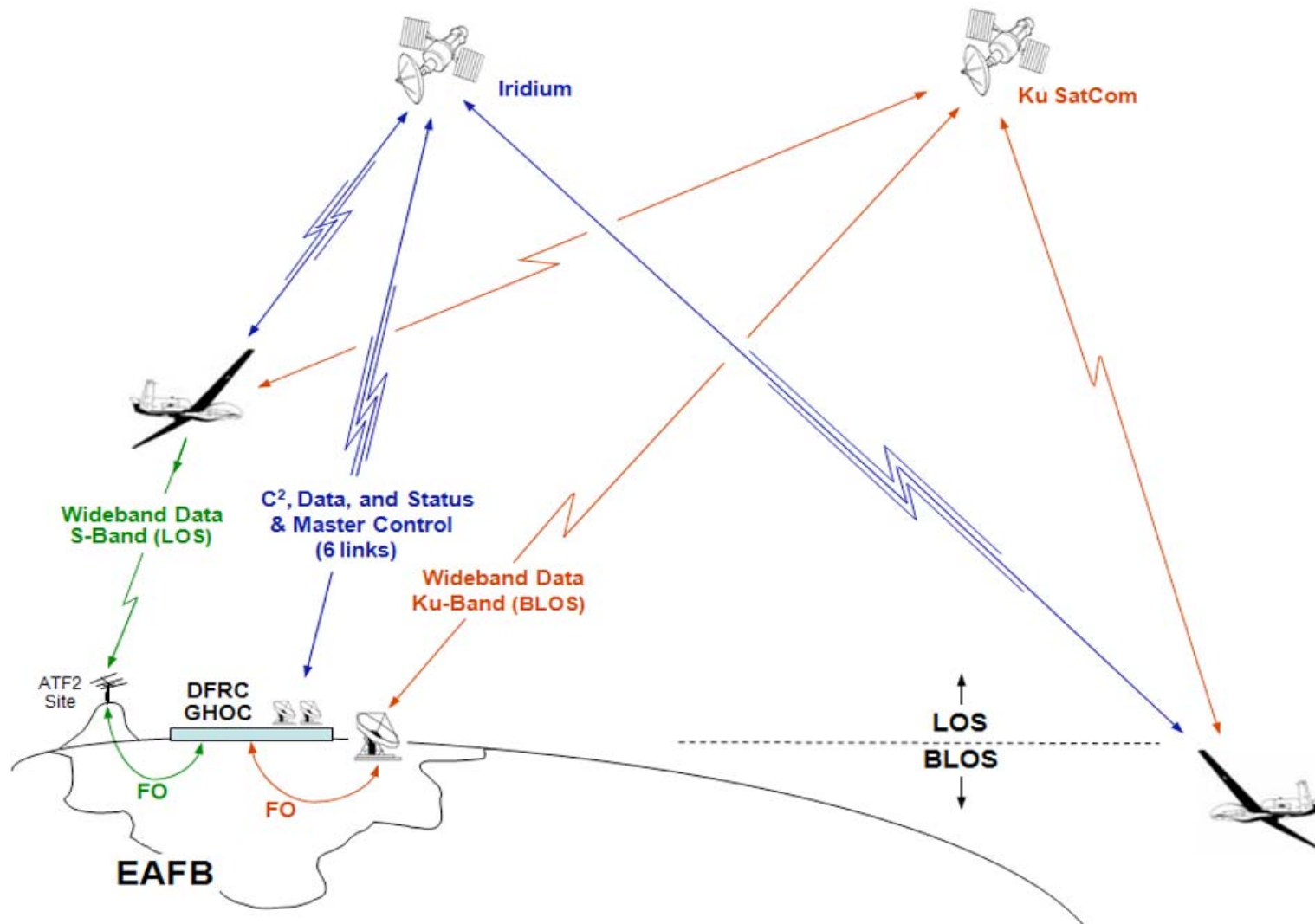
NASA Global Hawk 10/23/09



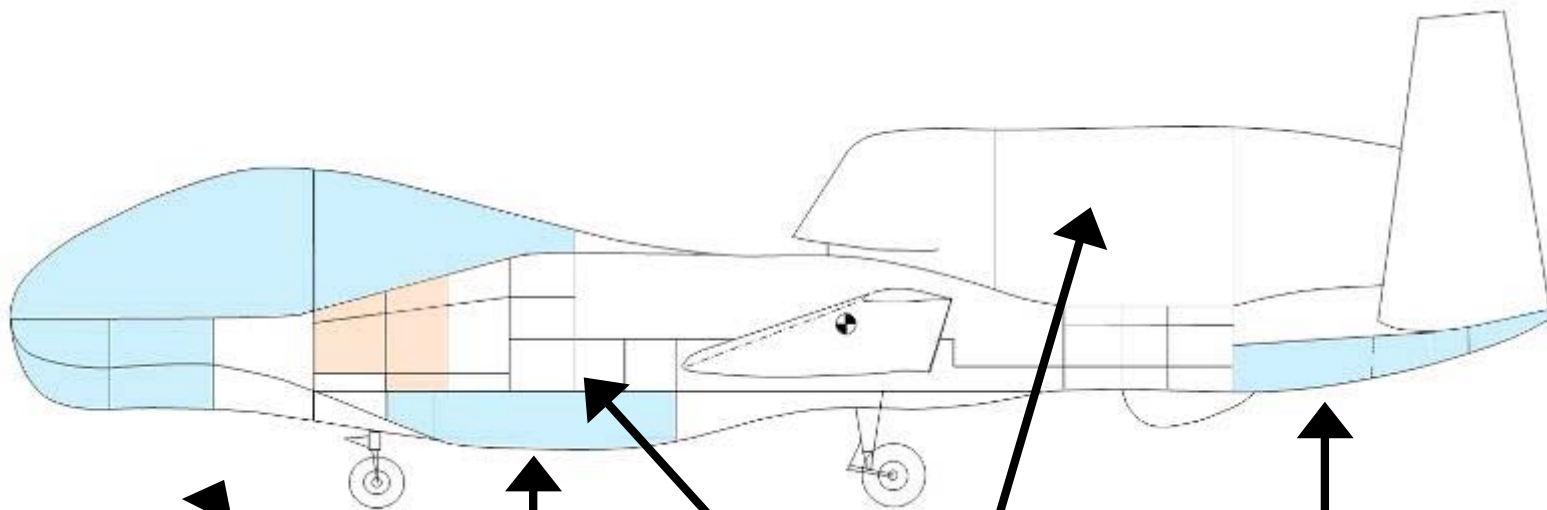
GHOC Flight Operations Room



GH UAS Communications



GRIP GH Payload



HAMSR

High Altitude MMIC Sounding Radiometer
(Temp, H₂O_v, Cloud liquid & ice distribution)

HIWRAP

High Altitude Imaging Wind and Rain Profiler
(Horizontal wind vectors and ocean surface winds)

LIP

Lightning Instrument Package
(Lightning and Electrical Storm observation)

Driftsondes

High Altitude Lightweight Dropsonde
(Vertical profiles of temp, humidity, pressure & winds)

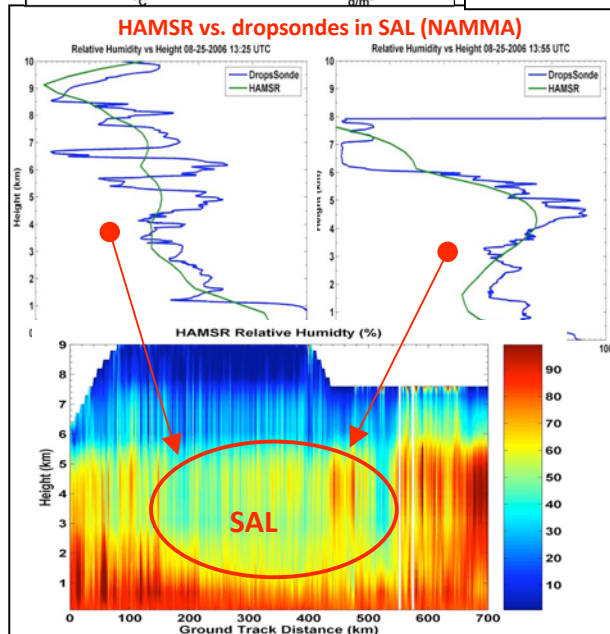
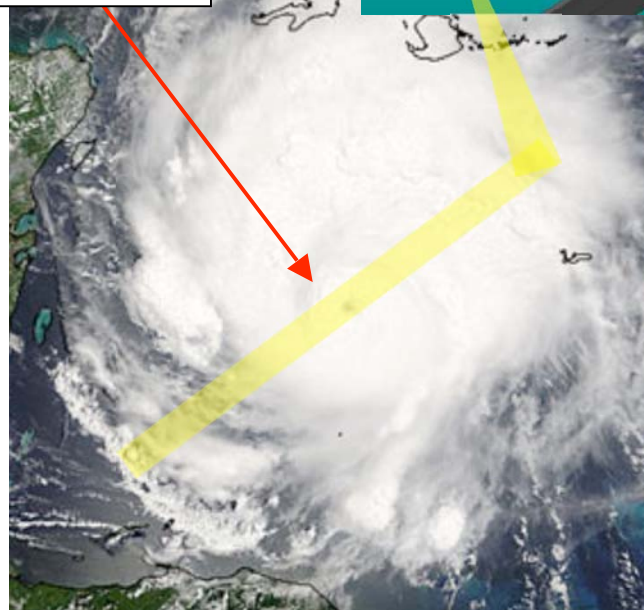
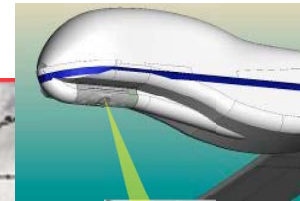
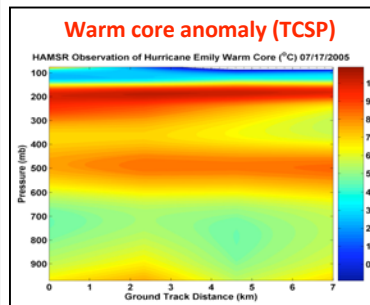
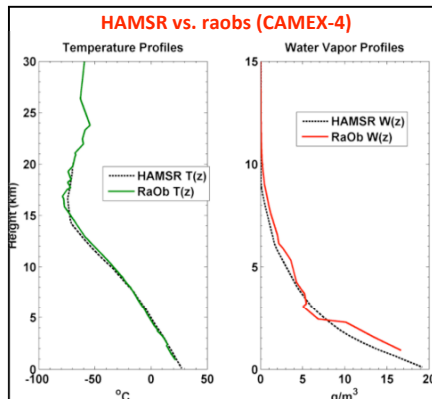


HAMSR Microwave Sounder on Global Hawk

Bjorn Lambrigtsen, Shannon Brown - JPL

Thermodynamic structure

- $T(z)$, $q(z)$, $L(z)$ - clear & cloudy
- Rain rate, IWP (experimental)
- 1 km V x 2 km H in 40-km swath
- 25 channels: 50, 118 and 183 GHz

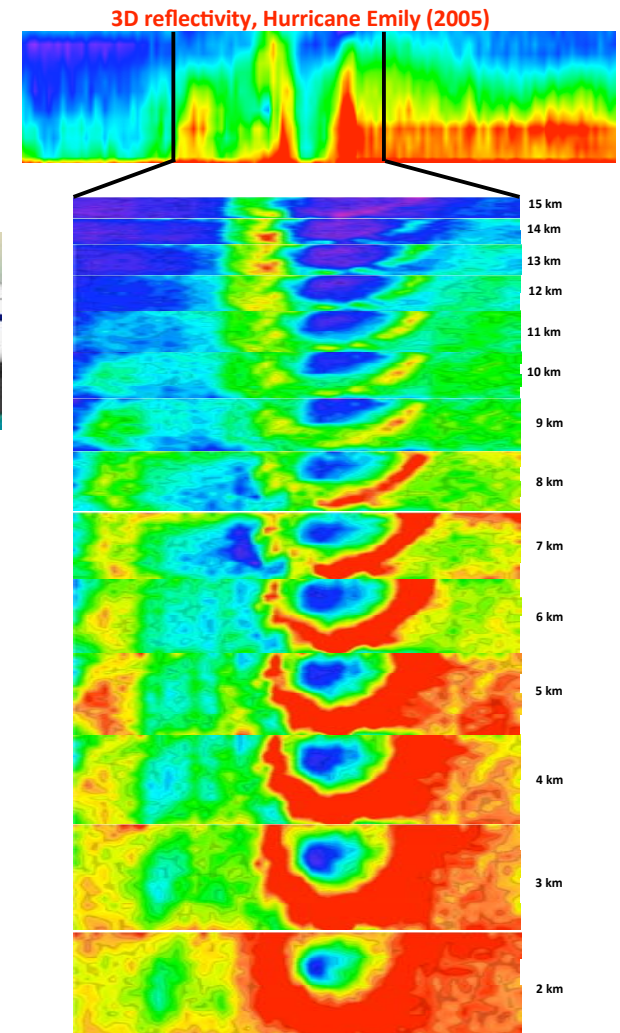


Multiple platforms

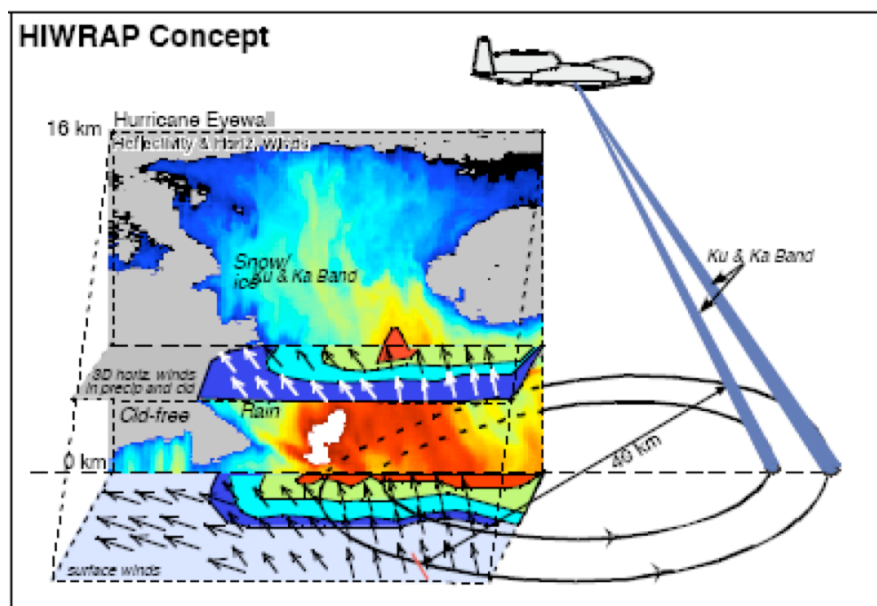
- ER-2 (CAMEX-4, TCSP)
- DC-8 (NAMMA)
- **Global Hawk (ready late 2009)**

Convective structure

- Radar-like reflectivity
- 1 km vert.res/40 km swath
- Conv.intens., precip(z), ice(z)



High-Altitude Imaging Wind and Rain Profiler (HIWRAP)



Hurricane Measurements

- *3D winds (grid point retrieval) and reflectivity
- *Ocean scatterometry (QuikScat-like measurements)



NASA Technology Development

- Low power solid-state transmitter and pulse-compression
- Single aperture antenna for two beams (incidence 30° , 40°) and two frequencies (14, 35 GHz), conical scan
- High altitude, power efficient real-time FPGA-based digital receiver and processor
- GPM frequencies



Pre-GRIP



April/May 2010

- Two test flights; 1 local in DFRC range and 1 24hr flight.

Test of Certificate of Authorization (COA) and Flight Information Regions (FIR) Process

- GH flight to the Gulf of Mexico, possibly Atlantic

Instruments on board

- HAMSR
- HIWRAP
- GH Wx Instruments
- LIP?

GH UAS Wx Hazard Mods



Install HD Camera in Aircraft Nose

- Low-Light / Visual / IR

Install Wx Severe Storm Instruments

- Storm-scope for lightening detection
- Data Link NexRad?

Install Turbulence Package

- Turbulence Sensor w/ Display

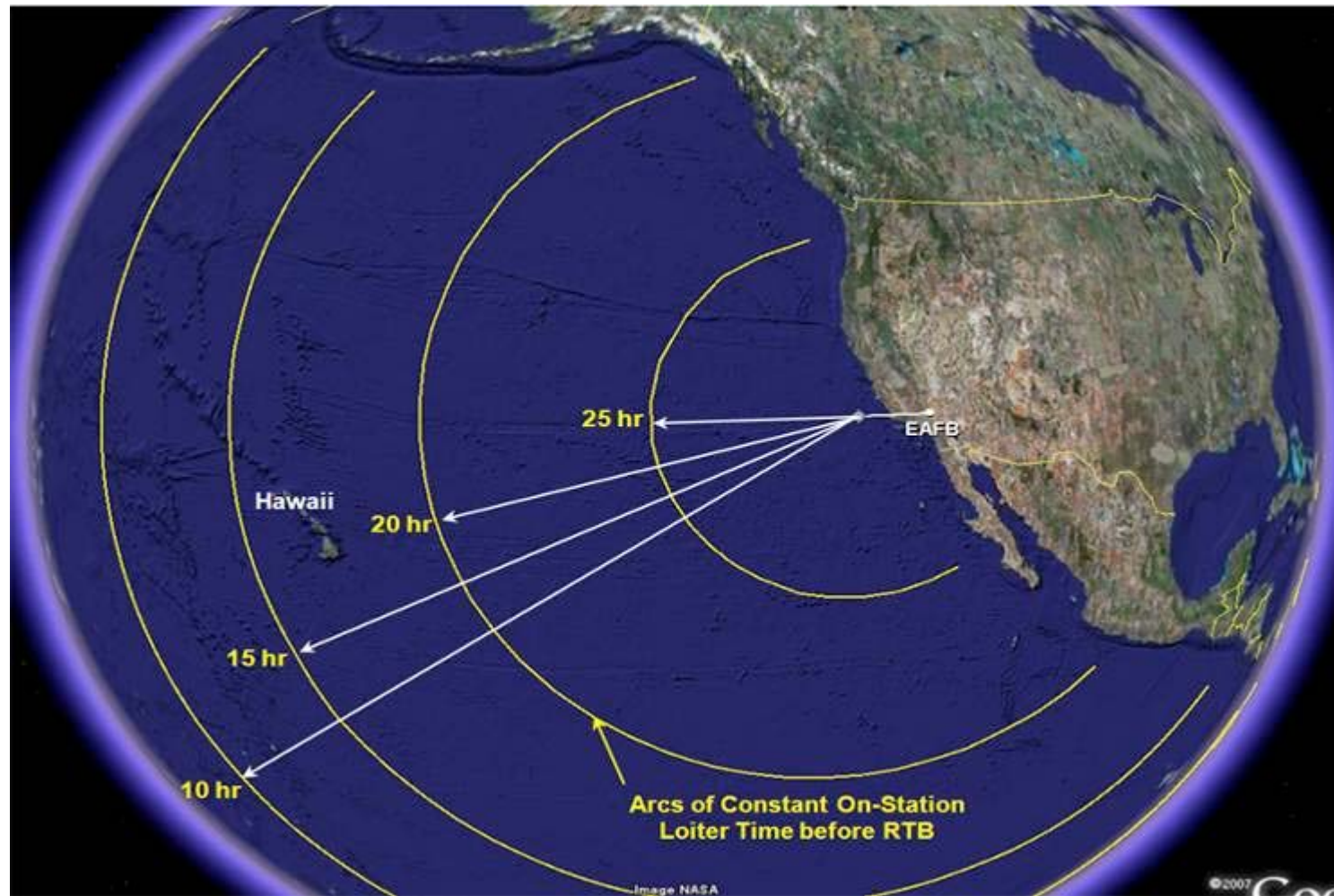
GRIP DC-8 Range from FLL



Loiter Capability from DFRC



East Pac Loiter Capability



GRIP Aircraft Platforms

Questions?

DC-8 Interior

