NRL/VXS-1
2008
UPDATE

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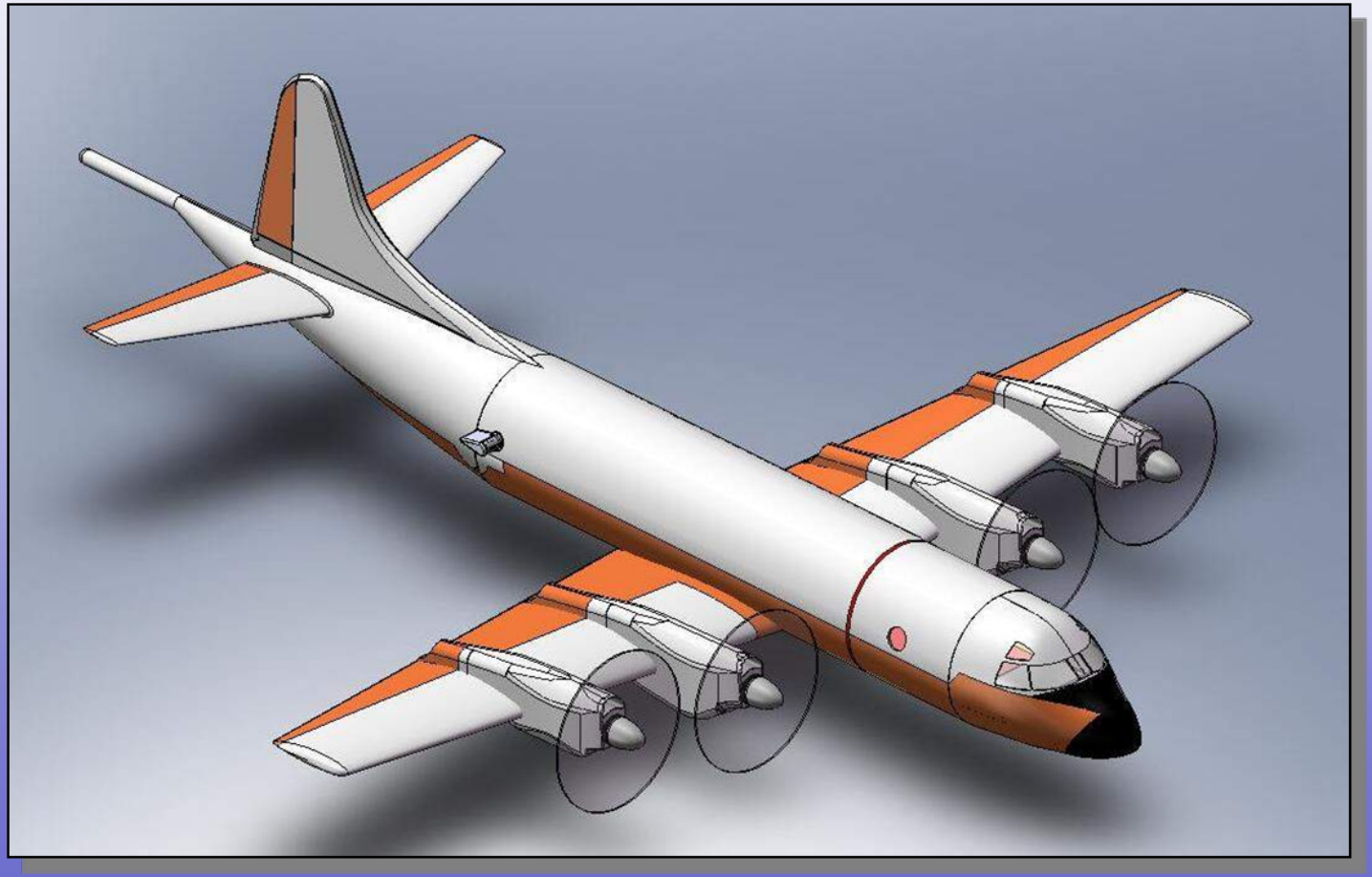
Interagency Coordinating Committee for Airborne Geosciences Research and Applications (ICCAGRA)
May 21, 2008

Facilities Update

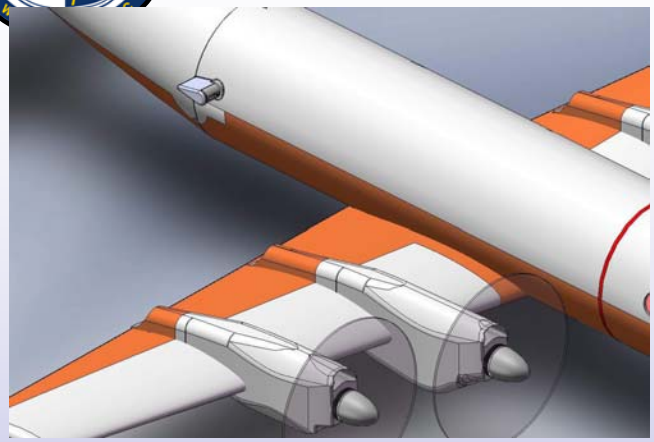
VXS-1 2008 Milestones

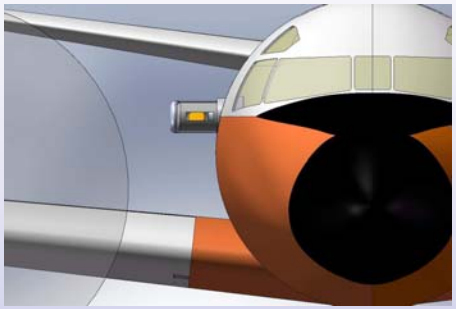
- NP-3D TCS-08 lidar installation on ELDORA A/C
  - Ongoing, ready for deployment in Aug 2008
- Rampant Lion II Afghanistan deployment
- Completed project modification on C-12 aircraft
  - Investigating wing pods
  - Electro Optic window Radome design currently undergoing NAVAIR approval process
- Acquisition of 4 Scan Eagle UAV aircraft
  - Completion of indoctrination flights
  - Initial payload up-grade flights flown
  - Available for project flights 4th quarter FY08

ELDORA/
Doppler Wind Lidar (DWL)
System Integration

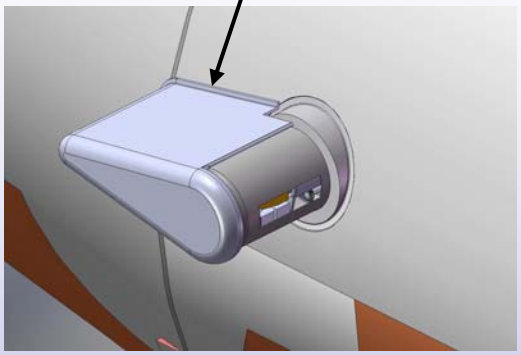


DWL Aircraft Installation



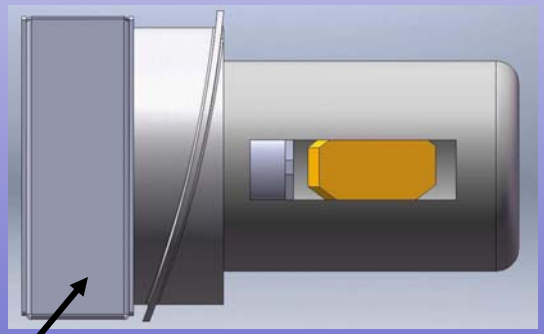


Stationary fairing will utilize pre-existing holes from other fairing installations

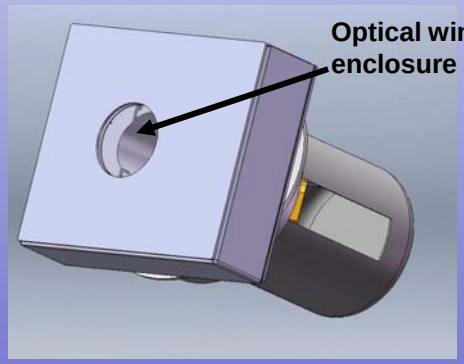


The Installation is in the aft observer window and will use a rotating cylinder over the scanner inside a stationary fairing to lessen drag loads.

Cylinder housing around the scanner will match the rotation of the scanner.



Machined window insert.

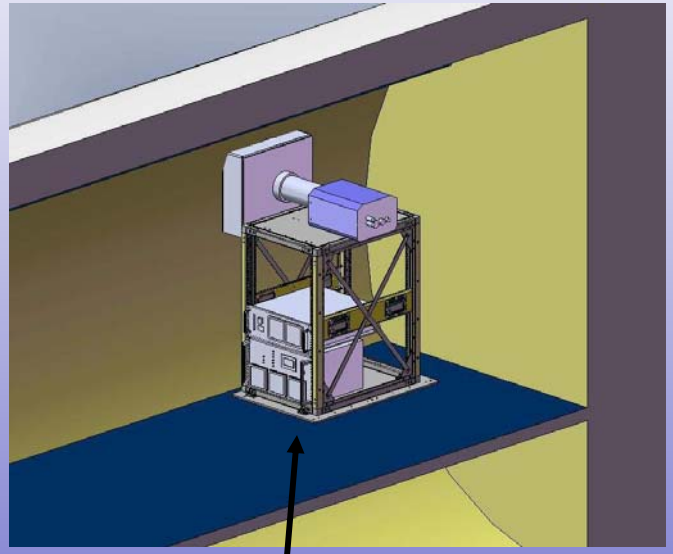


Optical windows for environmental enclosure and fairing.

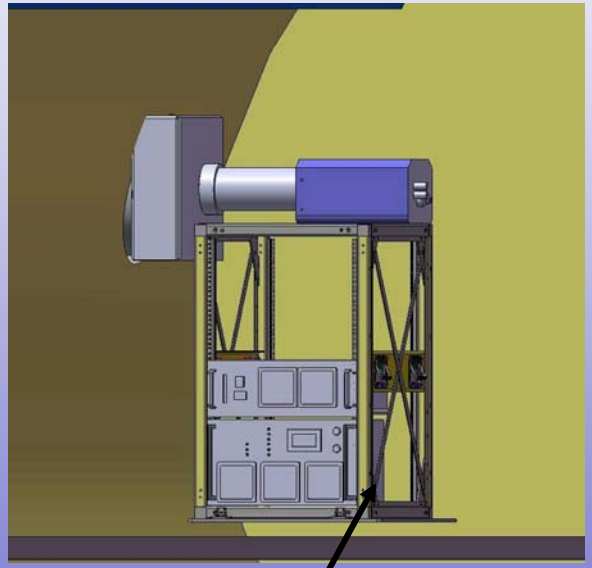
The rotating cylinder housing the scanner will utilize a nitrogen purge system to maintain proper dew point and Nichrome wire around the optical glass window to prevent fogging.

DWL Rack Installation

Environmental control will be maintained by using existing environment within the aircraft and equipment mounted to a custom rack.



Custom rack to mount equipment and transceiver



Transceiver will mounted to a shock isolated tray

Project Modifications for VXS-1 C-12 Aircraft

C-12 Modifications

Project Power Distribution Box:

115 VAC @ 400HZ, (1X) 10 Amp circuit, and (2X) 5 Amp Circuits

115 VAC @ 60HZ, (1X) 15 Amp circuit, (1X) 10 amp circuit

28 VDC (1X) 10 Amp circuit, (2X) 5 Amp Circuits

Starboard Power Distribution Panel

Power Box

GPS Antenna located on the upper fuselage

RO/RO Equipment Racks

Rack is 24” deep x 22” wide x 28” tall with standard 19” MX mounting pattern

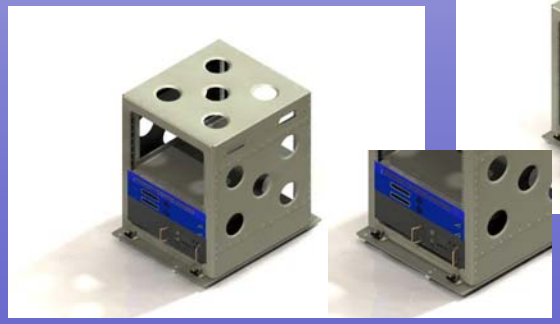
30” deep variation also designed

Designed to be lightweight to allow for more equipment, and lower cost

Equipment weight approx 200 Lbs

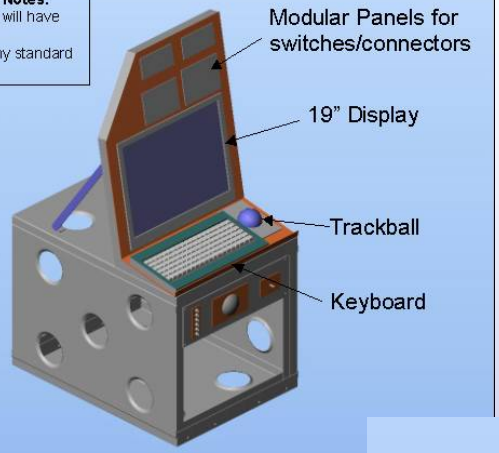
Two Power Boxes installed in the Aft Electronics Bay

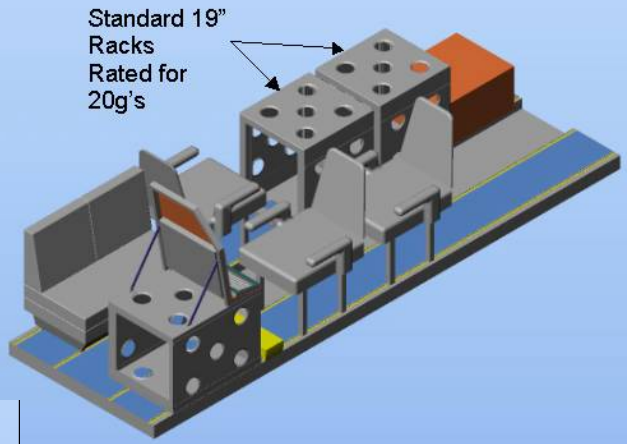
Inverters installed in the wing

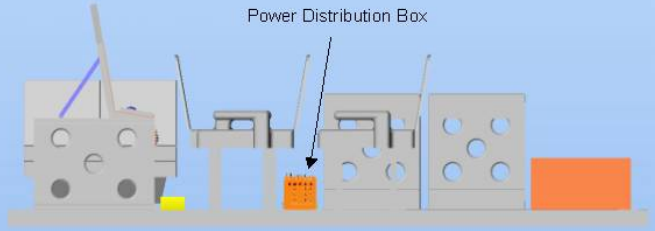


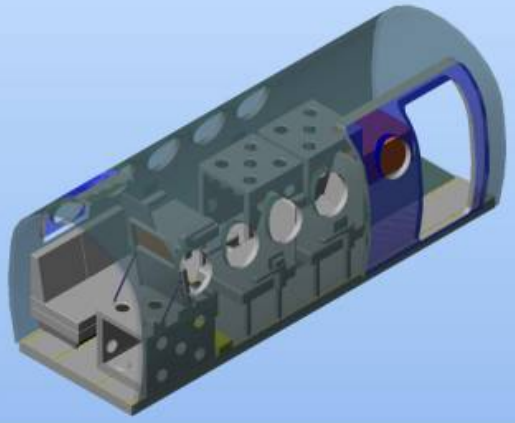
C-12 Internal Rack Configuration

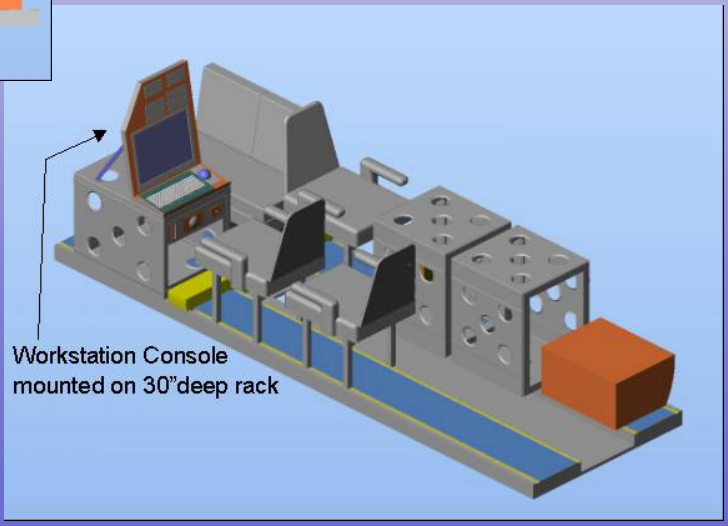
Workstation Notes:
- Modular panels will have Dzus rails
- Designed for any standard 19" display











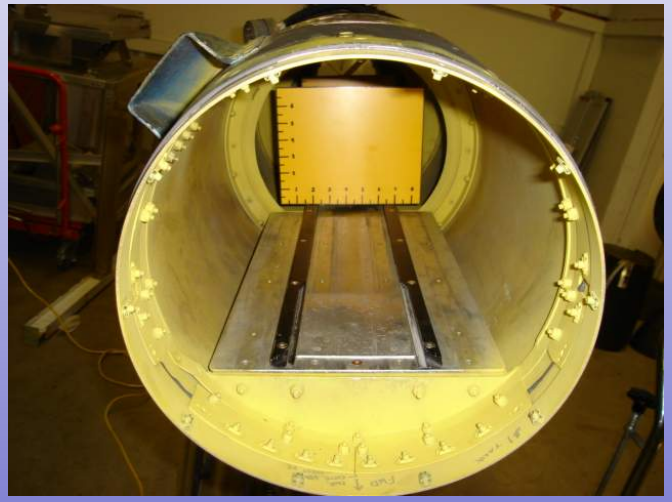
Wing Tip Tanks (in work)

Mount on the wing tips.

Formerly fuel tanks modified to carry electronics.

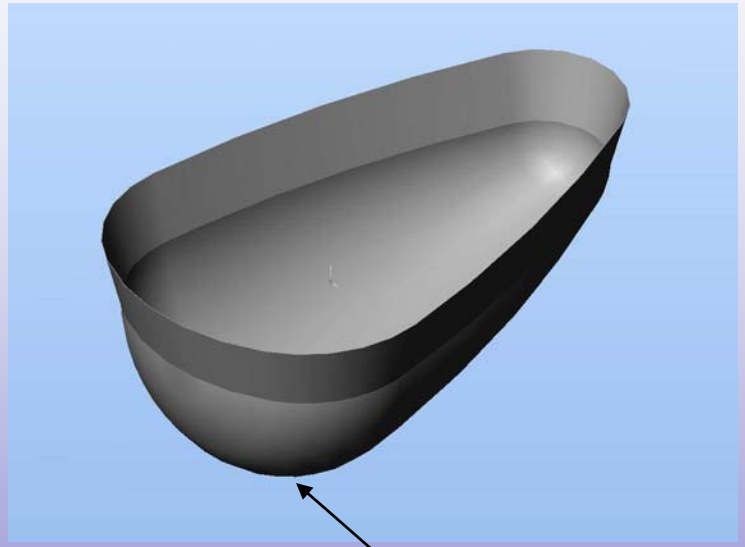
Incorporate a “Rail” system for slide in/slide out (SI/SO) capability.

Electronic equipment can be mounted to a blank plate which allows for SI/SO.



Window Option for Radome

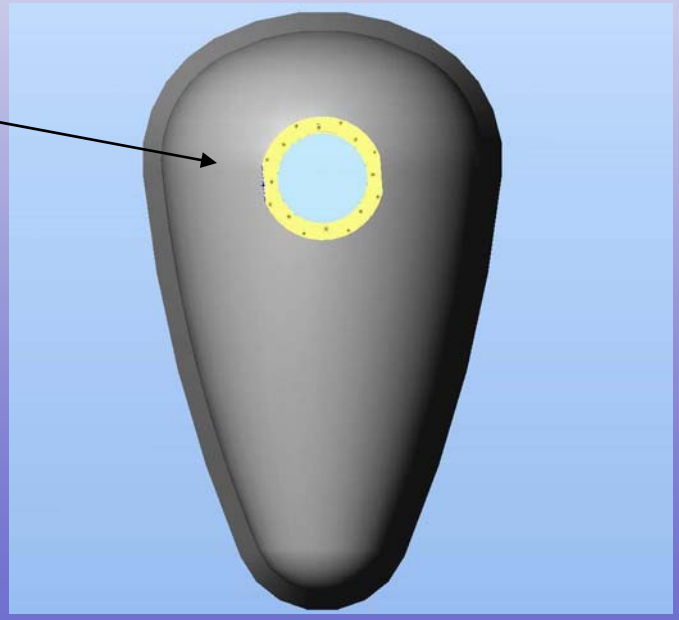
Will allow for large instruments to be used that require optical windows



C-12 Radome model

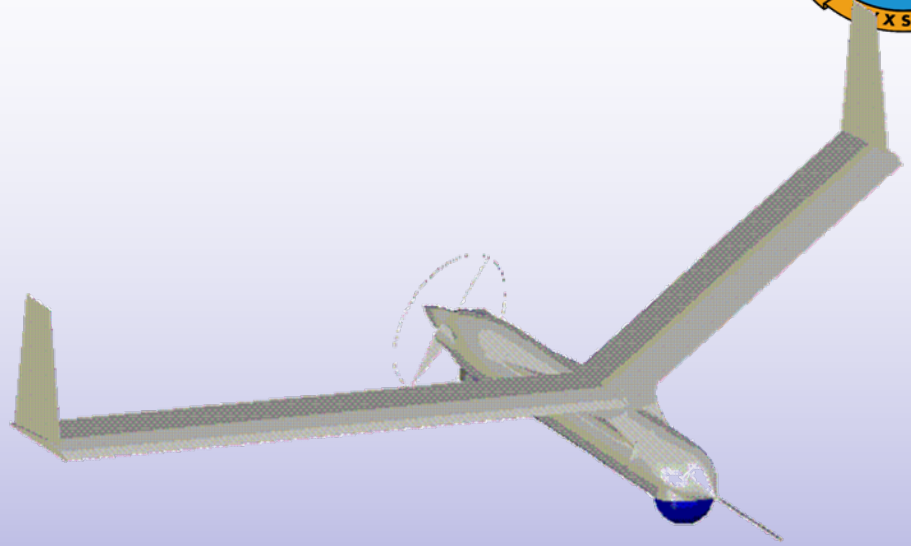
Currently undergoing NAVAIR approval process

Radome with window



Scan Eagle

- Components
  - Airframe
  - Ground Station
  - Launcher
  - Recovery Stand



Scan Eagle Parameters

PERFORMANCE

- Max Horizontal Speed 75 knots
- Cruise Speed 48 knots
- Ceiling 19,500 ft
- Endurance 12+ hours

DIMENSIONS

- Wing Span 10.2 ft
- Fuselage Diameter 7 in
- Length 5 ft

WEIGHTS

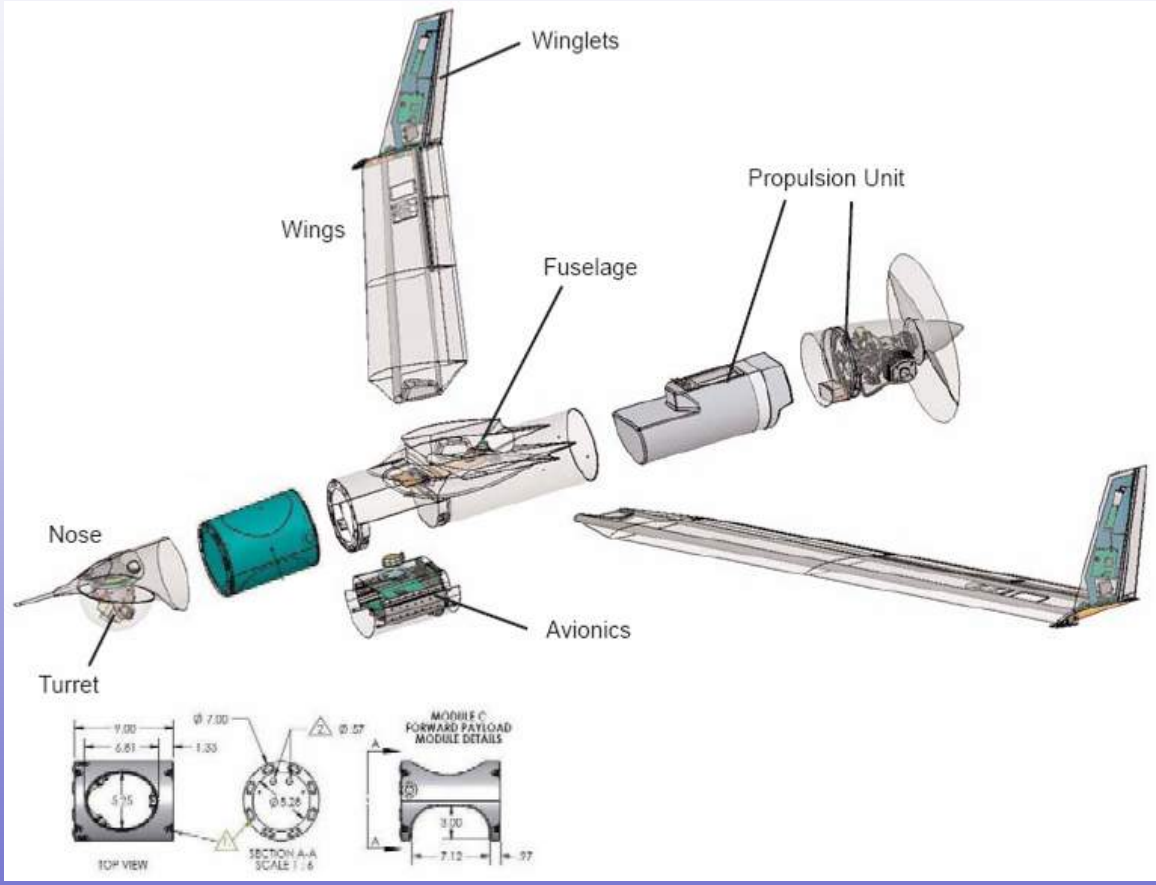
- Empty Weight 28 lb
- Fuel and Payload 15 lb
- Max Fuel 12.1 lb
- Max Takeoff Weight 44 lb

FREQUENCIES (MHz)

- C2/Telemetry: 1350-1390
- Video Downlink: 2300-2500

PAYLOADS

- Sony FCB-EX780 EO Camera
- DRS Tech. E3500 IR Camera



SE UAS has over 70,000 hours of flight time in theater

Project Highlights

Rampant Lion II: P-3 Airborne Survey of Afghanistan

RL-1 Multi-Sensor Survey Platform

NP-3D Research Aircraft

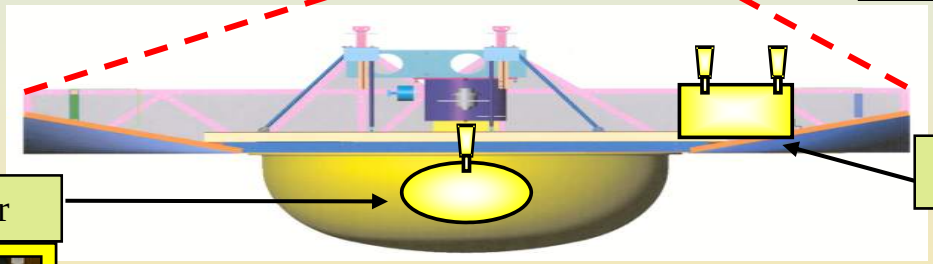
Magnetometer

KGPS

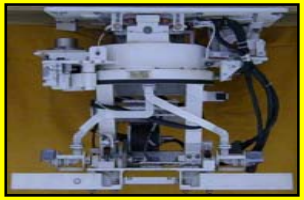
Dual Gravity Meters

CASI-1500 HSI

Common Sensor Bomb-bay Pallet



L-Band Polarmetric Imaging Radar



Applanix DSS Camera

RL-1 Sensor Suite

- **Magnetometer**
- **2 Gravity meters**
- **Photogrammetric camera**
- **Hyper-spectral camera**
- **Synthetic Aperture Radar**

CASI -1500 Hyper-Spectral Data

Collection Characteristics:

- ~ 3x4 m pixel size w lens/alt
- ~ 5 km swath width
- 288 spectral bands over .4 to 1 micron avg to 72 bands

Customers:

- econ (ag, hydrology etc)
- CFC-A CN (GoA CN)
- NGA
- ONR
- NGOs

Application:

- Resource Identification (minerals, hydrology, agriculture)
- Opium Eradication
- DoD Riverine Operations

USGS science for a changing world

NAVAL RESEARCH LABORATORY WASHINGTON, D.C.

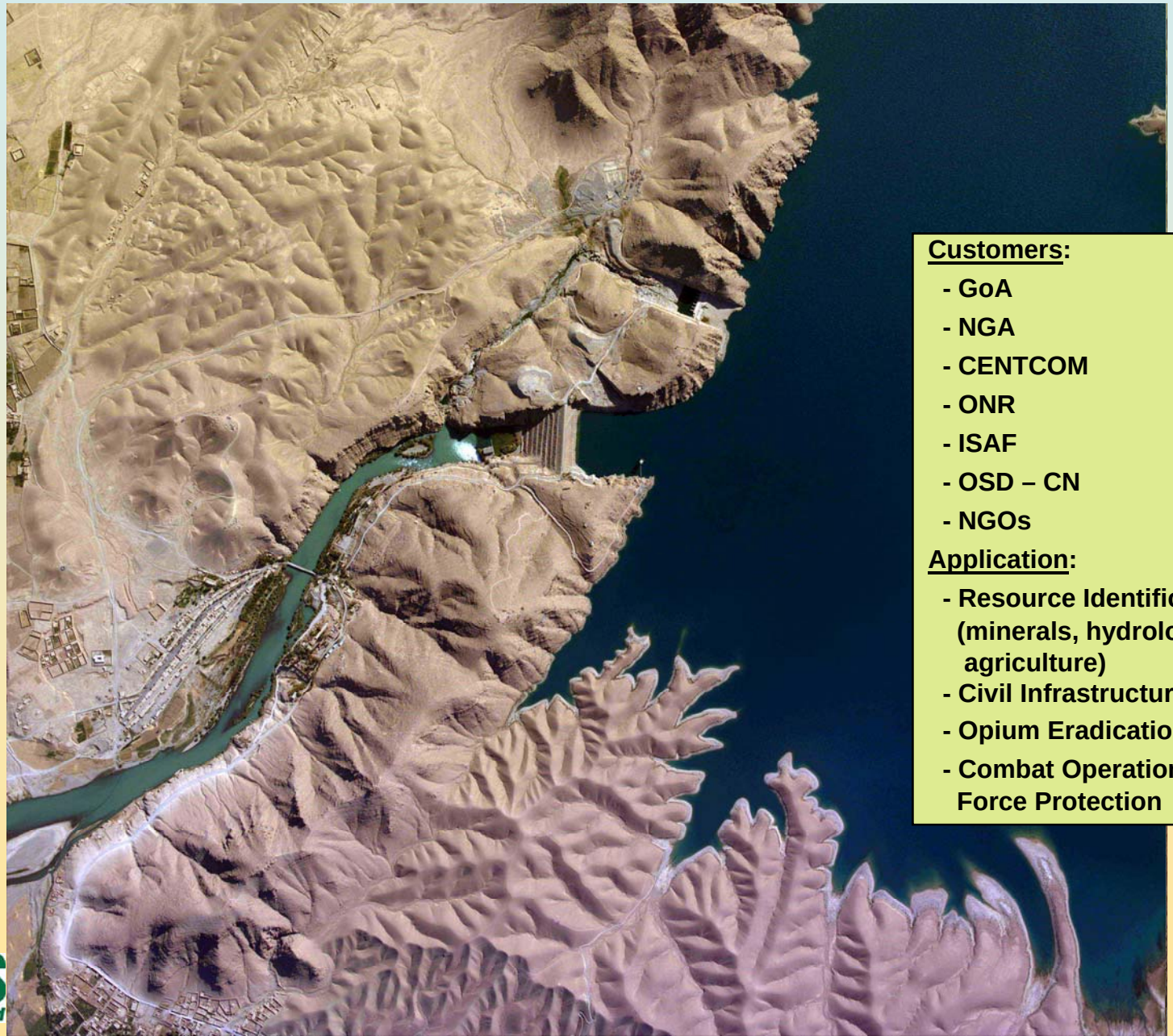
Hyperspectral Data and Spectral Masks

Vegetation →

Kandahar AF False Color Image

Buildings →

Digital Photogrammetry Data



Customers:

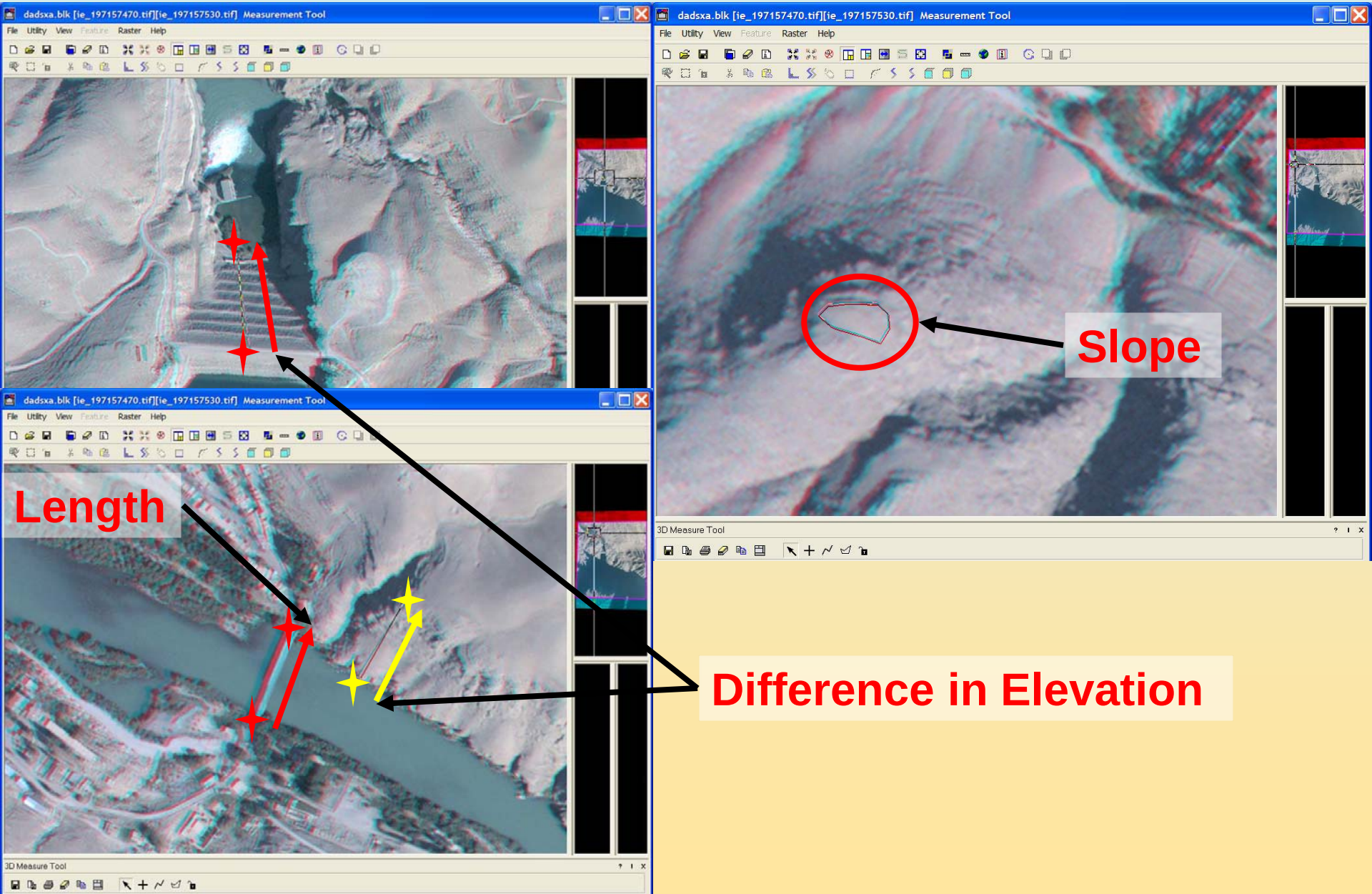
- GoA
- NGA
- CENTCOM
- ONR
- ISAF
- OSD – CN
- NGOs

Application:

- Resource Identification (minerals, hydrology, agriculture)
- Civil Infrastructure
- Opium Eradication
- Combat Operations and Force Protection

USGS science for a changing world

Stereo Imagery Analysis



RL II

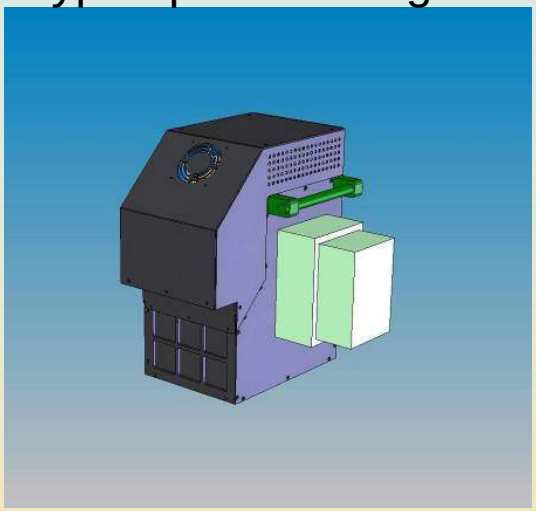
- **Integrated multi-sensor airborne program**
- **Common precise georeferencing of sensors**
- **VXS-1 P-3 – long range, large payload capability**
- **Can map up to 10,000 km^2/day @ ~ 18,000’ AGL**

Sensor Upgrades for RL II Survey

- **Digital Photogrammetry camera upgrade to 39 MPixels**
  - **Reduce GSD from ~ 1 m to 50 cm**
- **Increase spectral range of hyperspectral imaging from current 0.4-1.0 microns to 0.4-2.5 microns**
  - **Augment CASI-1500 with NGA MARS sensor**
- **Addition of high-altitude scanning LIDAR system**
  - **Produce digital elevation model with better than 10 meter post spacing and ~ 0.5 meter accuracy**
- **Thermal Imager**
  - **640 by 480 pixels**
  - **30 mK resolution on single frame**

Additional RL-II Multi-Sensor Collection on Aircraft and Ground

MaRS and ITRES Casi Hyperspectral Imagers



Analytical Spectral Devices (ASD) Portable Field Spectrometer

Aerosol Robotic Network (AERONET) and MICROTOPS hand-held Sun Photometers

Thermal Imager

Leica Topographic Scanning Lidar

Ref: J. Bowles NRL-7231

Ground site

- Kandahar Air Field (KAF)
  - Regional rawinsondes collected and archived (not augmented due to personnel/ resource limitations)
  - Calibration tarps flown over once a week
  - Aeronet site at KAF
  - Portable Field Spectrometer (most likely at KAF only due to resource limitations)
  - Handheld Sun Photometer(s) deployed with Canadian survey teams in ARSIC-C, N, E, S
    - Provide optical depth and possibly ground reflectance at various locations/times coordinated with airborne or overhead collects

RL2 Teams

- **NRL**
  - **Marine Physics (7420): Program management, data acquisition and processing (DSS photogrammetry, Topo LiDAR, gravity, magnetics), precise georeferencing for all sensors**
  - **Remote Sensing (7330): CASI, thermal camera, assistance with MaRS**
- **Canadian Forces – MCE and CFJIC**
  - **Joint with NRL for photogrammetry and LiDAR analysis (theater quick look processing and NRL processing facility final form products)**
- **NGA**
  - **Innovision and P: MaRS hyperspectral, mission planning**
  - **Enterprise RRS team: compression, replication and distribution of theater products**

RL2 Missions

- **Near real-time SMO and CN support**
  - **Quick-look ortho-photos/mosaics, limited area LiDAR**
  - **GEOTIFF format and subsequent MCE field operational products**
- **Mapping/CENTCOM/NGA requirements for distribution and archiving**
  - **Orthomosaics, LiDAR DEM, gravity, magnetics**
  - **NITF 2.1 format**
- **S&T**
  - **Data fusion/signatures, advanced sensors, phenomenology, next generation geospatial product development, rapid data acquisition, processing, analysis and dissemination**
- **Support of Afghan/US government and NGO/commercial partners in reconstruction and economic development**

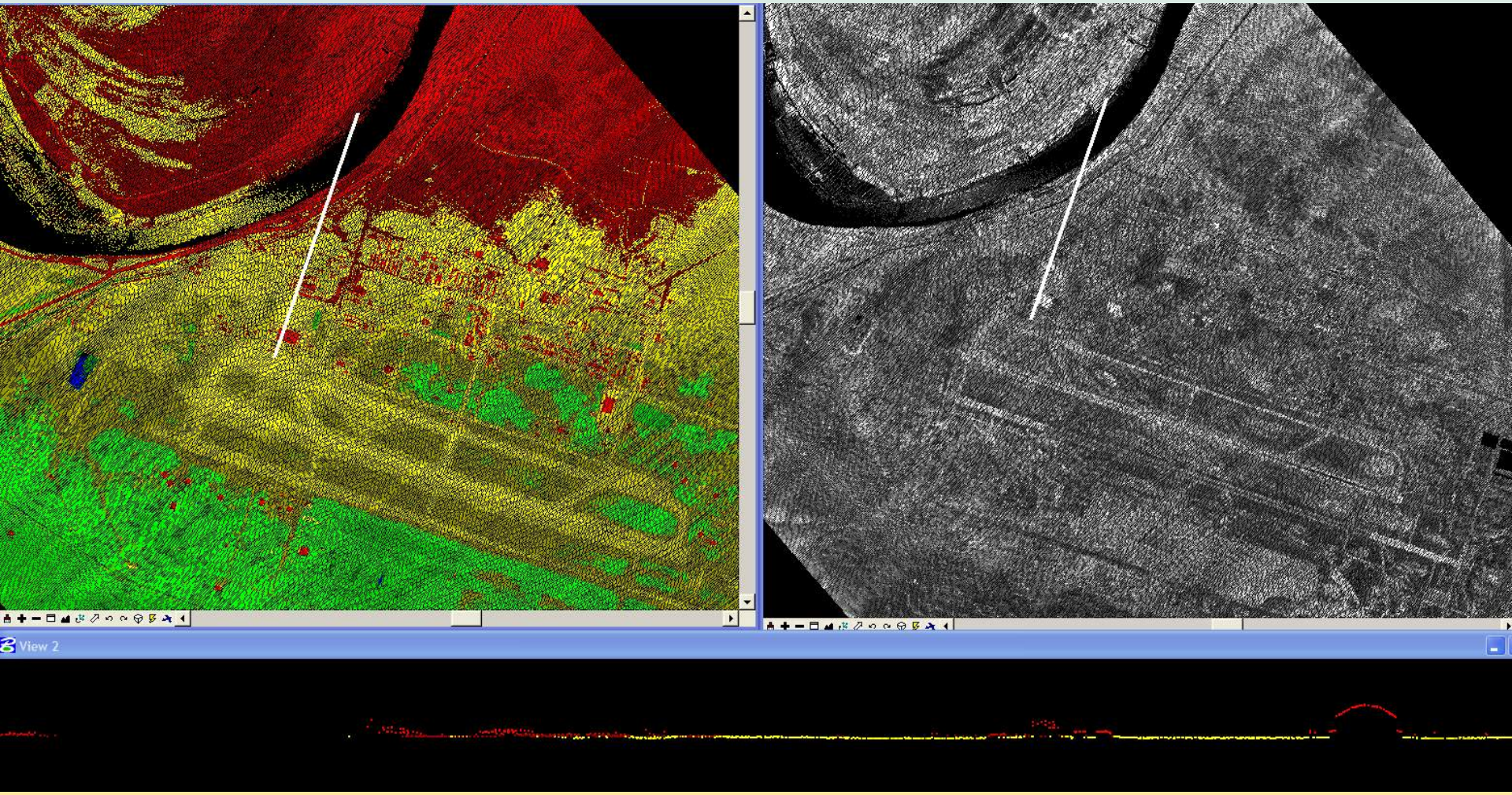
Ubaydah Bin Al Jarrah Airfield

on Tigris River

Leica ALS50 LiDAR Scanner

6000m/19700ft AGL 45deg FOV 38.5 kHZ pulse 13.4 Hz scan

92% return rate 5 meter post spacing



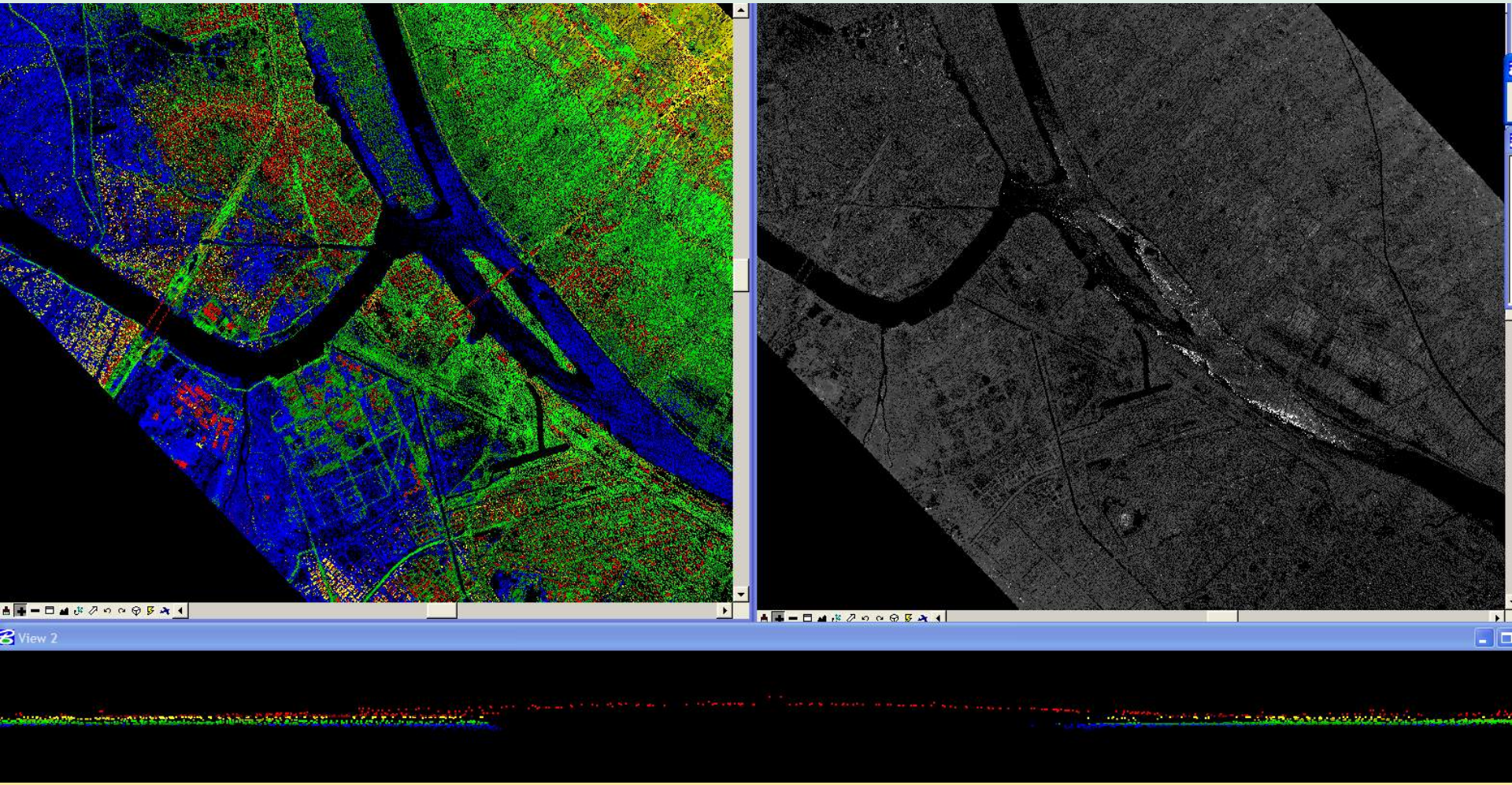
Al Basra

on Tigris River

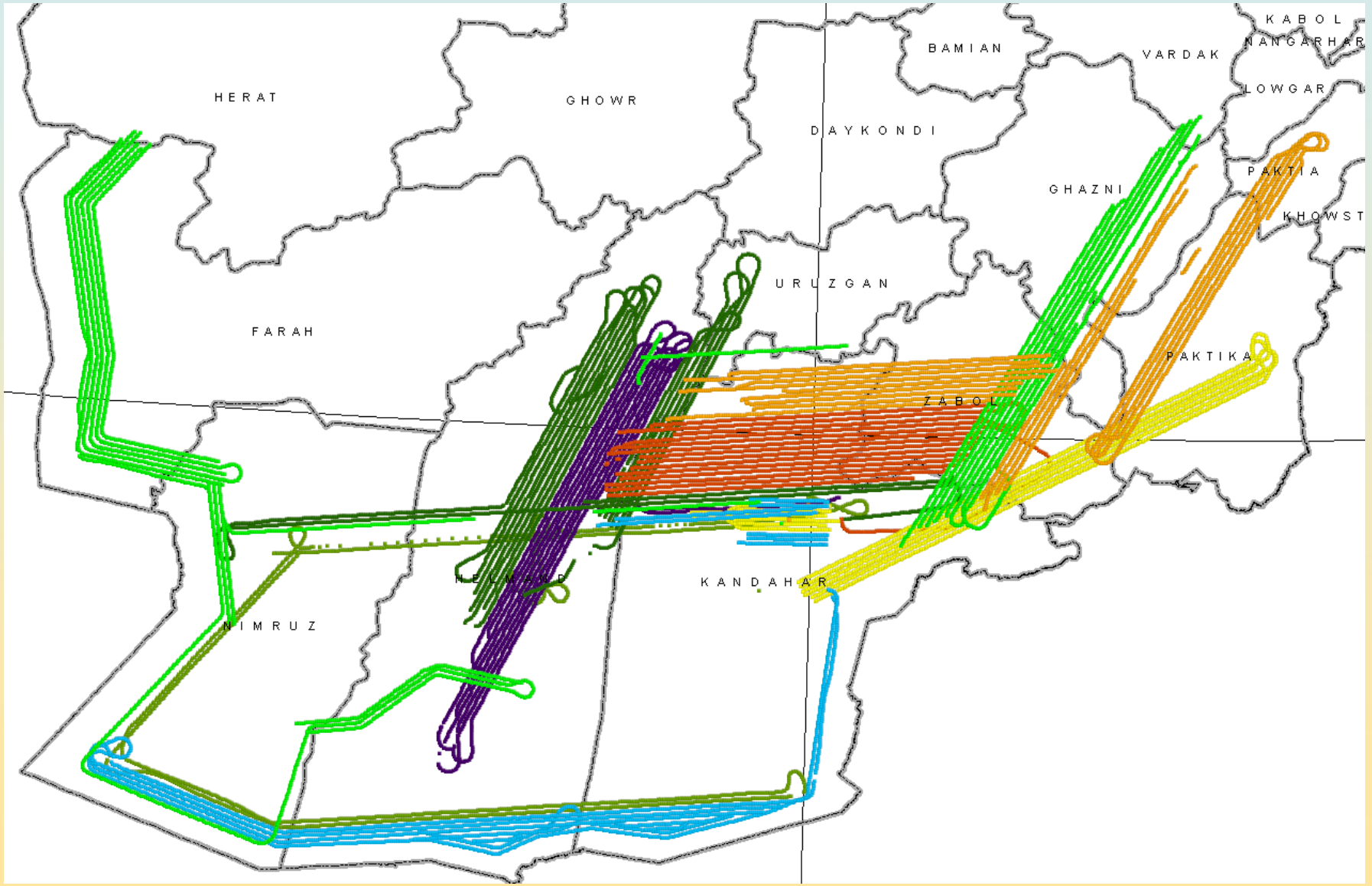
Leica ALS50 LiDAR Scanner

7300m/24000 ft AGL 45deg FOV 37.5 kHZ pulse 13.3 Hz scan

6 meter post spacing

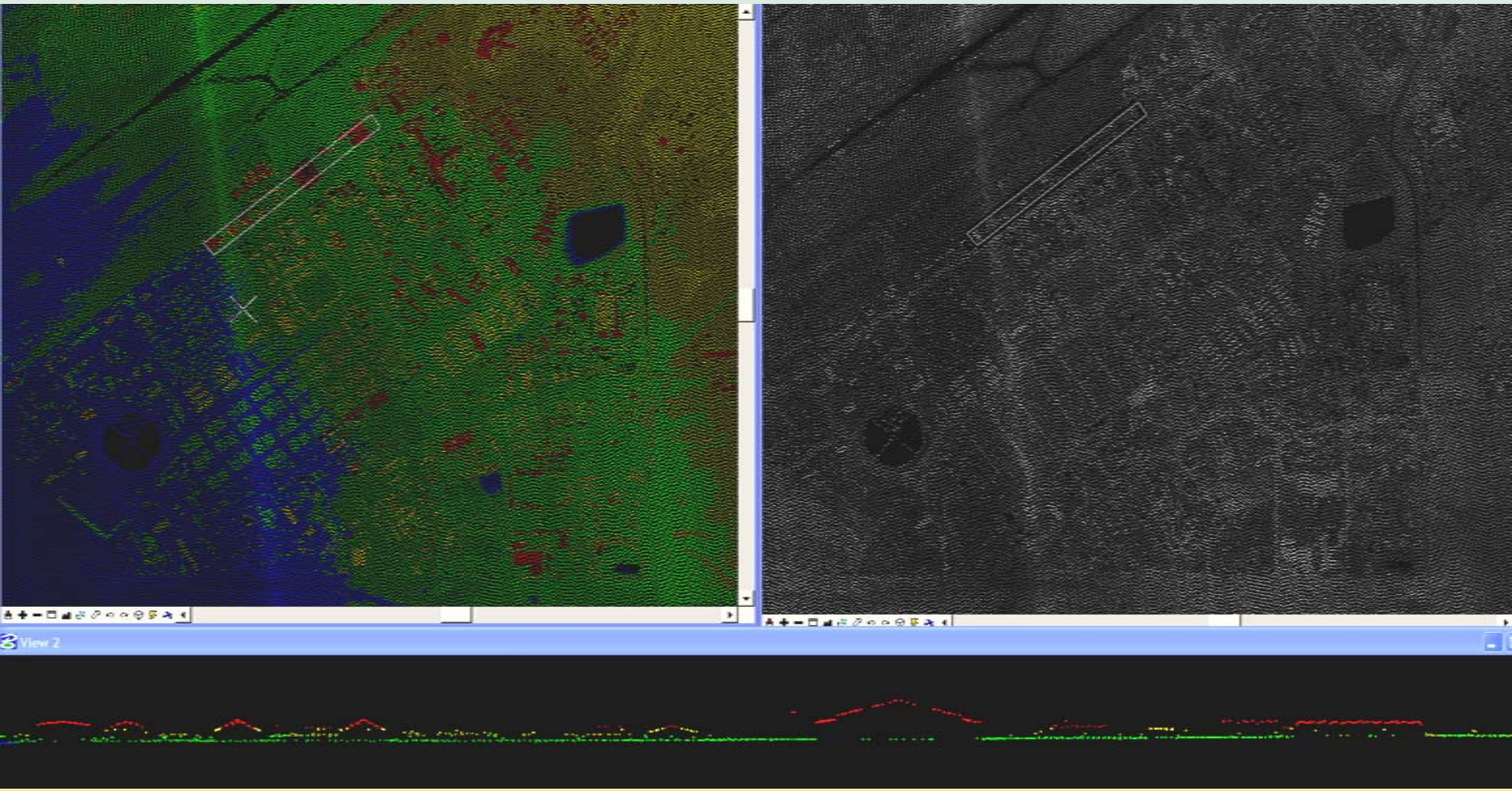


Flights 1-10


HERAT
GHOWR
BAMIAN
VARDAK
KABOL
NANGARHAR
LOWGAR
DAYKONDI
GHAZNI
PAKTIA
KHOWST
URUZGAN
FARAH
PAKTIKA
ZABOL
KANDAHAR
NIMRUZ

KAF

Leica ALS-50 Scannning Lidar
5800m/19000 ft AGL 45 deg FOV
5 m post spacing

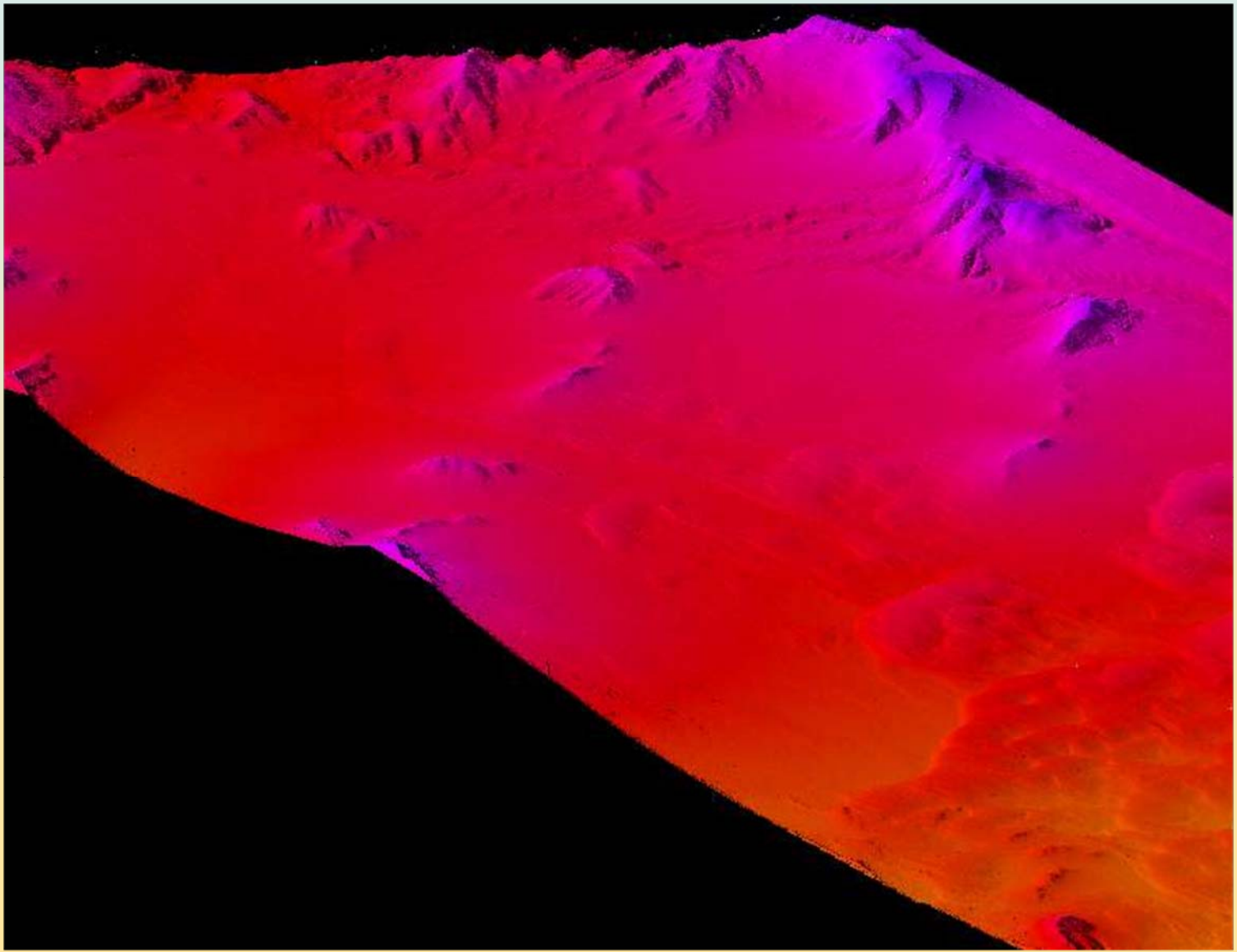


KAF

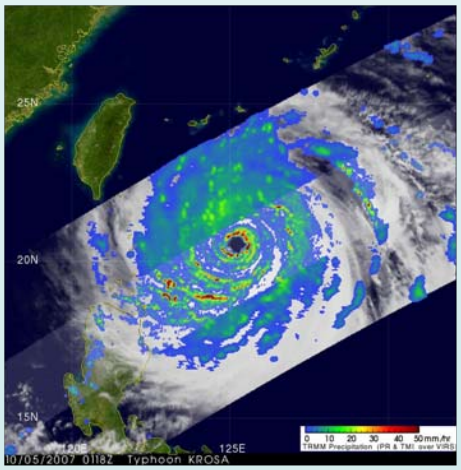
Applanix DSS-439 Digital Photogrammetry
5800m/19000 ft AGL 45 deg FOV
70 cm GSD orthophoto draped on 5 m post spacing ALS50 LIDAR DEM

Ghowrak Hills SW Kandahar Province

5800m/19000 ft AGL 45 deg FOV
5 m post spacing ALS50 LIDAR DEM



TROPICAL CYCLONE STRUCTURE 2008 (TCS-08) DEPARTMENTAL RESEARCH INITIATIVE



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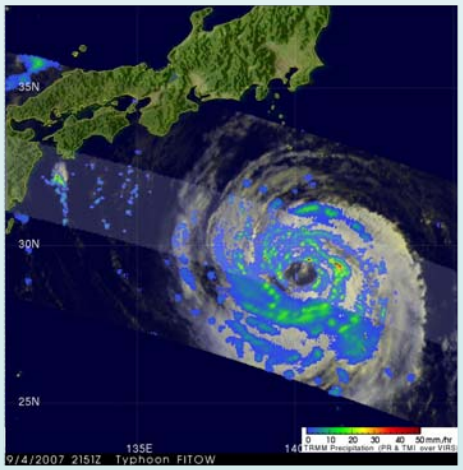

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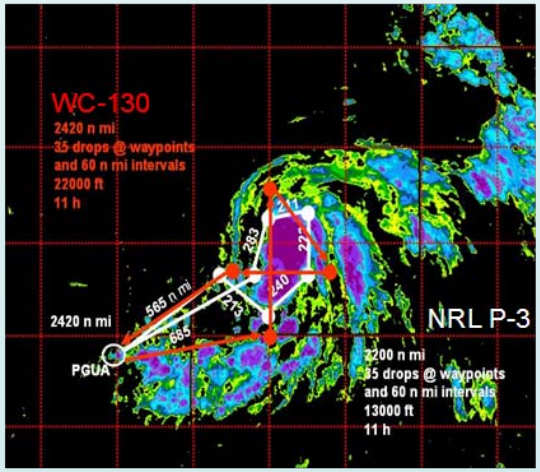
Mission Center time of 0000 UTC 29 August

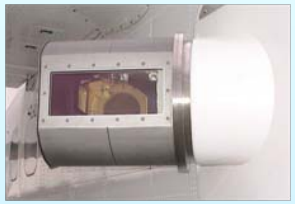


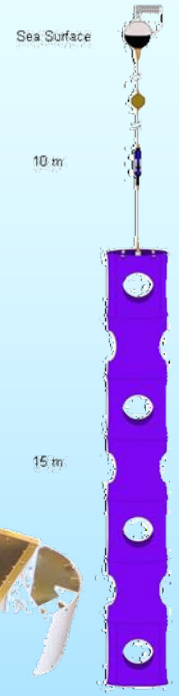
Timeline

- 2005/ 2006 Professional discussions/ conferences
- **Oct 2006 - ONR Sponsored Workshop – Monterey, CA**
- Dec 2006 - DRI Proposal
- May 2007 - Joint Workshop with NSF Partners – Monterey, CA
- May-Jul 2007 - Proposal Process
- **Aug-Sep 2007 Dry Run – Monterey, CA**
- Sept 2007 Dry-Run Review/ Initial Ops Mtg- Monterey, CA
- Dec 2007 - Joint Workshop with NSF and International Partners - Hawaii
- Ongoing 2008 - Science and Operation Plan Development/ Guam and Japan Site Visits/ Aircraft and Sensor Development & Integration
- **Mar 2008 - Interdepartmental Hurricane Conference and mini-Ops Meeting – Charleston, SC**
- Apr 2008 International Ops Mtg and Workshop – Tsukuba, Japan
- May 2008 AMS Tropical Conference – Orlando, FL
- Jun 2008 Final Operations Plan, Aircraft Integration and Test Flights
- **Aug-Sep 2008 Field Study – Guam and Japan**

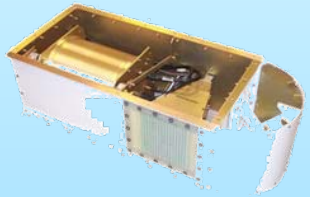
TCS-08 Airborne Resources

Naval Research Laboratory P-3
- ELDORA (Doppler Radar)
- Dropwindsondes
- Flight-level meteorological variables
- Doppler wind lidar





Air Force C-130J Reconnaissance aircraft
- Stepped frequency microwave radiometer (SFMR)
- Dropwindsondes
- Flight-level meteorological variables
- Airborne eXpendable BathyThermographs
- Nose weather radar display video capture



Air Force support aircraft
- Ocean Drifting buoy deployment

Taiwan DOTSTAR (if operating near Taiwan)
- Dropsondes

Other TCS-08 Resources

SATELLITE

MTSAT - Continual monitoring during all phases of operations

Rapid scan – desirable during all flight operations

Polar-orbiters- Tied in to USAF Mark-IVB ground site for reduced data latency

Microwave for convective structure

Scatterometers

NUMERICAL MODEL ANALYSES AND FORECASTS

Global models (NOGAPS, GFS, UKMO, ECMWF)

Environmental conditions in all phases

Focus attention on cloud clusters

Mesoscale models

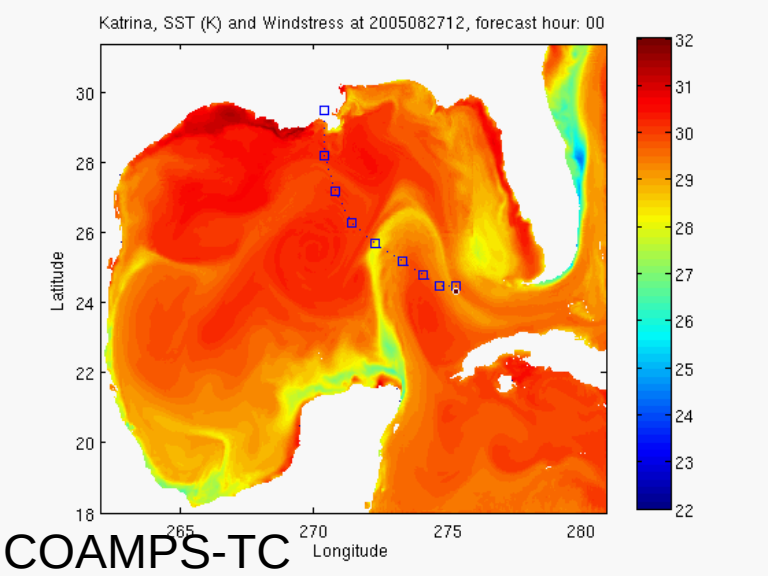
Naval Research Lab COAMPS

Central Weather Bureau NFS

Ocean Models

EAS(NCOM)FS (Ko)

AVISO (Niiler/ Yin) SSHA



COAMPS-TC

TPARC / TCS-08 Dry Run Field Catalog

EOL Deployment Development Data Services

September 2007

Catalog Home | Daily Reports | Operational Products | Model/Forecast Products | Research Products | Missions | Tools & Links

UTC:	Tues, Sept 11, 12:10 Z	Guam:	Tues, Sept 11, 10:10 PM	Tokyo:	Tues, Sept 11, 9:10 PM
Boulder:	Tues, Sept 11, 6:10 AM	Monterey:	Tues, Sept 11, 5:10 AM	Beijing:	Tues, Sept 11, 8:10 PM

Quick Links:

Facilities Status

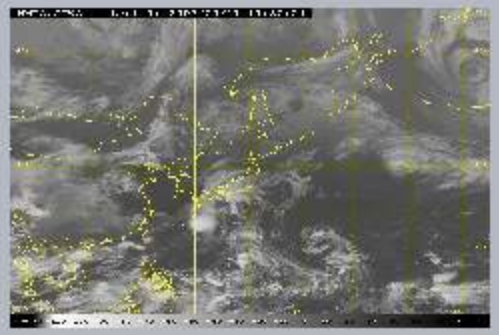
Operations Plan of the Day

TPARC Weather Discussion

NPS Weather Briefing Website

TPARC / TCS-08 Operations Exercise is occurring from 27 Aug to 21 Sept 2007

Northwest Pacific Latest Infrared Image



Additional Satellite Imagery:

Latest 2 hours Visible
Latest 2 hours Water Vapor

Information Links:

JTWC Website

Honolulu Weather

Guam Weather

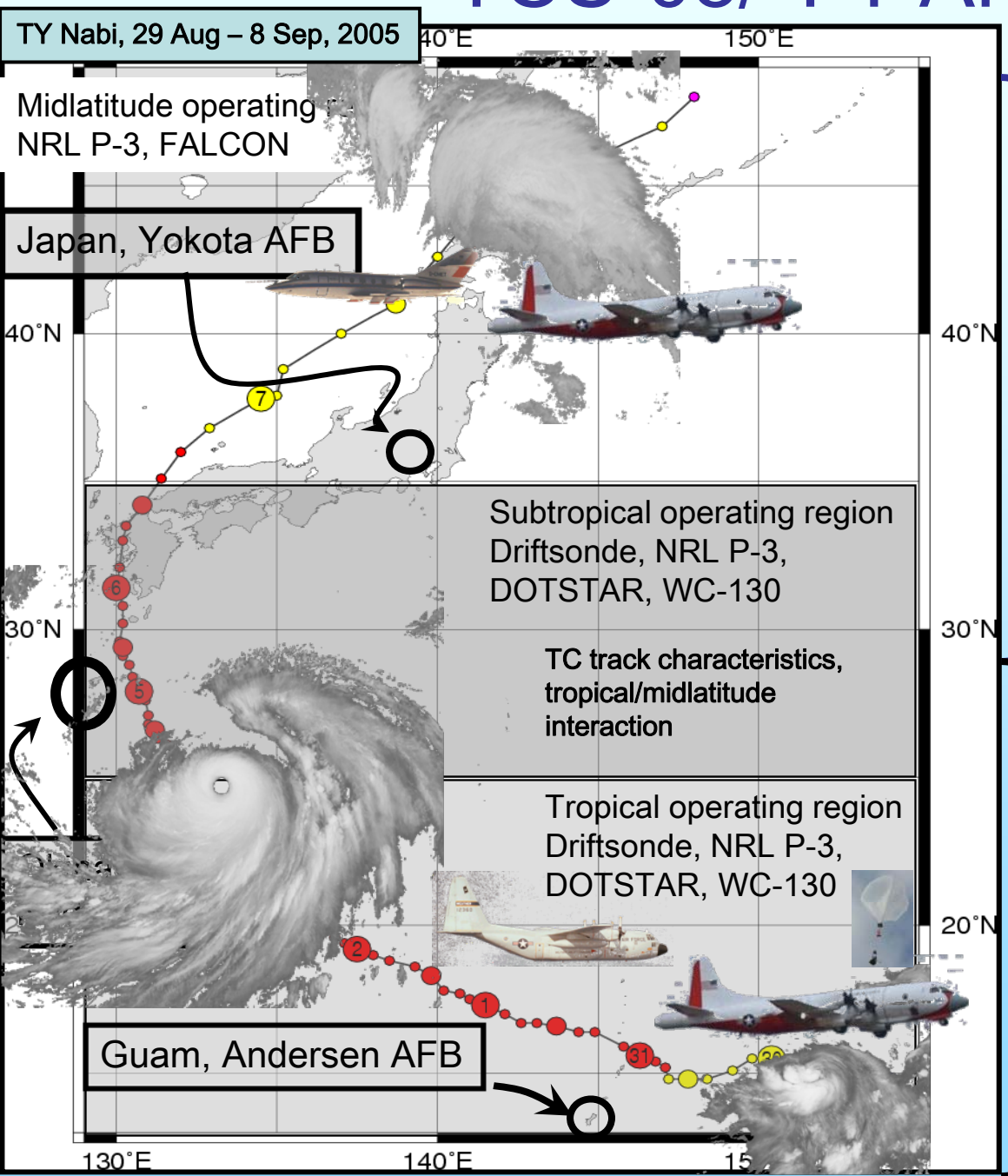
Okinawa Weather

Monterey Operations Center
(831) 656-XXXX

Boulder Operations Center
(303) 497-xxxx

Comments

TCS-08/ T-PARC Components



Extratropical Transition (ET – recurvature), Downstream Impacts

ET characteristics, forcing of downstream impacts, tropical/midlatitude interactions, extratropical cyclogenesis

TC Intensification and structure change, ocean eddy interaction, Recurvature, initiation of ET

Tropical Measurements

Large-scale circulation, deep convection, monsoon depressions, tropical waves, TC formation