Observing Systems in 2030

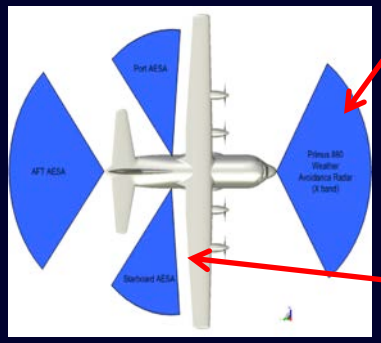
A comprehensive suite of multiple wavelength instruments on

the same platform to probe the atmosphere from clear air to severe storms, from aerosol

to chemical species.

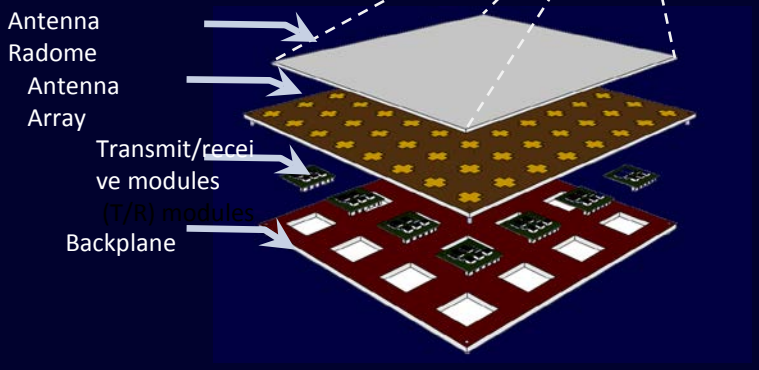
Jim Moore
NCAR Earth Observing Laboratory
TCORF, March 2016

EOL Airborne Phased Array Radar (APAR)



Surveillance radar.

APAR horizontal scans

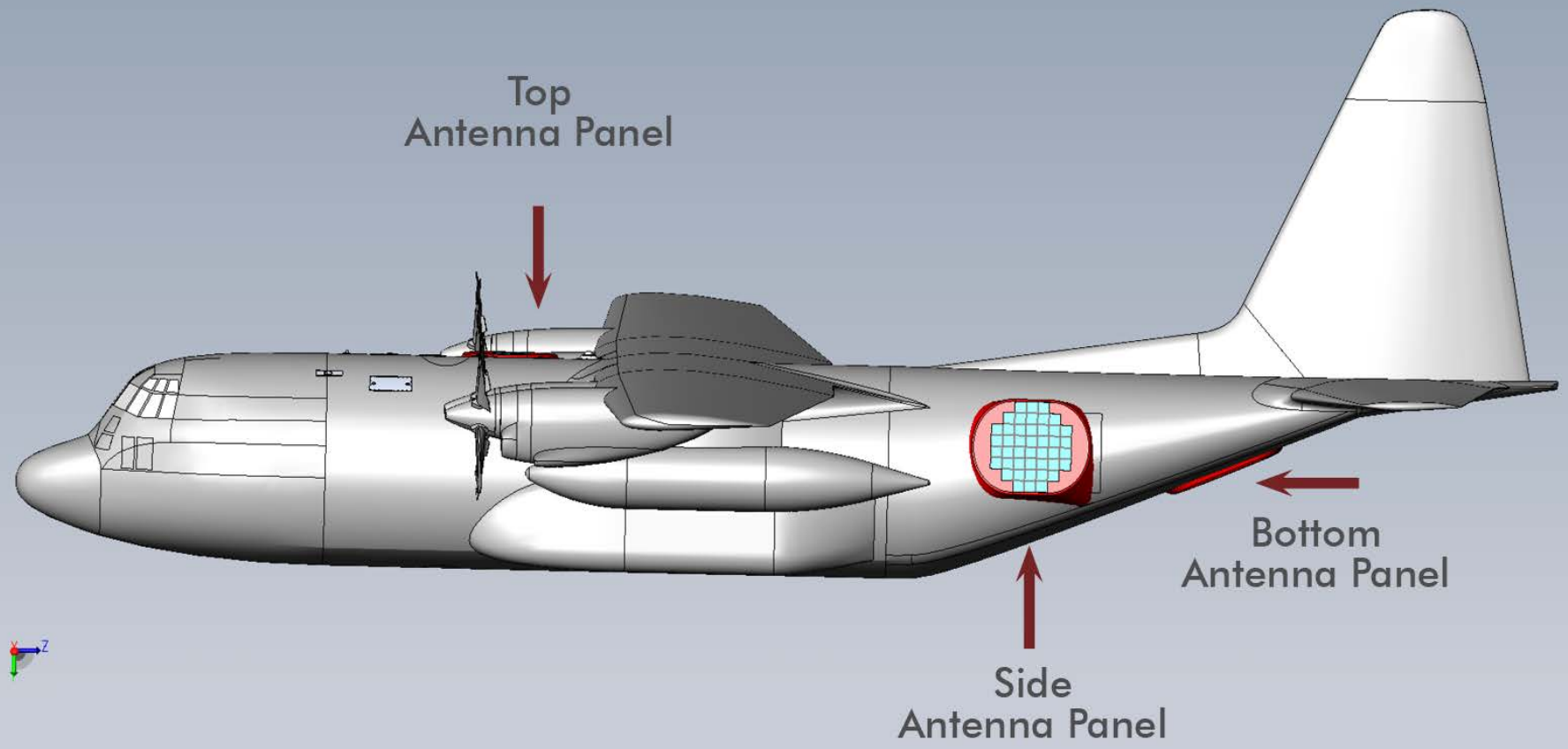


- Electronically scanned (no moving parts)
- 4 Phased-array antennas on the aircraft
- 3-D Volume scanning from the aircraft
- Operates at C-band (look deep into storms)
- Dual polarization, high resolution

- Enabling focused scientific research in high-impact weather, cloud microphysics, storm dynamics, radiation and climate
- Compliment a suite of existing instruments on NSF/NCAR C-130
- Addresses specific objectives in NSF and NCAR Strategic Plans
- Data at spatial/temporal scales that match numerical models

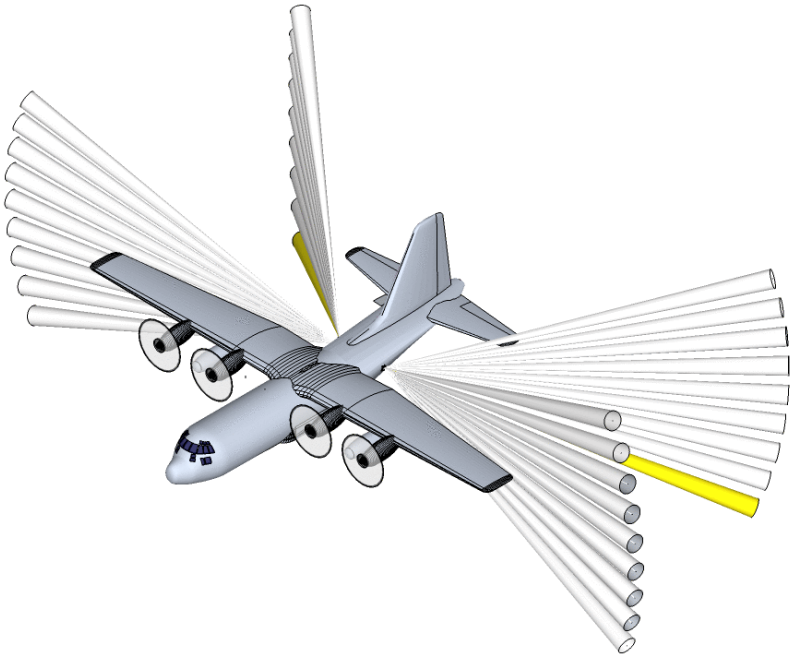
- Seven-year development schedule
- University and industry partnerships key to successful design and build
- Deployable on NSF/NCAR C-130 aircraft or similar platforms
- 20+ year operational lifetime
- APAR can be implemented in operational storm measurements (e.g. flown on US Air Force C-130 Hurricane Hunters)

C-130 with Airborne Phased Array Radar (APAR) Panels



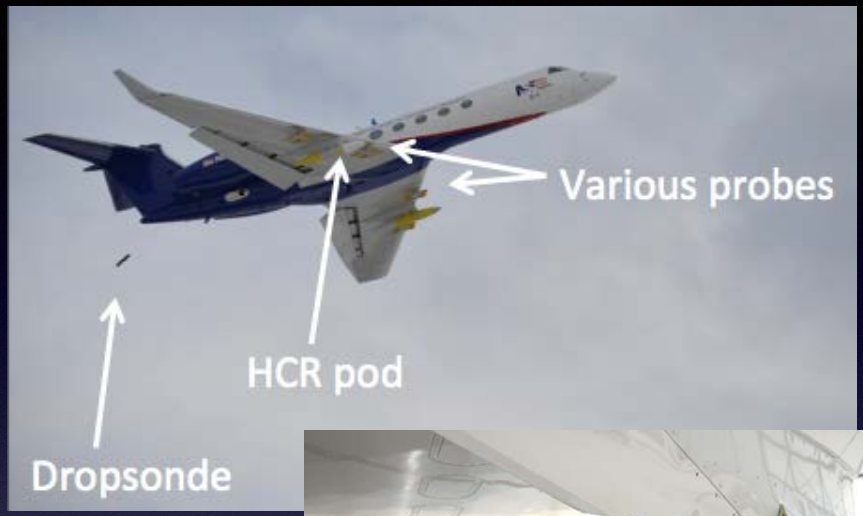
APAR Scanning Strategy

APAR single forward angle as it appears coming from the 4 APAR array faces. Maximum radar range ~75km depending on attenuation at C-band



APAR combines reflectivity, velocity and **dual-polarization** measurements. Attenuation at C-band frequency is lower in heavy rain.

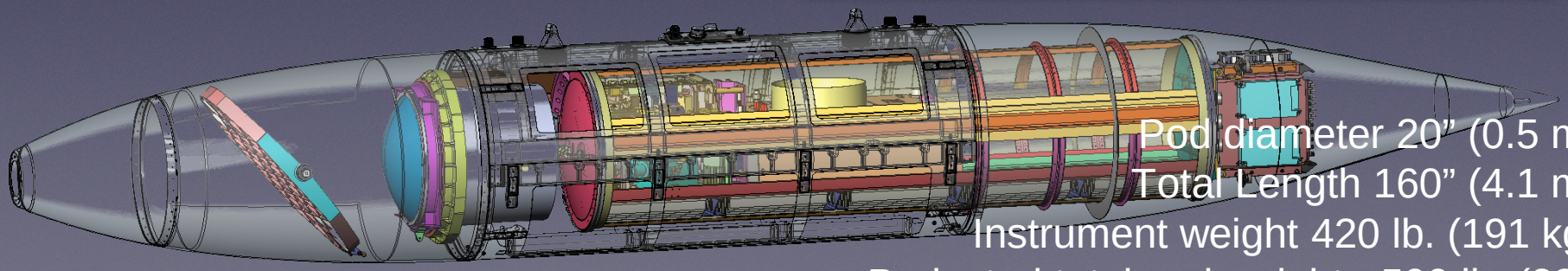
HIAPER Cloud Radar



Deployable on NCAR GV (HIAPER)
- Pod-based (under-wing)
- Nadir/zenith pointing
- Scanning from zenith to nadir
- Aircraft that can support large pod

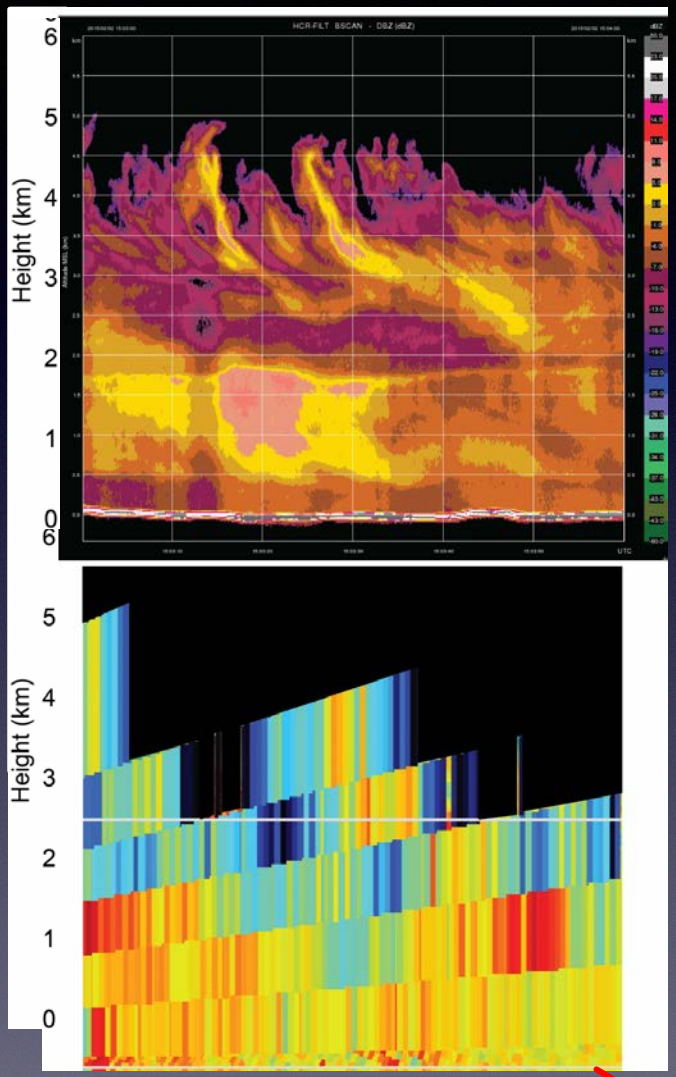
Dual-Polarization, polarimetric radar
Real-time stabilization of pointing angle
Time-series data recorded
Ground deployable
Quick-look images to ground every 5 minutes

Great sensitivity -43 dBZ@1km
High resolution: 20 ~ 150 m vertical
Beamwidth = 0.7 deg horizontal
Along-track resolution = 20 m @ 200 ms-1
Real-time product display (Z, Vel, W, LDR)

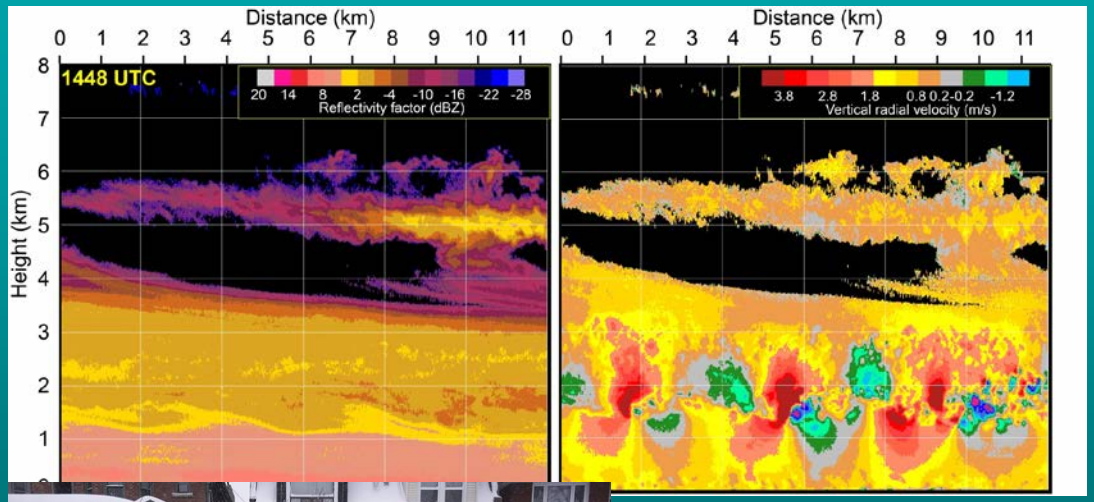


Pod diameter 20” (0.5 m)
Total Length 160” (4.1 m)
Instrument weight 420 lb. (191 kg)
Projected total pod weight ~500 lb. (227 kg)

HIAPER Cloud Radar (HCR)



Reflectivity and Velocity measurements resolved wave structures and fine features in the same storm

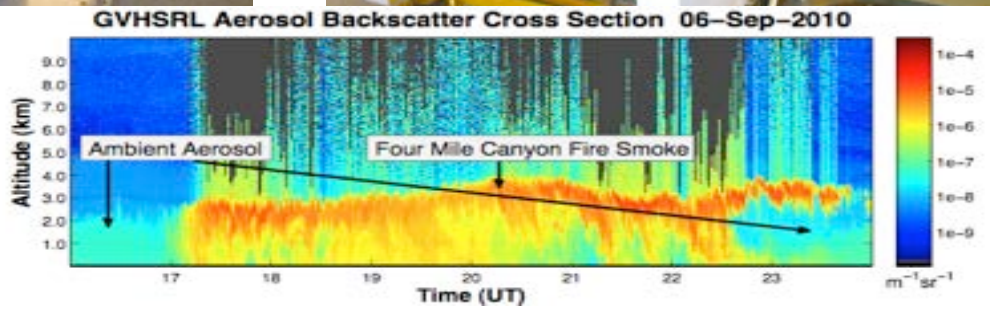


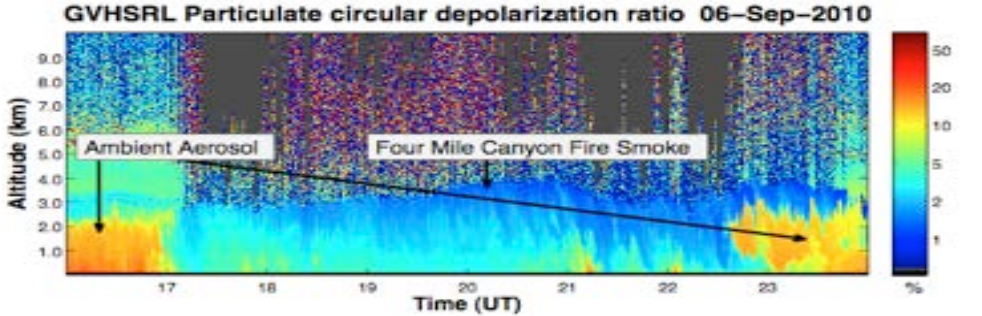
HCR Reflectivity and coincident Boston NEXRAD cross-section during NOR'EASTER

HSRL on the NCAR G-V Research Aircraft

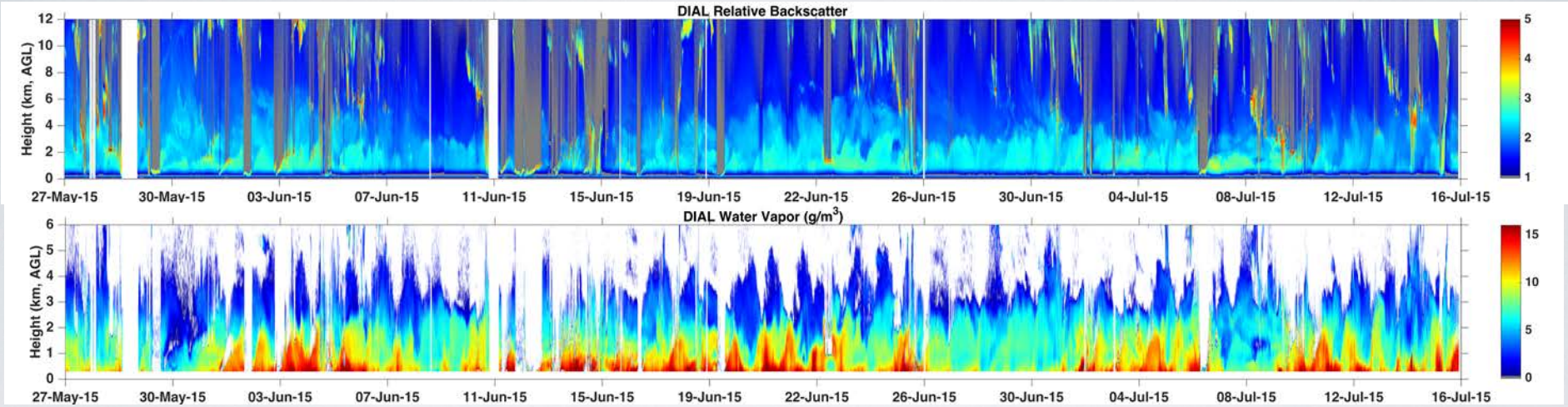
Technical Specifications:

Wavelength: 532 nm
Pulse repetition rate: 6 KHz
Average power: up to 400 mW
Range resolution: 7.5 m
Telescope diameter: 40 cm
Angular field of view 0.025 deg
Filter bandwidth: 1.8 GHz





NCAR diode-laser-based WVDIAL



Continuous water vapor profiles 30-May to 16-Jun during PECAN (Ellis, KS, USA)

- Water Vapor Differential Absorption Lidar (WVDIAL)
- Diode-laser-based for low-cost and low-maintenance
- Continuous water vapor profiling at 5 minute resolution
- Next generation instrument
- First eye-safe diode-laser-based DIAL capable of continuous operation in all conditions from 300m to 4 km (or cloud base) with 150 m vertical resolution