Innovations Over the Past Decade Enhancing the NOAA WP-3D and Gulfstream G-IV Aircraft

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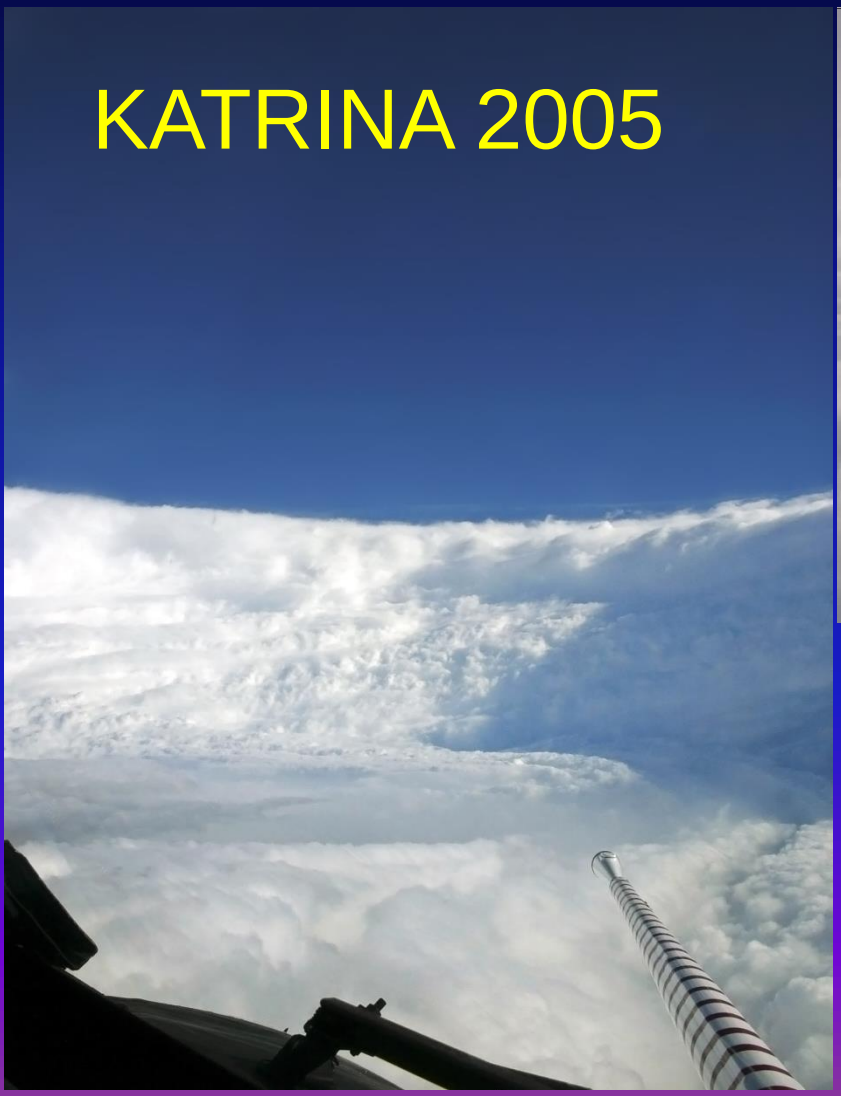
96th American Meteorological Society Annual Meeting

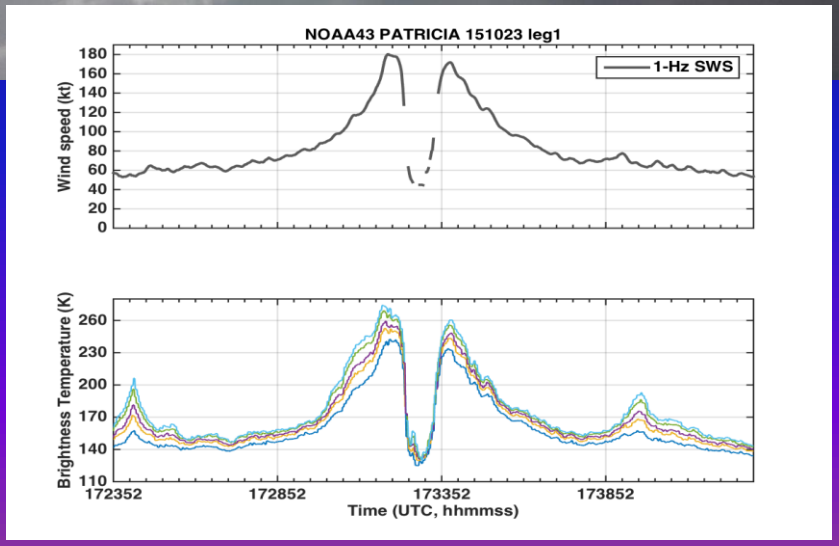
N42RF and N43RF Lockheed WP-3D Orion "Kermit and Miss Piggy"

N49RF Gulfstream G-IV "Gonzo"

KATRINA 2005



PATRICIA 2015



Some Major Enhancements to Reconnaissance and Research Capabilities of the P-3 and G-IV

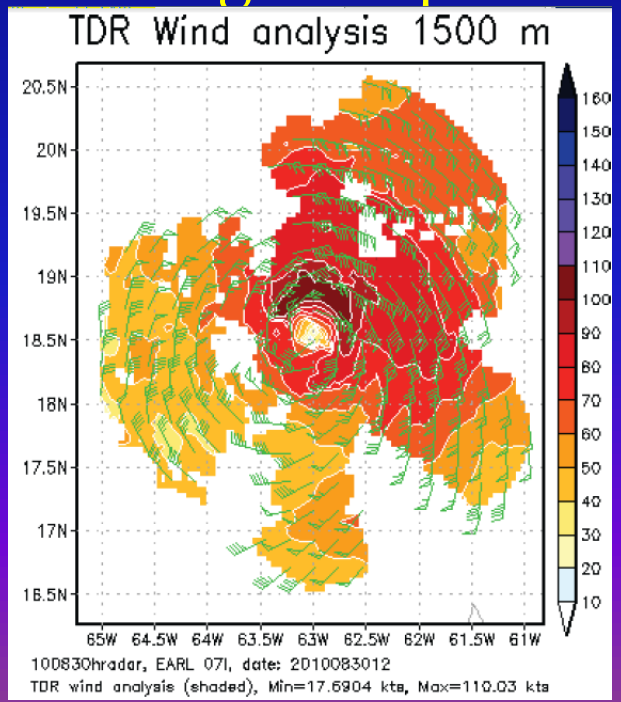
- Tail Doppler Radar (TDR) radial velocity products now being transmitted in real time off the aircraft for assimilation into operational HWRF runs
- New RVP-8 P-3 Lower Fuselage (LF) radar imagery transmitted in real time to NHC Forecasters
- Introduction of TDR to G-IV with same real time product model assimilation capability as the P-3
- Advancements in Scatterometry: Airborne IWRAP C & Ku Band systems used in calibration of polar orbiting satellites / Wide Swath Radar Altimeter (WSRA)
- Coyote UAS deployed for the first time into a hurricane

Additional Enhancements to Reconnaissance and Research Capabilities of the P-3 and G-IV

- Hybrid tropical cyclone core transect missions flown for the first time on G-IV Synoptic Surveillance Missions
- Introduction of prototype IR sensors to dropsondes for expanded capability to measure sea surface temperatures (augmenting AXBTs, AXCPs, AXCTDs)
- Addition of the SFMR to the G-IV
- State of the art AAMPS data system replaces RAMS on the P-3 and MADS on the G-IV
- ASPEN 3.2 standard across all recon platforms (AOC, AFRES WC-130Js, NASA Global Hawk). Dropsondes can also now be processed from the ground

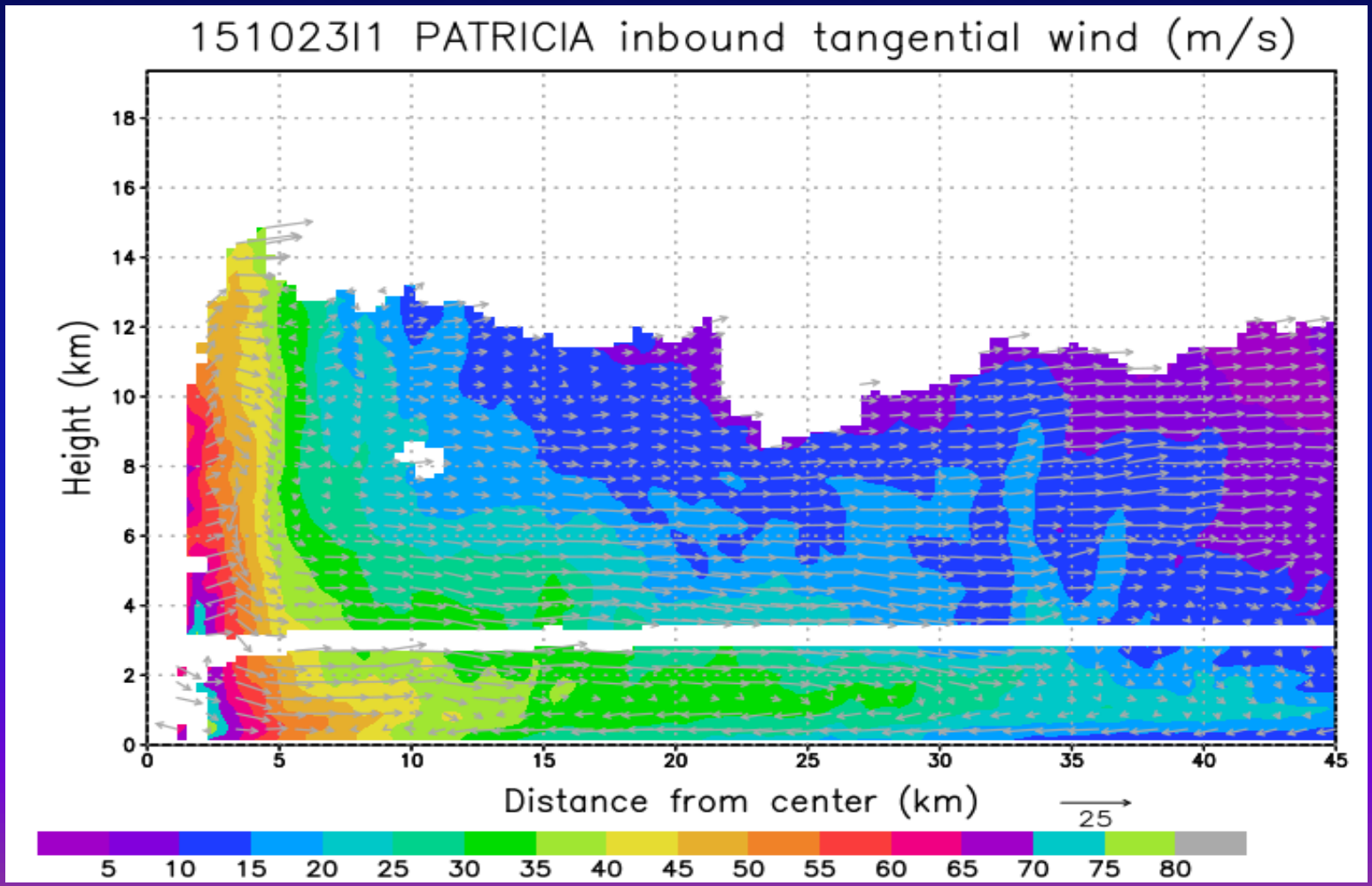
REAL TIME ASSIMILATION OF P-3 & G-IV TDR DATA INTO HWRF

- A major focus of HFIP (Hurricane Forecast Improvement Program) since its establishment in May of 2009.
- Goal is to significantly improve vortex initialization, thereby leading to improved track and intensity forecasts

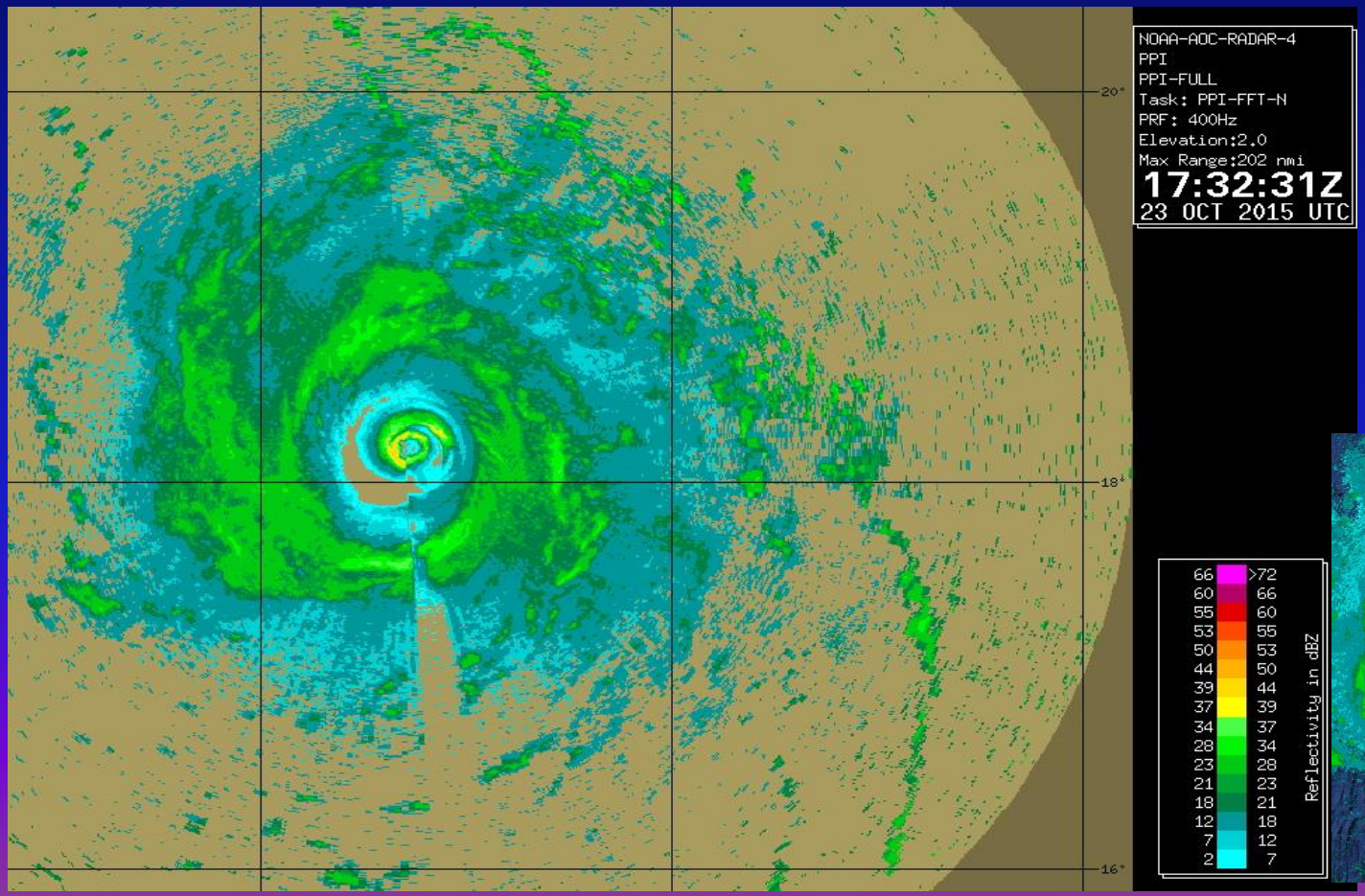


The TDR data is too finely scaled in resolution for ingestion into even the most advanced mesoscale models. The data is therefore averaged across a more coarsely granulated grid into "SUPEROB" packets that can readily be transmitted off the plane via high bandwidth SATCOM to EMC. This still involves many Gigabytes of TDR data per flight.

TDR TANGENTIAL VELOCITIES IN PATRICIA EYEWALL



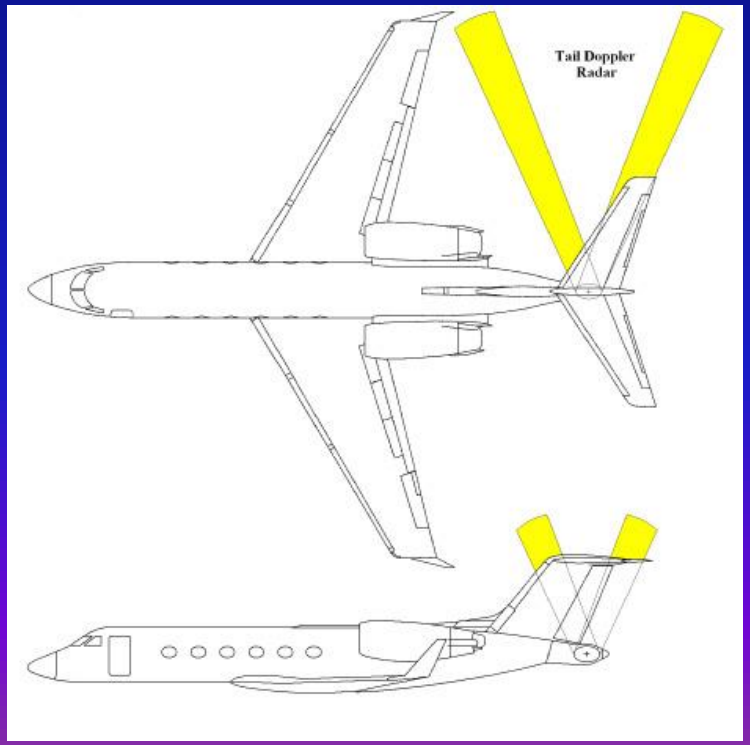
REAL TIME TRANSMISSION OF GEORECTIFIED P-3 LOWER FUSELAGE RVP-8 RADAR IMAGERY TO NHC



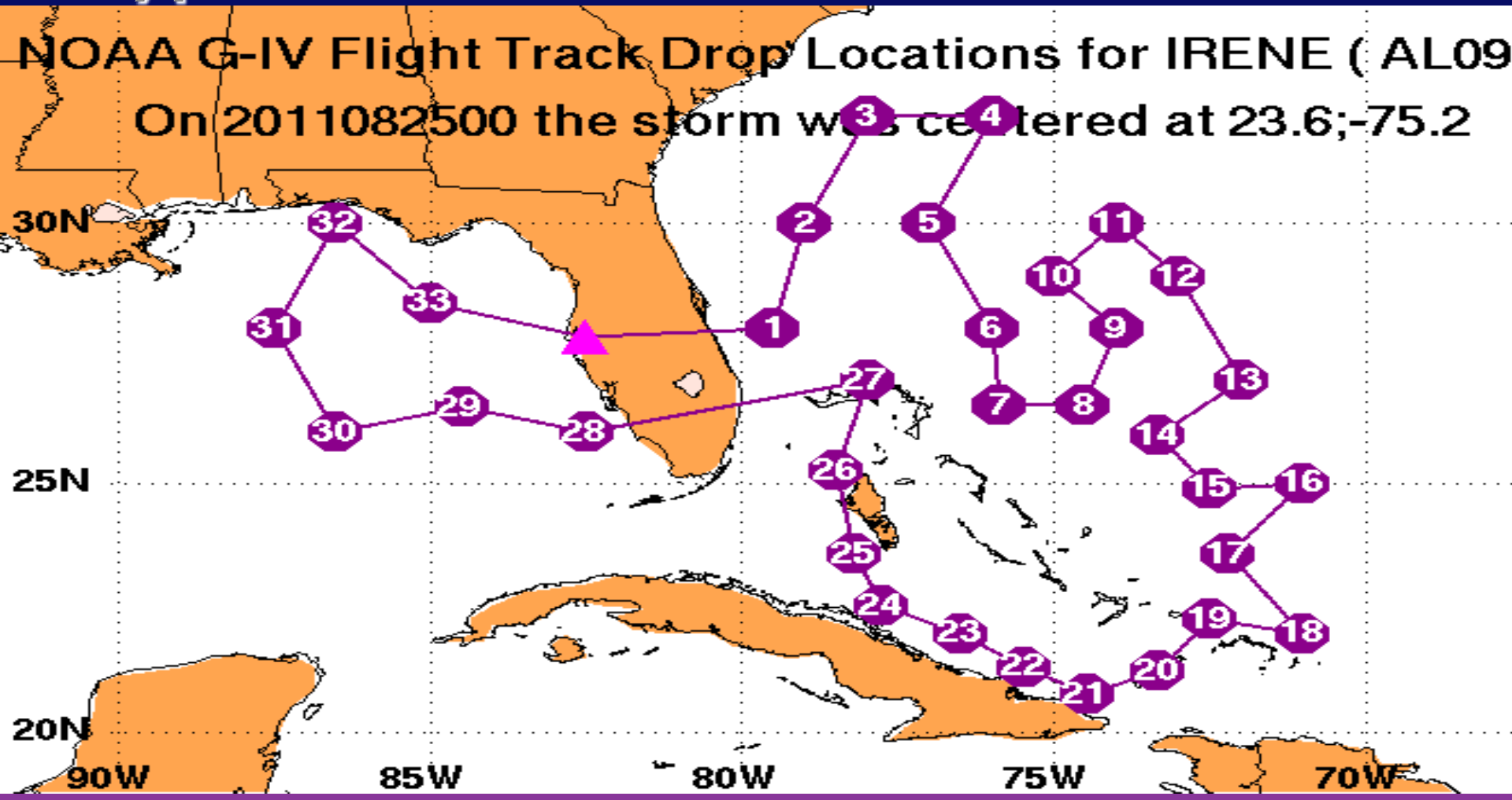
Category 5 Hurricane Patricia

KMZ files can be viewed with Google Earth

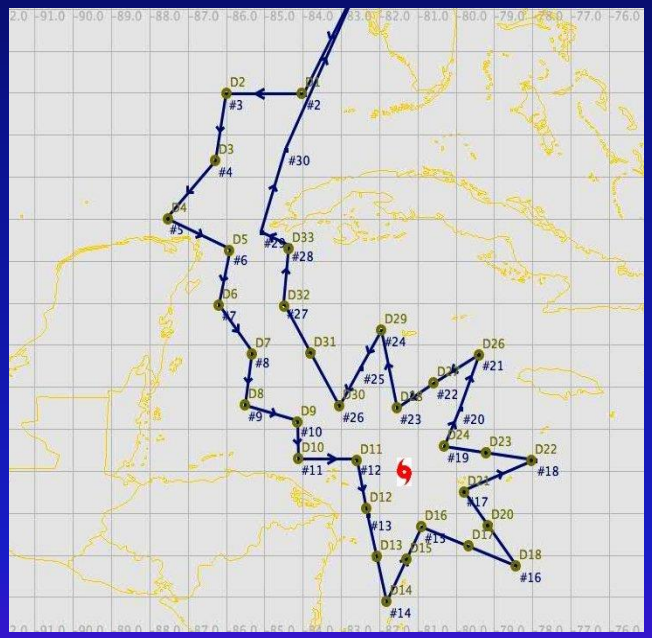
G-IV TDR NOW FULLY OPERATIONAL



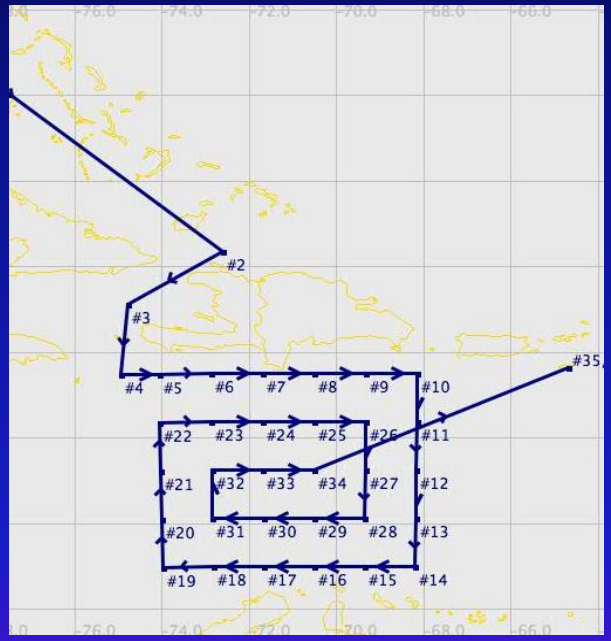
Typical Hurricane Surveillance Mission



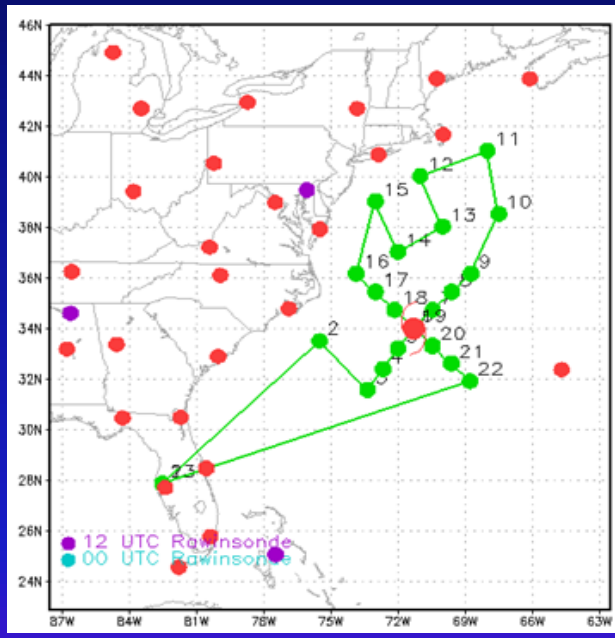
Some G-IV TC Research Mission Profiles



Star Pattern

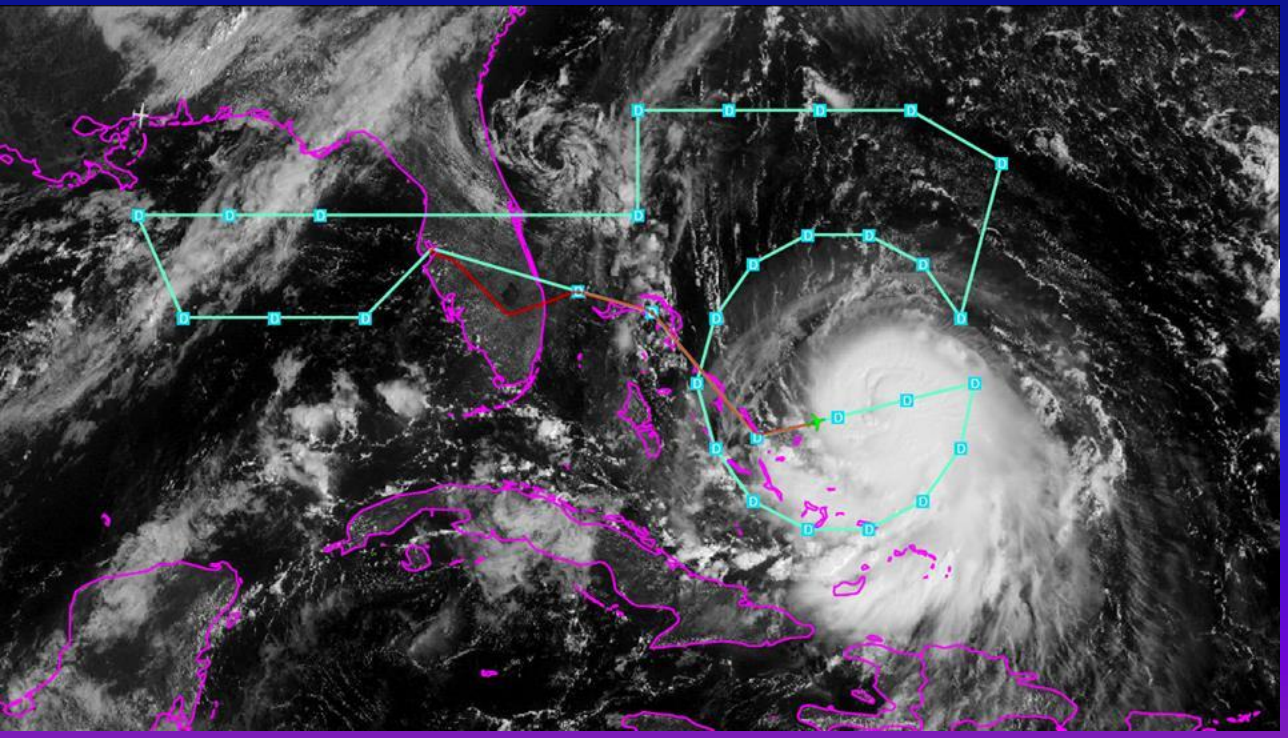


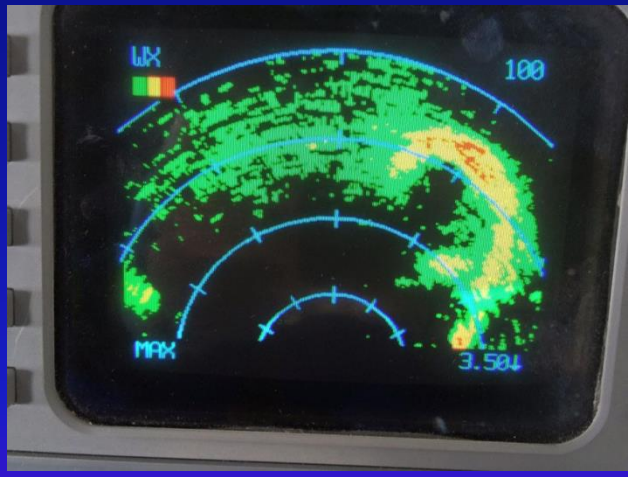
Contracting Square



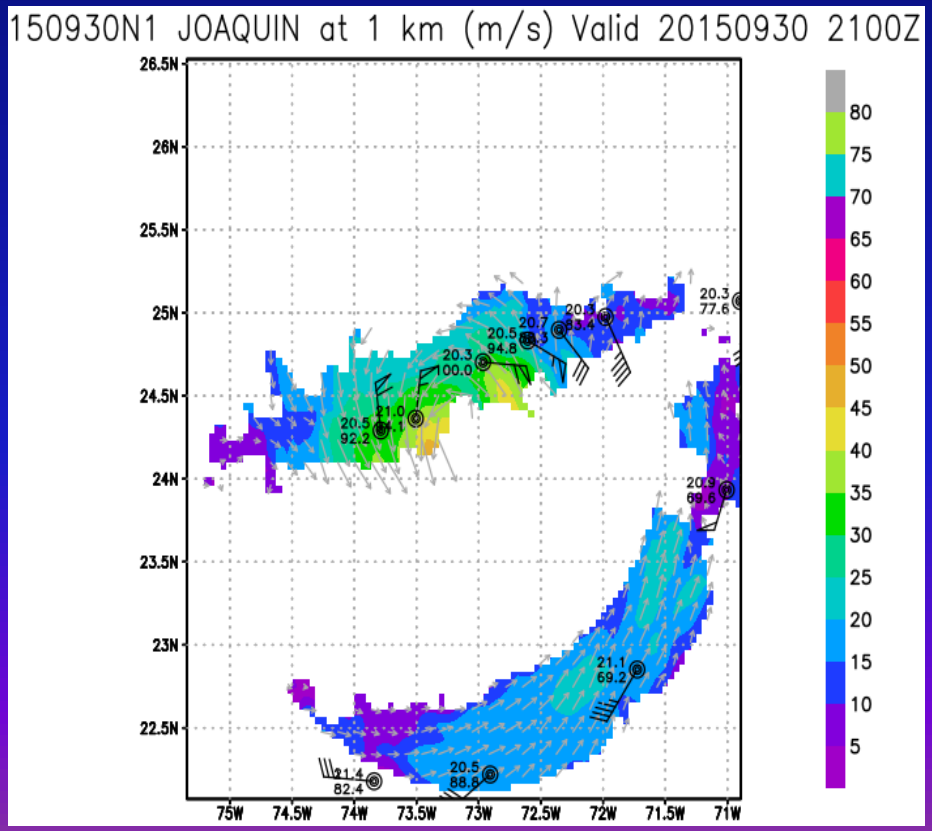
Modified Figure 4

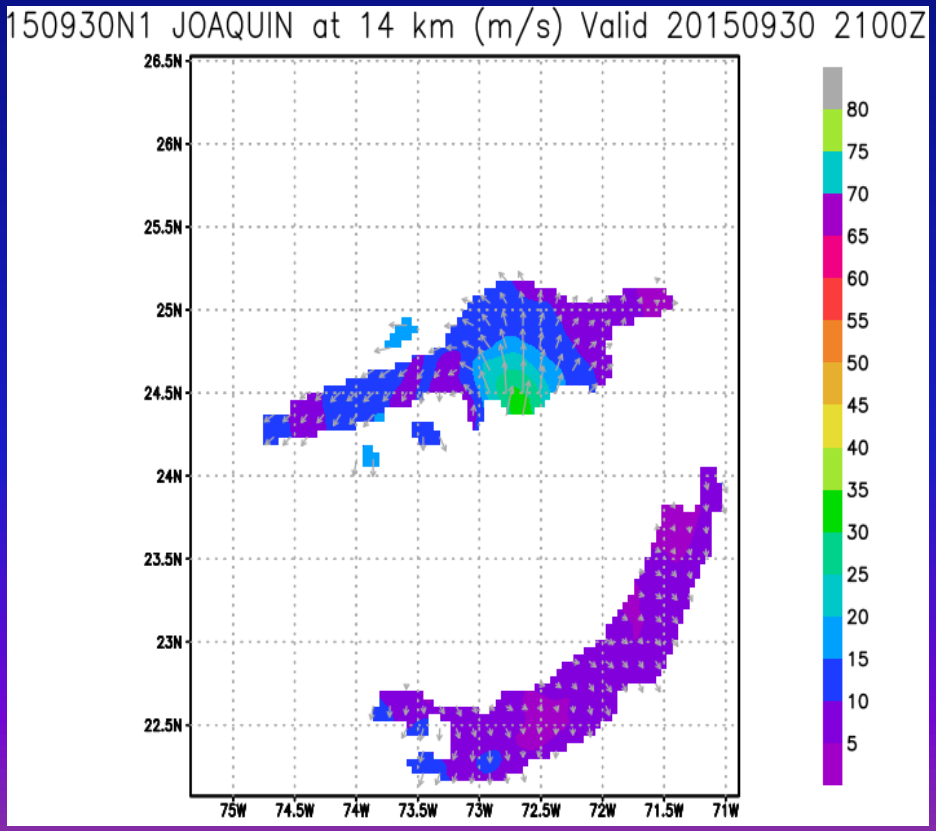
Hybrid G-IV mission profile incorporating a transect of TC core with a standard Synoptic Surveillance pattern around Joaquin



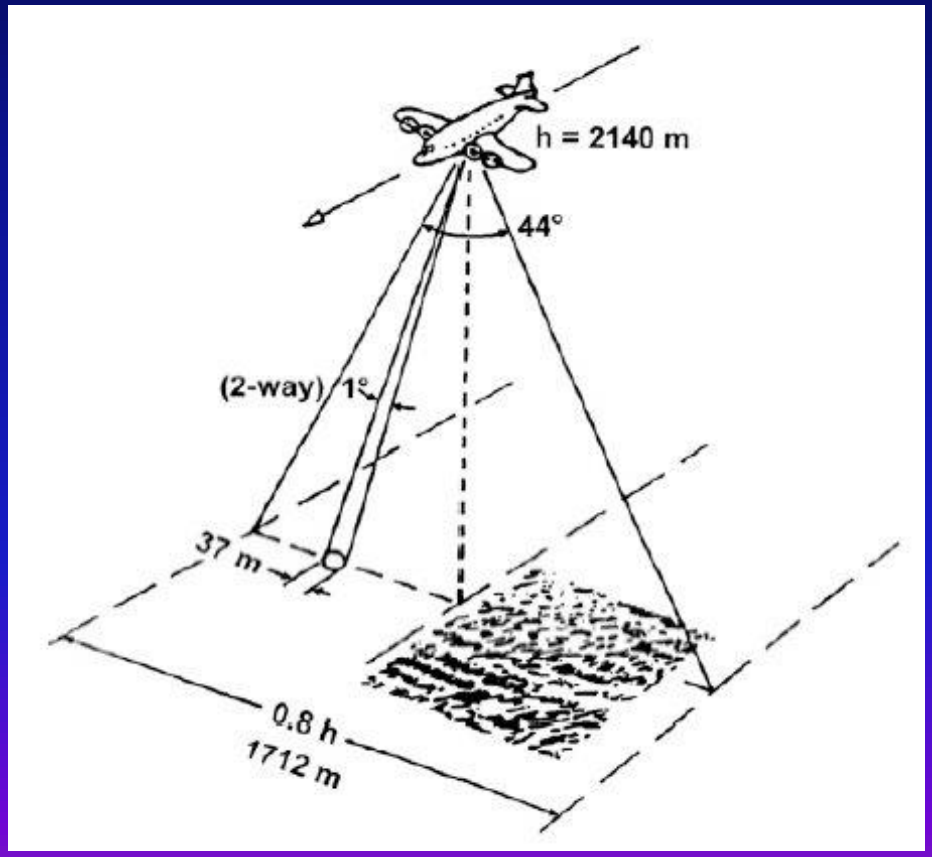


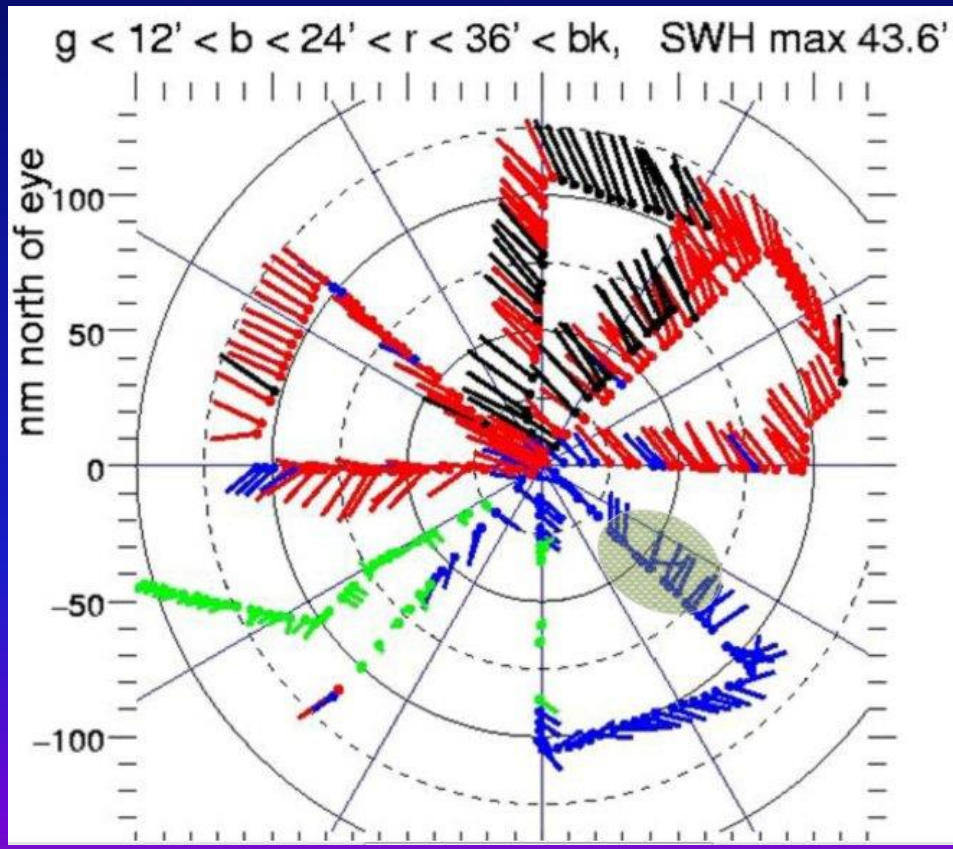
G-IV TDR velocities during transect of TC core through Joaquin



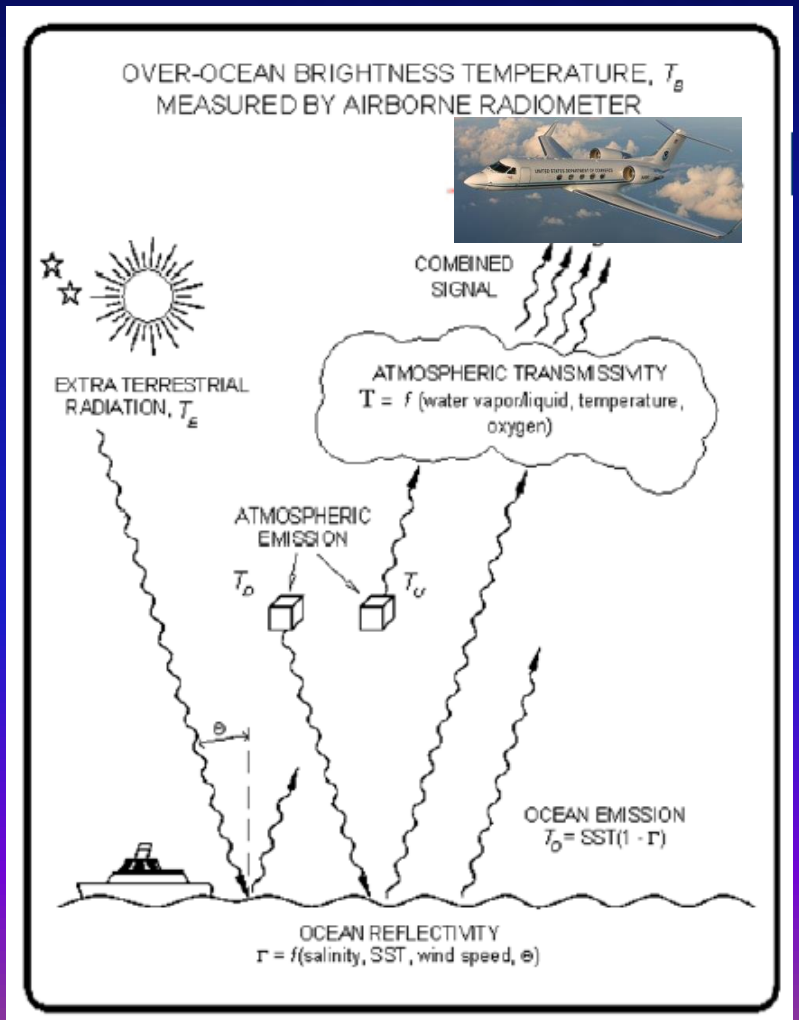


P-3 Wide Swath Radar Altimeter (WSRA)





INTRODUCTION OF SFMR ONTO THE G-IV



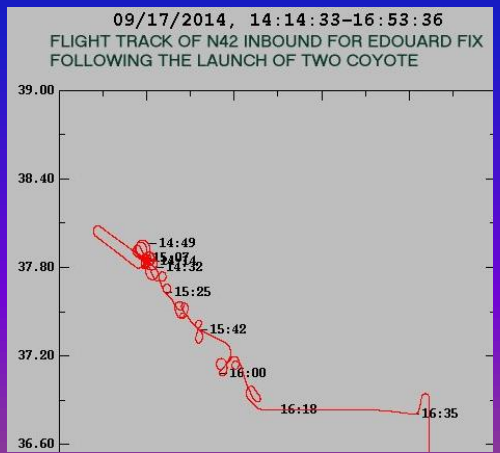
Biggest Challenge: accurate instrument calibration at the typical operational altitudes flown by the G-IV: 41,000 - 45,000 feet

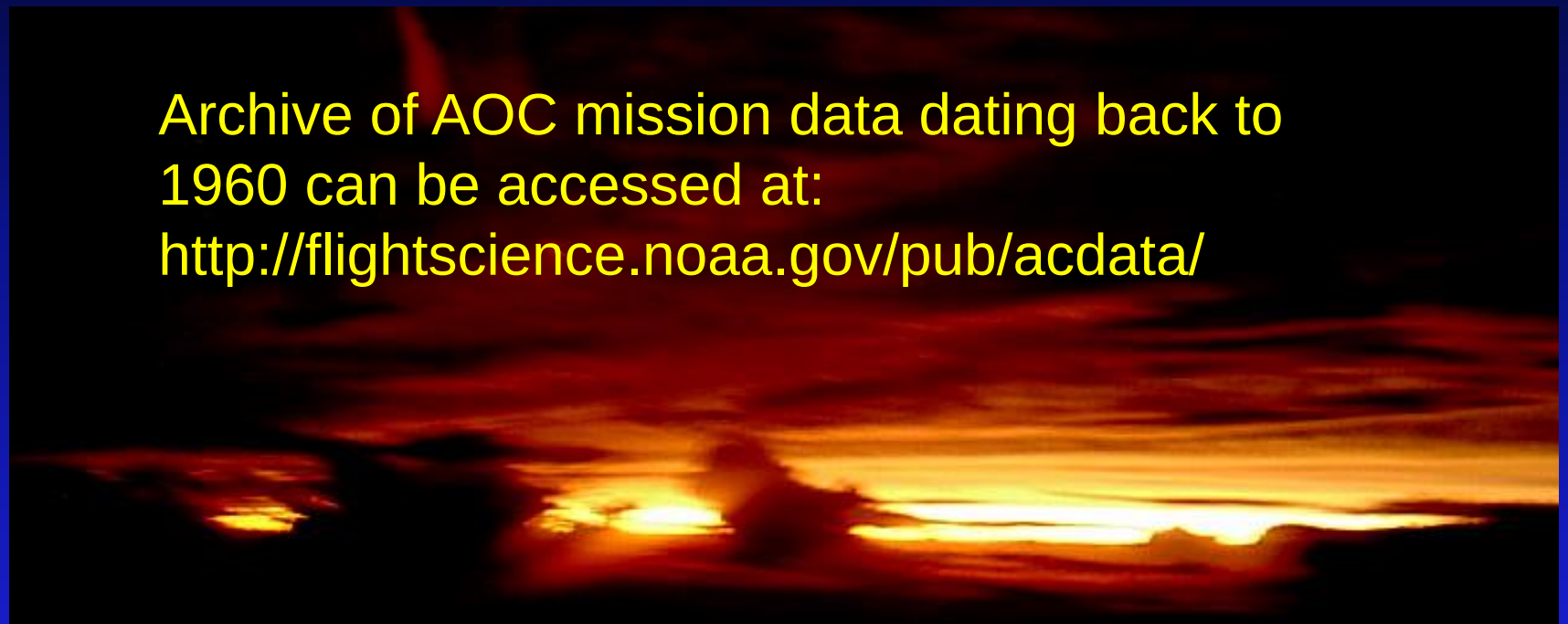
Additional Challenge: Long acclimation time of thermistors within the instrument to the extreme changes in ambient air temperature seen following takeoff and climb to operational altitude (an hour or more)

Since the G-IV flies patterns typically further out from the center than the P-3 or WC-130J, in large storms the envelope of 50 knot and 34 knot winds can be mapped

FIRST SUCCESSFUL DEPLOYMENT OF COYOTE UAS INTO A HURRICANE FROM P-3 (EDOUARD 2014)

Drew Osbrink and Eric Redweik of Sensintel and NOAA hurricane researcher Joe Cione monitor data from the Coyote as it flies into Hurricane Edouard. Photo: NOAA





Archive of AOC mission data dating back to 1960 can be accessed at:
http://flightscience.noaa.gov/pub/acdata/

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