

ICCAGRA Meeting Fall 2012

(Expanded) Collection of
Atmospheric Observations by
Federal Aircraft?

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- Background
- Current Program
- Communications
- Variants
- Assessing Potential for Expanded Data Collection by Federal Fleet

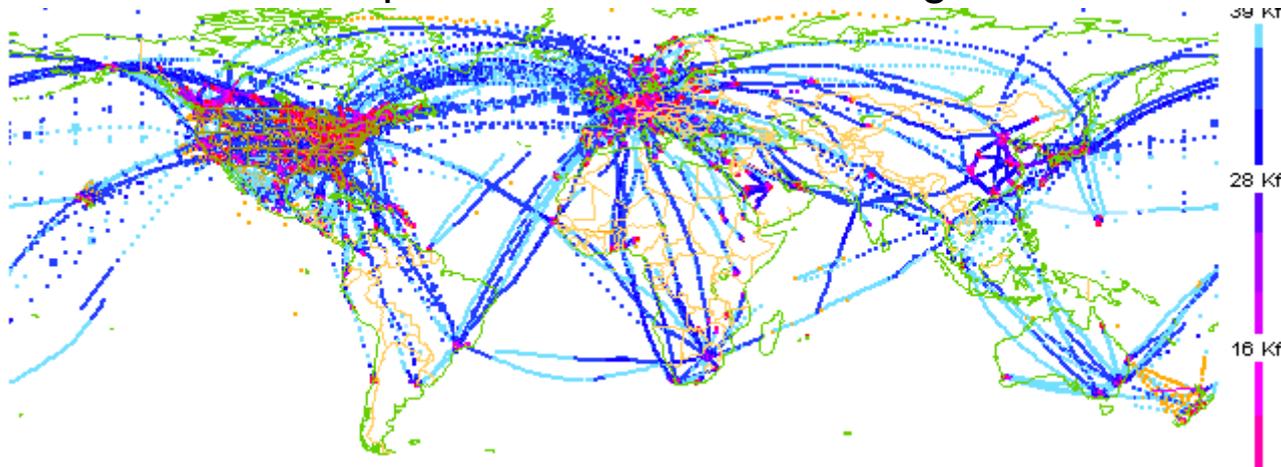
Background: First Weather Bureau and Regional Airline Collaboration



Background: Atmospheric Observations from Commercial Aircraft

Objective: Leverage platforms of opportunity using Enterprise Infrastructure

- Aircraft Meteorological Data and Reporting (AMDAR):
 - An international effort within the World Meteorological Organization (WMO) to coordinate the collection of environmental observations from commercial aircraft
- U.S. AMDAR - Meteorological Data Collection and Reporting System (MDCRS)
 - A private/public partnership facilitating the collection of atmospheric measurements from commercial aircraft to improve aviation safety
- Aircraft Reporting And Collection System (ACARS)
 - MDCRS is the weather part of an ACARS message



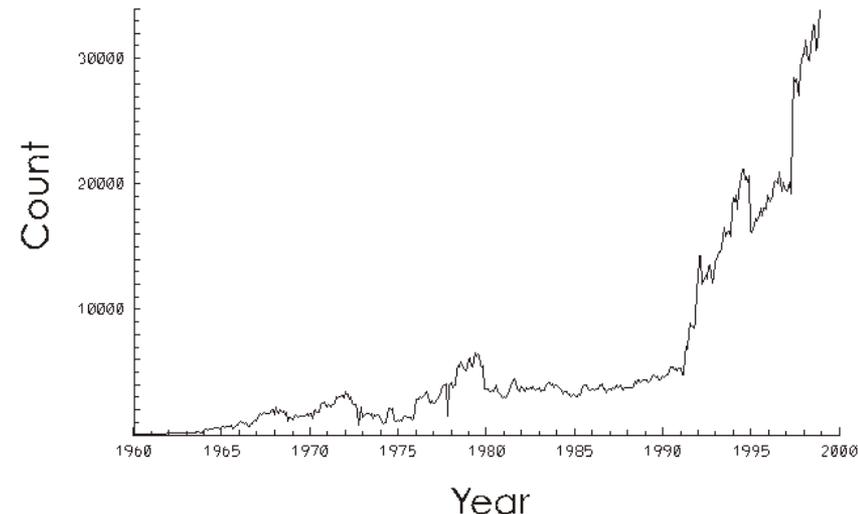
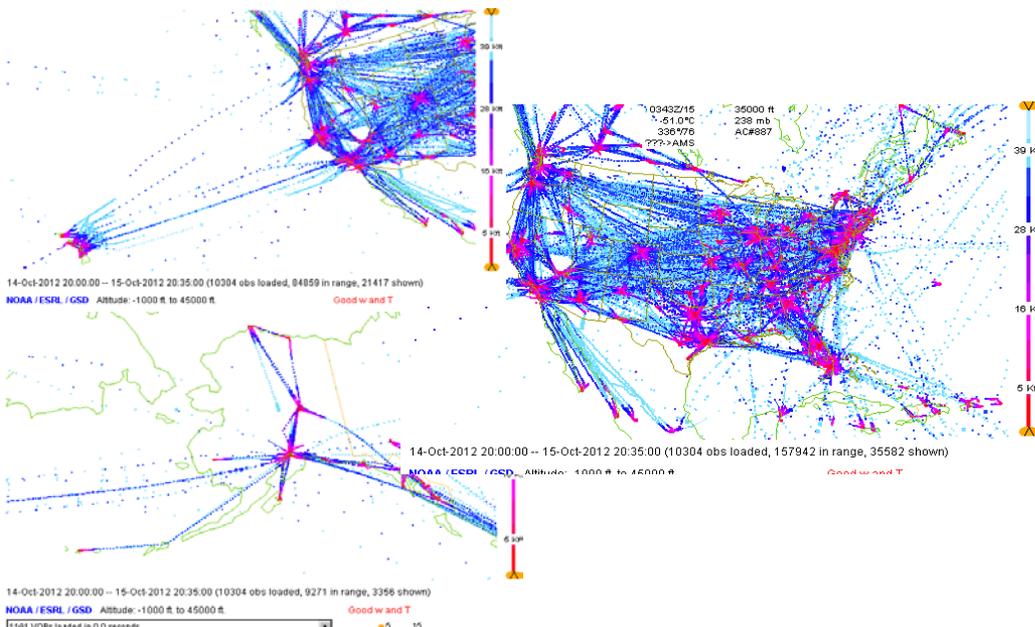
Background:

Current MDCRS Partners

- Air Carriers: Alaska Airlines (2011), American, Delta, FedEx, Northwest, Southwest (2007), United/Continental, United Parcel Service
- Federal Agencies: NOAA and FAA

200,000 Observations per Day

Collecting data since the early 1980's with dramatic increases after 1991.

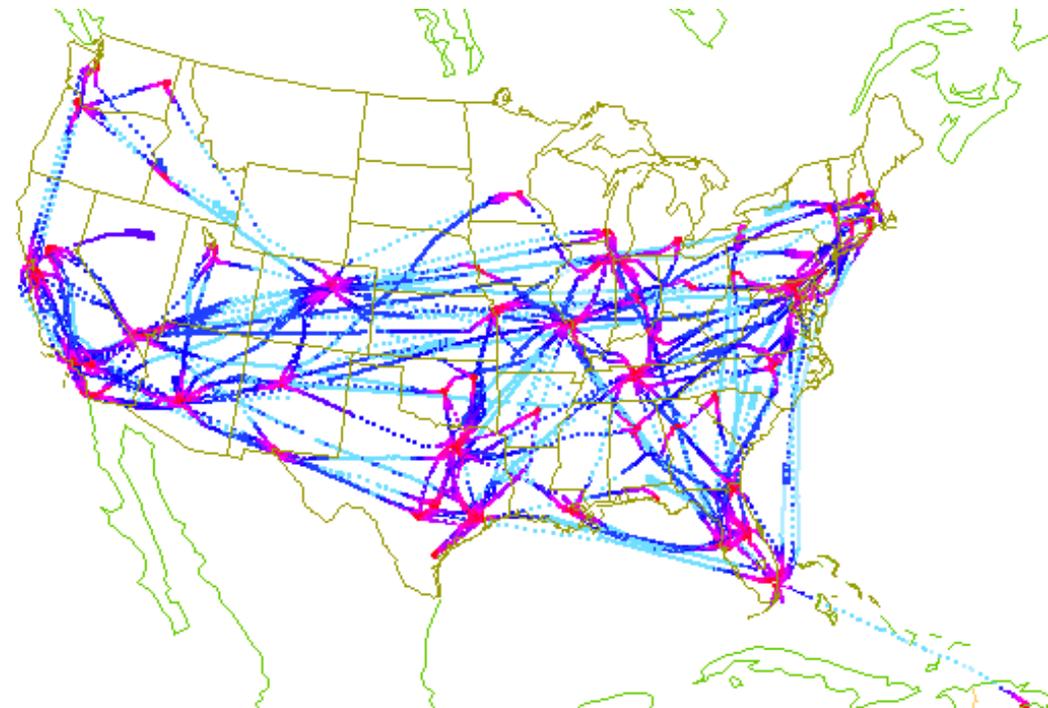
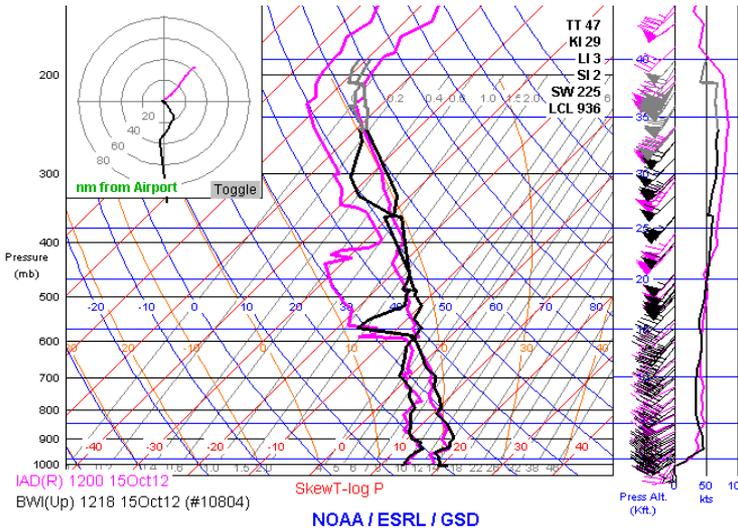


Current Program: Role of Partners in MDCRS/WVSS

- 8 US Air Carriers Participating in MDCRS (1,500 aircraft)
- 2 US Air Carriers Participation in WVSS
 - Southwest (57(87) aircraft) and United Parcel Service (25 aircraft)
- ARINC provides:
 - Prime contractor
 - Air-to-ground communications (satellite and VHF)
 - Ground processing/dissemination
- Spectra Sensors provides the Water Vapor Sensing System (TDL) – 4 STCs
- FAA, WMO and International AMDAR Programs
 - Reimbursable agreements signed with FAA

Current Program: Water Vapor Sensing System (WVSS)

- 57 (112) Aircraft
- ~545 Soundings per Day
- CONUS and Caribbean Sea

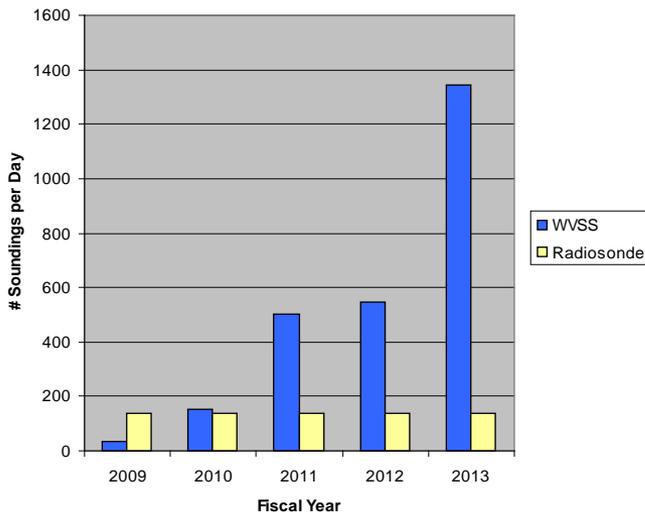


14-Oct-2012 20:00:00 -- 15-Oct-2012 20:35:00 (10304 obs loaded, 23397 in range, 10026 shown)

NOAA / ESRL / GSD Altitude: -1000 ft. to 45000 ft.

Good w and T vapor

CONUS Soundings per Day



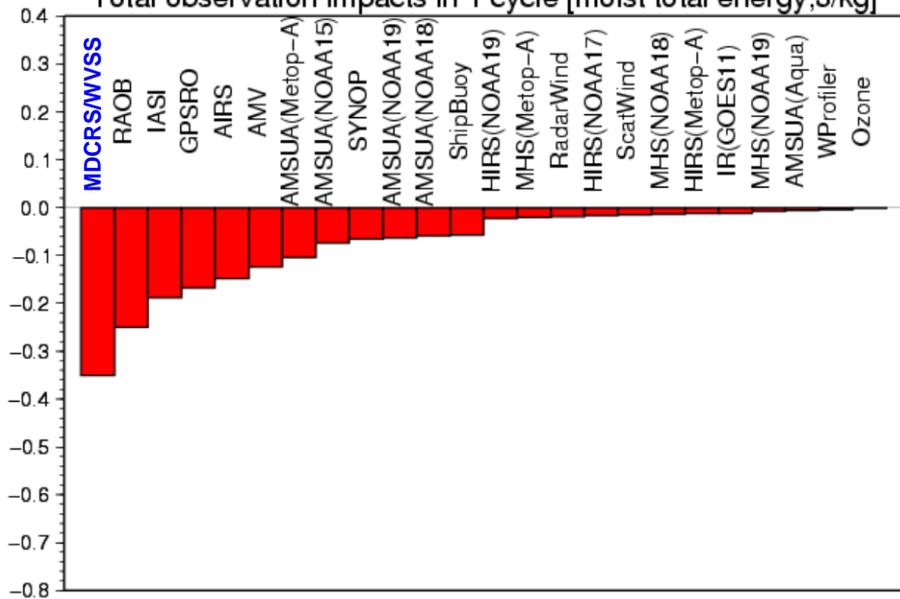
Current Program - Impact

NOAA Model Sensitivity Studies presented at the

5th WMO Workshop on Impact of Observations on NWP, May 22-25, 2012

NOAA Global Forecast System (GFS) Model Impact

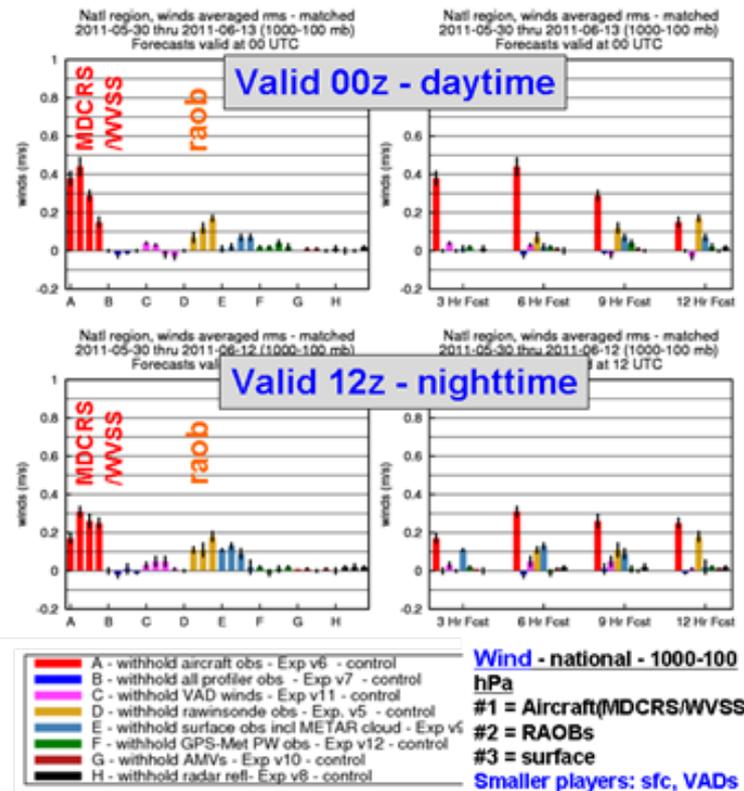
Total observation impacts in 1 cycle [moist total energy, J/kg]



For the total impact, 1: MDCRS/WVSS, 2: AMSU-A, 3: radiosonde, 4: IASI, 5: GPSRO

“The impact of aircraft (MDCRS/WVSS) observations is extremely large over US”

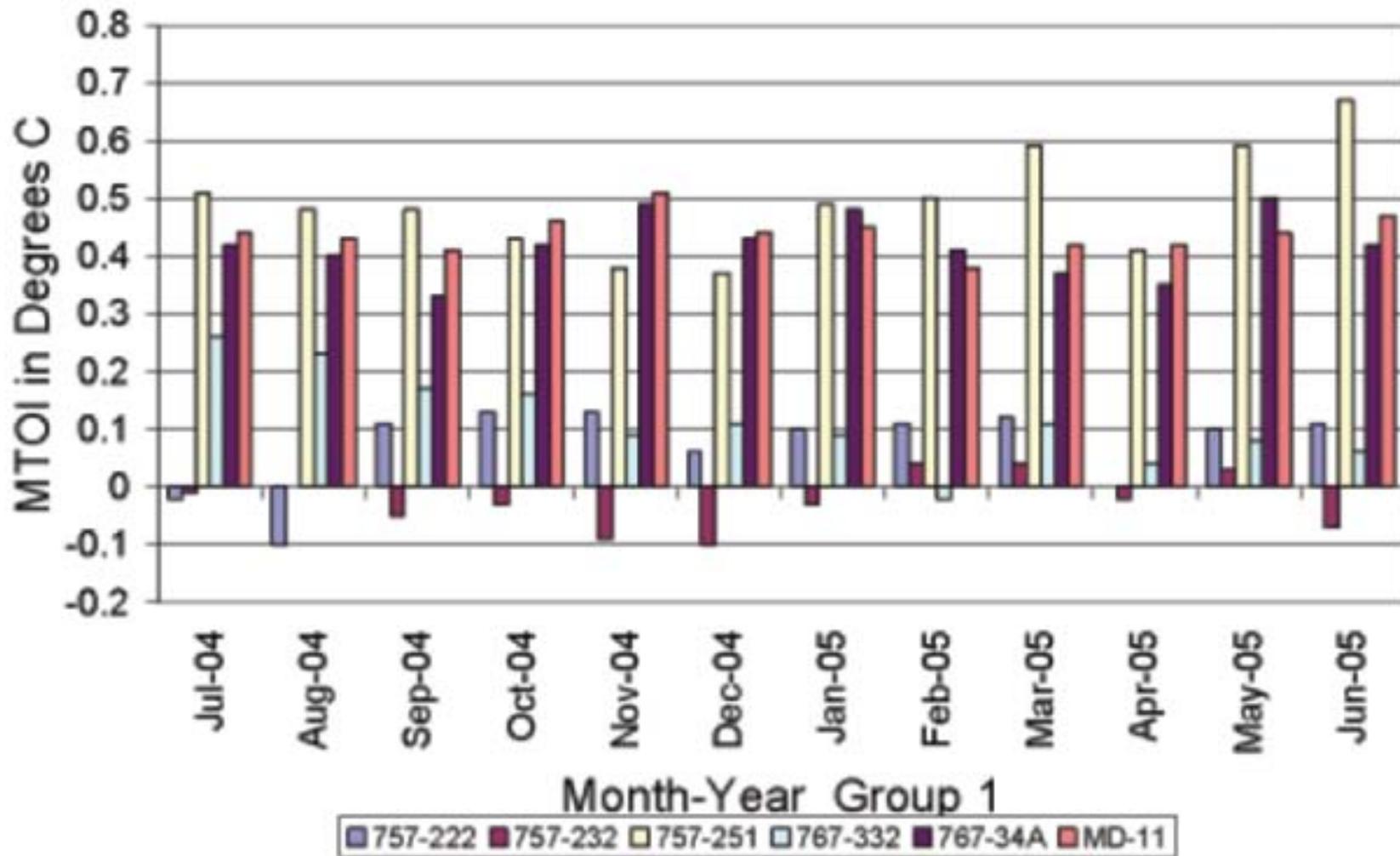
NOAA High-Resolution Rapid Refresh Model (RAP) Impact



“Aircraft (MDCRS/WVSS) data are the most important observation overall for short-range forecasts, providing a 10-20% error reduction for 6hr forecasts of wind, temperature, and moisture”

Current Program - Impact

a) ACARS Mean Temperature Observation Increments by Aircraft Types 300 hPa up



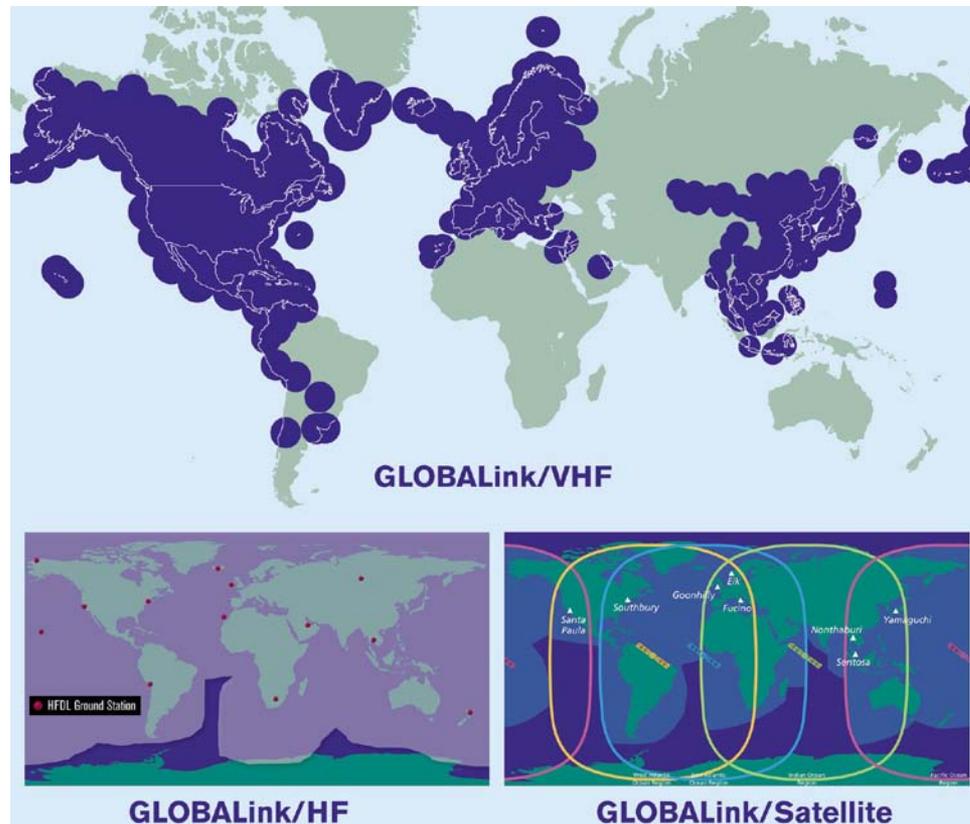
Why do air carriers support MDCRS?



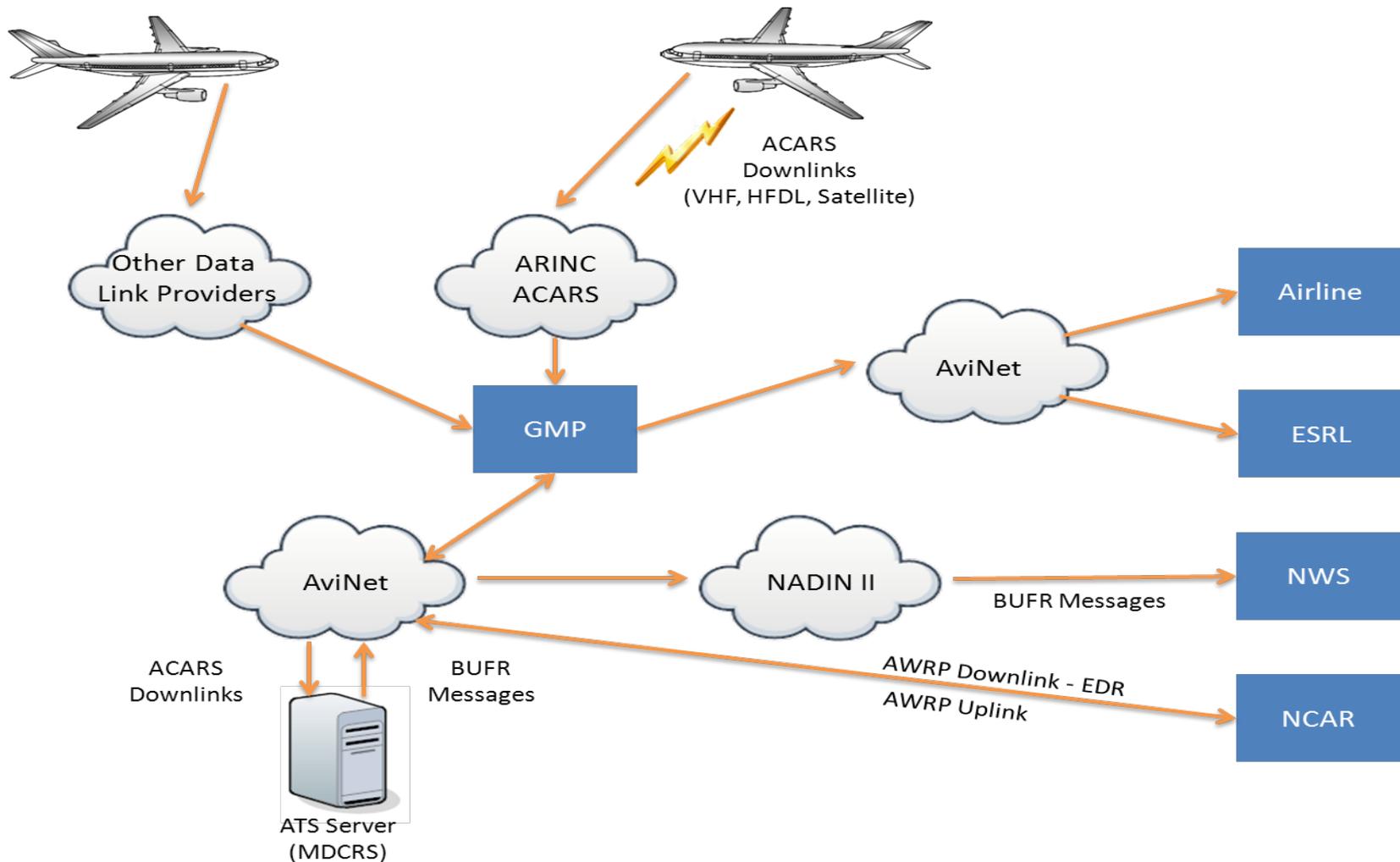
ARINC Air-Ground Communications Services

- HF/VHF Voice
- VHF Data Link ACARS/VDLM2
- SATCOM
- HF Data Link (HFDL)

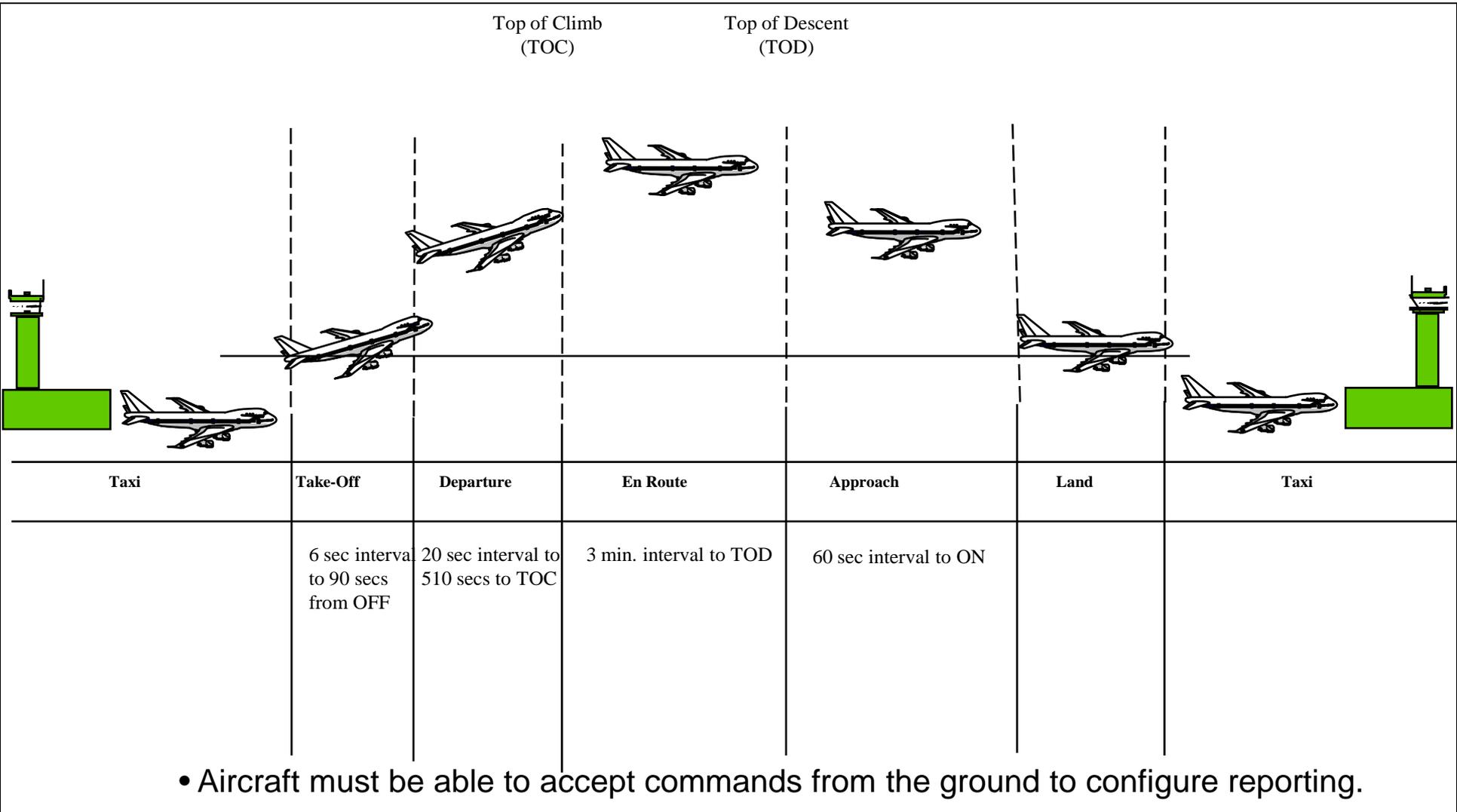
ARINC Communications Coverage



MDCRS Data Processing



Typical ARINC 620 Reporting



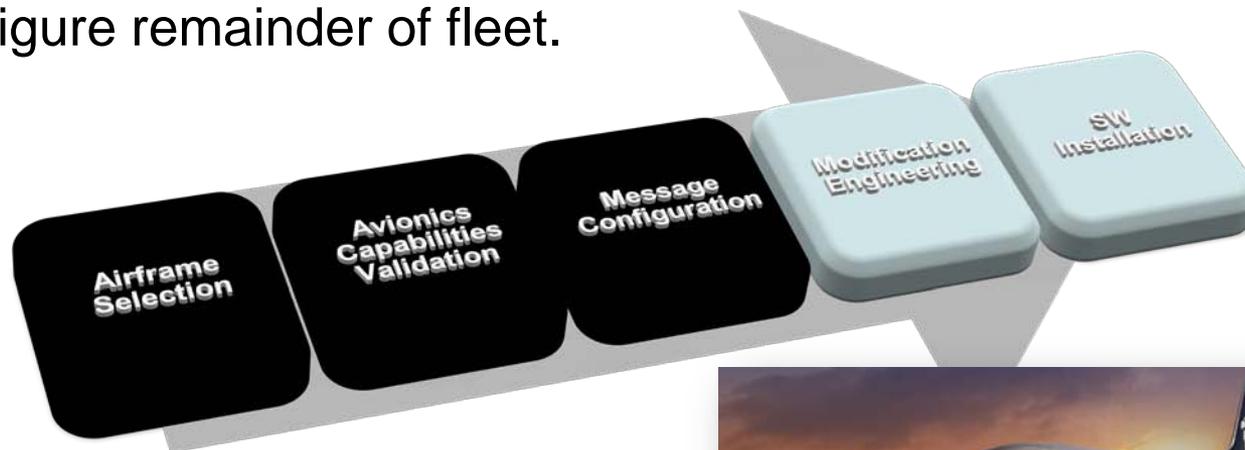
91 samples during a typical 2:15 flight

Content of Typical MDCRS Messages

- ACARS Header info contains Aircraft ID, Departure Station, Destination Station.
- Time of Observation – Day, Hour, Minute (6 char.)
- Latitude in Deg, Min, Tenths (6 char.)
- Longitude in Deg, Min, Tenths (7 char.)
- Pressure Altitude, feet (4 char.)
- Wind Direction (3 char.)
- Wind Speed (3 char.)
- Static Air Temperature – degrees C (4 char.)
- Roll Angle Flag (1 char.)
- Phase of Flight (when available) (4 char.)
- Turbulence (when available) (4 or 5 char.)
- Icing (when available) (4 char.)
- Water Vapor Mixing Ratio (when available) (4 char.)

Steps to Implement MDCRS

- Airlines work with avionics vendor to obtain Software to load in Digital Flight Data Acquisition Unit (DFDAU) to collect observations and transmit via ACARS.
- Configure reporting as shown previously for Typical ARINC 620 Reporting.
 - ARINC can provide sample messages as examples.
- Configuring aircraft to provide AMDAR data.
 - ARINC will confirm that message configuration and aircraft reporting is OK.
 - ARINC will establish routing to ensure AMDAR data are forwarded to NWS.
- Configure remainder of fleet.



MDCRS Variants

- MDCRS/WVSS: Specialized sensors, leveraged commercial communications, leveraged protocol
- IAGOS: Specialized sensors, leveraged commercial communications, specialized protocol
- AirDat/TAMDAR: Specialized sensors, leveraged commercial communications, specialized protocol
- FlyHT AFRIS: Leveraged aircraft sensors over specialized commercial communications, leveraged protocol
- Emerging Communications: ADS-B, ADS-C, Mode-S

WVSS Sensor on B737



What about the Federal Fleet?

- DoD/USAF is using the MDCRS model (C-17 fleet)
- Getting started:
 - Federal fleet inventory?
 - Are the aircraft capabilities: sensors, avionics, communications?
 - What are the opportunities to leverage communication COTs and existing sensor certifications?

Questions?

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Air-Ground Communications Services

- Airlines use VHF and Satellite air/ground data link service to communicate air traffic control, airline operational control, and airline administrative control between ground-based organizations and the cockpit.

