

ARM Aerial Vehicles Program



ICCAGRA Fall Meeting
October 22, 2008

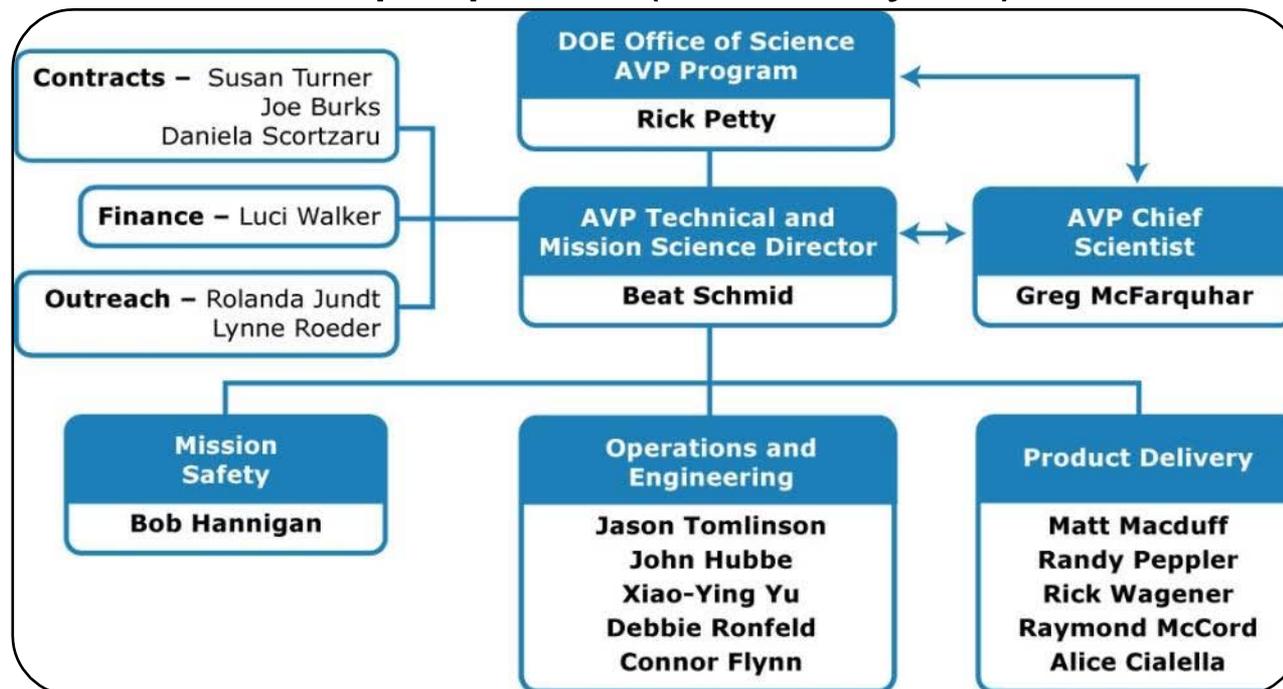
***Jason Tomlinson and Beat Schmid
Pacific Northwest National Laboratory***

Outline

1. ISDAC IOP
2. Routine observations
3. AVP Airborne Instrument Workshop

AVP History & Organization

- ▶ June 2006: Former ARM UAV program was re-competed as ARM AVP among DOE National Labs
- ▶ Oct 2006: PNNL proposal (PI J. Voyles) successful



CLASIC (2007)

- ▶ **C**loud and **L**and **S**urface **I**nteraction **C**ampaign
- ▶ ARM Southern Great Plains Climate Research Facility
 - June 8-July 2, 2007
- ▶ Coordination between 9 aircraft
 - CLASIC
 - CIRPAS Twin Otter, NASA P3, NASA ER2, NASA J-31, Twin Otter International, Duke University Helicopter Observation Platform, and Cessna 206
 - CHAPS
 - NASA B-200 and DOE G-1
- ▶ A workshop was held in March 2008
- ▶ Data is now publicly available
 - <http://acrf-campaign.arm.gov/clasic/>

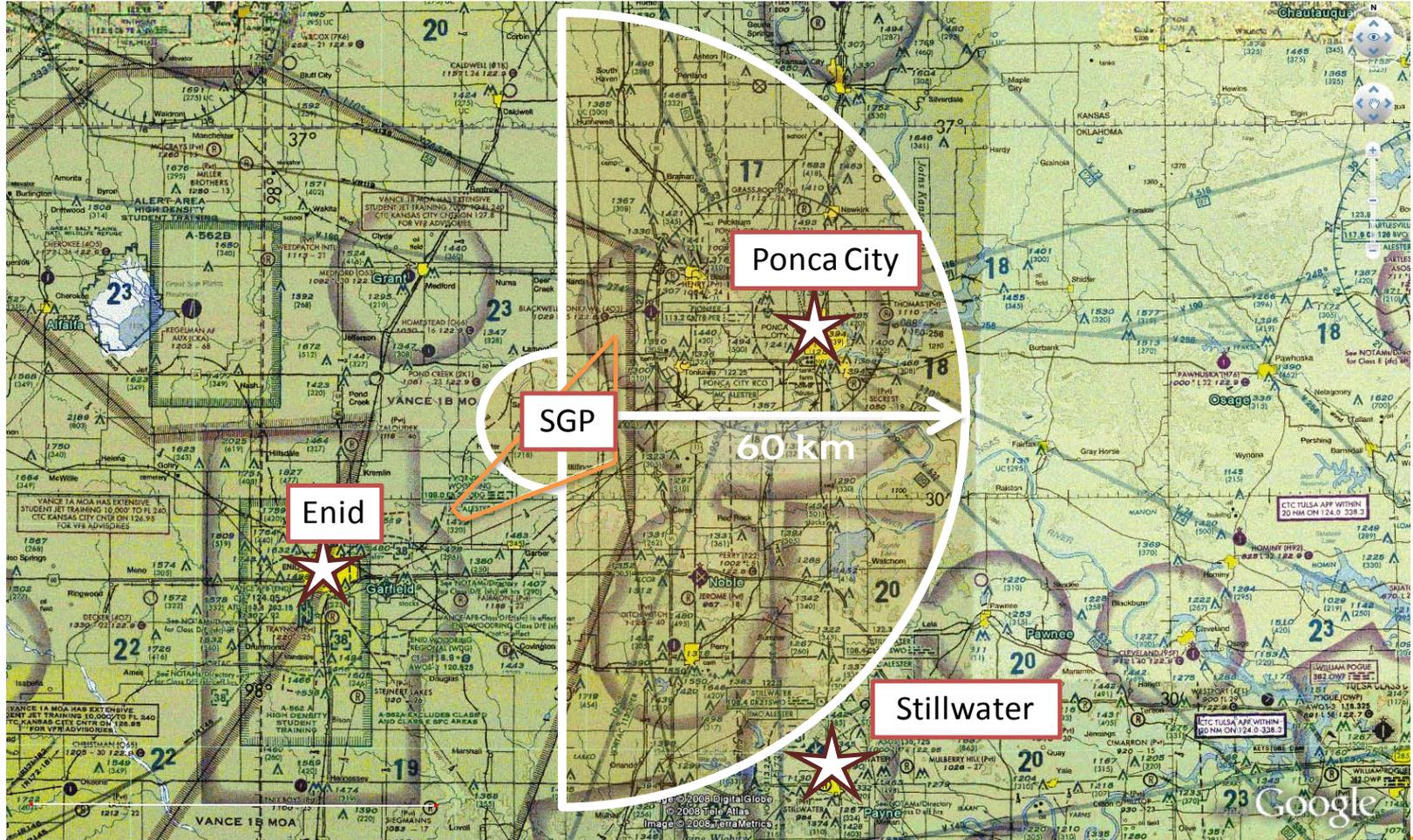
- ▶ Indirect and Semi-Direct Aerosol Campaign
- ▶ Measured aerosol and cloud properties over the North Slope of Alaska in close proximity to the ARM site located in Barrow
- ▶ April 1st to 30th 2008
 - 103 Flight hours
- ▶ AVP collaborated with Environment Canada, the National Research Council of Canada, and various U.S. research entities
 - Aircraft platform was the NRC Convair-580
- ▶ Field campaign overlapped with the NASA ARCTAS and NOAA ARCPAC campaigns all based in Fairbanks, AK
- ▶ ISDAC Workshop
 - November 13th and 14th
- ▶ Data should be public by beginning of 2009

- ▶ **R**outine **A**VP **C**loud with Low Optical Water Depths (CLOWD) **O**ptical **R**adiative **O**bservations
 - January 22nd to June 30th 2009
- ▶ CLOWD Type clouds
 - Low-level, boundary-layer clouds constitute the largest uncertainty in climate models
 - Low-level cloud properties are very sensitive to changes in aerosol loading, and the aerosol effect on cloud albedo remains the dominant uncertainty in radiative forcing
- ▶ Routine Measurements
 - 300 Flight Hours
 - 2 to 3 flights per week

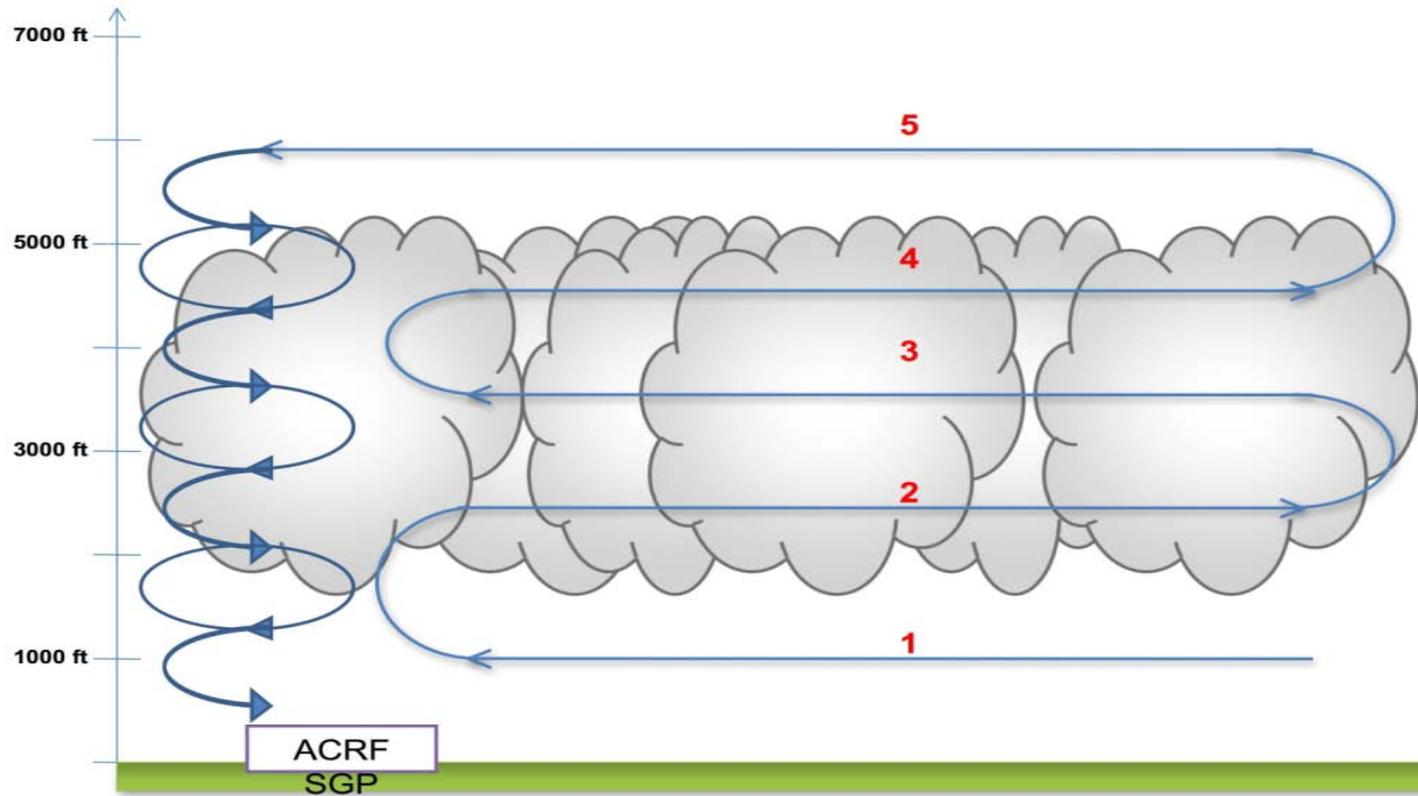
RACORO Aircraft



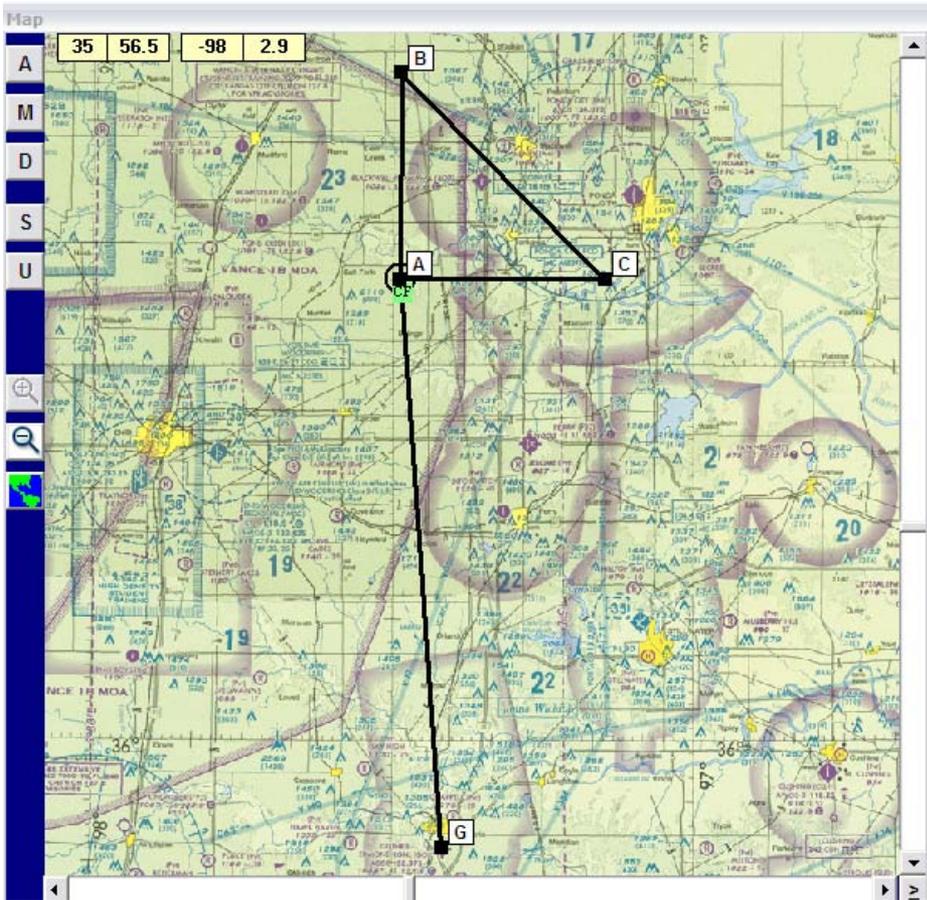
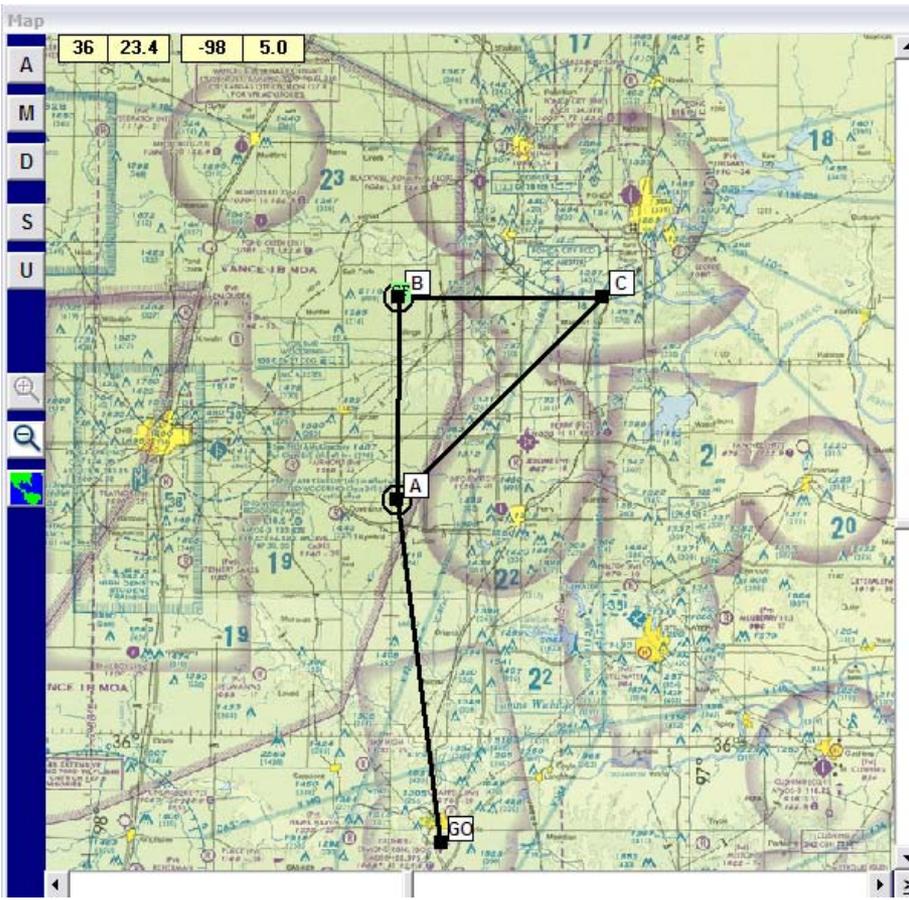
RACORO Flight Plans



RACORO Flight Plans



RACORO Flight Plans



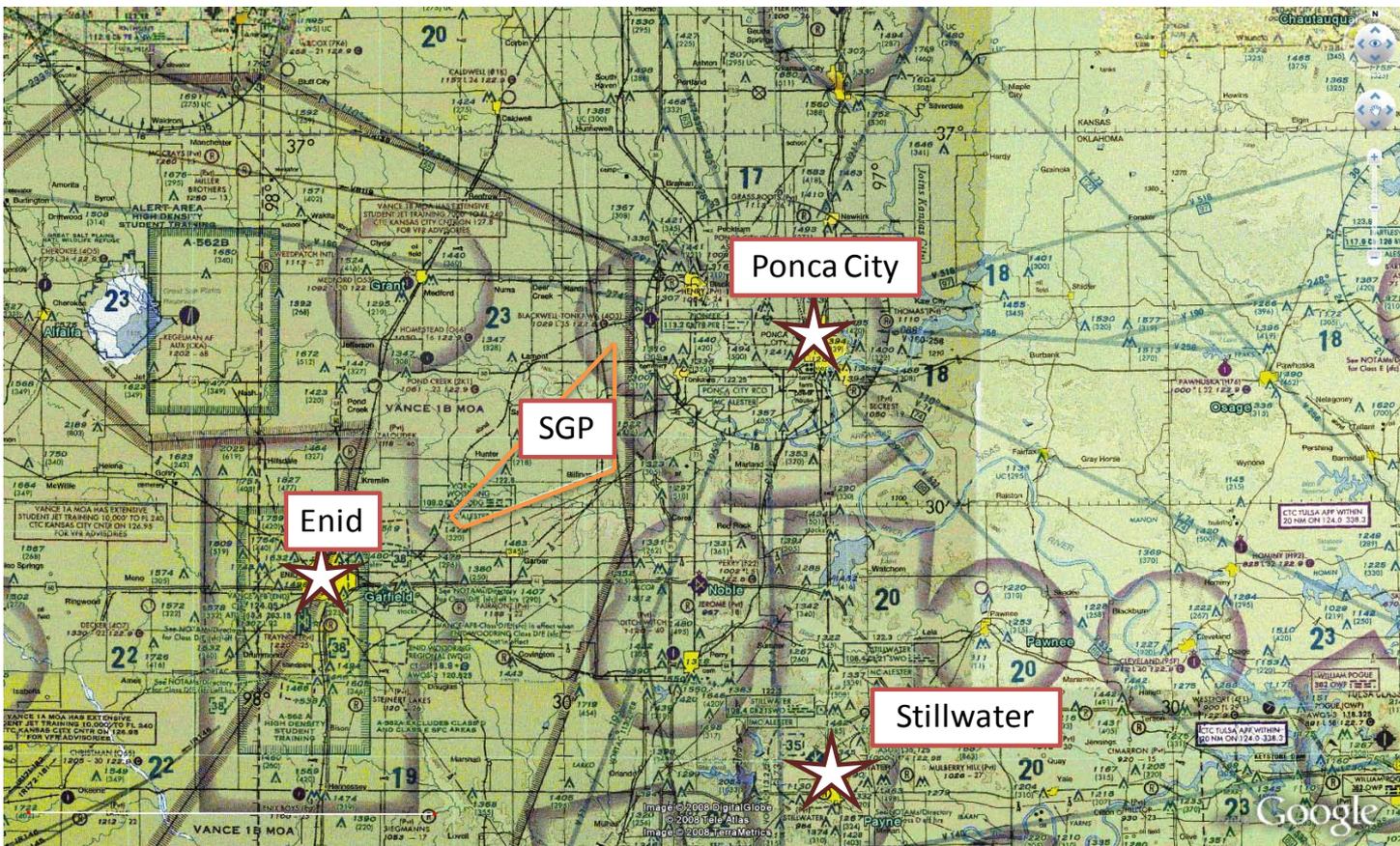
Cessna 206

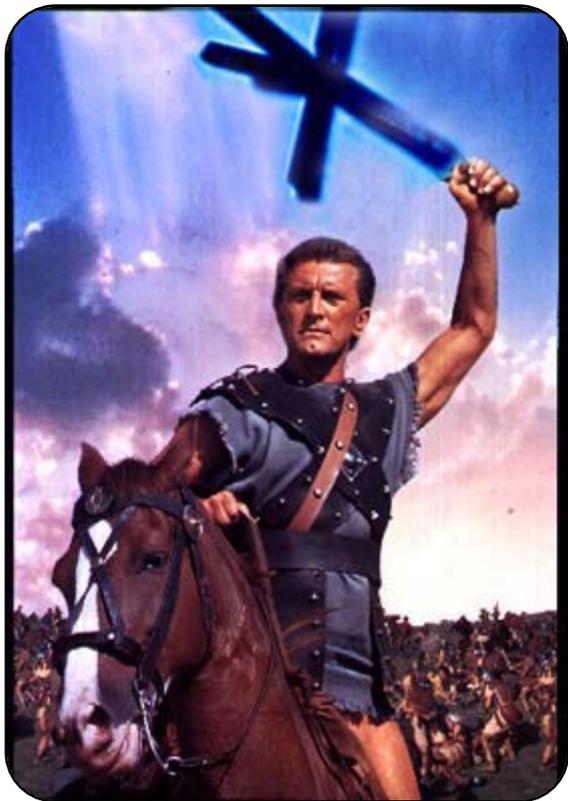
- ▶ Two-year airborne study of atmospheric composition and carbon cycling in the Southern Great Plains



- ▶ PI's: Sébastien Biraud & Margaret Torn, Lawrence Berkeley National Laboratory

Cessna 206





- ▶ **Small Particles In Cirrus**
 - October 1, 2009 – May 30, 2010
- ▶ Routine measurements of Cirrus microphysical properties
- ▶ Flights will be over the SGP ACRF site
- ▶ NASA Support?
 - WB-57 may participate in May 2010
- ▶ PI: Jay Mace, University of Utah

- ▶ Foster collaboration between scientists and develop new techniques for airborne measurements
- ▶ Meeting was held last week at the University of Illinois Urbana-Champaign
 - Scientists from NASA, NCAR, DOE, DRI, and various universities
 - International participation: EUFAR, NRC, and Meteo France
 - Private Companies: SPEC, DMT, and Brechtel
 - Nearly 60 presentations
 - Aerosol Instrumentation, In-situ cloud microphysics, active and passive remote sensing, UAS, and state parameters

▶ Meeting Summary

- Need to improve accuracy and precision of measurements
 - Need better tools for calibration
 - Need error bars
 - Larger sample volume for cloud microphysics probes
 - Need to fix the shattering/bounce problem with cloud microphysics probes
 - Better measurement techniques for aerosol direct effect
 - Improving spatial/temporal resolution of aerosol measurements near cloud
 - Wing pod mounted aerosol instruments
 - Forward pointing Lidar
- ▶ ARM will be providing funding in FY11 for instrument maturation/hardening

Cox Wind Tunnel

OAP-2DC arm

D ~ 2.5cm

TAS ~ 70m/s



30 April 2008, NRC Convair 580, ISDAC, Fairbanks



Summary

- ▶ AVP facilitated a highly productive workshop on airborne instrumentation
- ▶ Finalizing the data collected from ISDAC
- ▶ Moving forward with missions that are based on Routine Flying
 - RACORO
 - C206 Carbon Flights
 - SPARTICUS

DOE Research Aircraft Facility G1 Aircraft



ICCAGRA Fall Meeting
October 21, 2008

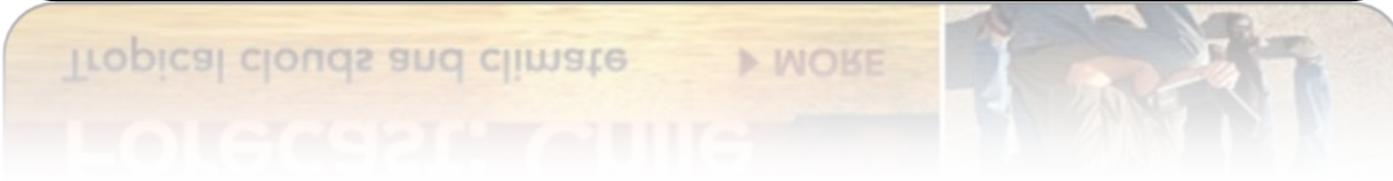
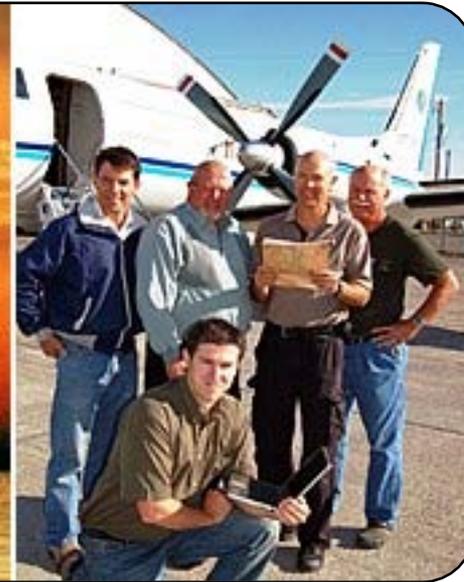
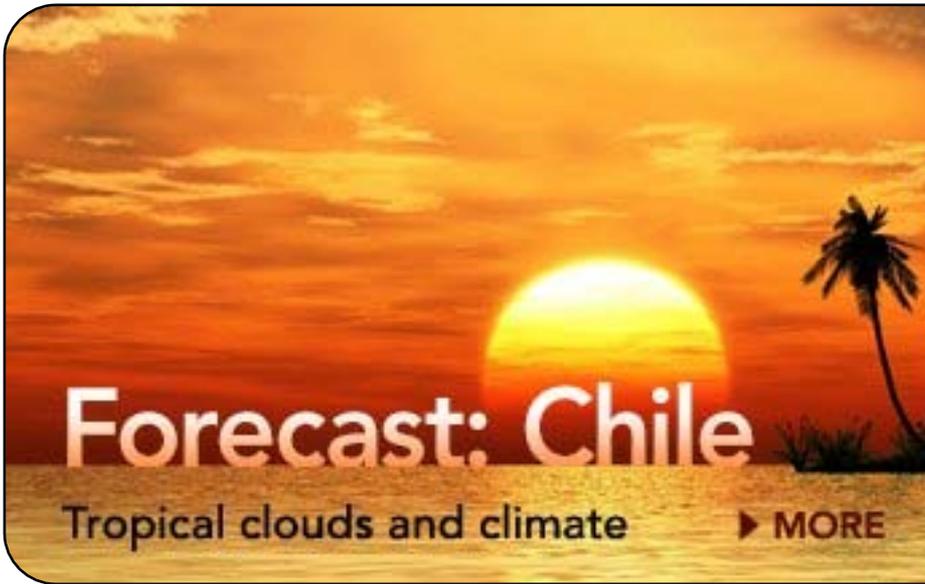
***Jason Tomlinson and John Hubbe
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G1 Overview

Aircraft length:	63.75 ft (19.44 m)
Aircraft wingspan:	78.33 ft (23.88 m)
Aircraft height:	23.33 ft (7.11 m)
Maximum gross weight:	36,000 lb (16,330 kg)
Nominal operating altitude:	1,000 ft AGL to 25,000 ft (7.5
Maximum operating altitude:	30,000 ft (9 km) MSL
Nominal cruise speed:	160 - 290 knots (80 - 150 m s ⁻¹)
Nominal sampling speed:	195 knots (100 m s ⁻¹)
Nominal rate of climb:	500-1000 ft min ⁻¹ (2.5-5 m sec ⁻¹)
Endurance with maximum	6 hours
Crew capacity:	2 pilots and 1 to 5 scientists and
Cabin payload at maximum	2,500 lb (1,134 kg) including
gross weight, with full fuel:	scientific crew and instruments
Supplemental air conditioning:	3 heat-exchangers in cabin rated
	at ~6000 BTU each
Electrical power:	300 A @ 28 VDC provides 4,000
	V-A at 115 VAC 60 Hz and 4,000
	V-A at 230 VAC 60 Hz



Current G1 Activities

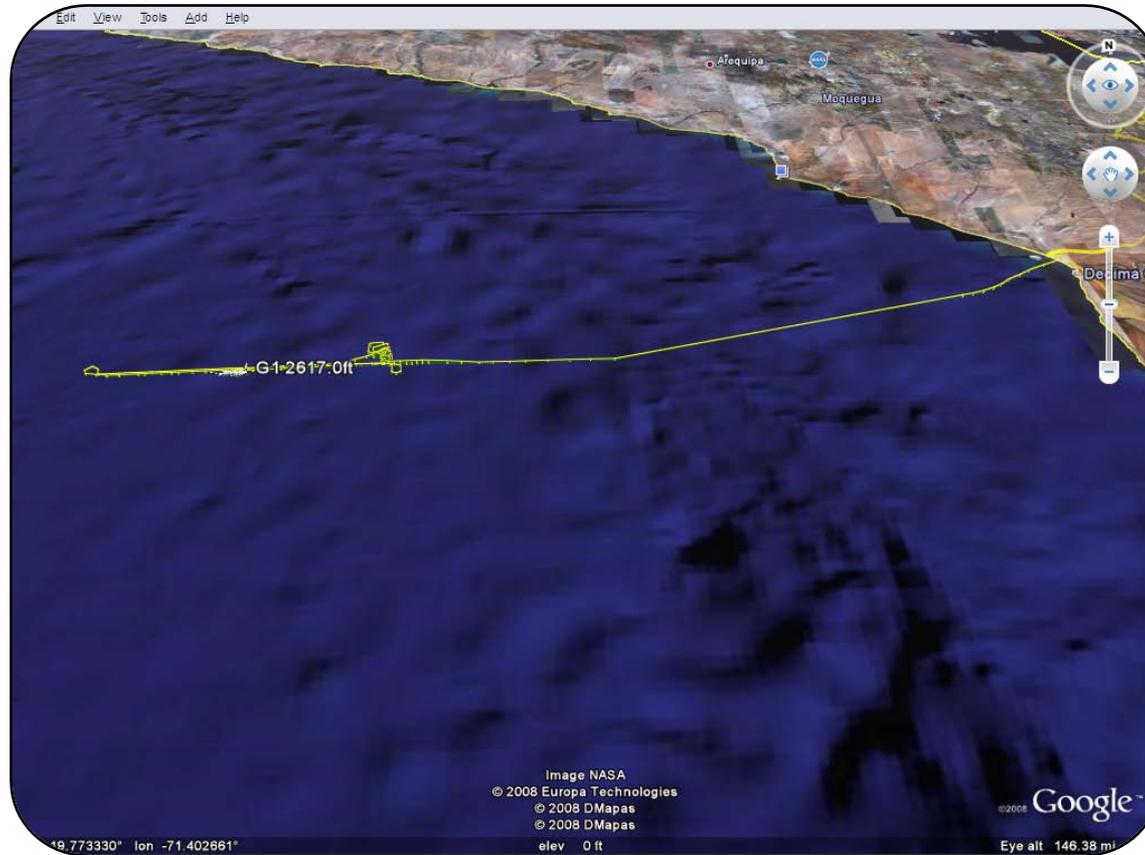


VOCALS

- ▶ **VAMOS** (*Variability of the American Monsoon Systems*) **Ocean-Atmosphere Land Study**
- ▶ October 15, 2008 – November 15, 2008
 - Aircraft is based in Arica, Chile
- ▶ Measurements of gas phase, aerosol, and cloud properties
 - FIMS
- ▶ Have conducted 3 research flights so far



Real Time Mission Monitoring



<http://www.pnnflightops.org/g1.kml>

