The background image is an aerial photograph of a large, dark, irregularly shaped facility, likely the DOE Atmospheric Radiation Measurement Aerial Facility. The facility is situated on a flat, open landscape, possibly a tundra or a similar natural environment. The sky is overcast with grey clouds. The text is overlaid on the image in a semi-transparent white box.

# DOE Atmospheric Radiation Measurement Aerial Facility

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Pacific Northwest National Laboratory

November 09, 2009

ICCAGRA Fall Meeting

MacDill AFB

# AAF Changes

- ▶ Growing the size of our team
  - New mechanic, pilot, and science & operations lead
- ▶ AAF is now fully managing the G1 operations
- ▶ Recovery Act has funded the procurement of 17 new instruments
- ▶ Improvements to the G1
- ▶ Increasing the number of field campaigns

# Recovery Act

- ▶ Procured 1 aircraft/met state parameter probe
  - AIMMS-20
- ▶ Procured 6 state of the art cloud probes
  - Fast FSSP, 2D-S, HVPS-3, CSI/CDP, Fast CDP, and WCM-2000.
- ▶ Procured 11 aerosol & gas instruments
  - UHSAS, Dual Column CCN, SP2, **SMPS**, PASS-3, **Humidigraph**, **CVI**, **PILS**, and Cavity Ring Down.
  - **Trace Gas** - CO, O<sub>3</sub>, SO<sub>2</sub> and (NO, NO<sub>2</sub>, NO<sub>y</sub>) measurements.
- ▶ Also funding improvements to the G1
  - New instrument rack
  - New data system
  - Instrument Integration and Setup



# G1 Improvements

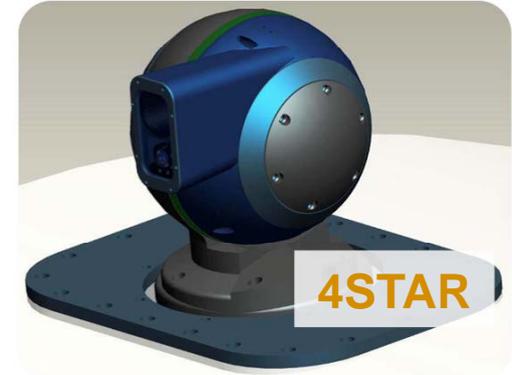
## ▶ Wing Pylons

- Final testing on going
- Once approved, the G1 can carry 8 probes
  - 6 probes on the wing pylons
  - 2 probes on the nose pylons

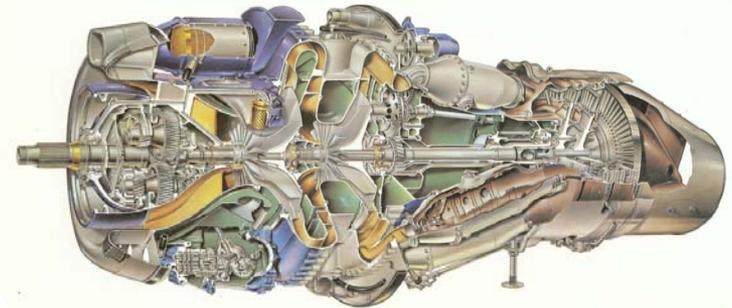


# G1 Improvements

- ▶ Zenith looking port for radiometers
- ▶ Rolls Royce DART1860 Engines
  - More power (2.5%)
  - Greater Fuel efficiency (10-12%)
  - Higher operating ceiling
  - Higher capacity generators
- ▶ Power distribution and inverter upgrade
  - Higher capacity inverters for 115/230 VAC



 DART turboprop





## Aircraft Technical Information

**Length:** 63.75 feet (19.44 m)

**Wingspan:** 78.33 feet (23.88 m)

**Height:** 23.33 feet (7.11 m)

**Cabin space:** 165 square feet

**External probes (PMS cans, etc.):** 8

**Maximum gross weight:** 36,000 pounds (16,330 kg)

**Endurance with maximum fuel:** 6 hours

**Crew capacity:** 2 pilots, 1-4 scientists

**Cabin payload:** 4,200 pounds

**Research Power:** 400A @ 28 VDC (incl. 4 KVA @ 110 VAC, 4 KVA @ 220 VAC, 60 Hz, 1-phase).



## Routine AAF Clouds with Low Optical Water Depths (CLOWD) Optical Radiative Observations (RACORO)

<http://acrf-campaign.arm.gov/racoro/>

# RACORO



- ▶ January 22<sup>nd</sup> – June 30<sup>th</sup>, 2009
- ▶ The goal was 300 hours of routine measurements of CLOWD type clouds



- ▶ The CIRPAS Twin Otter flew 260 research hours over a 5 month period
  - Aerosol, radiation, cloud, and turbulence measurements
- ▶ Coordinated flights with the NASA B200 in June
  - HSRL & RSP (Glory)
  - <http://www.nasa.gov/topics/earth/features/hsrl-glory.html>



Ray Rogers, NASA LaRC



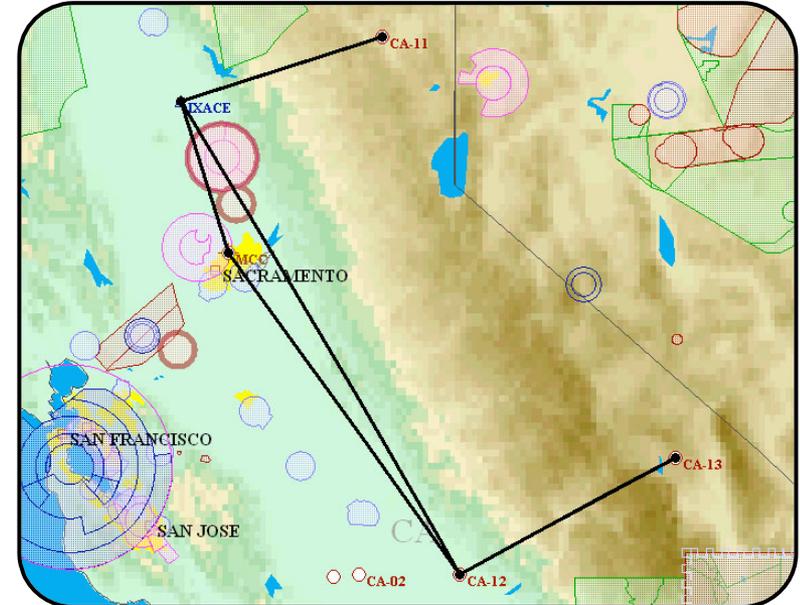
## Small Particles in Cirrus

- ▶ **SPEC Learjet 25**
  - 190 Research hours and 10 test flight hours
- ▶ **Instruments**
  - FSSP, CDP, 2D-S, 2D-P, CPI, PCASP, Deep Cone Nevzorov, Rosemount, AIMMS-20, and DLH (NASA – LaRC)
- ▶ **Mid-latitude Airborne Cirrus Properties Experiment (MACPEX)**
  - WB-57



## California Energy Commission- CalWater

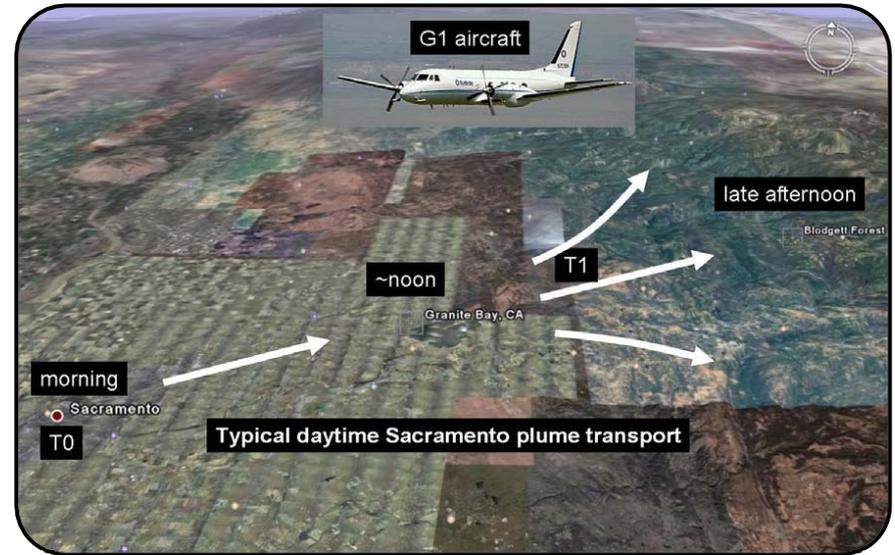
- ▶ Investigating the effects of anthropogenic emissions on winter precipitation in the California Central Valley and Sierra Nevada mountain range
- ▶ 80 flight hours on the G1
  - Feb. 15 – Mar. 19, 2010
- ▶ Measurements
  - Atmospheric state, LWC/TWC, cloud microphysics, aerosol, and gases
  - Collaborating with CIRPAS on several instruments
  - First campaign to use the new pylons



## Carbonaceous Aerosols and Radiative Effects Study (CARES)

- ▶ Evolution of the Sacramento Plume
  - 2 Ground Sites (T0 & T1)
- ▶ 70-80 flight hours on the G1
  - June 2 – 28, 2010
- ▶ Coordination
  - NASA B200
    - HSRL & RSP
  - CalNex - NOAA WP-3D

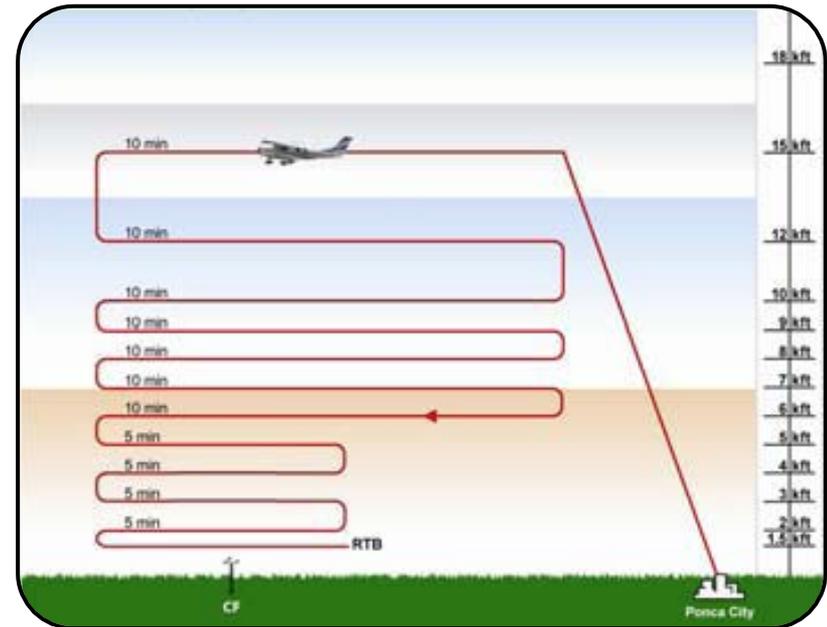
<http://acrf-campaign.arm.gov/cares/>



# ARM-ACME

## ARM Airborne Carbon Measurement Experiment (ACME)

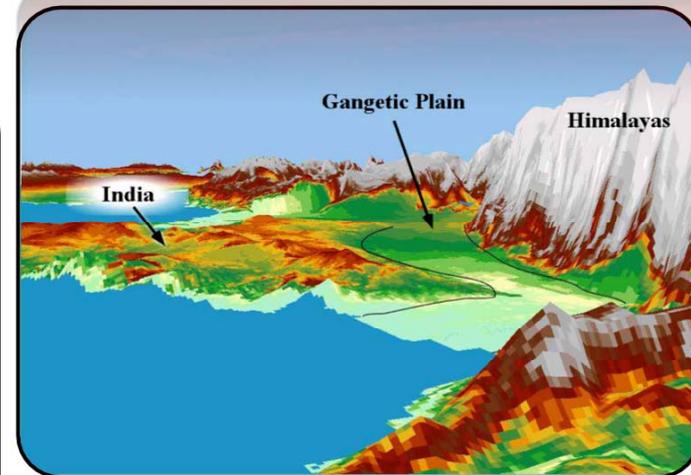
- ▶ Routine flights over the SGP site using a Cessna 206
- ▶ Measurements of carbon cycle gases and ozone



# GVAX - India

## Ganges Valley Aerosol Experiment

- ▶ Study the impact of increasing aerosols on the Indian Summer Monsoon, specifically the impact on precipitation
- ▶ G-1 Aircraft
- ▶ Coordinated with the ARM Mobile Facility
- ▶ Spring/Summer of 2011
  - Specific dates TBD



# AAF FY10 Schedule

## ▶ FY10 – G1

- Now - December 15<sup>th</sup>
  - Inspection
- December 15<sup>th</sup> - February 14<sup>th</sup>
  - CALWATER Integration
- February 15<sup>th</sup> – March 19<sup>th</sup>
  - CALWATER (80 hours)
- March 20<sup>th</sup> – April 1<sup>st</sup>
  - CALWATER de-integration
- Sometime in April
  - SBIR flights (10 hours)
- April – May 31<sup>st</sup>
  - CARES Integration
- June 2<sup>nd</sup> – 28<sup>th</sup>
  - Cares (80 hours)
- July 1<sup>st</sup> – July 14<sup>th</sup>
  - CARES de-integration
- July 15<sup>th</sup> – Sep 30<sup>th</sup>
  - G-1 Upgrades

## ▶ FY10 – NonG1

- Now – December 1<sup>st</sup>
  - SPartICus test flights (10 hours)
- December 1<sup>st</sup> – April 15<sup>th</sup>
  - SPartICus (190 hours)
- Summer – End of FY10
  - Instrumentation develop

- ▶ **Overseeing 170 hours of G1 Flights**
- ▶ **200 hours of non G1 flights**

# More Information

## ARM

## ARM Aerial Facility

The screenshot shows the ARM website homepage. At the top, there is a navigation menu with tabs for ABOUT ARM, ABOUT ACFP, SCIENCE, SITES, INSTRUMENTS, MEASUREMENTS, DATA, PUBLICATIONS, EDUCATION, and FORMS. Below the navigation is a search bar and a main heading: "A Science Research Program for Global Climate Change". The main content area features a "RESEARCH SPOTLIGHT" section with a graph titled "Sounding" showing atmospheric profiles. To the right, there are sections for "Field Campaigns for FY 2011 Announced", "Recovery Act", "Field Campaigns", "User Survey", "News", "Data", and "Results". The "Field Campaigns" section mentions the Department of Energy's announcement of the ARM Mobile Facility and ARM Aerial Facility. The "Data" section highlights the extension of the Arctic Flux Archive to North Slope of Alaska.

<http://www.arm.gov>

The screenshot shows the ARM Aerial Facility website page. The header includes the ARM logo and navigation tabs. The main heading is "ARM Aerial Facility". Below this, there is a detailed description of the facility's mission: "As an integral measurement capability of the ARM Climate Research Facility (ACRF), the ARM Aerial Facility (AAF) provides airborne measurements required to answer scientific questions proposed by the ARM Science Team and the aerial research community." The page lists several key capabilities and services provided by the AAF, such as in-situ measurements of cloud properties, aerial sampling, and aircraft requirements. It also mentions that the AAF enhances the utility of long-term ground-based measurements. At the bottom, there is a "AAF Information" section with links to "Program Overview", "Science Instruments", "Data", and "Contacts".

<http://www.arm.gov/sites/aaf.stm>

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