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## **NASA DC-8 Platform Update** **University of North Dakota** and **NASA Airborne Science**

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# NSERC DC-8 Recent Activities

- **Transfer of DC-8 equipment, parts and documentation to new Dryden Aircraft Operations Facility (DAOF) in Palmdale, CA.**
- **Preparations, integration, and deployment for ARCTAS Fairbanks deployment**
- **Additional platform upgrades**
- **CARB flights and ARCTAS Cold Lake, Alberta, Canada deployment**
- **Preparation for AMISA mission to Kiruna, Sweden**

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# Dryden Aircraft Operations Facility



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# ARCTAS IPY Mission

## SCIENTIFIC THEMES OF ARCTAS

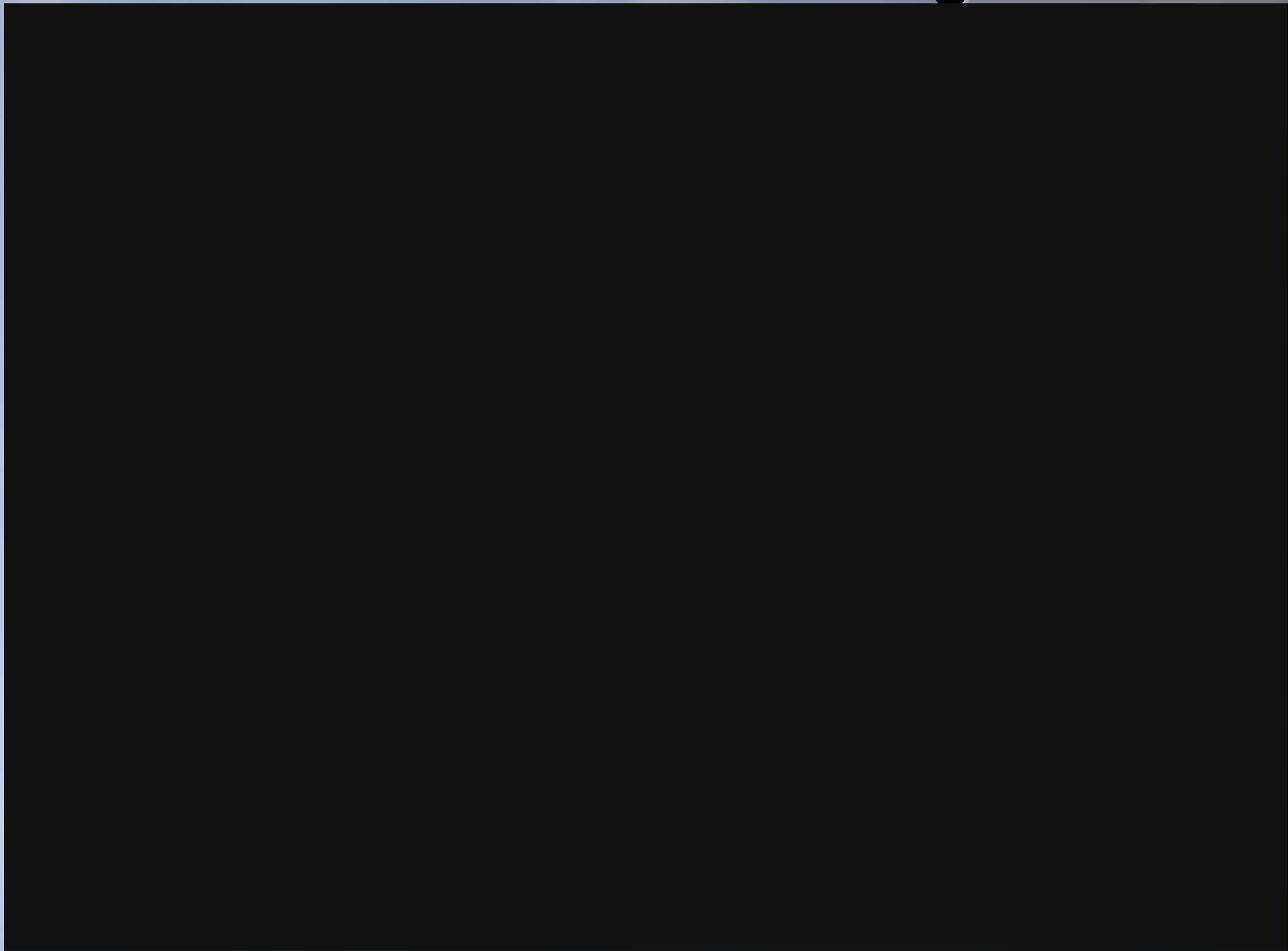
1. Longrange transport of pollution to the Arctic including arctic haze, tropospheric ozone, and persistent pollutants such as mercury;
2. Boreal forest fires and their implications for atmospheric composition and climate;
3. Aerosol radiative forcing from arctic haze, boreal fires, surface deposited Black carbon, and other perturbations;
4. Chemical processes with focus on ozone, aerosols, mercury, and halogens.

**Deployment sites include Fairbanks, AK in April, Palmdale, CA in June, and Cold Lake, Alberta, Canada in July**

**DC-8 payload includes 23 instruments from 11 institutions measuring:**  
OH, HO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>, O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>y</sub>, H<sub>2</sub>O<sub>2</sub>, HCN, OVOCs, HC, CFCs, PAN, SO<sub>2</sub>, CH<sub>2</sub>O, CH<sub>3</sub>OH, HNO<sub>3</sub>, O<sub>3</sub> profiles, Hg, Black Carbon, Aerosols, Aerosol composition, Aerosol properties, and other atmospheric constituents.



# ARCTAS Instrument Integration



# ARCTAS Fairbanks flight in formation with NOAA P-3



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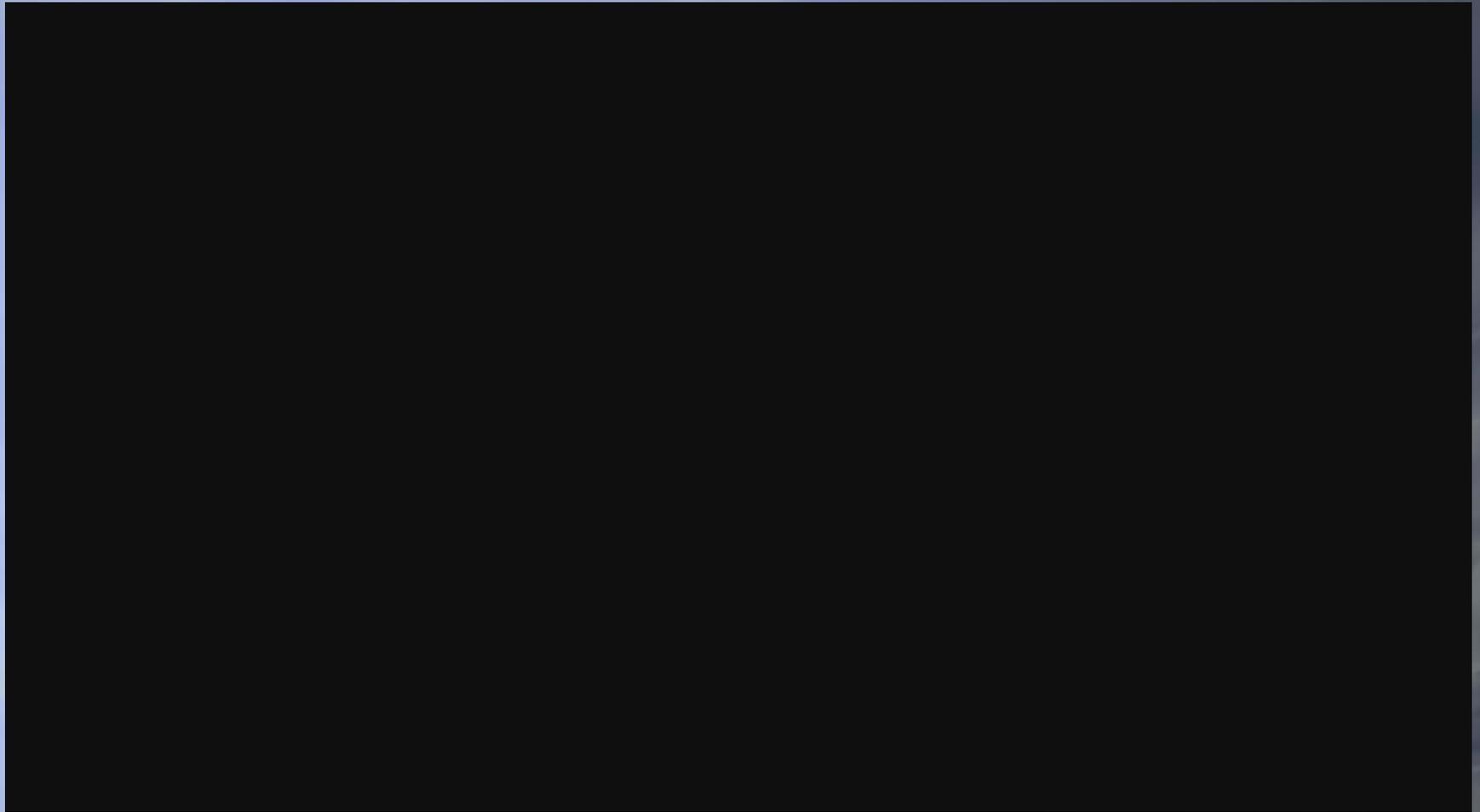
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# ARCTAS missed approach at Barrow



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# ARCTAS Summer deployments

## California Air Resources Board flights from Palmdale, CA

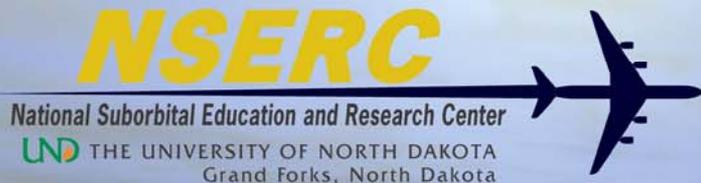
4- 8 hours flights to study Asian, livestock, and ship inputs into the California airshed, test existing models, and perform comparisons with existing groundstations.

This is an excellent example of leveraging resources between agencies

CARB is sponsoring some of the instrument teams and paying for DC-8 flight hours. They can then perform a study with a complete instrument payload NASA TCP program can accomplish more during ARCTAS as a result of the additional instruments

## ARCTAS flights from Cold Lake, Alberta, Canada

6-8 hour flights from Cold Lake to study boreal fire inputs into the polar regions including pyrocumulonimbus inputs to the upper troposphere



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# DC-8 Platform Upgrades

## Precision and high rate position and attitude system

Current DC-8 INS only provides 1 Hz attitude data

Scanning radiometers for AMISA mission have requirements of 20-40 Hz attitude and precision position data

New Aventech AIMMS-20 system purchased and integrated

System provides 5 Hz real time position, pitch and roll, and 3D winds data for real time display

20 Hz 1.2 meter accuracy post processed position data

40 Hz post processed pitch and roll data with  $<0.1$  deg accuracy

Fall 2008 addition of the Air Data Probe for 3 D winds

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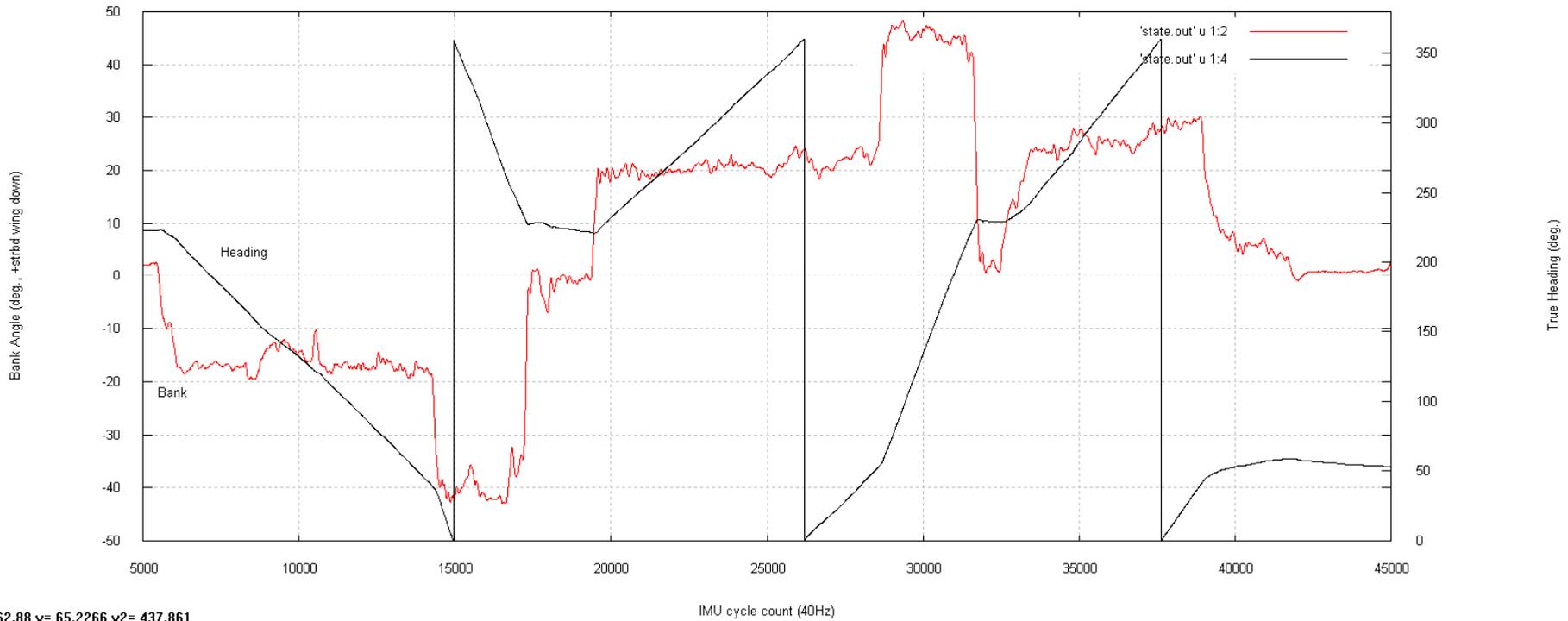
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# Flight Test Data from AIMMS-20 system

Aircraft State Parameters, AIMMS-20 GPS-Inertial Subsystem Flight Test (Dryden DC-8) May 14/08



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# DC-8 Platform Upgrades (con't)

## **New 4 channel Iridium based downlink system**

**Problems were encountered with the existing N-channel Iridium downlink system during the TC-4 and April ARCTAS deployments**

**A new 4-6 channel system has been designed and tested and will be implemented on the DC-8 and NASA P-3 for the ARCTAS summer deployments**

## **Improvements to network based data display system**

**New Linux based display computers for faster update**

**Addition of time series plots of experimenter and aircraft parameter data**



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# Arctic Mechanisms of Interaction between the Surface and Atmosphere

## GOAL:

To further understand the overall dynamics of the ice-atmosphere interaction process, accurate observations of Arctic sea ice cover and type along with meteorological conditions representative of mesoscale processes are required.

## STRATEGY:

Integration of a ship-based meteorological campaign which is occurring during IPY on the Swedish ice breaker Oden with an airborne campaign using the NASA DC-8 aircraft. The DC-8 measurements will include high resolution microwave imagery of sea ice using the Polarimetric Scanning Radiometer (PSR) system, discrimination of fresh water meltponds using the SLFMR L-band imaging radiometer, and direct sampling of thermodynamic and cloud variables over wide areas using in situ cloud probes, aerosol measurements, dropsondes, and radiometric profiling.

# AMISA deployment to Kiruna, Sweden

Deployment to Kiruna August 7-29

Based in Arena Arctica hangar at Kiruna airport

Plans for 6 Science flights 8-9 hours in duration

Coordination with the Swedish Icebreaker Oden for low level intercomparison legs

New smaller less expensive dropsondes

Tested on the DC-8 May 14, 2008



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# NSERC Education and Outreach Activities

## Airborne Science Bibliography

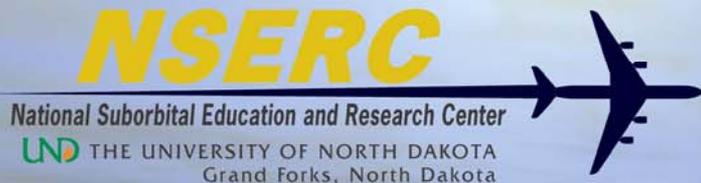
1988-2007 we found 1130 Scientific articles using data collected on Airborne science platforms and missions

Those articles resulted in >15,000 citations

We plan to use other search engines to find any additional articles

## Outreach

Provide an Airborne Science informational booth at various conferences and meetings including, the Fall AGU, Annual AMS, Odyssey of the Mind World Finals, and other student meetings.



# Questions?

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