National Aeronautics and Space Administration

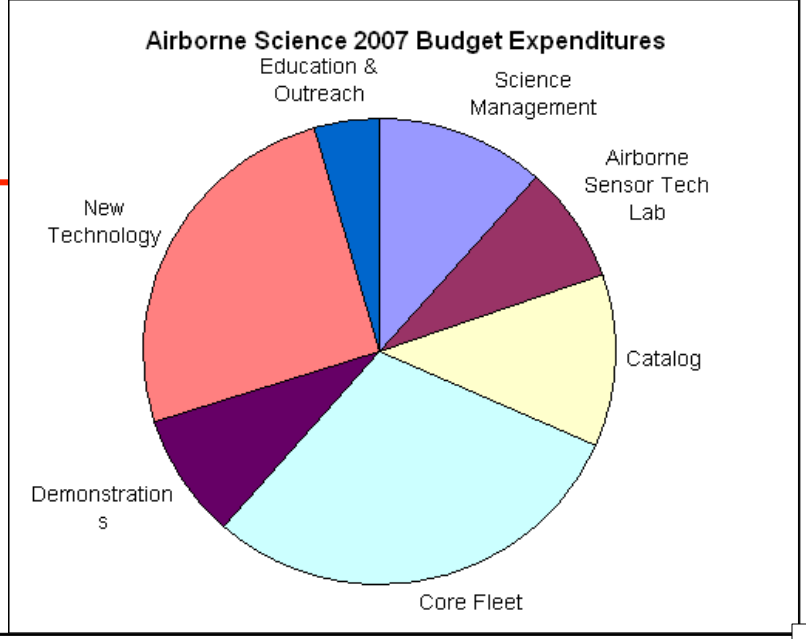
NASA Update
April 6, 2010

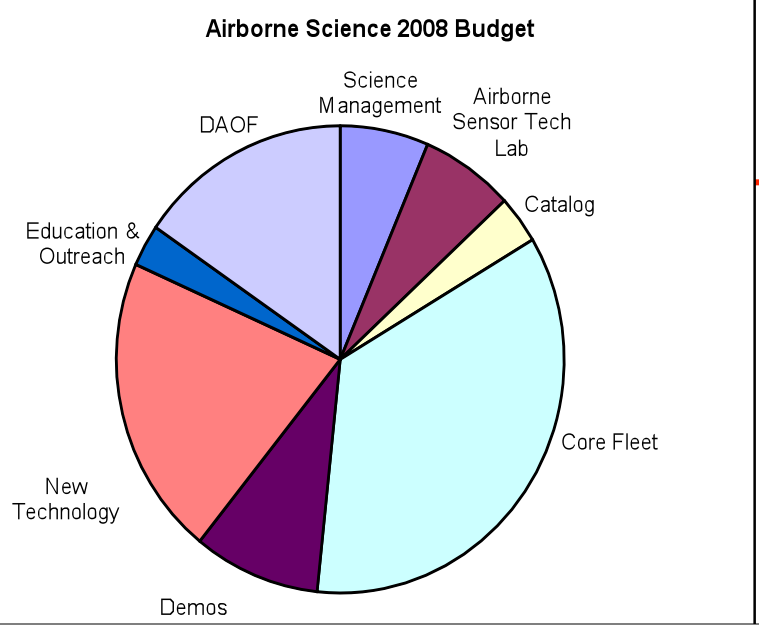
Airborne Science Program

Observing Platforms for Earth System Science Investigations

Anthony R. Guillory
NASA/ GSFC/WFF

www.nasa.gov


Airborne Science 2007 Budget Expenditures
Education & Outreach
Science Management
Airborne Sensor Tech Lab
Catalog
Core Fleet
Demonstrations
New Technology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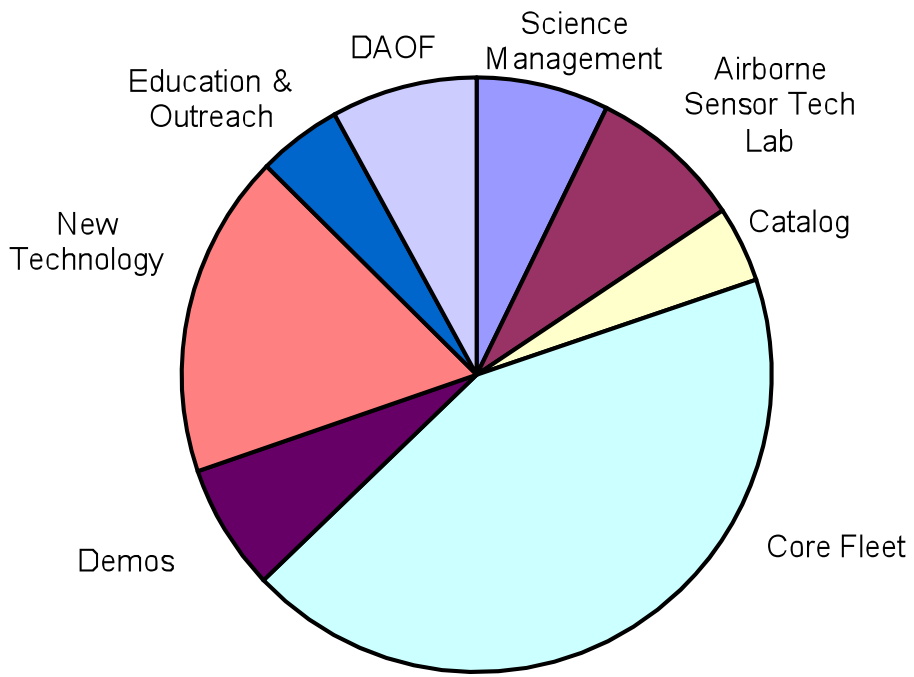
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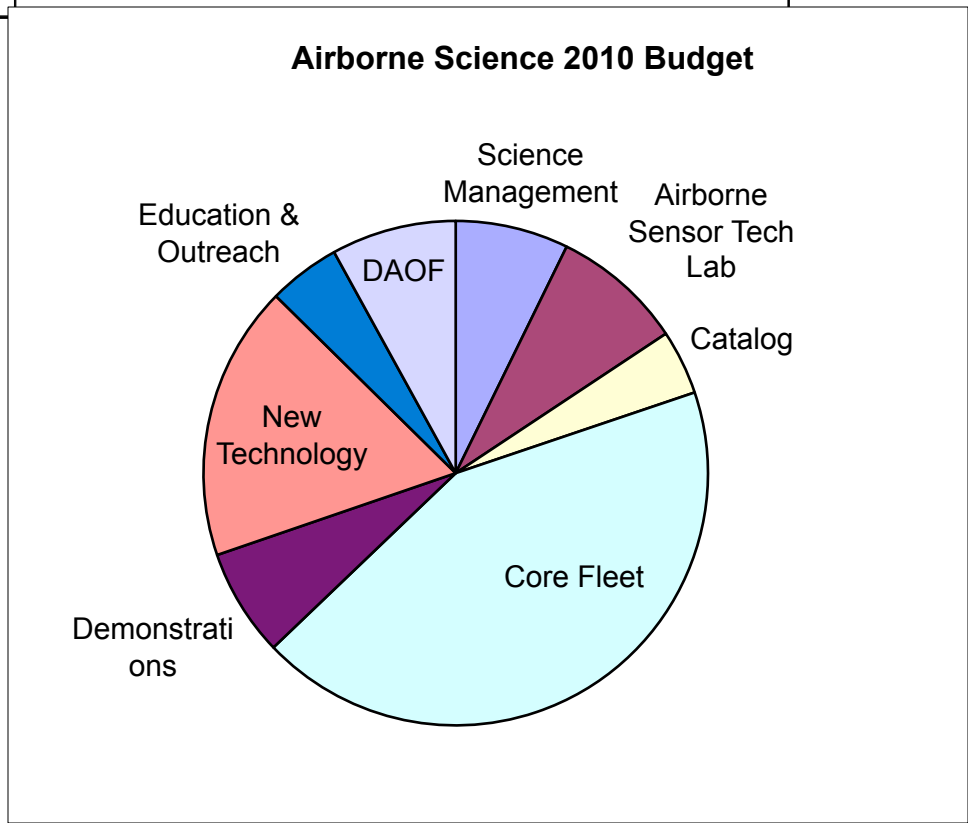
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Airborne Science American Recovery and Reinvestment Act (ARRA) Overview

- The Operating Plan for Airborne Science ARRA funding states:
  - "**+$28.0M, Airborne Science** - enables NASA to initiate ICEBridge, a data gap filler between ICESat I and ICESat II. This will ensure continuity of land ice measurements, which are critical to our understanding of global climate change. Additionally, these investments will allow for aircraft infrastructure, instrument, and ground system improvements."

- The primary objective is to address Operation Ice Bridge and unfunded priority overguide requests

- $4M reduction (now $24M) to op plan due to inability to use it as fast as anticipated due to agency requirements for ARRA

Current and Planned ARRA Activities

- **Ice Bridge**
  - Science/Instrument Team Support
  - Platform Support
- **Sensor Network (Airborne Segment)**
- **Aircraft and Facility Modifications and Upgrades**
  - B-200
  - WB-57
  - P-3
  - Global Hawk
  - G-III (UAVSAR Pod)
  - Dryden Aircraft Operations Facility (DAOF)
- **Maintenance Related Activities**
  - DC-8
  - ER-2
- **Studies**
  - UAS Access to the NAS
- **Earth Science Technology Office - Related Tasks**
  - GOLD
  - E-MAS
  - Ruggedized LVIS
  - UAVSAR Global Hawk Pylon

Airborne Science Program Operations

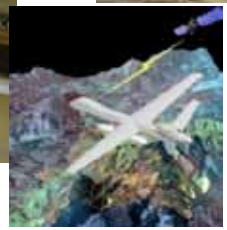
Core Airborne Systems:
ER-2, WB-57, DC-8, P-3, G-III





New Technology Airborne Systems
Global Hawk, Sierra, OTH/Networks





Catalog Airborne Systems (Utilized)
Ikhana, B-200, S-3, Learjet, Twin Otter, Caravan, Aerosonde, etc



Airborne Sensor Facility, Mission/Campaign Management

Represent all SMD Aviation Assets including SOFIA to the Agency

Over 50 aircraft available to the Program

Operations Tempo in FY09

Aircraft	Submitted	Total Approved	Total Completed	Total Science Flight Hours Flown
DC-8	8	3	3	20.3
ER-2	31	17	13	150.7
P-3	15	9	7	216.1
WB-57	10	1	1	44.5
Twin Otter	26	4	2	103.8
B-200	13	8	8	331.8
G-3	33	25	24	526.0
Lear 25	5	NA*	3	66.7
T-34	1	1	1	26.4
Cessna 206	1	1	1	41.0
Aerosonde	3	0	0	0
Global Hawk	3	1	0	0
Ikhana	3	0	0	0
SIERRA	8	5	5	76
Other	7	2	2	273.4
TOTAL	167	80	70	1876.7

KEY

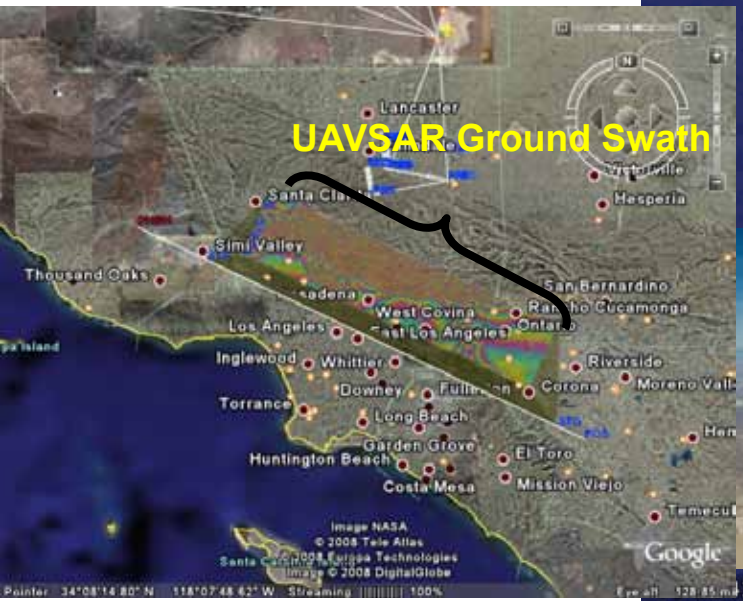
Submitted: Flight Request entered into the system

Total Approved: All flight requests that have been approved.

Total Completed: Flight requests completed or partially completed.

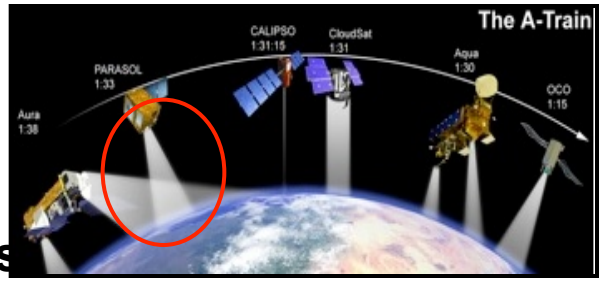
UAVSAR Missions

- Repeat pass interferometry
- G-III and L-band UAVSAR
- G-III modified to accept signals from radar unit for precision trajectory control
- 500 flight hours per year



GloPac Science Objectives and Missions

- First demonstration of the Global Hawk unmanned aircraft system (UAS) for NASA and NOAA Earth science research and applications.
  - First GloPac flight was a 7.4 hour flight on Friday

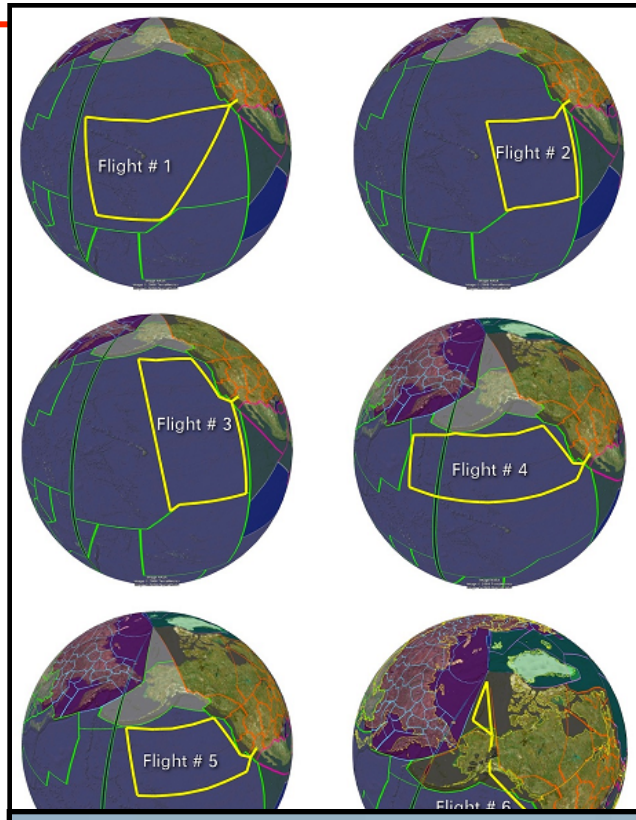


- Validation of instruments on-board the Aura satellite.
  - 11 NASA/NOAA sensors

- Exploration of trace gases, aerosols, and dynamics of remote upper Troposphere / lower Stratosphere regions.

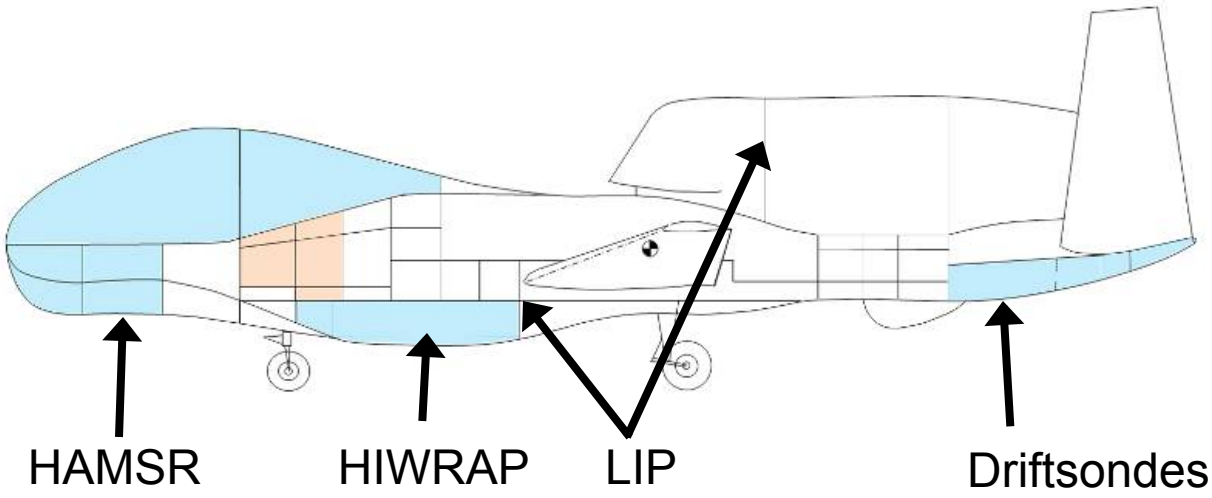
- Sample polar vortex fragments and atmospheric rivers.

- Risk reduction for future missions that will study hurricanes and atmospheric rivers.



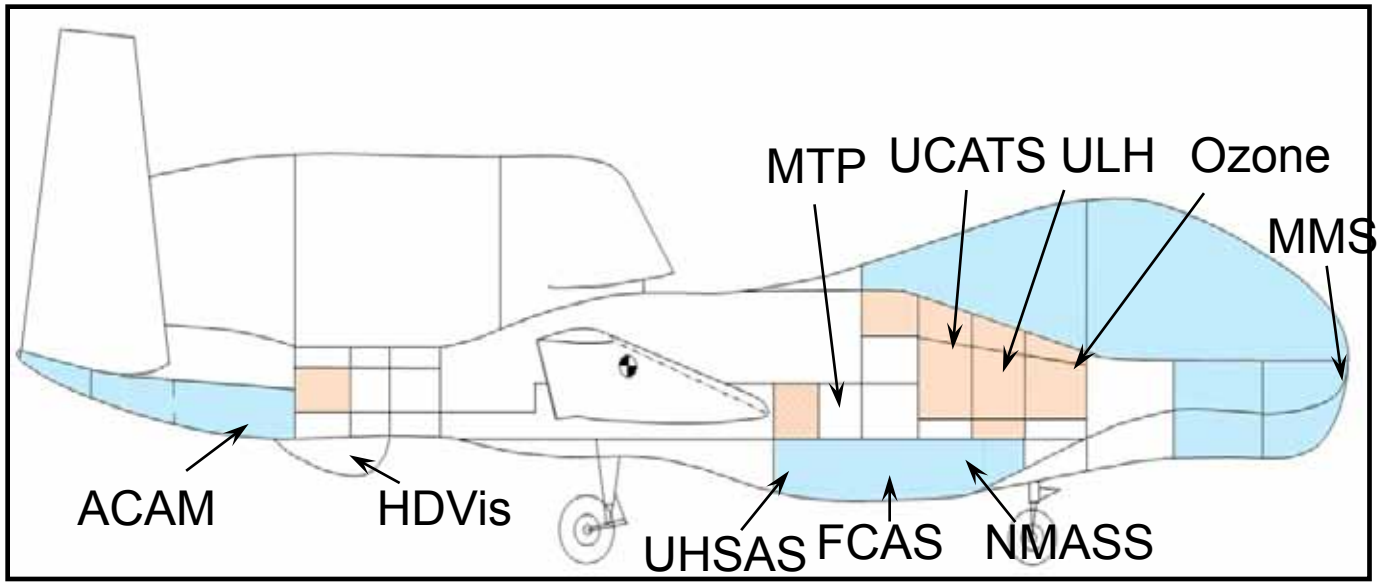
Scenes from GloPac

Global Hawk Payload Configurations



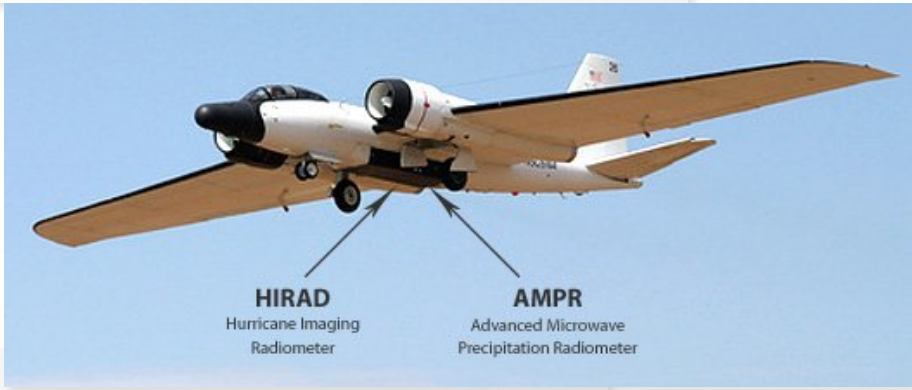
GRIP

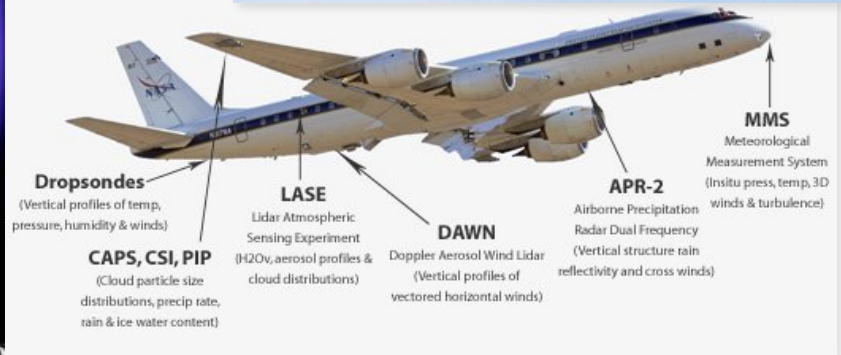
GloPac



GRIP: (Hurricane) Genesis and Rapid Intensification Processes Field Experiment

- The Global Hawk adds considerable surveillance capability
- Greater range and duration than DC-8 or ER-2
- Allows for extended on-station time in hurricane genesis regions
- Geosynchronous simulator
- 3 Aircraft (GH, DC-8, WB-57)

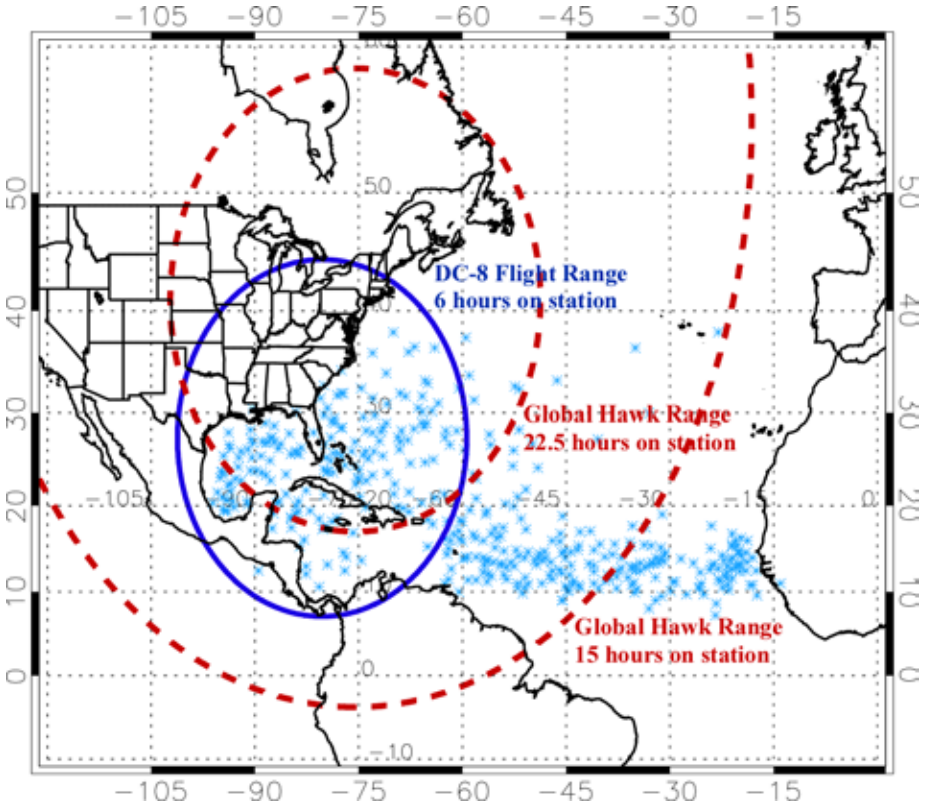




GRIP: (Hurricane) Genesis and Rapid Intensification Processes Field Experiment

- **Global Hawk** (UAV) (240 hours)
  - Radar (Heymsfield/GSFC)
  - Microwave Radiometers (Lambrigtsen/JPL)
  - Dropsondes (NOAA)
  - Electric Field (Blakeslee/MSFC)
- Geosynchronous Orbit Simulation
- **DC-8** (4-engine jet) (120 hours)
  - Dual frequency precipitation radar (Durden/JPL)
  - Dropsondes (Halverson/UMBC), Variety of microphysics probes (Heymsfield/NCAR)
  - Lidars for 3-D Winds (Kavaya/ LaRC) and for high vertical resolution measurements of aerosols and water vapor (Ismail/ LaRC)
  - In-situ measurements of temperature, moisture and aerosols (Bui/ARC)
- Six to Eight week deployment centered on September 1, 2010

  RED= IIP, GREEN= IIP+AITT



Blue line: DC-8 range for 12-h flight, 6 h on station

Red lines: GH range for 30-h flight with 15 and 22.5 h on station

Light blue X: Genesis locations for 1940-2006

Operation Ice Bridge Mission

ICESat data continuity using airborne science: 2009-2015

Operation Ice Bridge, a six-year NASA field campaign, is the largest airborne survey of Earth's polar ice ever flown. It will yield an unprecedented three-dimensional view of Arctic and Antarctic ice sheets, ice shelves and sea ice.

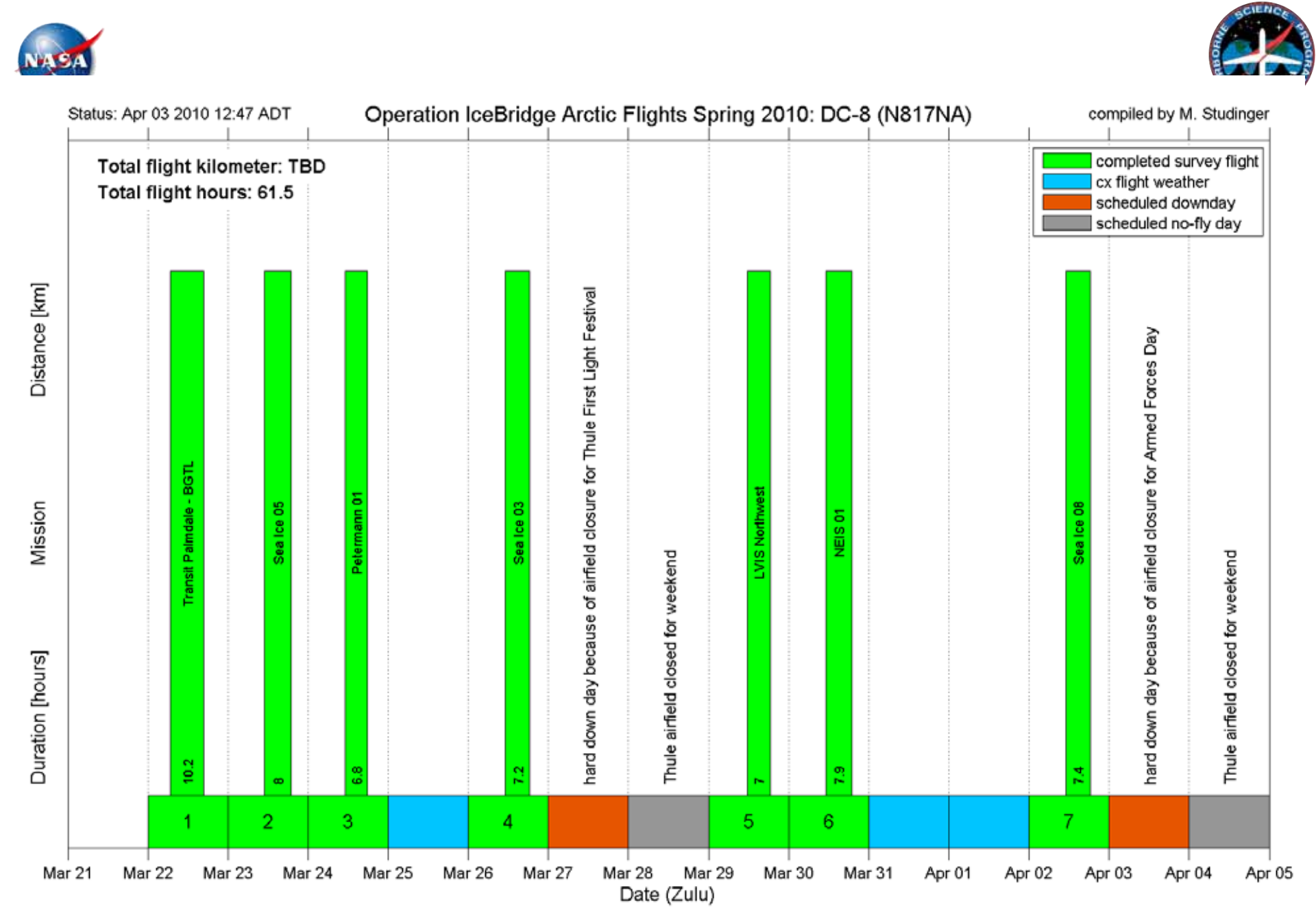
Operation Ice Bridge

OIB Spring 2010 DC-8 Flight Hours

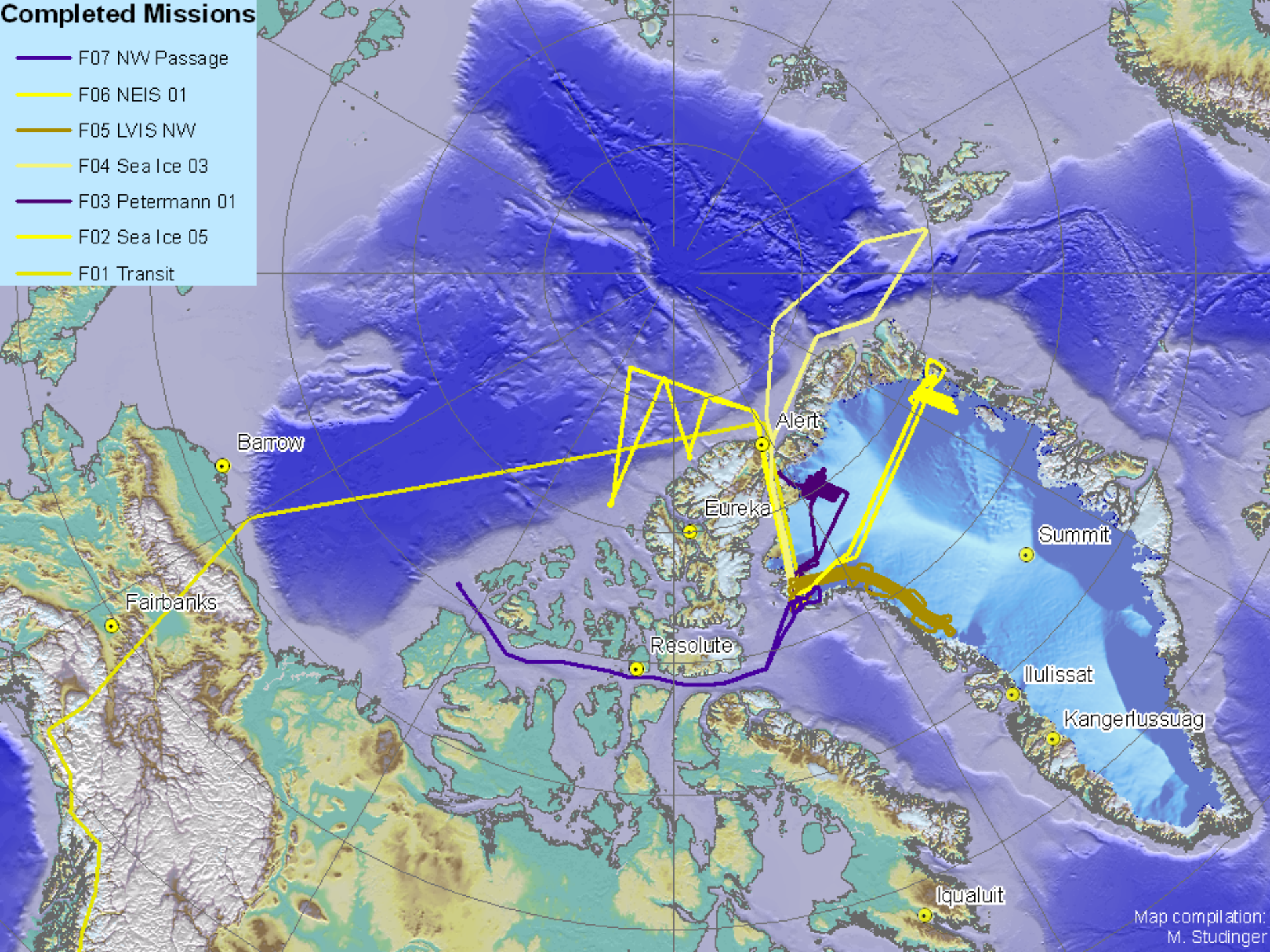
Summary of Flight Hours	
Approved Flight Hours	**125.0**
Remaining Flight Hours	63.5
Remaining Science Hours	49.5
Planned - Actual	1.3
TOTAL FLIGHT HOURS	**61.5**

Date	Mission Details				Flight Details			
	Takeoff	Landing	Purpose	Flight No	Flight Number	Flight Req. #	planned	actual
15-Mar-2010	Palmdale	Palmdale	payload shakedown	T01	100201	108013	1.2	1.2
17-Mar-2010	Palmdale	Palmdale	payload checkout	T02	100202	108013	5.8	5.8
22-Mar-2010	Palmdale	Thule	transit DAOF - BGTL	F01	100203	108013	9.6	10.2
23-Mar-2010	Thule	Thule	Sea Ice 05	F02	100204	108013	7.6	8.0
24-Mar-2010	Thule	Thule	Petermann 01	F03	100205	108013	7.4	6.8
26-Mar-2010	Thule	Thule	Sea Ice 03	F04	100206	108013	7.5	7.2
29-Mar-2010	Thule	Thule	LVIS Northwest	F05	100207	108013	8.2	7.0
30-Mar-2010	Thule	Thule	NEIS 01	F06	100208	108013	7.6	7.9
02-Apr-2010	Thule	Thule	Sea Ice 08	F07	100209	108013	7.9	7.4

updated April 4, 2010



updated April 4, 2010


Completed Missions
F07 NW Passage
F06 NEIS 01
F05 LVIS NW
F04 Sea Ice 03
F03 Petermann 01
F02 Sea Ice 05
F01 Transit
Barrow
Alert
Eureka
Summit
Fairbanks
Resolute
Ilulissat
Kangerlussuag
Iqualuit
Map compilation:
M. Studinger

WB-57 Gross Weight Increase

- Weight increase driven by need for more endurance with heavier payload (to include ER-2 Superpods)
- Supported by multi-year landing gear upgrade
- Certifying aircraft to 72,000 lbs maximum gross weight
  - Up from 63,000 lbs (14% increase)
- Certifying new configurations (those including Superpods)
- Certified the payload bay to 5,000 lbs (up from 4,000 lbs)
- Total payload capability now just under 8,800 lbs
- Weight increase enables almost any payload weight without off-loading fuel
- All ground and flight tests complete
  - In process of certifying aircraft for operations

Student Airborne Research Program 2009

SARP's Objectives

- Inspire students to pursue STEM disciplines.
- Develop next generation of Earth System Scientists—with fresh research ideas.
- Demonstrate integration of science, engineering, and operations in major missions.
- Expose students to NASA programs.

SARP 2009 Research Topics

- **Evapotranspiration, Central Valley**
  Dr. Susan Ustin, UC Davis
- **Air Quality, Central Valley**
  Dr. Don Blake, UC Irvine
- **Algal Blooms, Monterey Bay**
  Dr. John Ryan, MBARI

50 applications for admission

Student Profile: **18 Female/11 Male**

Average GPA: **3.60**

Academic Disciplines:

Earth Sciences	41%
Atmospheric Science	21%
Engineering	17%
Chemistry, Physics, Biology	17%

26 Universities from 20 states

5 week program: **7/12/2009-8/13/2009**

- The program concluded with the students presenting their research results in formal presentations
- In addition the top 3 student presentations were given at the NASA booth during the Fall AGU meeting in San Francisco
- All of the lectures and student presentations were videotaped and are available on the internet

SARP used the DC-8 for two 6-hour data flights

Instruments employed were:

- **MASTER** for remote sensing of algal blooms and agricultural processes
- **Whole Air Sampler (WAS)** for in situ gas sampling

SARP 2009 Facebook page 84 fans that follow SARP 2009

http://www.facebook.com/#!/pages/Student-Airborne-Research-Program-SARP-2009/61457681433?ref=ts

SARP 2009 Website

http://www.nserc.und.edu/learning/SARP.html

NSERC
National Suborbital Education and Research Center
UND THE UNIVERSITY OF NORTH DAKOTA

Student Airborne Research Program 2010

NASA Opportunity for Student Airborne Research

NASA seeks highly motivated advanced undergraduate and early graduate students for participation in a summer 2010 research program in Earth system science using its DC-8 flying laboratory. The Student Airborne Research Program (SARP), is managed by the National Suborbital Education and Research Center (www.nserc.und.edu).

Students will acquire hands-on research experience in all aspects of a scientific campaign, using a major NASA resource for studying Earth system processes, calibration and validation of space-borne observations, and prototyping instruments for possible satellite missions. Students will operate instruments onboard the DC-8 aircraft to sample atmospheric gases and to image land and water surfaces in multiple spectral bands.

Applicants should have a strong academic background in disciplines relevant to the Earth system, including the physical, chemical, or biological sciences, or engineering.

Eligibility requirements include full-time student status at an accredited U.S. college or university. Women and minorities are strongly encouraged to apply. Successful applicants will be awarded a stipend for participation in the 6 week program in Southern California for classroom, laboratory, and aircraft experience. NSERC will provide travel to and from California and living expenses while in California.

Application materials should include:

- 2 page personal statement describing the student's interests in pursuing research in the Earth sciences and other special qualifications.
- Letter of recommendation from a professor or advisor familiar with the student's abilities.
- Official undergraduate and/or graduate transcripts.

Selection criteria will include:

- Excellent academic performance
- Promise for contributing to nation's future workforce as judged by career plans
- Evidence of interest in Earth system science and hands-on research
- Geographic, gender and ethnic diversity
- Ability to perform in teams

DEADLINE FOR APPLICATIONS IS MARCH 16, 2010

Submit by mail to:
Rick Shetter, NSERC Director
Center for People and the Environment, University of North Dakota
4149 University Avenue, Stop 9011
Grand Forks, ND 58202-9011

Or submit electronically to:
r.shetter@nserc.und.edu

More information can be found at http://www.nserc.und.edu/learning/SARP, or by telephoning Mr. Shetter at (701) 330-2126.

Dr. Rowland with student

110 Applications for admission

Student Profile:	**15 Female/14 Male**
Average GPA:	**3.67**
Academic Disciplines:	
Earth Sciences	**35%**
Atmospheric Science	**14%**
Engineering	**17%**
Chemistry, Physics, Biology	**31%**

25 Universities from 18 states

6 week program: **6/20/2010-7/30/2010**

SARP 2010 Research Topics

- **Evapotranspiration, Central Valley**
  Dr. Susan Ustin, UC Davis
- **Air quality effects of dairies, Central Valley**
  Dr. Don Blake, UC Irvine
- **Kelp growth and biomass, Pacific Ocean**
  Dr. Raphael Kudela, UC Santa Cruz

SARP on the DC-8 for two 6-hour research flights

Instruments will be MASTER, WAS, and DMS
In addition, four ASCENDS CO_2 instruments will piggyback

SARP 2010 Facebook page **54 fans of SARP 2010 already**
http://www.facebook.com/#!/pages/Grand-Forks-ND/SARP-2010/299754969335?ref=ts

SARP 2010 Website
http://www.nserc.und.edu/learning/SARP2010.html

"NASA should support Earth science research via suborbital platforms: airborne programs, which have suffered substantial diminution, should be restored, and UAV technology should be increasingly factored into the nation's strategic plan for Earth sciences."
-- NRC Decadal Survey for Earth Science, 2007