

NSF Airborne Status: ICCAGRA, Stresa, Italy May 2009

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C-130Q



NRL P-3 and ELDORA Radar



CIRPAS T-O



Wyoming King Air



A-10 replacement for T-28 SPA



Gulfstream V



LC-130 Ski



NSF Sponsored Lower Atmospheric Observing Facilities

- NCAR Operated and Maintained
 - Ground based sounding systems
 - Deployable (S-POL) radar
 - Airborne instrument/sounding systems
 - Research aircraft – GO/CO (restrictions per 41 CFR 102-33, "Management of Government Aircraft")
- Aircraft supported through Cooperative Agreements at the University of Wyoming (King Air)
- Interagency and International Facilities
 - Campaigns conducted in collaboration with partners, e.g., NOAA, NASA, NRL, DOE, UK Met Office, CNES, DLR



NSF has two Separate Programs that own Federal Aircraft

- The G-V and C-130 aircraft operated and maintained by the National Center for Atmospheric Research (NCAR), a NSF FFRDC, for the Division of Atmospheric Sciences
 - These aircraft operate as Public Use in the United States, and now internationally as State aircraft
- LC-130 aircraft maintained and operated by the NY ANG 109th Airlift Wing for the Office of Polar Programs (Antarctica and Greenland). As military operated aircraft they are not managed per 41CFR 102-33
- The University of Wyoming King Air is a state owned aircraft

Airborne Platforms

- Most expensive of the facilities to deploy (entire deployment pool funding is on the order of \$5M per year) – with exception of NSF ship fleet
- Typical deployment (2-8 weeks) requires \$100K – 2.5M
- Observing Facilities Assessment Panel (OFAP) meets semi-annually to provide guidance on experimental design (flight hours, proper suite of instruments, as well as other facilities)
- Will be applying for the ICAP Gold Standard in Aviation
 - Voluntary self certification program by individual civilian agencies
 - ARMS (Aircraft Resource Management Survey) required
 - Agencies committed to Federal aviation safety by implementing and actively supporting the ICAP Safety Standards Agreement, the Guidelines, and adhering to 41 CFR 102-33



NSF LC-130 ski plane Maintained and Operated by ANG109th Military Tail Numbers



A Navy C-130 is undergoing tests of the NP2000 propeller system (8 bladed). If sufficient increased thrust is realized then the objective is to remove JATO assist from LC-130s. The annual cost savings would be significant, ~\$7M.



NP2000 Propeller System



NP2000 8 bladed propellers and electronic propeller controls – in testing

Advantage: more thrust, some fuel savings, much less vibration (crew and instruments), low maintenance

GV has completed several major science missions, **T-REX**, Terrain Induced Rotor Experiment, **PACDEX** (Pacific Dust) mission, **GISMOS** (GPS Multistatic and Occultation Instrument for Atmospheric, Oceanographic and Land Remote Sensing), **START-08** (Strat-Trop Analyses of Regional Transport) and just completed the first of several **HIPPO** (HIAPER Pole to Pole) missions. Shortly will be an atmospheric electrification mission, **SPRITE SPECTRA**, and **ADELE**, a study to examine electron runaway breakdown in thunderstorms. In addition scheduled are numerous FAA certification flights for the large underwing pods.



NSF C-130Q

Highly modified, re-engined
medium altitude, large payload
platform



Plan to fund an avionics modernizations program for the aircraft;
estimated cost \$6.5M (consistent with NexGen)

2008 Deployments

2008 Planning Chart													
NCAR / EOL Research Aviation Facility													
Aircraft	Project Location PI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
C130													
Approved	VOCALS (Chile) Wood								1	1	15	20	1
	Maintenance Schedule (JeffCO)		PKG 8	PKG 1	PKG 2	PKG 3	PKG 4						4 yr Insp prep
GV													
Approved	Pre-HIPPO (JeffCO) Wofsy				15	1	18	28	10			15	
Approved	START-8 (JeffCO) Atlas & Pan		15	1	21	18	1						
required	HEFT - 2 "GISMOS" (JeffCO)	1	22	6									
	Large Wing Pod (JeffCO)			design	design	fab.	fab.	fab.	fab.	GVT 1	30		
	Maintenance Schedule (JeffCO)								24 Month Inspect		ANNUAL	1	15
P3													
Approved	T-PARC (Japan) Parsons						9	1	30	15			

C-130 successfully completed several major campaigns over the last 18 months.

These include:

PASE – The Pacific Atmosphere Sulfur Experiment, Christmas Island

ICE-L – flown out of RMMA

VOCALS – VAMOS Ocean-Cloud-Atmosphere-Land Study, Arica, Chile (multi-agency and multi-national (DOE G-1; UK Bae146; DLR Falcon, NOAA Ron Brown))

C-130 will undergo major inspection this spring

After the inspection possible Avionics modernization to meet anticipated SMS and NexGen requirements and then upload to next major campaign, **PLOWS**, Profiling of Winter Storms.



C-130 during PASE field project Christmas Island

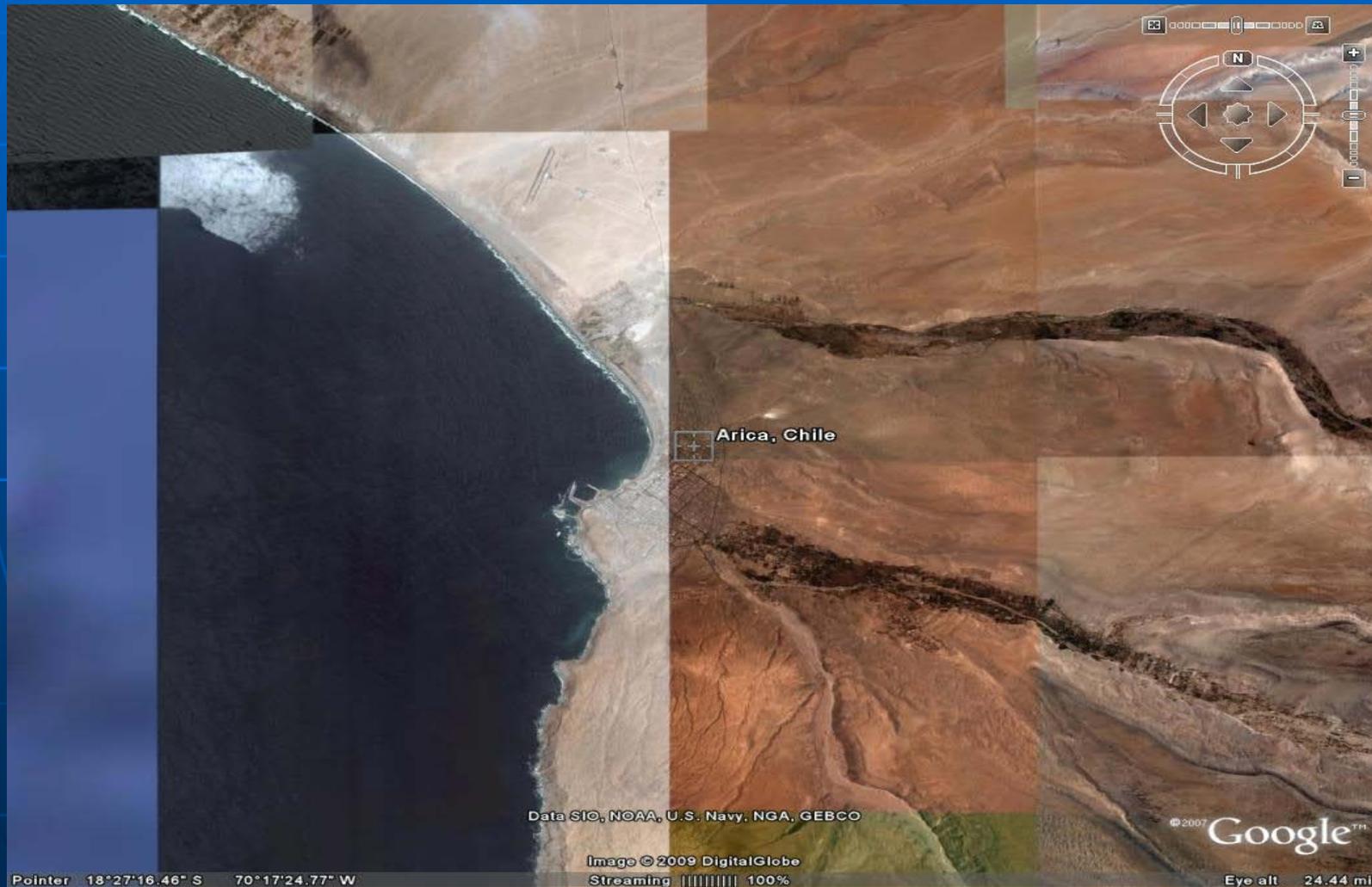


Kiritimati (Christmas Island)



Arica, Chile

Primary site for VOCALS



2009 Deployments

2009 Planning Chart													
NCAR / EOL Research Aviation Facility													
Aircraft	Project Location PI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
C130													
Approved AJS/JBJ	PLOWS (US Mid-west) Rauber									15	-----	-----	-----
Approved AJS	ASP Colloquim (JeffCO) Jensen / Lee					24 31	1 12 17						
	Maintenance Schedule (JeffCO)	4 yr Insp -----> prep	4 yr Insp -----> prep	-----	4 Yr Inspection	-----	-----	Instrument -----> restoration	PKG 7	PKG 8			
GV													
Approved PR / PR	HIPPO (Global) Wofsy	2 7 31	-----	10							10	-----	-----
required PR	HAIS HEFT - 3 (JeffCO)						1	-----	1 21 31				
required DCR / PR	Large Wing Pod Cert. (JeffCO/Sav)			GVT & SLT		FAA							
	Optical View Ports (JeffCO)			3 28	6	1 6 27							
required ML	Lightning Detection (California)										1 design	fab & test	19
required BO			9 28										
Approved AJS / JBJ	ADELE /SPRITE (Florida) Smith / Nielsen								1 15 31	-----	-----	1	
	Maintenance Schedule (JeffCO)									4 7	-----	-----	----->
										ANNUAL (6 weeks)			
P3													

2010 Deployments

		2010 Planning Chart											
		NCAR / EOL Research Aviation Facility											
Aircraft	Project Location PI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
C130													
Approved AJS / JBJ	PLOWS (US Mid-west) Rauber	----- 1 15	----- 28	----- 15									
	Maintenance Schedule (JeffCO)			PKG 1		PKG 2			PKG 3			PKG 4	
GV													
Approved TBD	HIPPO (Global) Wofsy			----- 10	----- 1 24 30				----- 10	----- 1 24 30			
request	GLIMPSE (Antarctica) Parish					----- 24	-----	-----	----- 1 31	----- 15			
request	PREDICT (St Croix) Davis						----- 23	-----	----- 1 15 31	----- 30	----- 10		
required	HEFT- 4 "HSRL" (JeffCO)	----- 1	----- 21 28	----- 1									
	Maintenance Schedule (JeffCO)							Gear Inspect (GAC)			24 Month & ANNUAL (6 weeks)	----->	
P3													



GPS Dropsonde



Deployment an issue
over land and congested
air routes

ICAO involvement

NRL P-3 and ELDORA

A new MOU between NSF and NRL to provide platform support until 2012 – involved in the large multi-agency, multinational August-September 2008 **T-PARC** campaign.



NSF sold its Electra (end of useful life) and modified the NRL P-3 to carry the large Eldora Radar

University of Wyoming King Air State Owned – NSF Funded



T-28 Storm Penetration Aircraft (Removed from Service 2003)

Maintained and operated by SDSMT
under a Cooperative Agreement with NSF



Performance was too limited for new
science requirements



A-10: Replacement for T-28 Storm Penetration Aircraft

Engineering evaluation by Zviko, Inc.



UASs

- Unpiloted Aerial Vehicle Systems will play an increasing role in ATM's research programs
- NSF will leverage its partner agencies (NASA, NOAA, DOE, DOD) to maximize return on investments
- NSF, and other agencies, have used UAS platforms to acquire critical research data (e.g., Alaska, Maldives, Galapagos) and NSF will continue to expand their use



NSF ATM's Support of Observational Science

- ATM provides a variety of observational tools to support NSF approved science proposals, and makes the facilities accessible to other agency PIs
- The cost of the deployment of the facilities is at no cost to the PI
- Approximately \$5M per year is allocated for the deployments (this is separate from funds for the science proposals)
- Most facilities are operated and maintained by NCAR, but several are maintained and operated by the university community as national facilities under cooperative agreements
- A major facilities assessment has been completed, but it is a living document and will be periodically updated
http://www.eol.ucar.edu/dir_off/FacAssess/NSF%20Facilities%20Assessment%20Final%20Report.pdf
- Increased interagency and international cooperation is planned (which will require a new paradigm for allocation of facilities)



Use of non-traditional facilities:
POST - Physics of Stratocumulus Tops
CIRPAS Twin Otter – Monterey, CA



An Assessment of Observational Research Facilities and Future Needs

- Activity funded by NSF and covered US agencies, private companies and some international partners
- On-going two year study the results of which recently released and available at
- Consisted of 8 subcommittees: airborne platforms; airborne measurements; in-situ surface and surface atmosphere exchange; surface based remote sensing; solar measurements; satellite data; emerging technology and data support
- Data base can be updated and new observational facilities inserted; data base maintained for NSF by NCAR
<http://www.eol.ucar.edu/fadb/resource>



Airborne Platform Example

- | Name | Resource Type | Description |
|--|-------------------|---|
| <u>Airborne Laboratory for Atmospheric Research (ALAR)</u> | Airborne Platform | The ALAR platform is a light twin engine aircraft, a Beechcraft Duchess, inst... |
| <u>ALTAIR NASA/NOAA</u> | Airborne Platform | Details to come shortly... |
| <u>Battelle G-1</u> | Airborne Platform | Gulfstream 159, pressurized turboprop. Typical research payload (instrumen... |
| <u>CIRPAS Twin Otter</u> | Airborne Platform | Twin engine, non-pressurized turboprop airplane, De Havilland model DHC-6-200. |
| <u>DeHavilland Twin Otter (DHC-6)</u> | Airborne Platform | The DeHavilland Twin Otter (DHC-6) is a highly maneuverable, high-winged, unp... |
| <u>DOE ARM Cessna</u> | Airborne Platform | |
| <u>DOE ARM Cessna</u> | Airborne Platform | Cessna 206 |
| <u>ER-2</u> | Airborne Platform | Operating at 70,000 feet (21.3 km) the ER-2 acquires data above ninety-five p... |
| <u>Helicopter Observation Platform (HOP)</u> | Airborne Platform | HOP is based on a Bell Jet Ranger 206B3 with a total available payload for sci... |
| <u>Ikhana</u> | Airborne Platform | A NASA MQ-9 Unmanned Aerial System (UAS) |
| <u>NASA WB57</u> | Airborne Platform | |



Battelle G-1 Example

Click on any entry and find:

- Airborne platform name : Battelle G-1
- Description : Gulfstream 159, pressurized turboprop.
Typical research payload (instruments + crew) 4000lb; typical duration four hours.
- Availability : Scheduled 4-12 months in advance.
- Request procedure : contact: RAFmanager@pnl.gov
- Web site : <http://www.pnl.gov/atmospheric/programs/raf.stm>
- Status : Operational
- References :
- Remarks :
- Responsible Contact
- Contact name : John Hubbe
- Institution : Battelle - Pacific Northwest Division
- Address : PO Box 999 Richland, WA 99352
- Telephone : 509-372-6134
- E-mail address : john.hubbe@pnl.gov URL
- Details: while not shown it includes specifications on aircraft operations, racks, data system, external pods, etc



Developing Issues that are affecting field campaigns national and international: the NSF experience

- Public vs. Civil aircraft operations
 - Re-write of AC 00-1.1 (government aircraft operations) to determine whether operations are civil or public within the territory of the US
- Designation of State aircraft status
 - Dept of State attorney in 2003 communicated with GSA/ICAP that they concurred with our position that NASA, NOAA, NSF scientific research flights to be State aircraft under the Chicago Convention
 - EUROCONTROL in 2004 stated Definition of State aircraft in Principle 1 that "only aircraft used in military, customs and police services shall qualify as State Aircraft."
 - "...to fully preserve the sovereignty of every State to define what State Aircraft are *within their national borders*."
 - Principle 3: "States shall ensure compliance with the above mentioned recommendations and investigate reports of incorrect claims."
 - Enforcement of policy could have significant implications for non-State Aircraft (non-certificated) operating internationally
 - Canada recently rejected State designation for our aircraft: "However, Canada recognizes only three classes of aircraft as "State" aircraft: these are Military, Police and Customs as these are the aircraft listed specifically in the Convention on International Civil Aviation (the Chicago Convention)." US Embassy, Ottawa, CA 3/30/09
- Travel – Federal travel; reporting of senior officials on board a federal a/c even if on board as a qualified non-crew member



Concluding Remarks

- NSF sponsors a number of research facilities that are available to an NSF funded PI(s) at no cost to deploy worldwide
- Deployment supports NSF funded science proposals (all sciences eligible)
- Facilities available to other agencies at reimbursable cost and non-interference basis
- Facilities mix is changing in response to science initiatives and on-going facilities assessment
- *Planning charts* and *"how to request facilities"* are on line on new NCAR/EOL web site
(<http://www.eol.ucar.edu/about/our-organization/fps>)

