



National Aeronautics and Space Administration

Airborne Science Newsletter



Winter 2012

Editors Note: In this edition of the ASP newsletter, we are featuring articles detailing two recent missions sponsored by NASA's Hands-On Project Experience (HOPE) program: the Development and Evaluation of satellite ValidatiOn Tools by Experimenters (DEVOTE) pg. 2, and The Coastal and Ocean Airborne Science Testbed (COAST) Project, pg. 3. Team members are featured in "Spotlight On" (pg. 4), as well. Find out what these two teams managed to achieve in an incredibly short period of time.

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In Brief ...

WRAP completes Western States Fire Missions

The Wildfire Research and Applications Partnership flew the final western states 2011 fire missions in October, acquiring a three-day series over an instrumented controlled burn near San Jose, CA. The DFRC B-200 (N801) carrying the Autonomous Modular Sensor (AMS) obtained a unique fire radiative power data set observing the fire progression over five hours, as well as pre- and post-fire conditions.

Contributed by Steve Wegener

ATTREX Integration and Science Flights on the Global Hawk

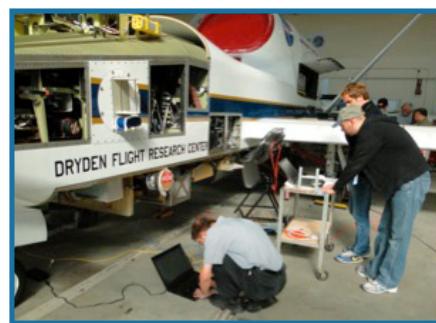
The Airborne Tropical Tropopause Experiment (ATTREX) Science Team was onsite at DFRC during Fall 2011 for instrument integration and a series of science flights in the tropical region of the Pacific Ocean. This activity included the mechanical and electrical integration of the eleven ATTREX instruments on the aircraft, demonstration of the science data gathering capability of the instruments as the aircraft flew within the Pacific tropical tropopause, and data from the aircraft systems and fuel temperatures while flying in the coldest temperatures ever experienced by a NASA Global Hawk.

The ATTREX instrument suite includes six instruments (CPL, MMS, MTP, UCATS, ULH and Ozone) that have previously flown on Global Hawk missions. In addition, five ATTREX instruments have not previously flown on Global Hawk (AWAS, DLH, SSRF, Mini-DOAS, and FCDP). This eleven-

instrument configuration is the largest and heaviest payload suite ever flown on a NASA Global Hawk. In addition to normal aircraft systems, special temperature sensors were flown in various aircraft locations to assist with the documentation of the temperature profiles on the aircraft, which will support planned engineering efforts in 2012 prior to the next series of ATTREX flights.

During the 2011 ATTREX science flights, several "firsts" for the NASA Global Hawk Project were accomplished, as well as the 50th flight of a NASA Global Hawk. Among the firsts were: lowest latitude ever flown, largest number of vertical profile maneuvers conducted during a single flight, first use of low-freeze point fuel, first in-flight re-tasking of the payload data telemetry Ku System to a different satellite transponder, and the first re-filing of a flight plan with the FAA while conducting a mission. The science data collected during the three long duration Pacific flights included numerous profiles through the tropical tropopause layer, sampling of in-situ cirrus, convective detrainment, numerous jet crossings, and a comprehensive dataset for evaluating fuel temperature response to very cold ambient tropopause temperatures.

Contributed by Chris Nafte



ATTREX Instrument Integration.



Global Hawk Project Team and ATTREX Science Team.

DEVOTE

*A NASA Hands-On Project Experience:
East Coast*

Scientists at NASA's Langley Research Center recently completed flights for their latest science mission, DEVOTE, a hands-on training initiative that not only provided early-career and career-transitional scientists and engineers with mission experience, but also produced data on the characteristics of clouds and particles in the Earth's atmosphere.

As part of the NASA Hands-On Project Experience (HOPE) program, the Development and Evaluation of satellite ValidatiOn Tools by ExperimenterS (DEVOTE) involved 16 scientists and engineers to a project that would take a full mission lifecycle of many years and completed in just 15 months. DEVOTE team members received high-impact, on-the-job training in aircraft-based atmospheric research. Every aspect of the mission process was completed, from the proposal and project management, to executing flights, data analysis, and data archival.

While in training, DEVOTE team members had specific science objectives such as incorporating a complex suite of instruments onto an aircraft along with developing and integrating a novel, in situ sensor. This instrument suite included the Langley Aerosol Research Group Experiment (LARGE), Diode Laser Hygrometer (DLH), and the Polarized Imaging Nephelometer (PI-Neph). The suite, placed on the NASA Langley B200 aircraft, frequently measured sources of natural and anthropogenic aerosols at relatively low cost. On the NASA Langley UC-12, DEVOTE scientists placed High Spectral Resolution Lidar (HSRL) and the Research Scanning Polarimeter (RSP). Together, the two aircraft flew in coordinated flight patterns to evaluate the measurements and associated retrievals from the remote sensors, and to gain a richer perspective of atmospheric aerosol properties. The UC-12 typically flew level at 28,000 ft, while the B-200 flew coordinated patterns below the UC-12, sampling aerosols at altitudes from 50 to 15,000 ft.

Over the course of the mission, the DEVOTE team executed 11 coordinated flights, including local flights from NASA Langley Research Center and Jackson, Mississippi, to sample agriculture biomass burning. Flights from Groton, Connecticut, sampled the

Director's Corner



and execution of Operation Ice Bridge Antarctic, the crews (sorry, too many to name in my short space!), and ESPO (Kent Shiffer and Jhony Zavaleta). As always, feel free to contact me directly with any comments, concerns, and ideas about the Airborne Science Program, and be safe in this new year.

*Bruce Tagg
Airborne Science Program Director*

urban pollution near Boston, Massachusetts. DEVOTE scientists strategically planned these flight paths over ground-based measurement sites and along satellite ground tracks to evaluate and improve the next generation of Earth-observing satellites. DEVOTE helped scientists evaluate data generated from the current Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite mission, which measures the properties of clouds and particles in the atmosphere.

The coordinated flights will also help scientists as they prepare for the Aerosol-Cloud-Ecosystem (ACE) decadal survey mission, which will examine the interaction between

clouds and particles in the atmosphere more comprehensively than other satellite programs. Scientists will use a similar combination of a lidar and polarimeter on the ACE satellite as were used for DEVOTE. Demonstrating the compatibility of these instruments through the DEVOTE flights is strategically aligned with laying the groundwork for ACE and future NASA satellite programs.

For more information and data from the DEVOTE mission, visit <http://science.larc.nasa.gov/devote/> or contact the DEVOTE PI, Dr. Johnathan Hair (jonathan.w.hair@nasa.gov).

Contributed by Bruce Fisher

Call for Content

Working on something interesting, or have an idea for a story? Please let us know, we'd love to put it into print.

Contact Steve Wegener (650/604-6278, steven.s.wegener@nasa.gov) or Matt Fladeland (650/604-3325, mattew.m.fladeland@nasa.gov).



The DEVOTE team gave their close-out presentation to NASA Headquarters in December 2011.

HS3 Integration and Test Flights on the AV-6 Global Hawk

The Hurricane and Severe Storm Sentinel (HS3) team conducted three test flights this summer in preparation for their 2012-2014 deployments. Two Global Hawks (GH) will be used for HS3, the first for over storm observations (AV-1) and the second for sampling the storm's environment (AV-6). This summer, the AV-6 was integrated and test flights were conducted.

HS3 flew two instrument configurations on AV-6. First, the AV-6 2012 suite (Scanning High-resolution Interferometer Sounder (S-HIS), Cloud Physics Lidar (CPL) and the Advanced Vertical Atmospheric Profiling System (AVAPS/dropsondes) was on a 6-hour range flight (September 1). CPL was then replaced with the High-Altitude MMIC Sounding Radiometer (HAMSR), and the GH performed



a 23-hour flight (Sept. 8-9) over the Central Pacific to compare observations between HS3 instruments. This was important because HAMSR will fly on AV-1 while S-HIS and AVAPS will be on AV-6 during future missions. The final flight (Sept. 13-14) was coordinated with the NOAA G-IV over the Gulf of Mexico with 26 coincident dropsonde launches. All science instruments performed well, and HS3 is now ready for its first deployment to Wallops Island in August-September 2012.

Contributed by Marilyn Vasques

OIB Fall 2011

Operation IceBridge again took place out of Punta Arenas, Chile. The mission this year included the NASA DC-8 as well as the NSF G-V. A total of 35 flights originated from Punta Arenas with the NASA DC-8 performing 24 successful flights over the Antarctic continent and surrounding sea-ice in the 40 days on station. The NSF G-V aircraft, flying the LVIS altimetry instrument, completed 11 successful science flights in its 25 days on station. Typically weather is the greatest factor in gathering data over and around Antarctica but with the excellent flight planning for both the platforms, this year proved to be a major success all around, including the discovery of a crack in the ICE.

The new rift was discovered on an early IceBridge mission over Pine Island Glacier. Analysis of satellite images indicates that

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COAST

A NASA Hands-On Project Experience: West Coast

The Coastal and Ocean Airborne Science Testbed (COAST) Project is a NASA Earth-science flight mission that advances coastal ecosystems research and ocean color calibration and validation capability by providing a unique airborne payload optimized for remote sensing in the optically complex coastal zone. The first COAST mission took place October 21-28, 2011 over Monterey Bay, successfully culminating the NASA Hands-On Project Experience (HOPE) project at Ames Research Center. Liane Guild (PI), Jennifer Dungan (PM), and Maryland Edwards (PSE) executed the first of it's kind airborne mission by successfully integrating and flying simultaneously three instruments in the testbed; the AATS sunphotometer (Phil Russell, lead, NASA Ames), Headwall imaging spectrometer (Jeff Myers, lead, NASA Ames Airborne Sensor Facility), and the first flight of the C-AIR radiometers (John Morrow, lead, Biospherical Instruments, Inc.). Raphe Kudela, UC Santa Cruz, lead the in situ measurements from the Research Vessel John Martin stationed in Monterey Bay, CA. The COAST mission obtained ocean/coastal/



The COAST team on the final day of the mission.

atmosphere data simultaneously in flight and coincident with measurements from MODIS and MERIS satellite sensors, in addition to in situ measurements from the R/V John Martin and from a small set of ground calibration sites in Aptos and Watsonville, CA. Kudela leads the COAST cal/val effort relating field and airborne measurements with satellite data.

The imaging spectrometer (Headwall) is optimized in the blue region of the spectrum to emphasize remote sensing of marine and

freshwater ecosystems. Simultaneous measurements supporting empirical atmospheric correction of image data was accomplished using the Ames Airborne Tracking Sunphotometer (AATS-14). Based on optical detectors called microradiometers, the NASA Ocean Biology and Biogeochemistry Calibration and Validation (cal/val) Office team has deployed advanced commercial off-the-shelf instrumentation that provides in situ measurements of the apparent optical properties at the land/ocean boundary including optically shallow aquatic ecosystems (e.g., lakes, estuaries, coral reefs). A complimentary microradiometer instrument package, Coastal Airborne In situ Radiometers (C-AIR, Biospherical Instruments, Inc.), developed for COAST for airborne campaigns from field-deployed microradiometer instrumentation, provided measurements of apparent optical properties at the land/ocean boundary including optically shallow aquatic ecosystems.

Contributed by Liane Guild



Spotlight On

NASA HOPE Project Teams, COAST and DEVOTE



The NASA Langley UC-12 aircraft served as the remote sensing platform during DEVOTE, which carried the HSRL and the RSP.



DEVOTE scientist, Luke Ziembra, monitoring LARGE during one of the mission flights.



The NASA Langley B-200 aircraft was an *in situ* sensing platform containing LARGE, DLH, and the Polarized Imaging Nephelometer (PI-Neph).



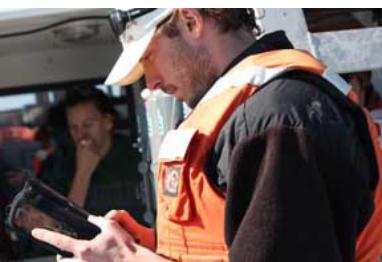
Above: Misty Blakely and Anna McGaraghan (UCSC) prepare to launch an optical instrument package measuring hyperspectral scattering and absorption as well as salinity, temperature, and depth from the R/V John Martin in Monterey Bay during COAST. Below: Mike Jacox (UCSC) uses a handheld sunphotometer to measure aerosol optical depth and water vapor at the air-sea interface.



Roy Johnson and Michael Soulage during a fit check of the AATS at CIRPAS hangar prior to the start of the COAST mission.



John Livingston cleans the AATS located in the zenith port of the CIRPAS Twin Otter after a COAST mission flight.



Raphe Kudela (UCSC), Maryland Edwards (COAST System Engineer), Liane Guild (COAST PI), and John Morrow (Biospherical Instruments) meet post-mission to discuss that day's collection of data.



Brad Lobitz (CSUMB) and George Scheer (UCD) use a field spectroradiometer to gather ground truth data at Rio Del Mar beach.

NASA SMD ESD Airborne Science Program 6-Month Schedule

FY12		Jan	Feb	Mar	April	May	June
ER-2	806	AirMSPI MR-TCDL	MR-TCDL CATS, etc.	RSP/ICE CATS, etc.	Pilot Prof Transit	MABEL Greenland	AVIRIS LAC
	809	Phase Inspection				eMAS LAC AVIRIS EXRAD	LAC SEAC4RS
G-III	30502	Sac Delta Hawaii Mexico	Sac Delta	Ops 1 & 3 Inspect & Maint.	Sac Delta	Mexico	
GH	871	KQX Envelope Expansion					
	872	KQX Envelope Expansion					
	873	Non-flyable Storage					
P-3	426	L R A D	Maint.	O I B	O I B	OIB SARP	SARP
DC-8	817	GCPX	GCPX	Maintenance	DC-3 Field Campaign	DC-3 Field Campaign	
WB-57	926	N926 Deploy MX Inspection		OCONUS			
	928	N928 Min. Ops Insp		ASMLS H2 Fit Chk	Autopilot I&T		

CATALOG		Jan	Feb	Mar	April	May	June
Ikhana (DFRC)	870						
B200 (DFRC)					Air SWOT		Air SWOT Alaska
B200 (LaRC)	529			OIB			
UC-12B (LaRC)	528						
Cessna 206H (LaRC)	504						
SIERRA (ARC)	707	Integration Surprise Val	AFSRB Test Fit Fault Det		Transit Cedar Key	SeaGrass Transit Tobago	SeaGrass Transit: Moffett
S-3B	601	Maintenance GLEAM					
LJ25 (GRC)	616	Maintenance	ALIST SOLARCELL	NAIMS Integ	NAIMS Test Flight	NAIMS DwnLd	Ferry GRC
T-34C	606						
Twin Otter (GRC)	607	AFRL CASH					
Viking 300 UAS (WFF)	Catalog						
Twin Otter (WFF)	Contract						
Twin Otter (JPL)	Catalog						

For an up-to-date schedule, see http://airbornescience.nasa.gov/aircraft_detailed_cal

ASP Upcoming Events

- * 50th AIAA Aerospace Sciences Meeting
Jan. 9-12, 2012; Nashville, TN
<http://aiaa.org/content.cfm?pageid=230&lumeetingid=1964>
- * 92nd American Meteorological Society Annual Meeting
Jan. 22-26, 2012; New Orleans, LA
<http://annual.ametsoc.org/2012/>
- * Combined Program in Arctic Regional Climate Assessment (PARCA) and Operation Ice Bridge Science Team Meetings
Jan. 25-27, 2012; GSFC, MD
http://bpvc.osu.edu/rsl/IST/index_files/January2012OIB.htm
- * AUVSI Unmanned Systems Program Review 2012
Feb. 7-9, 2012; Washington, DC
<http://www.auvsi.org/>
- * AGU Chapman Conference
Feb. 19-22, 2012; Hawaii
<http://www.agu.org/meetings/chapman/2012/acall/>
- * 2012 Ocean Sciences Meeting
Feb. 20-24, 2012; Salt Lake City, UT
<http://www.sgmeet.com/osm2012/>
- * IEEE Aerospace Conference
March 3-10, Big Sky Montana
<http://www.aeroconf.org/>
- * ASPRS Annual Meeting
March 19-23, 2012; Sacramento, CA
<http://www.asprs.org/Annual-Conferences/Sacramento-2012/>
- * 2012 National Hurricane Conference
March 26-29, 2012; Orlando, FL
<http://www.hurricanemeeting.com/default.htm>
- * 2012 HypsIRI Symposium
May 7-8, 2012; GSFC, MD
<http://hypsiri.jpl.nasa.gov/events/2012-hypsiri-symposium>
- * 2012 UAS Summit hovering over Grand Forks
May 22-23, 2012; Grand Forks, North Dakota
<http://www.auvsi.org>
- * Infotech@Aerospace 2012
June 19-21, 2012
Garden Grove, CA
<http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2607>
- * IGARSS 2012
July 22-27, Munich, Germany
Call for Papers is open: Abstracts are due by Jan. 12, 2012
<http://www.igarss12.org/CallForPapers.asp>

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Platform Capabilities

Available aircraft and specs



Airborne Science Program Resources	Platform Name	Center	Duration (Hours)	Useful Payload (lbs.)	GTOW (lbs.)	Max Altitude (ft.)	Airspeed (knots)	Range (Nmi)	Internet and Document References
Core Aircraft	ER-2	NASA-DFRC	12	2,900	40,000	>70,000	410	>5,000	http://www.nasa.gov/centers/dryden/research/AirSci/ER-2/
	WB-57	NASA-JSC	6	6,000	63,000	65,000	410	2,172	http://jsc-aircraft-ops.jsc.nasa.gov/wb57/
	DC-8	NASA-DFRC	12	30,000	340,000	41,000	450	5,400	http://nasa.gov/centers/dryden/research/AirSci/DC-8/
	P-3B	NASA-WFF	12	16,000	135,000	30,000	330	3,800	http://wacop.wff.nasa.gov
Gulfstream III (G-III) (mil: C-20A)		NASA-DFRC	7	2,610	45,000	45,000	459	3,400	http://airbornescience.nasa.gov/platforms/aircraft/g3.html
	Global Hawk	NASA-DFRC	31	1500	25,600	65,000	335	11,000	http://airbornescience.nasa.gov/platforms/aircraft/globalhawk.html
NASA Catalog Aircraft	King Air B-200 AND UC-12B	NASA-LARC	6.2	4,100	12,500	35,000	260	1250	http://airbornescience.nasa.gov/platforms/aircraft/b-200.html
	DHC-6 Twin Otter	NASA-GRC	3.5	3,600	11,000	25,000	140	450	http://www.grc.nasa.gov/WWW/AircraftOps/
	Learjet 25	NASA-GRC	3	3,200	15,000	45,000	350/.81 Mach	1,200	http://www.grc.nasa.gov/WWW/AircraftOps/
	S-3B Viking	NASA/GRC	>6	12,000	52,500	40,000	450	2,300	http://www.grc.nasa.gov/WWW/AircraftOps/
	Ikhana (Predator-B)	NASA-DFRC	30	3,000	10,000	52,000	171	3,500	http://airbornescience.nasa.gov/platforms/aircraft/predator-b.html
	SIERRA	NASA-ARC	11	100	445	12,000	60	550	http://airbornescience.nasa.gov/platforms/aircraft/sierra.html
	Cessna 206H	NASA-LARC	5.7	1,175	3600	15,700	150	700	http://www.nasa.gov/centers/langley/pdf/70892main_FS-2004-07-92-LaRC.pdf

Upcoming Events

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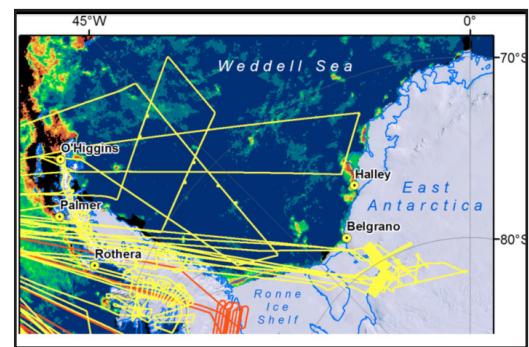
- * AUVSI North America Aug. 6-9, 2012; Las Vegas, NV Call for Papers is open: Abstracts are due by Jan. 13, 2012 <http://www.auvshishow.org/auvsi12/public/content.aspx?ID=786&sortMenu=103001>
- * SPIE 2012 Remote Sensing Conference Sept. 24-27, 2012; Edinburgh, UK Call for Papers is open: Abstracts due April 2, 2012 http://spie.org/x6262.xml?WT.mc_id=RERS12CE

OIB

(continued from page 3)

the new rift has formed between late September and early October. It is currently 80 meters wide on average and widening 2 meters per day. The size of the future iceberg is estimated to be 880 square km. IceBridge did the first ever airborne survey over a newly formed rift with detailed ice surface topography measurements from laser altimetry and high-resolution aerial photography supported by ice penetrating radar measurements. “The discovery was featured by many news media such as GMA NBC, CBS, CNN and more”, said Michael Studinger in his final mission report.

Flight reports for this past campaign as well as previous years can be found on



Flight line patterns for both the NSF G-V and the NASA DC-8 shows the extent of the science target area. Image provided by Michael Studinger.

the ESPO web site at: <http://www.espo.nasa.gov/oib/flightDocs.php>

Contributed by Kent Shiffer