



National Aeronautics and Space Administration

Airborne Science Newsletter



Summer 2013

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In Brief ...

SEAC4RS

The Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC4RS) mission is set to deploy to Ellington Field, Texas. SEAC4RS will include the NASA DC-8, ER-2 and be joined by the SPEC Learjet while at Ellington Field. Science flights will take place from August 6 through September 30 with as many as 300 total participants.

Contributed by Kent Shiffer

PROTEUS

NASA WFF has contracted for the use of the Scaled Composite's Proteus aircraft to support ICESat-2/MABEL science flights in Thule, Greenland and Hampton, VA. Flights will occur July 15 through August 22. A total of 96 flight hours is planned. Proteus is a high-altitude, long-duration platform. For this mission, flight altitude up to about 50,000 ft is planned.

Contributed by Mike Cropper

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Operation IceBridge 2013 Spring Arctic Campaign

From mid-March through early May 2013, Operation IceBridge (OIB) returned to the Arctic for a campaign of science flights out of bases in

Thule and Kangerlussuaq, Greenland, and Fairbanks, Alaska. Researchers aboard NASA's P-3B airborne laboratory gathered data on sea ice, ice sheets and glaciers in and around Greenland, the Arctic Ocean and off the north coast of Alaska.

During these flights, OIB measured changes in ice surface elevation, mapped bedrock beneath Greenland's ice sheet and glaciers, and produced a near real-time dataset of Arctic sea ice thickness. This new quick-look product uses data processing

techniques developed last year and aims to provide researchers producing seasonal sea ice forecasts with more up-to-date initial conditions for use in computer models.

During the first few weeks of the campaign, OIB flew surveys of Arctic sea ice from Thule Air Base in northern Greenland and Fairbanks, Alaska. Arctic sea ice has been the subject of increasing attention, especially following a record-breaking 2012 annual minimum and the appearance of several large cracks in Arctic ice in February of this year.

This year marks the second time OIB has deployed in Fairbanks. The transits between Greenland and Alaska give researchers data on

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Helheim Fjord in eastern Greenland seen from the NASA P-3B on the April 5, 2013 OIB survey flight. Helheim Glacier, one of the largest in Greenland, drains into the ocean through this fjord. Credit: NASA / Jim Yungel

In Brief (continued from page 1)

EVS-2

The final text for ROSES solicitation for Earth Venture Suborbital-2 proposals (Appendix A.30) was released on June 25. There are new dates and new text. Notices of Intent to propose are requested by November 8, 2013. The due date for full 35-page proposals is January 10, 2014. See final text and Frequently Asked Questions on the ROSES website Solicitation: NNH13ZDA001N-EVS2

Contributed by Susan Schoenung

AirMOSS flies from Costa Rica to Canada

Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) is an Earth Venture-1 mission flying a P-band synthetic aperture radar (SAR) on a Gulfstream-III aircraft operated by NASA's Johnson Space Center. The AirMOSS instrument is similar to the UAVSAR flown on the Dryden G-III aircraft, except it operates at a different wavelength (70 cm) compared to the L-band UAVSAR, which operates at 24 cm. The aircraft and instrument are shown in Figure 1.

The AirMOSS experiment is designed to minimize one of the largest components of uncertainty in net ecosystem carbon exchange (NEE) by measuring root zone soil moisture (RZSM) and its spatial heterogeneity.

NEE is a key parameter for the carbon cycle that describes the difference between net primary production (NPP), the rate of carbon uptake through photosynthesis, and ecosystem respiration, the rate of carbon release by soil and plant respiration. The current knowledge of NEE for North America has large uncertainties. AirMOSS will reach its goals by providing high-resolution regional observations of RZSM over nine major North American biomes (shown in Figure 2), and feeding the information to hydrologic and ecosystem models for estimation of NEE.

AirMOSS has recently flown over tropical forests in Costa Rica, boreal forests in Canada, and regions of California, Oregon, Oklahoma and Mexico. Extensive ground, tower, and

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Directors' Corner



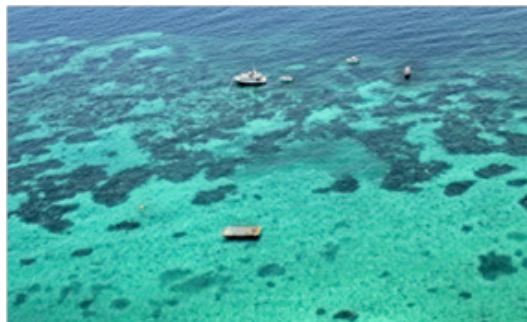
Welcome to the summer 2013, ASP Newsletter. I can't believe I've been here three years already, time flies when you are having fun, and I hope everyone is still having fun with Airborne Science. CARVE seems to be since they are up in AK now taking data and the GH is booked solid with ESTO and Earth Venture 1 work. DC-8 just finished up flying students for SARP and is getting ready for SEAC4RS, P-3 is in maintenance getting ready for Discover AQ, ER-2 just finished up flying for HypSPRI, checkouts of eMAS and getting ready for SEAC4RS, just to name a few. I'd also like to thank the folks at WFF and congratulate them on getting our newest addition to the ASP fleet, a C-130 with a 51 inch nadir port and working with ICESAT II for flights of MABEL in Greenland on Proteus. I look forward to another exciting summer, hearing about your ASP experiences, and I hope everyone stays safe over the summer months and gets a chance to enjoy some time off with family.

*Bruce Tagg and Randy Albertson
Airborne Science Program*

Sea Grass and Coral Reef UAS Project

Final deployment in Florida

The research goal of the NASA ROSES Seagrass/Coral Reef UAS Project involved testing the utility of UAS technology, particularly as it relates to assessments of change in seagrass and coral reef biomes. The team of investigators, led by Dr. Stanley Herwitz of the UAV Collaborative, completed experimental work in Florida in May. Detailed airborne and water-based datasets have been systematically collected from representative



Aerial view of Cheeca Rocks reef, the barge serving as the UAV launch pad, and the Project's associated research vessels

seagrass and coral reef sites on the Gulf Coast and in the Florida Keys. A total of 26 UAV flights involving 3 different UASs equipped with different multispectral and hyperspectral imaging payloads were completed over the past year.

The airborne data collection effort has featured four UAS deployments. Deployment #1 in May 2012 featured the fixed-wing Bat-4 UAV operated by MLB Company. The Bat-4 was equipped with a Tetracam multispectral imaging system. Deployment #2 in October 2012 featured the fixed-wing SIERRA UAV operated by NASA Ames. Operating from the Key West Naval Air Station under an agreement with the U.S. Navy, the SIERRA acquired more than 320 gigabytes of data using a Galileo hyperspectral imaging system. Deployment #3 in November 2012

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OIB 2013

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sea ice conditions across the entire Arctic Basin and the flights over the Beaufort and Chukchi seas provide the research community with data on changes in this economically important region.

After a few weeks of sea ice flights, the mission moved south to Kangerlussuaq where researchers carried out surveys of the ice sheet and important outlet glaciers in the southern half of Greenland. One of these areas, the Jakobshavn Glacier, is one of the fastest changing areas in Greenland, draining about 10 percent of the ice sheet.

While in Kangerlussuaq OIB also hosted three high school science teachers—one each from the U.S., Denmark and Greenland. For two weeks the teachers lived and worked alongside OIB researchers, gaining a special insight into polar science. The teachers will take these lessons back into the classroom and design new lessons and materials for their students.

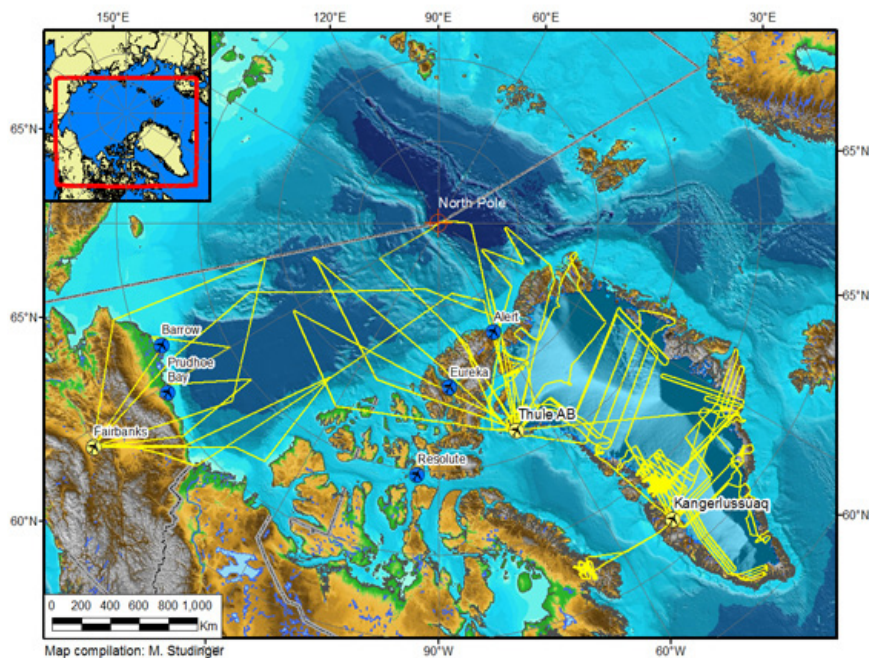
OIB finished out the campaign with a return to Thule, completing the campaign's remaining high-priority sea ice flights and surveying key

outlet glaciers in northern Greenland. These flights built on existing measurements from previous campaigns, filled in gaps in coverage and featured coordinated measurements with other research groups such as the European Space Agency's CryoSat-2 team.

In addition to giving teachers a behind-the-scenes look at science, IceBridge researchers also did live question and answer sessions with classrooms around the United States, reaching over 700 students. Using a custom web portal created by Airborne Science Program personnel at NASA Ames, classrooms were able to communicate through a text-based chat system via the P-3B's satellite communication system.

Later this year OIB will carry out a first-ever summer campaign in Greenland and fall science flights on the P-3B from Antarctica's McMurdo Station. The move from Punta Arenas, Chile, to McMurdo expands the mission's scientific reach to new parts of Antarctica.

*Contributed by
George Hale*



A map showing P-3B flight tracks for the 2013 OIB Arctic campaign. Credit: NASA / Michael Studinger

Seagrass/Coral Reef

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Vision II UAS carrying NovaSol hyperspectral imager

featured the Bat-4 equipped with the Tetracam operating in the area of Cedar Key north of Tampa.

Deployment #4 to the Florida Keys in May 2013 featured a jet-engine powered rotorcraft UAS named "Vision-II." (See illustration, page 4) This slow, low-flying platform was equipped with a downward-looking NovaSol hyperspectral sensor. Flight operations were carried out in two locations: one for the seagrass observations and a second, separate location for the coral reef observations. The seagrass measurements were conducted along the shoreline of Sugarloaf Key. Flight operations for the coral reef site were conducted from a floating barge strategically positioned offshore in the protected Cheeca Rocks marine sanctuary. A total of 12 successful morning and afternoon takeoff and landing sequences of the Vision-II were conducted at these two sites, with each flight sequence being 30-40 minutes in duration. The Vision-II acquired more than 500 gigabytes of data using the NovaSol hyperspectral imaging system.

The research achievement was the collection of high-resolution airborne spectral data using UAV-based hyperspectral and multispectral sensors in synchrony with intensive field measurements used to characterize current biological conditions. Information that increases our understanding of the spatial distribution and vigor of seagrass and coral are of particular interest. Analysis of the extensive datasets collected during all the phases of this

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TRANSITIONS

In Memorium

NASA's Airborne Science Program lost a pioneer and advocate on May 16th when Gary Shelton passed away at his home in Tucson, Arizona. Gary died from complications following Aortic Thoracic Aneurysm surgery. Gary's extended NASA family is saddened by his premature death.

Gary's career with NASA began in 1984 when he left a management position with the EPA in Las Vegas and joined the High Altitude Missions Branch at Ames Research Center. His responsibilities included oversight of the Applications Aircraft Data Facility and management of U-2 / ER-2 aircraft deployments. Gary was a very successful marketer for mapping programs supporting EPA, USFWS and USFS. NASA became the largest provider of aerial photography for the Forest Service for quite a while, covering many of the country's National Forests and the Appalachia's, including the gypsy moth mapping with the ER-2's specialized cameras.



Gary Shelton, 1941 - 2013

He knew more about aerial photography, from the technical to the business end, than anyone we've ever encountered. He set up a number of successful foreign deployments to difficult areas, including two to Brazil (SCAR-B in

1995 and TRMM in 1999) and the South African SAFARI in 2000. Gary had a knack for getting things done in third world countries. He always had a great way with people and personified the 'can-do' philosophy - the bigger the problem and the harder the challenge, the higher he rose to the occasion.

Gary moved with the Airborne Science aircraft to Dryden Flight Research Center in 1997 and ultimately became Director of the Dryden Airborne Science Program. Gary continued to support the Airborne Science Program in Washington, DC over the past decade under a contract with SAIC.

Gary was a remarkably accomplished individual who devoted his professional life to the goals of the American Society for Photogrammetry and Remote Sensing (ASPRS) for the betterment of the environment. He will be missed.

AirMOSS

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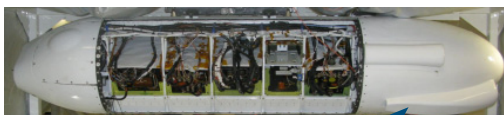
aircraft in-situ measurements are used to validate RZSM and carbon flux model estimates. AirMOSS measurements will conclude in August 2013.

The AirMOSS Level 1 radar imagery are produced at JPL and archived at the Alaska Satellite Facility (ASF). RZSM maps are produced at the University of Southern California, home institution of the AirMOSS Principal Investigator Mahta Moghaddam. Part of the RZSM products are also generated at JPL. These "snapshot" maps of soil moisture at the root zone are being assimilated into hourly estimates of RZSM by other members of the AirMOSS science

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AirMOSS FLIGHT SYSTEM

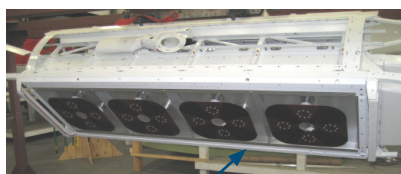
Backend electronics common to all radar frequencies



NASA Gulfstream-III



P-Band high-power amplifier in the nosecone



P-Band antenna



NASA SMD ESD Airborne Science Program 6-Month Schedule

SUPPORTED	July	Aug	Sept	Oct	Nov	Dec
DC-8	SEAC4RS Upl.	SEAC4RS: CONUS			OIB Antarctic	Potential ACCESS
ER-2 #806			AVIRIS/MASTER	AVIRIS/HYSPRI	HSRL HSRL Test	
ER-2 #809	SEAC4RS Upl.	SEAC4RS Houston Deployment				
G-III (D)	CA/CO Gulf Mexico			Cascade/Aleutian	CA Fault Lines	
G-III (J)	AirMOSS AirMOSS	AirMOSS	Deconfig Dir Rtn Recon AirMOSS	AirMOSS AirMOSS	Decon DRM	
G. Hawk #871	JAVSAR HS3 Upload		HS3 Deployment-Wallops	Dwnld GLISTEN Upload	GLISTEN Dwnld	
G. Hawk #872	Hawkeye Hawkeye	HS3 Upload	HS3 Deployment-Wallops	HS3 Dwnld		Aircraft Modification ATTRE
P-3	P-3 Avion Avion Up.	DISCOVER-AQ DISCVR	DISCOVER-AQ-Texas	OIB Upld	Operation Ice Bridge Antarctic	Maintenance
OTHER	July	Aug	Sept	Oct	Nov	Dec
UC-12	SLAP		DISCOVER-AQ	SLAP		
B200 (D)		FBOS				
B200 (L)			DISCOVER-AQ (TX)			
B200	Dynamo Photo Mzn					
C-130 Hercules		LVIS - Upload	LVIS LVIS Deploy.			
C-23 Sherpa	CARVE Phase 4	CARVE Phase 5	CARVE Phase 6	CARVE Ph7 Dwnld	Maintenance	
Cessna						
Falcon/HU-25C	AFRL GEO-TASO		GEO-TASO	NAVAIR Air-to-Air Radar	AFRL	ACCESS 2 ACES
Ikhana	DB-110 pod		UAS in the NAS			
Lear 25			NAIMS			
S-3B					Maintenance	
SIERRA	MIZOPEX Science Deployment		OCEANIA	OCEANIA		
T-34C		Maintenance				
T. Otter	Inspection					
UH-1			LADEE Range Survey	LADEE Range Survey	ORS3 Survey	
WB-57 #926						
WB-57 #928	Deployment					
COMMERCIAL AIRCRAFT						
Proteus	MABEL MABEL Gmland	MABEL Langley				
Twin Otter						

= Foreign Deployment
 = Stateside Deployment
 = Aircraft Modifications
 = Maintenance
 = Flight
 = Aircraft Configuration

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

AirMOSS

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team at the US Department of Agriculture (USDA) and NASA Goddard Space Flight Center (GSFC), which in turn are used by science team members at Harvard University to produce estimates of NEE, first over areas covered by the AirMOSS flights, but also scaled up to the entire north American domain. The final product of AirMOSS, which is a new estimate of NEE for north America with a quantified assessment of uncertainty, is expected at the end of the mission in 2015, with many intermediate products already delivered by the science team.

Contributed by
Mahta Moghaddam

Seagrass/Coral Reef

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mission is currently in progress, with results expected for publication within the next year. (This is one of three projects awarded by the Airborne Science Program as part of the "UAS-Enabled Earth Science" solicitation.)

Contributed by
Stan Herwitz

ASP Upcoming Events

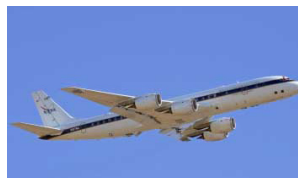
- * IGARSS 2013
Sun, July 21, 2013– Sat, July 27, 2013
Melbourne, Australia
www.igarss2013.org/
- * AUVSI North America "Unmanned Systems 2013"
August 12-15, 2013; Washington, DC
Registration is open
<http://www.auvsishow.org/auvsi13/public/enter.aspx>
- * AIAA Infotech@Aerospace 2013
August 19-22, 2013; Boston
<https://www.aiaa.org/Boston2013/>

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Airborne Science Program 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
ASP Supported Aircraft	DC-8	NASA-DFRC	12	30,000	340,000	41,000	450	5,400	http://airbornescience.nasa.gov/aircraft/DC-8
	ER-2	NASA-DFRC	12	2,900	40,000	>70,000	410	>5,000	http://airbornescience.nasa.gov/aircraft/ER-2
	Gulfstream III (G-III) (C-20A)	NASA-DFRC	7	2,610	69,700	45,000	460	3,400	http://airbornescience.nasa.gov/aircraft/G-III_C-20A_-_Dryden
	Gulfstream III (G-III)	NASA-JSC	7	2,610	69,700	45,000	460	3,400	http://airbornescience.nasa.gov/aircraft/G-III_-_JSC
	Global Hawk	NASA-DFRC	30	1900	25,600	65,000	345	11,000	http://airbornescience.nasa.gov/aircraft/Global_Hawk
	P-3B	NASA-WFF	14	14,700	135,000	32,000	400	3,800	http://airbornescience.nasa.gov/aircraft/P-3_Orion
Other NASA Aircraft	B-200 (UC-12B)	NASA-LARC	6.2	4,100	13,500	31,000	260	1,250	http://airbornescience.nasa.gov/aircraft/B-200_UC-12B_-_LARC
	B-200	NASA-DFRC	6	1,850	12,500	30,000	272	1,490	http://airbornescience.nasa.gov/aircraft/B-200_-_DFRC
	B-200	NASA-ARC/DOE	6.75	2,000	14,000	32,000	250	1,883	http://airbornescience.nasa.gov/aircraft/B-200_-_DOE
	B-200	NASA-LARC	6.2	4,100	13,500	35,000	260	1,250	http://airbornescience.nasa.gov/aircraft/B-200_-_LARC
	C-23 Sherpa	NASA-WFF	6	7,000	27,100	20,000	190	1,000	http://airbornescience.nasa.gov/aircraft/C-23_Sherpa
	Cessna 206H	NASA-LARC	5.7	1,175	3,600	15,700	150	700	http://airbornescience.nasa.gov/aircraft/Cessna_206H
	Dragon Eye	NASA-ARC	1	1	6	500+	34	3	http://airbornescience.nasa.gov/aircraft/B-200_-_LARC
	HU-25C Falcon	NASA-LARC	5	3,000	32,000	42,000	430	1,900	http://airbornescience.nasa.gov/aircraft/HU-25C_Falcon
	Ikhana	NASA-DFRC	24	2,000	10,000	40,000	171	3,500	http://airbornescience.nasa.gov/aircraft/Ikhana
	Learjet 25	NASA-GRC	3	3,200	1,500	45,000	350	1,200	http://airbornescience.nasa.gov/aircraft/Learjet_25
	S-3B Viking	NASA/GRC	6	12,000	52,500	40,000	450	2,300	http://airbornescience.nasa.gov/aircraft/S-3B
	SIERRA	NASA-ARC	10	100	400	12,000	60	600	http://airbornescience.nasa.gov/platforms/aircraft/sierra.html
	T-34C	NASA-GRC	3	500	4,400	25,000	75	700	http://airbornescience.nasa.gov/aircraft/T-34C
	Twin Otter	NASA-GRC	3	3,600	11,000	25,000	140	450	http://airbornescience.nasa.gov/aircraft/Twin_Otter_-_GRC
	WB-57	NASA-JSC	6	6,000	63,000	60,000+	410	2,500	http://airbornescience.nasa.gov/aircraft/WB-57

ASP Upcoming Events

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- * SPIE Remote Sensing 2013
September 23-26, 2013
Dresden, Germany
Call for papers is open: Abstracts due April 1, 2013
http://spie.org/x6262.xml?WT.mc_id=RERS13CE
- * 2013 NASA HypIRI Science Workshop,
October 15-17, 2013
Caltech, Pasadena, CA
Currently accepting abstracts
<http://hypiripl.nasa.gov/events>

- * Alaska Unmanned Aircraft Systems (UAS)
Interest Group Annual Meeting:
Anchorage, Alaska
October 22-23, 2013
Leonard.ligon@ataero.com

- * SMAP Cal/Val Workshop #4
November 5-8, 2013
Oxnard, CA

- * Unmanned Systems Canada 2013 Annual
Conference
Vancouver Canada
12 - 14 November 2013
<http://www.unmannedsystems.ca/>

- * TAAC UAS 2013 Conference
<http://taac.psl.nmsu.edu/>
9-12 December 2013
Santa Ana Pueblo, NM

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, matthew.m.fladeland@nasa.gov).