National Aeronautics and Space Administration

Airborne Science Newsletter

Spring 2014

What's Inside...

In Brief ...

GPM Launch

GPM launched successfully from Japan on February 27, 2014. First of five NASA Earth Science space missions scheduled for this year, GPM will provide an "unprecedented picture of our planet's rain and snow." Airborne Science will support GPM cal/val this spring/summer with the IPHEX mission, coordinated by Goddard Space Flight Center, Wallops Flight Facility, and numerous university partners. That campaign will use the NASA ER-2 as a platform for collection of microwave radiometer and radar remote sensing data that simulate the observations of the GPM mission. The ER-2 aircraft campaign will be coordinated with ground-based radar and hydrologic network observations and with cloud in-situ measurements conducted using the University of North Dakota Citation aircraft.

Contributed by Walt Petersen

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NASA's Global Hawk research aircraft returned to its base at NASA's Armstrong Flight Research Center at Edwards Air Force Base, Calif., early Friday morning March 14, marking the completion of flights in support of this year's Airborne Tropical Tropopause Experiment (ATTREX), a multi-year NASA airborne science campaign.

On Feb. 13, the autonomously operated aircraft began conducting science flights from Andersen Air Force Base on Guam in the western Pacific region on a mission to track changes in the upper atmosphere and help researchers understand how these changes affect Earth's climate.

Jim Podolske (NASA Ames) and Mario Rana (Science Systems and Applications, Inc.) check data recorded by the Diode Laser Hygrometer installed on the Global Hawk following the March 9 flight over the western Pacific Ocean. (NASA / Dave Fratello)

"The western Pacific region is critical for establishing the humidity of the air entering the stratosphere," said Eric Jensen, ATTREX principal investigator at NASA's Ames Research Center at Moffett Field, Calif.

ATTREX measures the moisture levels and chemical composition of upper regions of the lowest layer of Earth's atmosphere, a region where even small changes can significantly impact climate. Scientists will use the data to better understand physical processes occurring in this part of the atmosphere and help make more accurate climate predictions. Studies show even slight changes in the chemistry and amount of water vapor in the stratosphere can affect climate significantly by absorbing thermal radiation rising from the surface. Predictions of stratospheric humidity changes are uncertain because of gaps in the understanding of the physical processes occurring in the tropical tropopause layer.

ATTREX is studying moisture and chemical composition from altitudes of 45,000 to 60,000 feet in the tropical tropopause, Scientists consider the tropical tropopause

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In Brief *(continued from page 1)*

Spring 2014 OIB Underway

NASA's P-3 took off for Greenland on March 10 to begin OIB 2014 Arctic campaign. The first part of the campaign will focus on sea ice in the Arctic Ocean north of Greenland and in the Beaufort and Chukchi seas north of Alaska. As in the past two years, IceBridge will provide data on ice thickness to help sea ice researchers develop more accurate seasonal Arctic sea ice models. The remainder of the campaign will turn to measuring ice surface elevation and thickness at many of the Greenland Ice Sheet's outlet glaciers, channels of ice that flow from an ice sheet, constrained on its sides by bedrock. The surface elevation measurements taken by IceBridge's laser altimeter, the Airborne Topographic Mapper, will provide scientists data on how the ice sheet is changing and give a useful benchmark for ICESat-2. The Coherent Radar Depth Sounder, operated by the Center for Remote Sensing of Ice Sheets at the University of Kansas in Lawrence, Kan., will peer beneath the surface to collect the data on ice thickness and sub-ice terrain, internal layering in the ice sheet and snow depth. The P-3 research aircraft's extensive instrument suite features a new component this year –a spectrometer that measures ice albedo.

Directors' Corner

Greetings from NASA Headquarters.

Considering this is usually the "slow season" for aircraft operations, the program has been quite busy during the first quarter of the calendar year, as noted in the articles in this newsletter. We are coming off the heels of the first deployment of NASA's Global Hawk outside the United States in support of the ATTREX mission flying out of Guam. The mission was not without its challenges, but the team was able to accomplish several science flight missions in an effort to better understand water vapor transport into the Stratosphere. As I write, the P-3 is flying over Greenland and has already been to Alaska and back again in support of Operation IceBridge, as they observe sea ice build-up and provide more data for time series on glacier outflows. While the P-3 is in Greenland, the C-20A is flying out of Panama studying the Earth's surface – it's a small world for ASP. OIB, as well as the ongoing ER-2 support for the HyspIRI science team flying AVIRIS and MASTER, are examples of the direct support Airborne Science provides to satellite missions in formulation. We hope you enjoy this latest installment of our newsletter and as always, please send your comments and suggestions. For everyone's information, after this issue, and since we now have an up-to-date (usually) website with our current and ongoing work, we will be transitioning to a semi-annual publication of the ASP newsletter instead of every quarter.

Fly safe and I look forward to hearing about science results as we continue our mission to study the Earth.

Bruce Tagg and Randy Albertson
Airborne Science Program

NASA plans to launch the Hyperspectral Infrared Imager (HyspIRI) satellite -- a mission recommended by the 2007 National Academy of Sciences Decadal Survey -- to determine the spectral and thermal characteristics of the world's ecosystems. Prior to flying the sensors in space, however, preparatory science investigations are underway using similar sensor technology installed on NASA's ER-2, a high-altitude aircraft based at NASA's Dryden Aircraft Operations Facility in Palmdale, California. The HyspIRI Airborne Preparatory campaign is conducting a minimum of three seasonal flights over large geographic regions of California for a minimum of two years, 2013 and 2014.

For these campaigns, NASA is flying the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) and the MODIS/

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HyspIRI

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ASTER Airborne Simulator (MASTER) instruments on a NASA ER-2 aircraft to collect precursor datasets in advance of the HyspIRI mission.

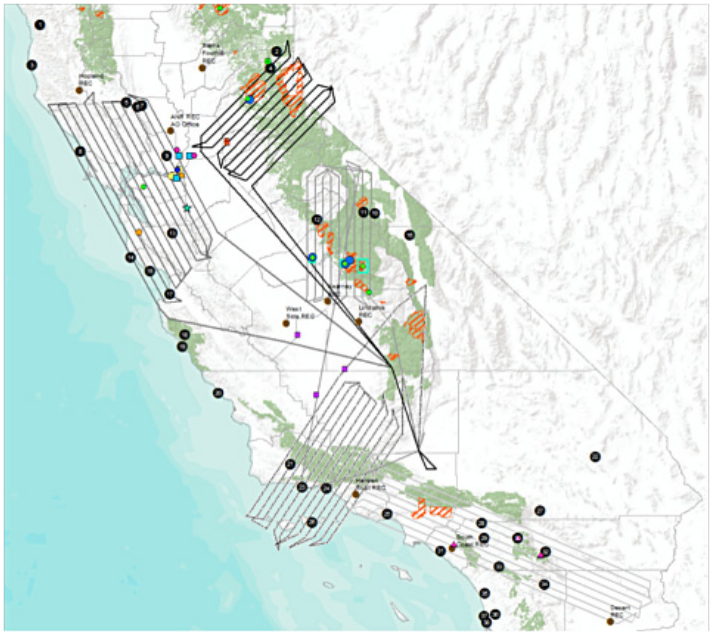
NASA solicited proposals using airborne data to address one or more, science or applications research topic aligned with the science questions for the HyspIRI Mission. A goal of this solicitation was to generate important science and applications research results that are uniquely enabled by HyspIRI-type data, taking advantage of the contiguous spectroscopic measurements of the AVIRIS, the full suite of MASTER TIR bands, or combinations of measurements from both instruments. NASA selected 14 projects for funding. The total funding to be provided for these investigations is approximately $6.3 million over three years.

The HyspIRI Preparatory Airborne team covers a wide range of investigation topics, including atmospheric science, ecology, forestry, geography, geology, and oceanography. Six study areas have been defined, which include five "boxes" that simulated a potential HyspIRI image area and one "soda straw" that follows a potential HyspIRI satellite track. The boxes cover a wide geographical gradient that represents diverse ecological, geological, and oceanographic zones across the state of California and some of Nevada. The figure below shows the five boxes and the soda straw on a map of California. These sites are titled Tahoe, San Francisco Bay Area, Santa Barbara, Southern California, Yosemite/NEON, and the Soda Straw. The Santa Barbara Box is approximately 7300 square miles, the Yosemite/NEON Box is approximately 6800 square miles, the Tahoe Box is approximately 6000 square miles, the Bay Area is approximately 13,000 square miles and the Southern California Box is approximately 15,000 square miles.

In 2013 the ER-2 flew a total of 112 flights hours with AVIRIS and MASTER to collect data over the HyspIRI study areas. Flights were conducted in 2013 during four periods in April, June, September and November. Additional sensors flew on the ER-2 including AirMSPI, NAST-I, NAST-M, S-HIS, and RSP for select flights. Other airborne platforms also conducted flights in conjunction with the ER-2 flights over the HyspIRI study area. The National Ecological Observing Network (NEON), a member of the HyspIRI Airborne Science team, flew their Airborne Observing Platform (AOP) for the June collection of the Yosemite/NEON Box. (The NEON AOP is a commercial Twin Otter flying a JPL built Next Generation Imaging Spectrometer, an Optech Waveform Lidar, and a high-resolution digital mapping camera.) During the April flights over the Yosemite NEON box, an over flight of the JPL Airborne Snow Observatory (ASO) was also achieved. (ASO is a commercial Twin Otter with an Optech Lidar and CASI Spectrometer.) In October ER-2 flights over the Monterey Bay were coordinated with the NASA Ames OCEANIA campaign that utilized the CIRPAS Twin Otter with a suite of radiometers and aerosol instruments. In addition to the OCEANIA Twin Otter, the University of California, Santa Cruz deployed the R/V Martin in Monterey Bay. During many of the flights field teams were deployed at most of the study sites.

A meeting of the science teams was recently held at NASA Headquarters to highlight the findings from the 2013 season, with 19 different science presentations. Plans were made for the 2014 season, including flights in April, June, August, and September-October.

Contributed by Ian McCubbin



Map of HyspIRI Preparatory Airborne Study Sites in California and Nevada

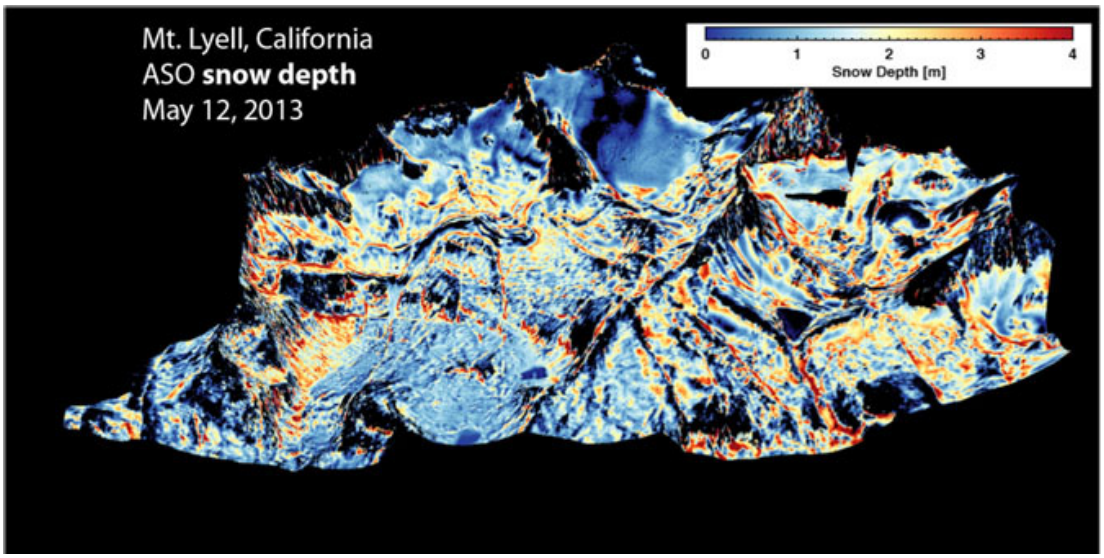
Airborne Snow Observatory Measures California Water

The two most critical properties for understanding snowmelt runoff and timing are the spatial and temporal distributions of snow water equivalent (SWE) and snow albedo. Despite their importance, snowpack albedo and SWE are still poorly quantified in the US and not at all in most of the globe. The Airborne Snow Observatory (ASO), a JPL imaging spectrometer and scanning lidar system, quantifies snow water equivalent and snow albedo, providing spatially complete, robust inputs to snowmelt runoff models and water management models. ASO flies in Colorado and California.

California is in one of its worst droughts on record. In this second year of the demonstration mission, the ASO continues flying the Tuolumne River Basin, the water supply to San Francisco and other Bay Area cities to give us unprecedented Earth science and operations benchmarks against which to understand climate variability and climate change. Ultimately, ASO provides a potential foundation for coming spaceborne missions.

ASO snow depth on Mt Lyell, the highest mountain inYosemite National Park, on May 12, 2013. (Figure courtesy of JPL AirborneSnow Observatory team).

Contributed by Tom Painter, JPL



ASO snow depth on Mt Lyell, the highest mountain inYosemite National Park, on May 12, 2013. (Figure courtesy of JPL AirborneSnow Observatory team).

ATTREX

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to be the gateway for water vapor, ozone and other gases that enter the stratosphere. For this mission, the Global Hawk carries instruments that will sample the tropopause near the equator over the Pacific Ocean. ATTREX scientists installed 13 research instruments on NASA's Global Hawk 872. Some of these instruments capture air samples while others use remote sensing to analyze clouds, temperature, water vapor, gases and solar radiation.

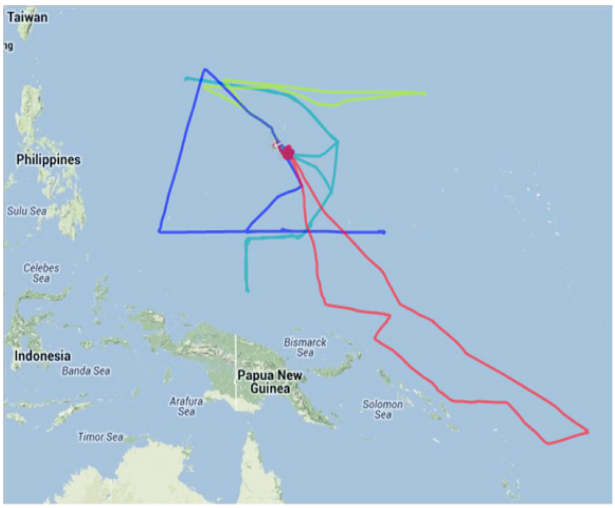
ATTREX conducted seven long-duration science flights totaling 121 hours, averaging more than 17 hours per flight. This year's flights bring the total hours flown in support of ATTREX to 297 hours since 2011. Flight tracks are shown in Figure 1.

Jensen and Project Manager Dave Jordan of Ames lead the ATTREX mission. It includes investigators from Ames and three other NASA facilities: Langley Research Center in Hampton, Va., Goddard Space Flight Center in Greenbelt, Md., and the Jet Propulsion Laboratory in Pasadena, Calif. The team also includes investigators from the National Oceanic and Atmospheric Administration, the National Center for Atmospheric Research, the University of California at Los Angeles, the University of Miami, the University of Heidelberg, and private industry.

ATTREX is one of the research missions of NASA's new Earth Venture project. These small and targeted science investigations complement NASA's broader science research satellite missions. The Earth Venture missions are part of NASA's Earth System Science Pathfinder Program managed by Langley.

Contributed by Eric Jensen, Dave Jordan, Chris Naftel

One of two groups of young visitors from Guam High School.



ATTREX mission flight tracks. Global Hawk flew from Andersen AFB in Guam.

Weather briefing on Feb. 28, 2014.

Dr. Lenny Pfister (NASA Ames) explaining science goals during outreach day.

A team of NOAA researchers checks out the UCATS instrument installed in the Global Hawk.

TRANSITIONS

Randy Berthold to Retire

Randy Berthold is retiring at the end of April. Randy came to the Airborne Sciences Program after having served as a payload manager for STS Life Science Payloads, as well as serving as a branch chief in the Science Payloads Operations Branch. A skilled and respected systems engineer and program manager, Randy easily transitioned to the UAS Projects manager position in the Biospheric Sciences Branch in 2004. His numerous duties included being a critical member of the Ames Small UAV team, managing day-to-day operations for SIERRA and Dragon Eye, assisting PIs with proposal preparation and cost estimates, and leading logistics and mission management for nearly every mission that SIERRA supported. In just the past year Randy was instrumental in implementing three separate UAS deployments in California, Florida and Alaska, while also supporting several proposal developments (EV, IIP, and AITT proposals). Randy also chaired the Extreme Environments Research Review Board for the Center, reviewing and supporting the development of fieldwork plans for ARC researchers and cooperators. Mentoring branch scientists and the numerous students over the years has always been Randy's passion. His personality and knowledge have served NASA well over the last 26 years. He and his lovely wife Shirley, who is retiring from NASA's Lunar Institute, are excited to finally spend time at their new home on Whidbey Island in Washington State.

A retirement party for Randy will be announced.

Contributed by Jim Brass and Matt Fladeland

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In Memoriam

Leslianne Monforton
1946 - 2013

Leslianne Monforton passed away this last Christmas Eve. Lesli, as she was known to most, was a one of the original Ames team that brought the SIERRA up to be a capable Earth science aircraft and its first deployed mission, the Characterization of Arctic Sea Ice Experiment (CASIE) in 2009 based in Svalbard, Norway.

Lesli, born in Bozeman, Montana in 1946, joined the Navy in 1966 and became an aviation warfare systems operator for P-3's. Lesli loved building and flying models from an early age and started competing in Radio Control in the early 70's. Lesli could design a plane, engineer, construct, and then fly it with precision. Lesli worked her way through college, earning a bachelor's degree in accounting. Like many, that wasn't what she loved and she used her mathematics background along with her building and design talent to head down the road of models that eventually transitioned to very early UAV's. She worked for several years at Dryden running the model lab before transferring to the Naval Weapons Lab where the models got more complex. When SIERRA was transferred to NASA, Lesli accompanied it to Ames. Lesli was credited with the SIERRA design and piloted a few missions such as CASIE. Following her time with SIERRA Lesli was hired on to again run the model lab at Dryden where she worked on many projects including INSPIRE and a collision-avoidance project where she was again both a pilot and engineer.

Lesli's passion for flight, attention to detail and innovative spirit will be missed, but her UAS legacy remains with SIERRA and the interns she influenced in INSPIRE.

Contributed by Jerry Budd and Randy Albertson

NASA SMD ESD Airborne Science Program 6-Month Schedule

SUPPORTED	Mar	Apr	May	Jun	Jul	Aug
DC-8	DC-8 Palmdale DAOF	Post Heavy C	ACCESSII FR148003	SARP Inst.	SARP	ASCENDS	ASCENDS Flights FR 148001&148004
ER-2 #806		HyspIRI	6-month insp	HyspIRI		AK MABEL Deploy	MABEL	HyspIRI
ER-2 #809	600-Hr Inspection/Maint	IPHEX	IPHEX	IPHEX	IPHEX Deployment Warner Robins		
G-III (D)	Scheduled Maint	Central & South America	California Science Flights	Scheduled Maintenance	New Orleans	CA SciFl
G-III (J)	Local	Direct	AirMOSS	AirMO	992 Maint	AirMO	Decon	Local	Direct	992 Maint	AirMOSS Mission	AirMOSS	AirMOSS Mission	Deconfig
G. Hawk #871	NGC Work	HS3-Upload	HS3-Flight
G. Hawk #872	ATTREX Deploy	ATTREX	TWiLiTE	HS3-Upload	HS3-Flight
P-3	WFF	Operation Ice Bridge	Post Mission	DISCOVER-AQ Upload	DISCOV	DISCOVER-AQ	P-3 Re-Wing

OTHER	Mar	Apr	May	Jun	Jul	Aug
UC-12	CALIPSO Cal/Val	SLAP Spring 2014 Campaign	HSRL-OBB
B200 (D)	AirSWOT Cal/Che	AirSWOT	AirSWOT	ISRNET	ISRNET	ISRNET	Phase Inspection
B200 (L)	Phase Inspection	DISCOVER-AQ (CO)
Sherpa	CARVE	CARVE	CARVE Tran	CARVE Mission	CARVE Mission	CARVE Mission	CARVE Mission
Cessna	Annual Inspection
Falcon	ACES	B Check	ACCESS 2	GEO-TASO	OIB 2014
Ikhana	UAS Modifications/Ground Tests	Local Flights	RIMPAC	ACAS-Xu
Lear 25	NAIMS
S-3B	UAS	Flight Testing	Flight Testing
SIERRA	Ship II Build-up
T-34C	UAS in the NAS	UAS in the NAS	UAS in the NAS
T. Otter	Remote Sensing
UH-1	Range
WB-57 #926	H-2 Payload I & T
WB-57 #928	Major Ops Inspection
WB-57 #927	Acceptance	New Autopilot Flight Test

= Foreign Deployment
= Stateside Deployment
= Aircraft Modifications
= Reimbursable
= Maintenance
= Flight
= Deployment Milestone

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

ASP Upcoming Events

* American Meteorological Society
  31st Conference on Hurricanes and Tropical Meteorology
  San Diego, California
  March 31–April 4, 2014
  http://www.ametsoc.org/MEET/meetinfo.html

* SMAP 3rd Applications Workshop
  April 9-10 2014; Boulder, CO
  https://www.signup4.net/Public/ap.aspx?EID=3RDS10E

* NASA LCLUC Spring Science Team Meeting
  April 23–25, 2014; Rockville, Maryland
  http://lcluc.umd.edu/meetings.php?mid=52

* 10th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-10); and "Future GHG Mission Challenges Workshop"
  Noordwijk, The Netherlands;
  May 5-7, 2014
  Call for papers is open, abstracts due February 1, 2014
  http://congrexprojects.com/2014-events/14c02/

* ICESAT-2 / Landsat 8 Joint Vegetation Tutorial
  May 7-8, 2014; University of Michigan, Ann Arbor, Michigan
  http://icesat.gsfc.nasa.gov/icesat2/apps-events.php

* AUVSI North America 2014
  May 12-15, 2014; Orlando, FL
  http://www.auvsishow.org/auvsi2014/public/enter.aspx

* 17th Symposium on Meteorological Observations and Instrumentation
  June 9–13, 2014, Westminster, CO
  http://www.ametsoc.org/MEET/fainst/201417moi.html

* 14th AIAA Aviation Conference
  6th AIAA Atmospheric and Space Environment Conference
  June 16-20, 2014; Atlanta, Georgia
  http://www.aiaa-aviation.org/ATIO/
  http://www.aiaa-aviation.org/ASE/

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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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* IEEE International Geoscience and Remote Sensing Symposium (IGARRS) 2014
July 13-18, 2014; Quebec City, Canada
http://www.igarss2014.org/

* SMAP Cal/Val Workshop #5
September 8-10, 2014; JPL, Pasadena, California
http://smap.jpl.nasa.gov/science/workshops/

* SPIE 2014 Remote Sensing
Amsterdam; 22 – 25 September 2014
http://spie.org/x6262.xml?WT.mc_id=RERS14CE

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

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