



EXPLORE

AIRBORNE SCIENCE

NEWSLETTER

Summer 2021

Leadership Corner



Welcome to the Airborne Science Program Summer 2021 newsletter. As the reach of the COVID-19 pandemic has lingered longer than anyone could have wanted, the ASP team has endured, adapted, and excelled, accepting the challenge of an increasing operational pace and safely executing missions. After a series of delays and postponements, the Earth Venture Sub-orbital campaigns are, once again, starting to take flight with ACTIVATE and Delta-X successfully completing missions aboard NASA and commercial aircraft. In addition, the team at Armstrong Flight Research Center (AFRC) conducted S-MODE flight tests and recently hosted the DCOTSS science team, completing a very successful series of checkout flights with preparations for future deployments. On top of addressing the labyrinth of COVID protocols, old aircraft issues are never far removed from our operations with the team at the Langley Research Center (LaRC) quickly addressing a major, HU-25A Falcon electrical issue to keep ACTIVATE data collection on track. LaRC also successfully completed its first Earth Science research campaign with the G-III nadir portals mapping air quality during MOOSE flights. In addition to flight operations, this period has been marked by significant maintenance efforts to keep the ASP fleet healthy into the future. The GV received a new set of cockpit displays as well as a set of freshly overhauled engines, and following an extensive period, the DC-8 has returned to service with four, fully repaired engines and a heavy maintenance check. The DC-8 is ready to spread its

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ACTIVATE

Contributed by Armin Sorooshian

The Aerosol Cloud meTeorology Interactions oVer the western ATlantic Experiment (ACTIVATE) conducted its third and fourth flight campaigns in January-March and May-June of 2021. A total of 15 joint flights were conducted in the winter campaign with the HU-25 Falcon and UC-12 King Air, while 32 joint flights were conducted between May-June 2021.

In total after two years of flying, four and seven joint flights have been coordinated with overpasses of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) and the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) platform,

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Flight scientists (left) Ewan Crosbie and (right) Edward Winstead preparing instruments just before an ACTIVATE research flight on June 16, 2021. Credit: Luke Ziemba (NASA LaRC)



(continued from Pg. 1)

respectively. The winter 2021 flights continued to build data statistics for cold air outbreak events off the East Coast that give rise to shallow cumulus clouds that current models simulate poorly. Flights examined conditions upwind of the cloud systems and along the transport path of these clouds as they transition from overcast areas to more scattered cloud fields. The summer 2021 campaign included two meticulously designed “process study” flights, whereby developing cloud clusters were extensively characterized with numerous stacked level legs by the Falcon below, in, and above the clouds. Simultaneously, the King Air conducted a “wheel and spoke” pattern centered around the cloud



ACTIVATE scientists consulting after a research flight in front of the HU-25 Falcon (left to right: Yonghoon Choi, Luke Ziemba, Edward Winstead). Credit: Johnathan Hair (NASA LaRC)

system, with multiple dropsondes launched above, and on the periphery of the cloud cluster along with remote sensing transects to characterize the cloud and aerosol profiles. Data from both planes will be used to characterize the range

of cloud types observed on such flight days, with a focus on understanding the processes that drive shallow cumulus organization.

For more information visit <https://activate.larc.nasa.gov/>

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Leadership Corner (cont.)



wings as AFRC is gearing up to conduct the CPEX-AW campaign and will, once again, provide the substantial value to the science community that a National Academies of Science report recently highlighted. <https://www.nap.edu/download/26079#>

The Student Airborne Research Program (SARP) is ongoing and virtual again this year and will be the last campaign for Dr. Emily Schaller. After more than a decade of the building SARP into a world-class program, she has accepted a new position as the science program officer for the Heising-Simons Foundation. ASP appreciates her hard work and dedication with sincere wishes for a bright future.

I hope you enjoy the updates in this newsletter. As we push forward to a return to normality, we never want to lose sight of safely executing our missions, placing an emphasis on taking care our most important asset, our people.



Bruce Tagg
Director,
Airborne Science Program

Melissa Yang-Martin
Deputy Airborne Science
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- Science

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Deputy Airborne Science
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Dr. Emily Schaller, Moving On

Contributed by Melissa Yang-Martin

Emily Schaller has been the National Suborbital Research Center (NSRC) Communications Lead and Student Airborne Research Program (SARP) Manager since 2010. Emily will be leaving the Airborne Science Program (ASP) at the end of August to join the Heising-Simons Foundation as the Science Program Officer.

Over the past 11 years, Emily has worked tirelessly and passionately to help promote NASA ASP and SARP through social media sites, classroom visits, site visits, going on deployment, and hosting classroom

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Dr. Emily Schaller, *Moving On* (cont.)

chats from either the comfort of her home or from the comforts of NASA aircraft. Through the years, Emily has contributed to the content on all the NASA ASP social media accounts. In 2017, Emily and SARP students created the first SARP Snapchat story. The story reached over 1.9 million

people. The NASA HQ social media team announced that the story was 11th most read story out of the 142 stories NASA had posted so far that year. Another example of Emily's achievements is seen in the Operation Ice Bridge (OIB) mission outreach. Since the start of classroom chats in OIB in 2010, Emily has connected over 300 teachers and their classrooms to the OIB science community, reaching over 10,000 students.

However, Emily's dedication ASP is most evident through SARP. Since joining NSRC, Emily has nurtured and transformed the annual SARP internship into a world-class program, making it one of the most successful internships at NASA. SARP has hosted a diverse class of 20 or more

undergraduate students each year, even during COVID. Thanks to Emily's commitment and hard work, the program boasts a 93% retention of students in STEM, with many of the alumni continuing in Airborne Science Research. Emily has always gone above and beyond the job responsibilities, constantly bringing new and exciting enrichment activities to the program and providing additional opportunities for the students.

We are sad to see Emily go, but are very excited for all the opportunities that lie ahead of her. We want to not only thank Emily for all her dedication and passion to the mission, but to wish her the very best and for her to know that she will always hold a special place with the NASA Family.



Dr. Emily Schaller, Manager of the Student Airborne Research Program.

Western Diversity Time Series Continues in California

Contributed by Rob Green

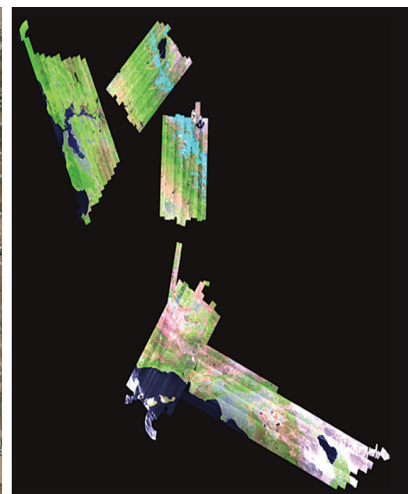
The Western Diversity Time Series (WDTS) campaign continues to extend a ~decade long time series of measurements by NASA airborne instruments AVIRIS-Classic, MASTER, and HyTES, covering five large-area blocks and a long transect in the Western United States. This combination of visible to shortwave infrared (VSWIR) imaging spectroscopy and multispectral thermal infrared (TIR) imagery has captured diversity of the encompassed environments as well as the changes in ecosystems across a range of elevational gradients through pre-drought, drought, and now severe drought. The instruments fly on the NASA ER-2 high-flying aircraft. The FY2021 campaign flew a total of 72.6 hrs.

The resulting dataset is a unique asset for research and applications

communities seeking to understand the influence of a changing water cycle on a wide variety of natural and human-dominated ecosystems in a large and biologically-diverse region, which is also characterized by very high levels of cultural and

economic diversity. Continuing this one-of-a-kind time series is well justified for scientific research with more the 100 articles published in the literature. In addition, the size of the large-area blocks imaged by the multi-year dataset and the combination of VSWIR imaging spectroscopy and multi-

spectral TIR imagery make these time series data a vital precursor for the Surface Biology and Geology (SBG) Designated Observable activity—one of the early missions recommended by the 2017 National Academy's Decadal Survey for Earth Science.



The five flight boxes and one long traverse are indicated on the left, with imagery on the right.

SnowEx Completes Successful Winter Campaign

Adapted from NASA Earth Science News, with Contribution from Hans-Peter Marshall

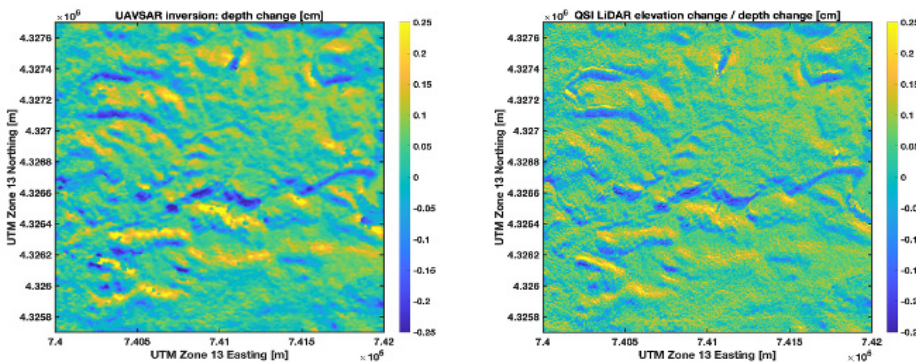
This year, SnowEx teams took snow measurements at six sites across the Western United States, on the ground and with drones and airplanes flying overhead. This information helps scientists determine how much water the winter snowpack holds, which is crucial for managing water resources for drinking, agriculture, hydropower, flood forecasting, drought and wildfire management and more. In addition to studying snow, SnowEx researchers are also evaluating how accurately various techniques can measure snow in different environments. In the future, NASA hopes to launch a satellite dedicated to studying snow – and the water it stores – from space, in order to under-

stand how changes in the snowpack affect droughts, wildfires, and more. One of the main goals of the multi-year SnowEx campaign is figuring out which remote sensing instruments may be best suited for the job. Measurements from these instruments is compared with comprehensive ground measurements made by the SnowEx team.

For 2021, the science team had three major goals: conduct a time series of L-band Interferometric Synthetic Aperture Radar (InSAR) observations in diverse snow conditions, measure the reflectivity (albedo) of the snow surface, and study snow distribution in a prairie landscape.

The JSC G-III aircraft, carrying the Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) flew 10 sorties over the sites in Colorado, Utah, Idaho and Montana from mid-January until the end of March, for a total of nearly 100 hours. (UAVSAR is an L-band InSAR instrument that SnowEx uses to measure changes in the mass of the snowpack.) The snowpack's mass can change drastically from one UAVSAR flight to the next if a snowstorm dumps more snow, or it melts or sublimates. Snow may also be redistributed by high winds. The SnowEx team is learning how well the UAVSAR sensor can detect these changes in the snow's mass, because a similar sensor will fly on the upcoming NISAR space mission. Researchers also measured snow albedo from the air using the Airborne Visible / Infrared Imaging Spectrometer (AVIRIS) Next Generation instrument. On a contracted aircraft, AVIRIS-NG flew 37.5 hours. Comparing the airborne and complementary ground measurements will help the scientists identify how different factors contribute to the snow albedo.

In Winter 2022, SnowEx is planning a joint campaign with the ABoVE mission in Alaska.



Comparison of the spatial pattern of snow depth change from airborne lidar (right), and UAVSAR L-band InSAR (left). The snow depth change shows locations of snow drifting and scouring, at -25 to +25 cm, over a two week period in February 2020, in an open area on Grand Mesa.

S-MODE Campaign Gets its Feet Wet

Contributed by Erin Czech and Sommer Nicholas

The Sub-Mesoscale Ocean Dynamics Experiment (S-MODE) recently completed a successful initial flight series, and the team is gearing up for a Pilot Campaign that will take place beginning in October 2021. The S-MODE inves-

tigation will explore the potentially large influence that small-scale ocean eddies have on the exchange of heat between the ocean and the atmosphere. The project will collect a benchmark data set of climate and biological variables

in the upper ocean that influence this exchange.

For approximately two weeks in May, test flights were conducted using two of S-MODE's research aircraft: a B-200 from Armstrong Flight

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S-MODE Campaign Gets its Feet Wet (cont.)

Research Center (AFRC); and a commercial Twin Otter. The B-200 was equipped with JPL's Doppler-Scatt instrument that measured currents and winds near the ocean surface with radar. The B-200 was also equipped with UCLA's Multiscale Observing System of the Ocean Surface (MOSES)

instrument that measured sea surface temperature. The Twin Otter was equipped with an instrument from the Scripps Institution of Oceanography at UCSD called the Modular Aerial Sensing System (MASS) that measured the height of ocean waves. The research aircraft were accompanied by Wave Gliders which were deployed in the ocean and measured several ocean conditions, including the speed and direction of the ocean eddies. The May campaign was an excellent way to intercompare the measurements from DopplerScatt, MASS, MOSES and Wave Gliders, and to better understand the data and increase confidence in the measurements for the upcoming fall campaign.

Laurent Grare (Scripps) recovers Wave Glider. Photo credit: Benjamin Greenwood



Instrument PI Dragana Perkovic-Martin (JPL) and teammate Fabien Nicaise (JPL) uploading Doppler-Scatt on April 13, 2021. Photo credit: Joe Piotrowski, AFRC

In October 2021, the Langley Research Center G-III, equipped with JPL's Portable Remote Imaging SpectroMeter (PRISM) will join the other research aircraft, all of which will operate out of NASA Ames Research Center. The Research Vessel Oceanus will also deploy for the experiment, as will several shipborne instruments that will operate in the area of study, about 200 miles off the coast of San Francisco.

AVIRIS-NG Goes to Europe

Contributed by Michael Eastwood

A joint NASA and European Space Agency (ESA) airborne imaging spectrometer campaign in support of future space missions is currently taking place in Europe to advance cooperation and harmonization of algorithms and products from future global imaging spectrometer missions. The effort is intended to support the future NASA Surface Biology and Geology (SBG) mission and the candidate European Copernicus Hyperspectral Imaging Mission for the Environment (CHIME) mission. The NASA Airborne Visible/Infrared Imaging Spectrometer Next Generation (AVIRIS-NG) deployed to Europe during May-July for this campaign. All measurements are rapidly calibrated,

atmospherically corrected, and made available to NASA and ESA investigators for the following objective: 1) further test and evaluate new state-of-the-art science algorithms: atmospheric correction, etc; 2) grow international science collaboration in support of ESA CHIME and NASA SBG; 3) test/demonstrate calibration, validation, and uncertainty quantification approaches; 4) collect strategic cross-comparison under-flights of the current space mission: DESIS, PRISMA, Sentinels, etc. Several examples of imagery

are shown below. For NASA, this campaign benefits the ongoing SBG Designated Observable activity that is one of the first missions called for in the 2017 National Academy's Decadal Survey for Earth Science.

AVIRIS-NG imagery supports Geology, Aquatics, Agriculture and other terrestrial science.

Mount Vesuvius, Geology



Venice Lagoon, Aquatics



DELTA-X Completes Spring Campaign

Measurements of Mississippi River Delta

Contributed by Cathleen Jones

Today most of the world's major deltas are losing land and whether they can be sustained in the face of sea level rise is unknown. Delta-X, an Earth Venture Suborbital-3 mission, uses a combination of remote sensing, in situ measurements, and modeling to study the processes controlling sediment capture and soil production in deltas, where sediment transport and ecogeomorphology is mediated by the exchange of water between the wetlands, ocean, and river. Delta-X kicked off its spring

campaign in southern Louisiana on March 26, 2021, with NASA's airborne science instruments AirSWOT, UAVSAR, and AVIRIS-NG all collecting remote sensing data, while four field teams collected measurements on the ground. AirSWOT is used to measure the water surface elevation in open channels, UAVSAR (flying on the JSC G-III aircraft) measures water level change in vegetated areas, and AVIRIS-NG measures vegetation status and the water turbidity. All three instruments were needed

to simultaneously capture sediment transport, vegetation conditions, and water flow path and extent. The study area encompasses two largely disconnected but adjacent areas, one with net accretion (Atchafalaya basin) and the other losing land at a high rate (Terrebonne), to identify the factors determining



AirSWOT and AVIRIS-NG prepare for Delta-X at the airport in New Orleans.

which parts of a delta will drown and which will survive. Repeated measurements were made at different phases of the tidal cycle to document the ebb and flow of water into the wetlands – only with airborne sensors can we capture these rapid processes. In the spring, data were collected at high river discharge and with little vegetation; Delta-X will return for a fall campaign in August 2021, collecting the same sets of data at low river discharge and maximum vegetation conditions.

View of Atchafalaya region of the Mississippi Delta from JSC G-III.



2021 NASA Student Airborne Research Program

Contributed by Emily Schaller

The 13th annual NASA Student Airborne Research Program (SARP) is taking place June 14-August 12 as an online program. From 2009-2019, SARP has competitively selected group of ~30 undergraduate STEM majors from across the United States for a summer internship experience in NASA Earth Science research that included flights on a NASA research aircraft. In

2020 and 2021, with COVID-19-related travel and social distancing restrictions still in place, SARP was unable to fly, but the internship continued with at-home data collection as well as the analysis of previously collected aircraft, ground, and satellite data. In addition, plans are underway to bring both the 2020 and 2021 classes out to Palmdale for science flights on the DC-8 in December 2021.

To provide the 2020 and 2021 SARP interns with a hands-on research experience in atmospheric science, as well as to better understand the unique environmental impacts of the pandemic, SARP leadership designed an at-home air sampling project to take advantage of the geographic distribution of interns across the United States. The Rowland/Blake Laboratory at the University of

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2021 NASA Student Airborne Research Program (cont.)

California Irvine (where SARP is typically based following student flights on the research aircraft at AFRC) provided over 1,500 air canisters to send to 2020 and 2021 SARP interns, mentors and faculty at their homes.

This year, canisters were mailed out to SARP participants in April 2021 before the official start of the program in June so that students could sample the air to compare with similar samples taken by the SARP 2020 class during the height of pandemic shutdowns in April 2020. These canisters will be analyzed in the UC Irvine laboratory for nearly 100 compounds including greenhouse gases such as methane and carbon dioxide, vehicular exhaust gases, and gases related to industrial activities.

In addition to the at-home air sampling project, SARP 2021 students are also collecting aerosol optical depth and particulate matter measurements at home through a collaboration with CEAMS (Citizen-Enabled Aerosol Measurements for Satellites) – a NASA-funded program at Colorado State University.

The majority of the time during the internship, however, will be spent developing individual research projects using the SARP airborne dataset from previous SARP flights as well as data from other NASA airborne, satellite and ground stations. The twenty-eight SARP 2021 participants are each developing an individual research project in one of four research focus groups (ocean

biology, terrestrial ecology, atmospheric sampling, and aerosols). They are supported by a team of faculty advisors, NASA scientists, and graduate student research mentors. Students work with their advisors daily online and also interact with them socially through shared online meals, group meetings, lectures, and other enrichment activities.

At the conclusion of the program in August, students will deliver a 12-minute AGU conference-style oral presentation on the results of their individual research projects. Though the program is completely online this summer, the students are still receiving a true research experience in NASA Earth and Airborne Science.



SARP 2021 interns are taking Whole Air Samples and aerosol measurements near their homes.

Multiple Payloads Operate Successfully on LaRC G-III for SMD

Contributed by Bruce Fisher

The NASA Gulfstream III aircraft maintained and operated by the Research Services Directorate at NASA Langley (N520NA) has successfully completed two Science Mission Directorate (SMD)-funded missions since January 1, 2021 and is engaged in a third.

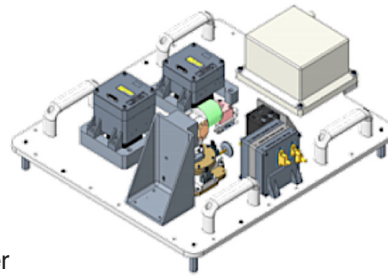
The first mission in 2021 was the research flight campaign for the Compact Midwave Imaging System (CMIS). CMIS was developed by the Applied Physics Laboratory (APL) of Johns Hopkins University for ESTO's Instrument Incubator Program. CMIS successfully completed its flight tests on N520NA on February 9, 2021. The campaign consisted of four research flights encompassing 16 flight hours preceded by a Compatibility Flight Profile flight with a duration of 3.1 flight hours. The airborne flights evaluated the accuracy/precision and radiometric calibration of CMIS stereo data collected to derive cloud heights, 2D wind fields, and boundary layer aerosol/cloud top height/wind fields at different times of day (and night) by CMIS. The science investigations targeted for these observables were coupled cloud-precipitation state and dynamics for monitoring the global hydrological cycle, as well as the impact of Planetary Boundary Layer (PBL) processes on weather, on the transport of pollutants/carbon/aerosols and water vapor, and their interactions with the large-scale circulation. All flights were based out of NASA LaRC. The flights were designed for a daytime collection with ground and ocean background, nighttime collection and daytime

collection with snow background and cloud cover. The flights also included flyovers of known targets and an under flight of the Atmospheric Laser Doppler Instrument (ALADIN).

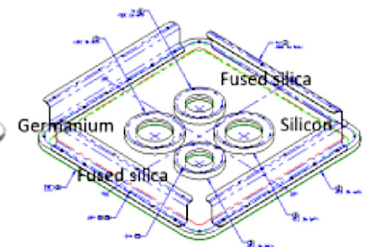
The flights covered areas from Lake Erie to Florida.

Following CMIS, N520NA successfully imaged Barium releases during the Kinetic-scale Energy and Momentum Transport Experiment (KiNET-X) sounding rocket launch from NASA Wallops Flight Facility on May 16/17, 2021. The KiNET-X experiment, funded by the NASA Heliophysics Program, seeks to explore the role of turbulence and waves in the transport of mass, momentum, and energy associated with fundamental heliophysics. Gyrostabilized imagers operating at several wavelengths and spatial resolutions on the G-III aircraft tracked and imaged the release of a Barium tracer gas lofted to 400 km altitude by the sounding rocket. The Barium releases occurred over the Atlantic Ocean north of Bermuda. The campaign consisted of eight science flights, all based at NASA LaRC, commencing on April 15/16 and ending May 16/17, 2021. A total of 35.6 flight hours were flown. The launch occurred in the last ten minutes of the launch window on the last date in the window. All instruments operated successfully.

The current mission on N520NA is the Michigan-Ontario Ozone Source Experiment (MOOSE), a multi-year



Instrument Plate



Window Plate

collaborative grass-roots field study in the eastern Michigan/western Ontario, Canada, region. The goal of this study is to investigate attainment strategies for the region's non-compliance with the National Ambient Air Quality Standard for ozone. NASA's Tropospheric Composition Program is providing support for these flights on the G-III to map nitrogen dioxide (NO₂) and formaldehyde (HCHO) column density data (ozone precursors) over this area of interest with NASA Goddard's GEOCAPE Airborne Simulator (GCAS) along with measurements from NASA Goddard's Cloud Physics Lidar (CPL) during the June-early July 2021 timeframe. GCAS and CPL are mounted over the forward and aft nadir portals, respectively. The external science partners in this work include the Michigan Department of Environment, Great Lakes, and Energy (EGLE), the Environmental Protection Agency, Environment and Climate Change Canada, and other supported research groups doing ground-based measurements for MOOSE. The plan is to collect data over at least three relatively cloud-free flights days (six 4-hour science flights). The Instrument Check Flight occurred on May 27, 2021 with the first research flight occurring on June 5, 2021.

CMIS installation in LaRC G-III over aft nadir portal.

Upcoming Activities:

DCOTSS Ready for Summer Mission

Contributed by Earth Science Project Office

ER-2 selected for DCOTSS to reach clouds in the stratosphere.



The Earth Venture Suborbital 3 (EVS-3) project Dynamics and Chemistry of the Summer Stratosphere (DCOTSS) integration and test flights (14.5 hours total) were recently completed at AFRC by Earth Science Project Office (ESPO) personnel and science teams. The ER-2 will ferry to Salina, Kan-

sas, for the science campaign beginning in July 2021. The DCOTSS mission is designed to measure material lifted into the stratosphere by intense thunderstorms. Water vapor and pollutants injected into the stratosphere can significantly alter its chemical composition and may even negatively affect stratospheric ozone.

CPEX-AW Weather Campaign upcoming in Western Atlantic / Caribbean Sea

Contributed by Aaron Pina

The Convective Processes Experiment – Aerosols & Winds (CPEX-AW) campaign is a joint effort between NASA and the European Space Agency (ESA), with the primary goal of conducting post-launch calibration/validation activities for the Atmospheric Dynamics Mission-Aeolus (ADM-AEOLUS) Earth observation wind Lidar satellite. The NASA CPEX-AW component of the mission also has a major focus on improving the understanding of coupled atmosphere-ocean processes that underpin the lifecycle of tropical convection, which currently limits the accuracy and forecast time of weather and climate models. The base of operations for the NASA DC-8 for the CPEX-AW campaign will be out of St. Croix in the US

Virgin Islands. St. Croix was chosen after COVID-19 restrictions prevented international travel to Cabo Verde, the base of operations for the ESA components of the larger airborne science mission. The size of St. Croix has smaller impacts on the tropical atmosphere compared with a larger island such as Puerto Rico. The location of St. Croix allows for the CPEX-AW team to meet many of the original science objectives while allowing flexibility to sample mature tropical storms as well as carry out joint flights with ESA in the middle of the Atlantic basin. In addition to joint calibration/validation of ADM-AEOLUS, CPEX-AW will study the dynamics and microphysics related to the Saharan Air Layer (SAL), African Easterly

Waves and Jets, Tropical Easterly Jet, and deep convection in the InterTropical Convergence Zone (ITCZ). Flight plans will include flying a series of processes-oriented convective modules in the Caribbean Sea / western Atlantic basin as well as 1-2 trans-Atlantic flights to Cabo Verde for coordinated Aeolus calibration/validation and SAL-focused process studies with the ESA aircraft. The campaign is scheduled for August through September.



Aircraft Status Updates

DC-8 Back in Business

Contributed by Chuck Irving

The NASA DC-8 “Flying Laboratory” at Armstrong Flight Research Center has completed a four-engine overhaul following engine damage that occurred during the FIRE-AQ mission in 2019. After a successful return to flight in

December 2021, the aircraft was ferried to San Antonio, TX for scheduled heavy maintenance, which was completed in May. With the CPEX-AW mission planned for early August, the team is working to re-assemble the aircraft interior,



DC-8 is once again airborne with a takeoff from San Antonio for the ferry flight to Palmdale on May 8.



DC-8 maintenance team from VT SAA and AFRC crew prior to ferry flight.

upgrade the passenger emergency oxygen system, and reinstall onboard systems that provide power, data, and communications capabilities to the science teams and their instrument payloads. Updates to the DC-8 will include faster ethernet switches and a permanent installation of the infrared camera pod.

Technical Developments

The XCube Carrier

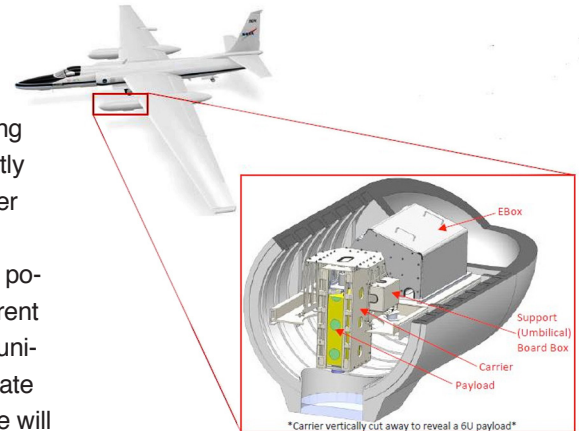
Contributed by James Jacobson

At the close of May, the Airborne Science Program at AFRC saw the delivery of the XCube Carrier System from our student partners at CalPoly San Luis Obispo (SLO). This delivery represented the conclusion of work that was supported by ASP, CalPoly SLO, and USRA.

XCube is designed as a standard for integration of CubeSats (or similar form factor) into NASA

aircraft for suborbital flight testing and experimentation. This greatly simplifies the process for smaller experiments to get time on our unique testing platforms before potential launch dates, or for different technologies to find test opportunities so long as they accommodate the CubeSat form factor. XCube will primarily fly as a secondary payload in the payload bays that are left empty on the ER-2 during science flights.

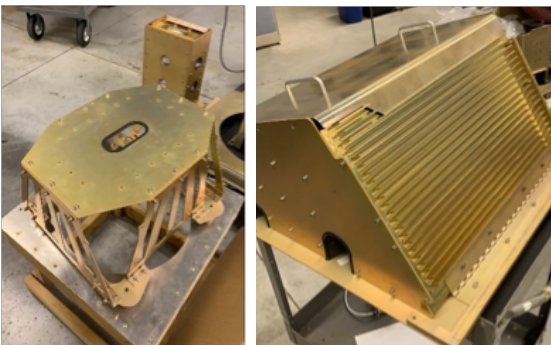
XCube consists of both a structural and electrical interface. The structural interface is referred to as the ‘Carrier’. The Carrier allows for a 6U payload if the payload desires to be turned on by having deployment/power switches on the +Z face actuated. However, if the payload



does not require this actuation, the Carrier can fit payloads 4.875” longer than a standard 6U. The payload will integrate into the Carrier using a rail system (based on the CubeSat Standard), and allows for additional space for electrical support boards on the outside of the 6U payload volume. The design allows for significant flexibility by its potential users so long as certain minimum requirements are met.

Diagram of XCube showing placement in Superpod.

LEFT: Carrier and Rail System. RIGHT: Ebox.



SOFRS Corner

Contributed by Vidal Salazar

Science Operations Flight Request System (SOFRS) Corner
SOFRS Website: <https://airbornescience.nasa.gov/sofrs>

The SOFRS form has been reorganized – In an effort to collect and display the flight request information more efficiently and to maintain the identifying information close at hand, we have reorganized the flight request form. This new layout will especially benefit those of you who have multiple flight requests since the identifying information, such as the name of the campaign, principal investigator and requested aircraft, are now at the top of the flight request.

Additional features added during the reorganization include the ability to choose current project Acronyms, add multiple instruments to the FR planned pay-load and add multiple data collection windows.

Adding associated users to flight requests - Two of the most frequently asked questions are (1) how do I share the flight request with other team members? and (2) how do I allow a team member to help me

submit flight reports? All this can be done by adding associated users to your flight request.

When adding an associated user, you can give permission to View, Edit, receive Mail (the email notifications) and submit Flight Report(s) for the flight request to the team member. To remove those permissions, you can simply uncheck the option that you would like to change.

Associated users must have a valid SOFRS account. If you need a SOFRS, account, please visit <https://airbornescience.nasa.gov/sofrs/> and click on “create new account”.

NASA Airborne Science Program 6 Month Schedule

starting July 2021 (generated 7/1/2021)

	FY21			FY22		
	Q4			Q1		
	Jul	Aug	Sep	Oct	Nov	Dec
ASP Supported Aircraft						
DC-8	Prep Aircraft for Sc	CPEX-AW Ir Flight	CPEX-AW Deployment (St. Croix)	CPEX 1A, 3	LA Oc	SARF
ER-2 #806	806 CARE Reassembly and Ground Check Outs					
ER-2 #809	Aircraft Main	DCOTSS Science Flights	DCOT 809 200 hr Mx / Canopy	(Tenta)	(Tentative) S	(Tenta) IMPA IMPA IMPA Flight Ejection Sea IMPA
C-20A	ASAR	ASAR Deployment - Loui	ASAR Maintenance	UAVSAR Flights		
G-III (JSC)	Maintenance	DeltaX	Commercial Crew Suppo			Maintenance
G-III (LaRC)	MOOSE	Maintenance	LVIS	S-MODE Fall FY21	CREX Heliophysics Norway	
GV	LVIS Integra	LVIS GEDI	TRACER-AQ Integ	TRACER-AQ	Commercial Crew Suppo	
P-3	Phase Maintenance	P-3 P	P-3 R P-3 IMPACT P-3 P VIPR IMPACTS - IMPACTS - IMPA			
Other NASA Aircraft						
UC-12B	ACTI	Annual Inspection	ACTIVATE Upload			ACTIVATE
B-200	Phase 3 & 4 Maintenance & Engine Hot Section					
B-200 (A)	SLAP - LIAISE			S-MODE Int	S-MODE deploy	S-MODE (D)
B200 (L)						
C-130H	C-130		C-130	C-130		
Cessna						
Cirrus SR22						
HU-25A #524	ACTI	Frame 33 Insp	200 Hr Check/1200 Hr Check/A Check/ 2A+ Check/ Z Che	Pilot F	ACTIVATE U	ACTI ACTIVATE
SIERRA						
T. Otter						
WB-57 #926	Major	Place	Place	Place	Placeholder	
WB-57 #928	Major Inspection					
WB-57 #927	Place	ACCLIP	Place			

- Unavailable
- Flight
- Maintenance
- Foreign Deployment
- Reimbursable
- Aircraft Configuration
- Aircraft Modifications
- Deployment Milestone
- Stateside Deployment



Calendar of Events

AGU Fall 2021 Meeting

(In person and online)
December 13-17, 2021
New Orleans, LA
<https://www.agu.org/Fall-Meeting>
REGISTRATION and HOUSING
WILL OPEN August 23

NASA PACE Applications Water Quality & Resources Focus Session (Virtual)

July 28, 2021
https://pace.oceansciences.org/events_more.htm?id=49

ACCP/AtmOS Community Forum;

July 29, 2021; 1:00-2:00p.m. EDT
NASA Webex

AIAA 2021 Aviation Forum

(Virtual)
August 2-6, 2021
<https://www.aiaa.org/aviation/>

Ecological Society of America Annual Meeting (Virtual)

August 2-6, 2021
<https://www.esa.org/longbeach/>

AUVSI Exponential (Hybrid meeting)

August 16-19, 2021; Atlanta
On demand through September 10
<https://www.xponential.org/xponential2021/public/enter.aspx>

2021 International Boreal Forest Research Association (IBFRA) Conference (Virtual)

August 16-20, 2021
<https://sites.google.com/alaska.edu/ibfra2021/home-page>

ECOSTRESS Science & Applications Team Meeting (Virtual)

August 17-19, 2021
<https://ecostress.jpl.nasa.gov/team/meetings>

NASA PACE Applications Workshop

(Virtual)
September 15-16, 2021
<https://pace.oceansciences.org/applications.htm>

IMPACTS Science Team meeting

(Virtual)
September 28-30, 2021
<https://espo.nasa.gov/impacts/science>

Biodiversity/Ecological Forecasting Team Meeting (Virtual or in person)

Oct 19-21, 2021
<https://cce.nasa.gov/biodiversity/index.html>

2021 Regional Conference on Permafrost and 19th International Conference on Cold Regions Engineering (Virtual)

October 24- 29, 2021
<https://uspa.memberclicks.net/2021-rcop-iccre>

19th Annual Unmanned Systems Canada Conference

(Virtual and in-person)
November 2-4, 2021
Calgary, Alberta, Canada
<https://www.unmannedsystems.ca/events#!event/2021/11/2/unmanned-systems-conference-2021>

Carbon Monitoring System Science Team Meeting & Applications Workshop

November 16-18, 2021
Location TBD
(Virtual or Denver, CO)
<https://carbon.nasa.gov/>

TFRSAC 2021 Fall Meeting

(November - TBD)
Contact:
Everett Hinkley
[ehinkley@fs.fed.us] or
Vince Ambrosia
[Vincent.g.ambrosia@nasa.gov]



Airborne Science Program Platform Capabilities

Available aircraft and specs

Platform Name	Center	Payload Accommodations	Duration (Hours)	Useful Payload (lbs)	Max Altitude (ft)	Airspeed (knots)	Range (Nmi)
ASP Supported Aircraft							
DC-8	NASA-AFRC	4 nadir ports, 1 zenith port, 14 additional view ports	12	50,000	42,000	460	5,400
ER-2 (2)	NASA-AFRC	Q-bay (2 nadir ports), nose (1 nadir port), wing pods (4 nadir, 3 zenith ports), centerline pod (1 nadir port)	12	2,900	70,000	410	>5,000
Gulfstream III (G-III)(C-20A)	NASA-AFRC	UAVSAR pod	7	2,610	45,000	460	3,400
Gulfstream III (G-III)	NASA-JSC	UAVSAR pod, Sonobuoy launch tube	7	2,610	45,000	460	3,400
Gulfstream III (G-III)	NASA-LARC	2 nadir ports; additional research mods in development	7	2,610	45,000	460	3,400
Gulfstream V (G-V)	NASA-JSC	2 nadir ports; additional research mods in development	10	8,000	51,000	500	>5,000
P-3	NASA-WFF	1 large and 3 small zenith ports, 3 fuselage nadir ports, 2 bomb bay nadir ports, 4 P-3 aircraft window ports, 3 DC-8 aircraft window ports, nose radome, aft tailcone, 10 wing mounting points, dropsonde capable	14	14,700	32,000	400	3,800
Other NASA Aircraft							
B-200 (UC-12B)	NASA-LARC	2 nadir ports, aft pressure dome with dropsonde tube, cargo door	6.2	4,100	31,000	260	1,250
B-200	NASA-AFRC	2 nadir ports	6	1,850	30,000	272	1,490
B-200	NASA-LARC	2 nadir ports, wing tip pylons, zenith site for aerosol inlet, lateral ports	6.2	4,100	35,000	275	1,250
C-130	NASA-WFF	3 nadir ports, 1 zenith port, 2 rectangular windows, wing mount for instrument canisters, dropsonde capable, cargo carrying capable	12	36,500	33,000	290	3,000
Cessna 206H	NASA-WFF	Wing pod, belly pod, modified rear window for zenith ports	5.7	1,175	15,700	150	700
Dragon Eye	NASA-ARC	In situ sampling ports	1	1	500+	34	3
HU-25A Guardian	NASA-LARC	1 nadir port, wing hard points, crown probes	5	3,000	42,000	430	1,900
Matrice 600	NASA-ARC	Imager gimbal	1	6	8,000	35	3
SIERRA-B	NASA-ARC	Interchangeable nose pod for remote sensing and sampling and one nadir port	10	100	12,000	60	600
WB-57 (3)	NASA-JSC	Nose cone, 12ft of pallets using either 3ft or 6ft pallets, 2 Spearpods, 2 Superpods, 14 Wing Hatch Panels	6.5	8,800	60,000+	410	2,500

More information available at: <https://airbornescience.nasa.gov/aircraft>