NASA Airborne Science Program: Capabilities for Terrestrial Ecology

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Role: Remote sensing, Upper Tropospheric and Stratospheric *In situ* sampling

Altitude: 70,000 ft
Payload: 2,900 lbs
Range: 5,000 + Nmi
Based: NASA DFRC

Role: Tropospheric *In situ* sampling, vertical profiles, Synthetic Aperture Radar, remote sensing

Altitude: 41,000 ft
Payload: 30,000 lbs
Range: 5,400 Nmi
Based: NASA DFRC / UND

Role: Remote sensing, Laser profiling, Tropospheric *In situ* sampling

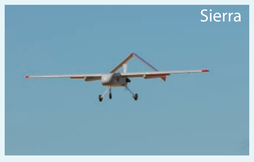
Altitude: 30,000 ft.
Payload: 16,000 lbs
Range: 3,800 Nmi
Based: NASA Wallops

Role: UAVSAR and mid-altitude remote sensing

Altitude: 45,000 ft
Payload: 2,610 lbs
Range: 3,400 Nmi
Based: NASA DFRC

Role: Long duration high-altitude remote sensing; upper Tropospheric and Stratospheric in situ sampling; UAVSAR

Altitude: 65,000 ft
Payload: 3,000 lbs
Range: 3,500 Nmi
Based: NASA DFRC



Role: Low altitude remote sensing and in situ sampling

Altitude: 12,000 ft
Payload: 100 lbs
Range: 550 Nmi
Based: NASA ARC

Role: Remote sensing, Upper Tropospheric and Stratospheric *In situ* sampling, vertical profiling

Altitude: 65,000 ft
Payload: 6,000 lbs
Range: 2,172 Nmi
Based: NASA JSC

Role: Long duration mid-altitude remote sensing and in situ sampling; real-time disaster response imaging

Altitude: 45,000 ft
Payload: 3,000 lbs
Range: 3,500 Nmi
Based: NASA DFRC

Role: Medium lift, medium altitude remote sensing

Altitude: 20,000 ft
Payload: 7,000 lbs
Range: 1,000 Nmi
Based: NASA Wallops

Role: Mid-altitude remote sensing and In situ sampling

Altitude: 32,000 ft.
Payload: 2,000 lbs
Range: 1,883 Nmi
Based: GSFC-WFF

Role: Low-altitude remote sensing and In situ sampling

Altitude: 25,000 ft
Payload: 5,000 lbs
Range: 500 Nmi
Based: Various

Abstract

The Airborne Science Program (ASP) within the Earth Science Division is responsible for providing aircraft systems that further science and advance the use of satellite data. ASP supports the Terrestrial Ecology program with a number of capabilities, including the high altitude ER-2 flying AVIRIS and MASTER sensors, G-III flying UAVSAR, and SIERRA UAS flying a variety of imaging and sampling instruments. The airborne sensor web and Mission Tools Suite provide real-time flight tracking, payload data access, and situational awareness on these and other platforms.

CCE TE Instruments, Aircraft and Missions

Instrument	Aircraft	Mission Supported
AVIRIS	ER-2, Twin Otter	HyspIRI, HyspIRI prep
AVIRIS-NG	Twin Otter	Terrestrial Ecology
PRISM	Twin Otter; ER-2	HyspIRI
HYTES	Twin Otter	HysPIRI
CARVE suite	Sherpa	CARVE (EV-1)
G-LiHT	B-200, C-206H	ICESat-2, HyspIRI
AirMOSS P-band SAR	G-III	AirMOSS (EV-1)
AIRMISPI	ER-2	ACE
UAVSAR (L-band)	G-III, GH	Ecosystem structure, DESDynI
ECOSAR	P-3	Biomass, DESDYNI
MASTER	ER-2, B-200	HyspIRI
eMAS	ER-2	NPP
MMS	SIERRA, GH	ATTREX
Picarro	SIERRA, GH	OCO-2
CO2, etc. samplers	SIERRA	OCO-2
Methane-JPL	DragonEye	Volcanology
LVIS	B-200, GH	Operation IceBridge
GLISTIN-A (Ka-band SAR)	G-III, GH	ICESat-2

Flight Request Process

Requests for the use of the catalog aircraft (both government and commercial) and facility instrumentation are submitted via the web tool at http://airbornescience.nasa.gov (new users must first register.) Details regarding platform, payload, and schedule, together with the science rationale and funding sponsorship, are entered. NASA-subsidized flight hour rates are made available to qualified researchers. Upon evaluation of the request, costs estimates are provided, and final approvals are obtained from Earth Science Division management.

It should be noted that individual arrangements with aircraft providers, outside of this process, to fly NASA equipment and/or personnel are expressly forbidden by agency regulations (NPD 7900.4b)

Contact Information

http://airbornescience.nasa.gov

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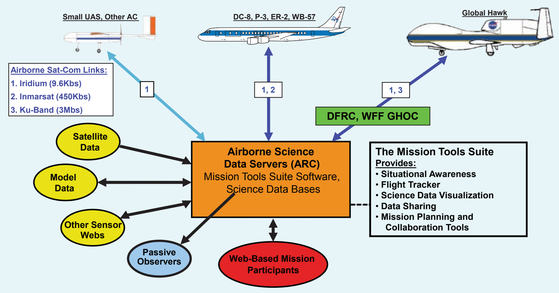
The ASP Sensor Network and Mission Tool Suite

The ASP Sensor Network and the MTS provide the hardware and software tools for real-time collaboration during science missions. The Sensor Network provides two-way Ethernet connections to the payload network onboard each of the core platforms. The web-based MTS includes tools for visualizing instrument observations and aircraft position, as well as a platform for collaborative discussion and analysis, in order to more efficiently execute airborne science missions.



Unmanned Aerial Systems

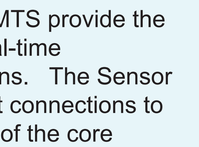
Global Hawk

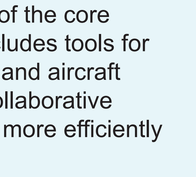
The two large Global Hawk platforms can carry nearly 2,000 lbs. of instrumentation to altitudes above 60,000 ft., with endurances over 24 hours. To date they have been used for continental-scale studies of atmospheric chemistry and dynamics, with both active and passive sensing systems. The UAV-SAR and LVIS LIDAR are currently being integrated to support land process studies.

Global Hawk in the HS3 hurricane sentinel configuration

Sierra

Science payloads on the mid-sized SIERRA UAS have included a hyperspectral imager; LIDAR and SAR for sea-ice topography; an airborne magnetometer for mapping seismic zones; and sampling devices for CO2, CH4, H20, and other atmospheric constituents.





SIERRA UAS: Mapping near-shore waters at Sugarloaf Key, Florida (Oct. 2012)

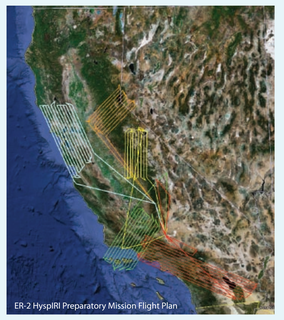
DragonEye

Payloads on these small hand-launched UAS have included sulfur dioxide and particle sensors, air sampling bottles for measuring gas concentrations, and visible and IR video cameras. Flights ranged up to 12,500 feet ASL, more than 2,000 feet above the summit and into the volcanic plume.

DragonEye UAS: Air sampling at Turrialba Volcano, Costa Rica (March 2013)

HyspIRI Prep

Data from the MODIS/ASTER Airborne Simulator (MASTER), together with the JPL AVIRIS imaging spectrometer, are being used to simulate the proposed Hyperspectral Infrared Imager satellite system. A multi-seasonal, repeat-pass data collection campaign (see map at right) has begun in the Spring of 2013.

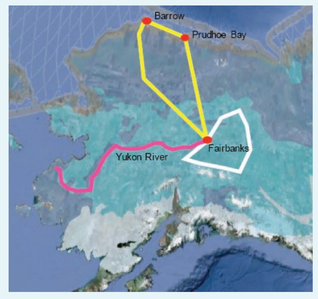


ER-2 HyspIRI Preparatory Mission Flight Plan

CARVE

Carbon in Arctic Reservoirs Vulnerability Experiment
Jet Propulsion Laboratory

This investigation is collecting an integrated set of data to provide unprecedented experimental insights into Arctic carbon cycling, especially the release of important greenhouse gases such as carbon dioxide and methane.
Instruments are being flown in Alaska on the NASA Sherpa aircraft to produce simultaneous measurements of surface characteristics that control carbon emissions.



UAVSAR

Uninhabited Aerial Vehicle Synthetic Aperture Radar

A polarimetric L-Band SAR designed for repeat-pass interferometry to study land surface deformation. (A Ka-Band is antenna currently in testing.) Aircraft flight path is controlled to within a 10 m tube. Operational on the NASA Gulfstream III, with planned transition to the Global Hawk UAS.

EcoSAR

EcoSAR is a GSFC ESTO-supported instrument that will fly on the NASA P-3 in July 2013. The P-band Digital Beamforming Polarimetric Interferometric SAR will be used for studies of biomass, canopy and surface height, ecosystem structure and extent, and disturbance and recovery