



ABOVE
October 2, 2015
Randy Albertson
Airborne Science Program
Deputy Director



Airborne Science Program Mission



The NASA Airborne Science Program exists to enable scientists to achieve NASA Earth science objectives and answer science questions that require the use of airborne platforms, services and infrastructure. The Airborne Science Program does this by providing the Earth Science community access to a pre-eminent suite of airborne capabilities.

- **Science and platform agnostic**
- **Right tool for the job**

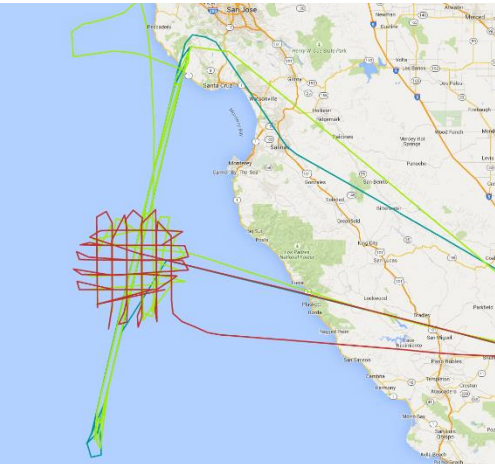


Program Objective 1



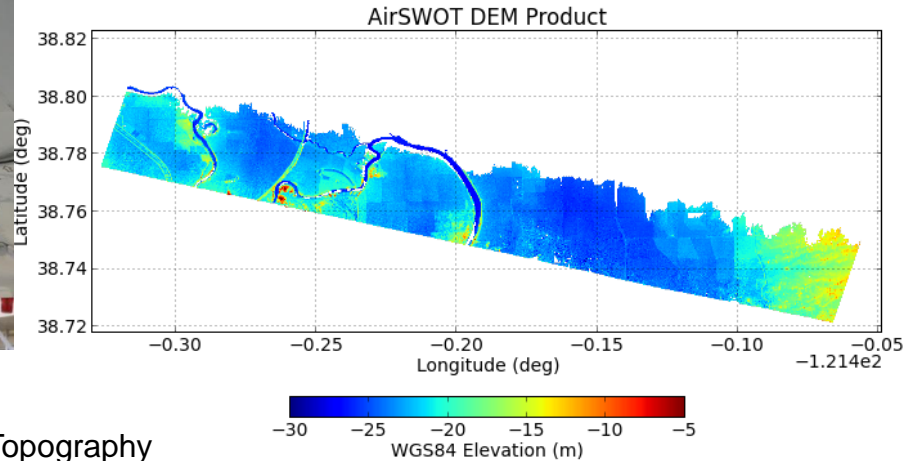
Satellite Calibration and Validation

Provide platforms to enable essential calibration measurements for the Earth observing satellites, and the validation of data retrieval algorithms.



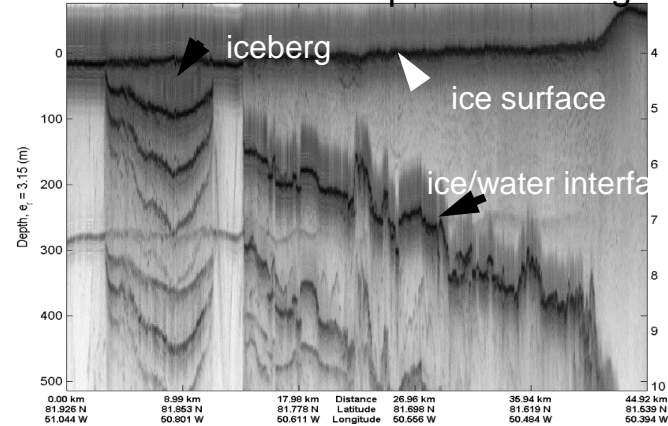
AirSWOT

Airborne Surface Water & Ocean Topography



Millimeter-wave radar interferometry used to map ocean surface topography and surface water heights and slopes. Designed to support SWOT mission: instrument and algorithm development, calibration/validation, ocean and hydrology science

MCoRDS radar quick look image

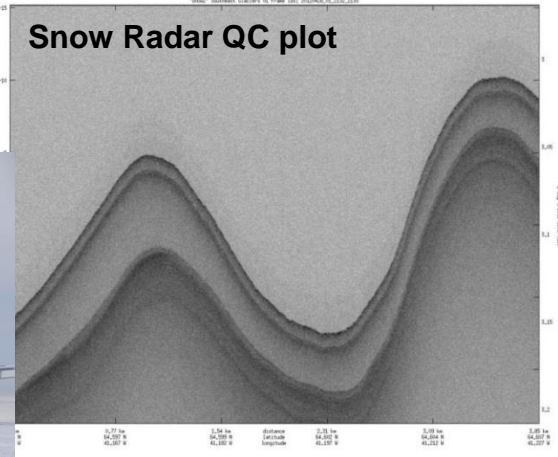


Operation IceBridge

ICESat to ICESat 2 data gapfiller mission



Snow Radar QC plot



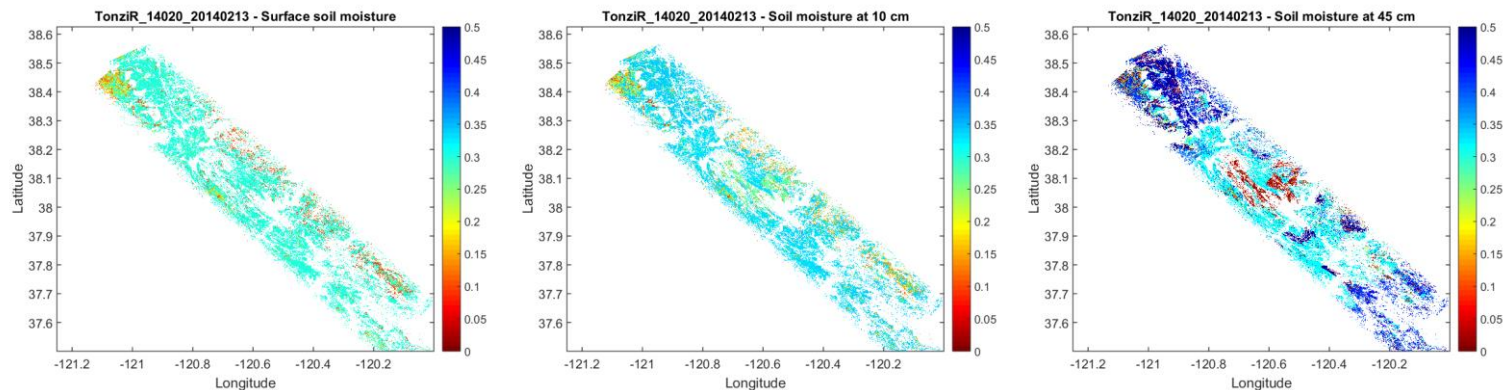


Program Objective 2



Process Studies

Obtain high-resolution temporal and spatial measurements of complex local processes, which can be coupled to global satellite observations for a better understanding of the complete Earth system.



Tonzi Ranch wet season soil water maps from AirMOSS, February 12, 2014



4 June 2015 CARVE Science Flight Yukon-Kuskokwim Delta



Program Objective 3



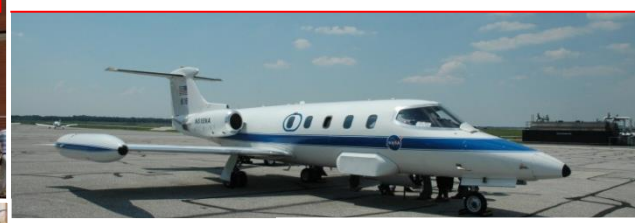
Support New Sensor Development

Provide sub-orbital flight opportunities to test and refine new instrument technologies/algorithms, and reduce risk prior to committing sensors for launch into space.

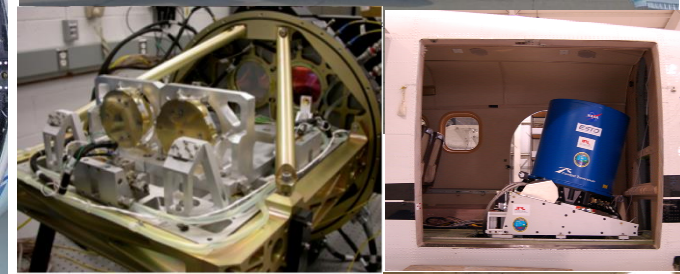
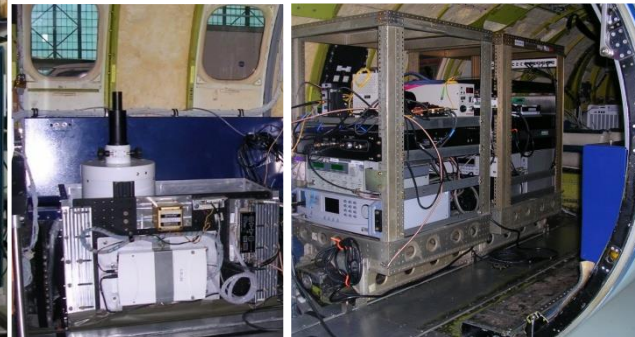
LaRC/ITT ACCLAIM lidar instrument in NASA UC-12



GSFC Airborne CO2 lidar instrument in NASA Lear-25



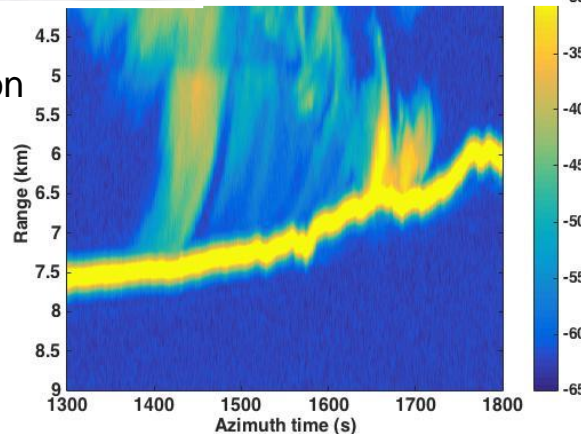
JPL Airborne CO2 lidar instrument in Twin Otter



RainCube is a technology demonstration mission that will enable Ka-band precipitation radar technologies to be flown on a 6U Cubesat

Rain return signal, 6/28/15

RainCube engineering team in cargo hold on board NASA DC-8





Program Objective 4



Develop the Next-Generation of Scientists and Engineers

Foster the development of our future workforce with the hands-on involvement of students, and young scientists/engineers in all aspects of ongoing Earth science investigations.





What does Airborne Science do?



- **Facilitate access to airborne assets capable of supporting NASA's scientific measurements**
 - Core, Catalog, Cooperative and New technology
 - Help get through acquisition, process and regulatory wickets.
- **Provide capabilities to enhance/enable scientific measurements**
 - Mission/Project Management and Logistics
 - Science support systems
 - Airborne networks
 - Approvals for Laser and Radiation, dropsonde release, pressure vessel safety, HAZMAT safety, EMI, foreign clearances, etc
- **Optimize the use of resources**

Science Requirement → Measurements → Platforms

Earth System Science



Sun- Earth
Connection

Climate Variability
and Change

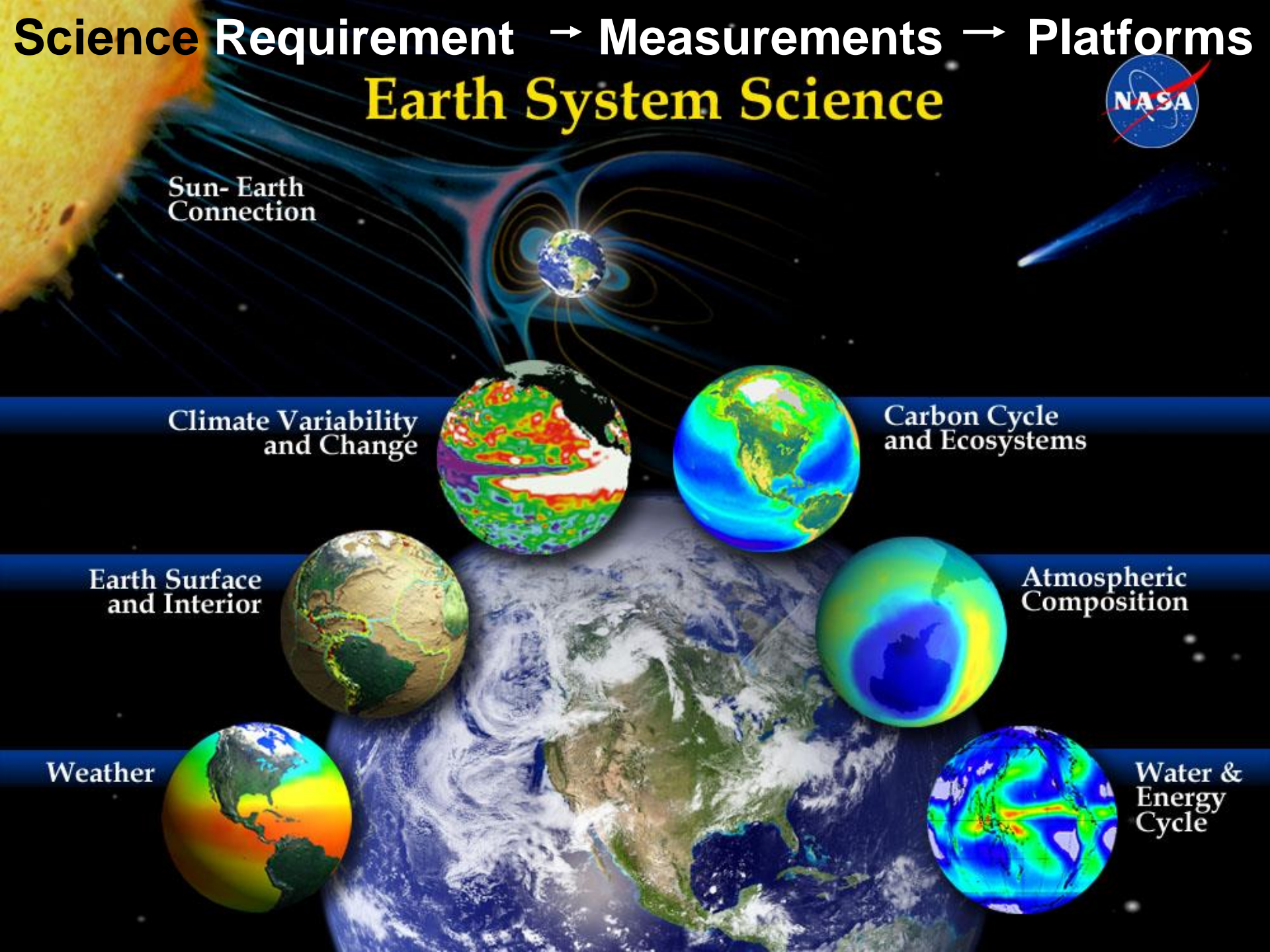
Carbon Cycle
and Ecosystems

Earth Surface
and Interior

Atmospheric
Composition

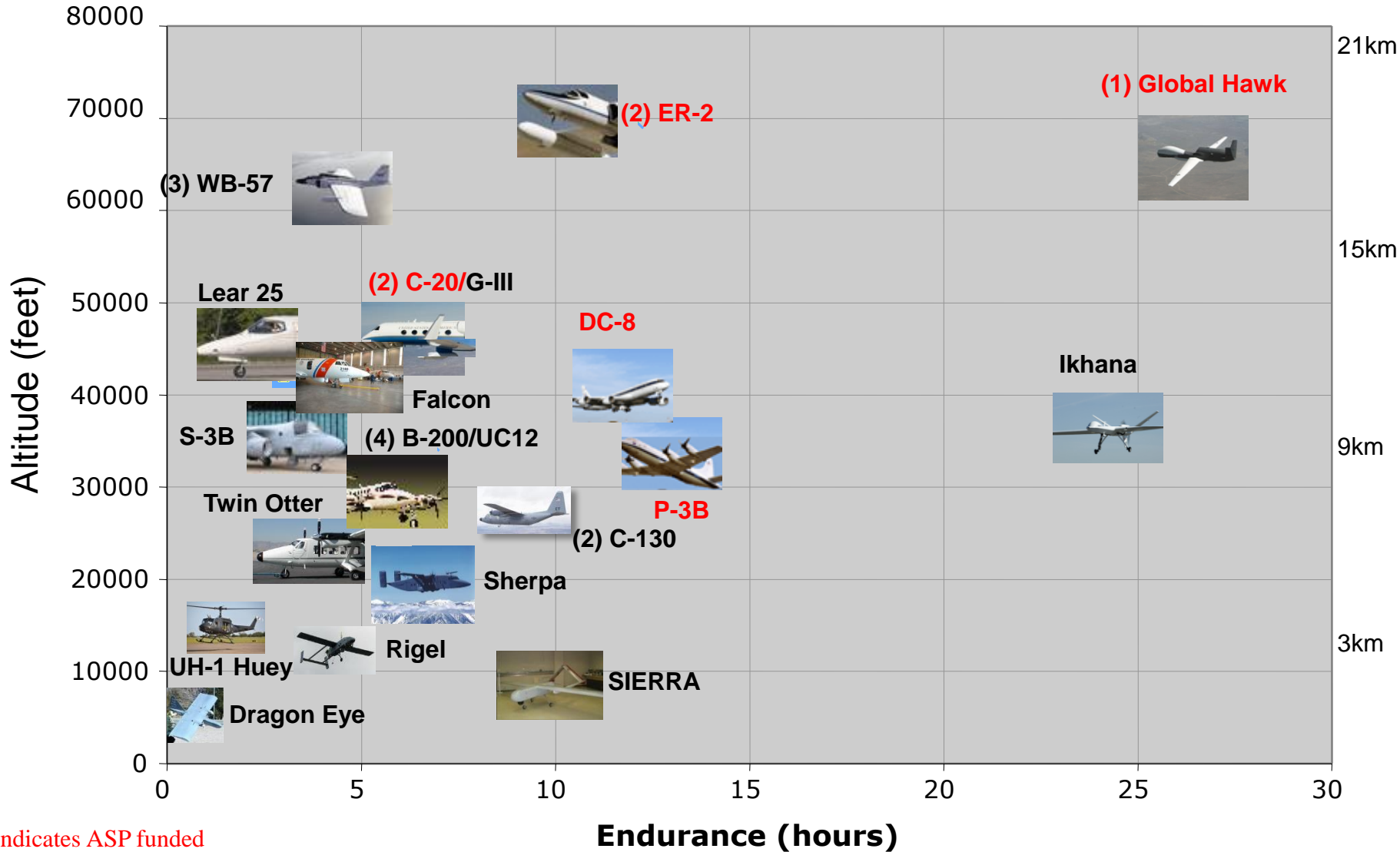
Weather

Water &
Energy
Cycle





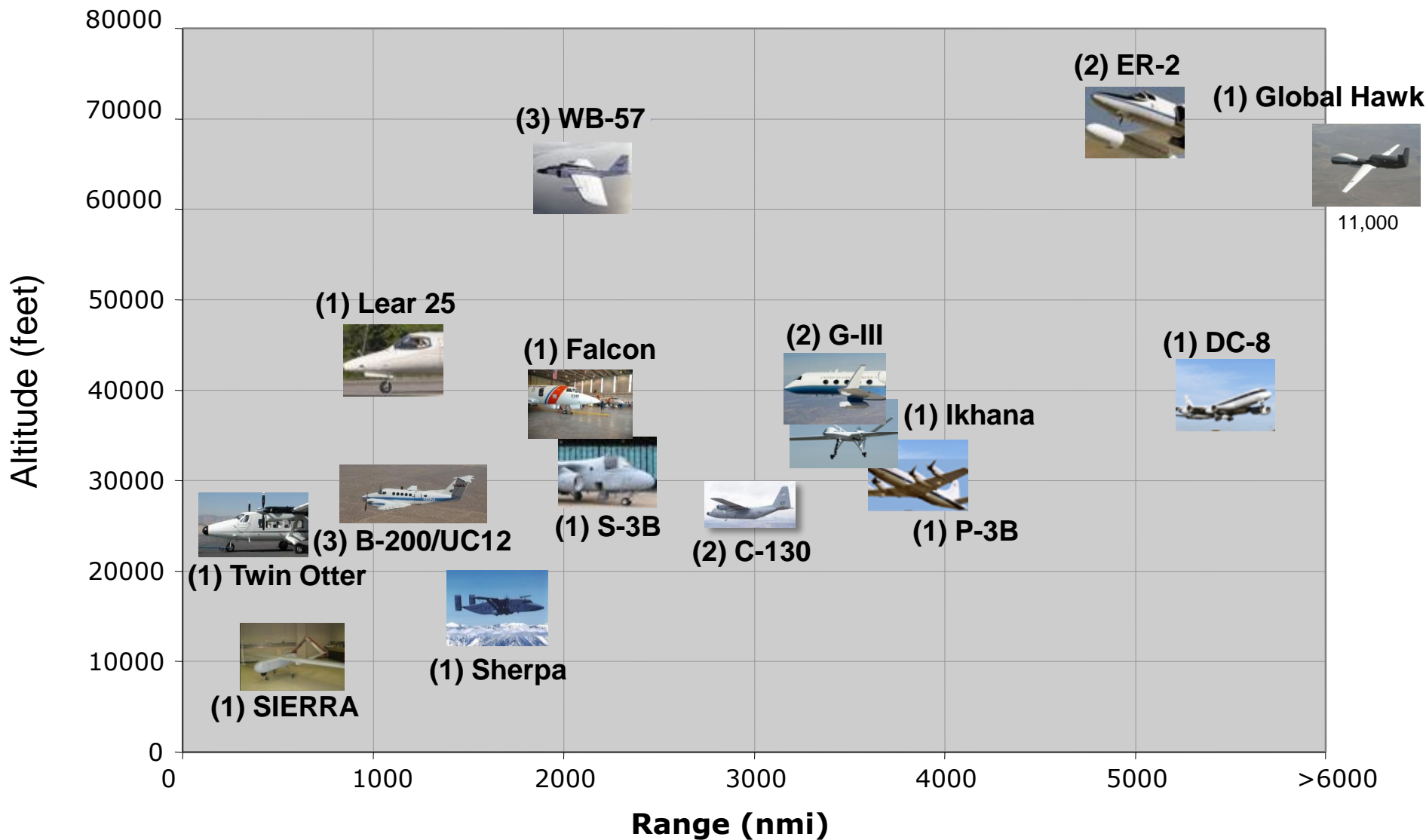
NASA Airborne Science Capable Aircraft

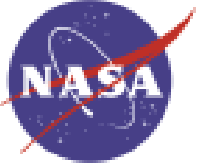


Red indicates ASP funded



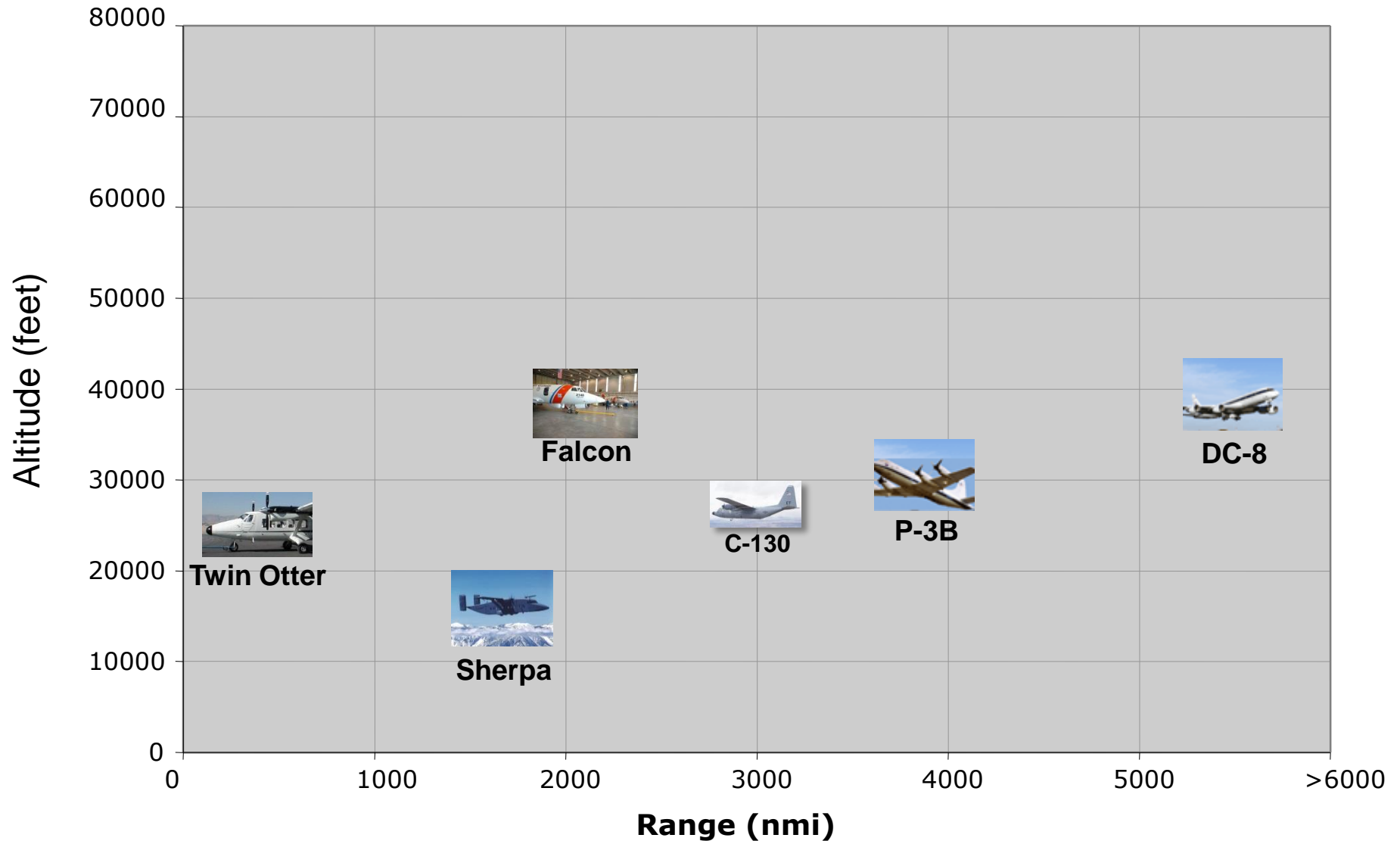
NASA Airborne Science Aircraft





NASA Manned Airborne Science Aircraft

(with nadir ports & room to work for 4 + people)





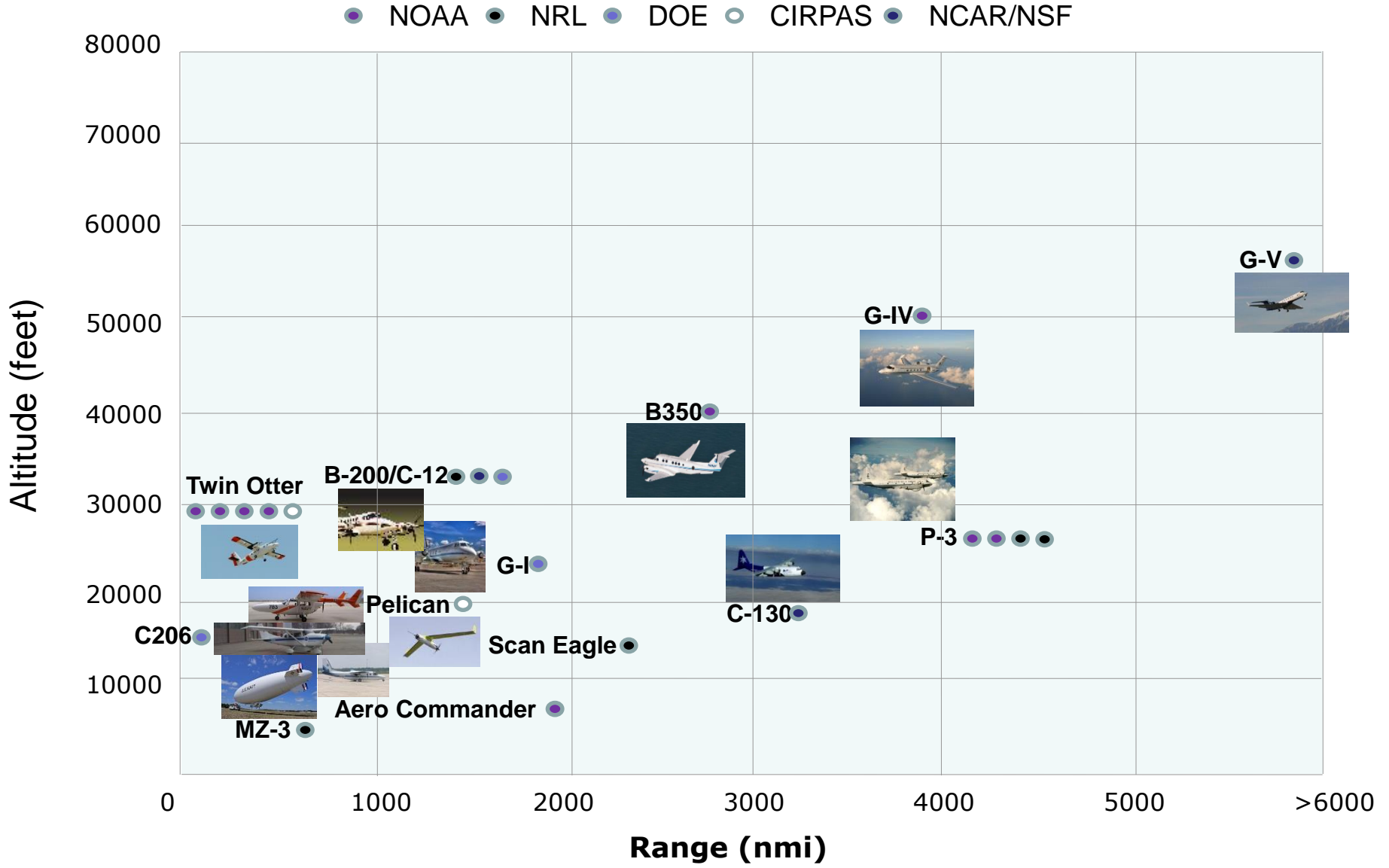
Other Factors for Science Platforms



- Speed
- Payload volume and capacity
- Power
- Perspectives/viewpoints
- Communications/network
- Operations cost/constraints
- Basing/airspace



ICCAGRA Science Research Aircraft (excluding NASA)

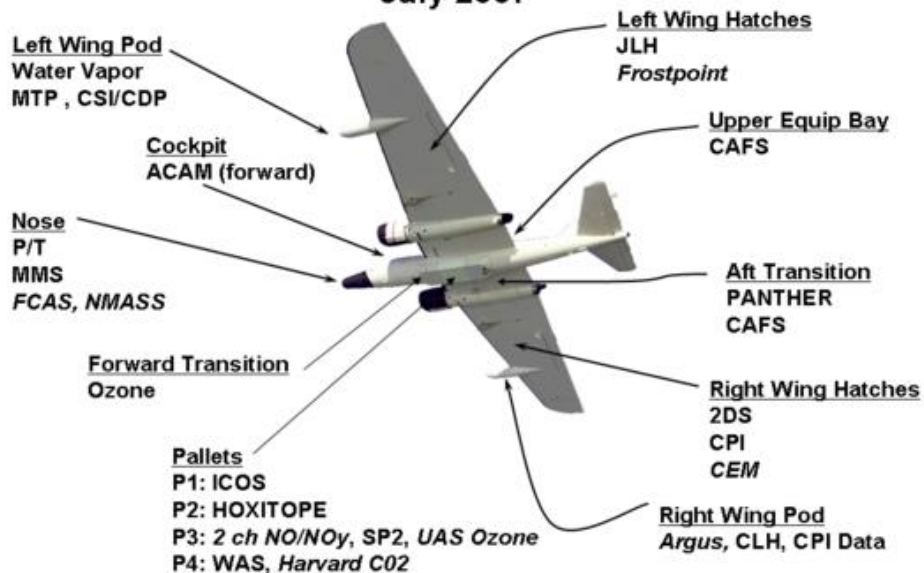




Payload Perspectives

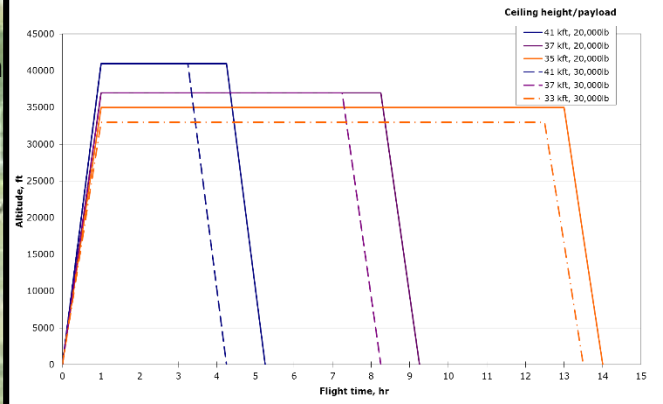
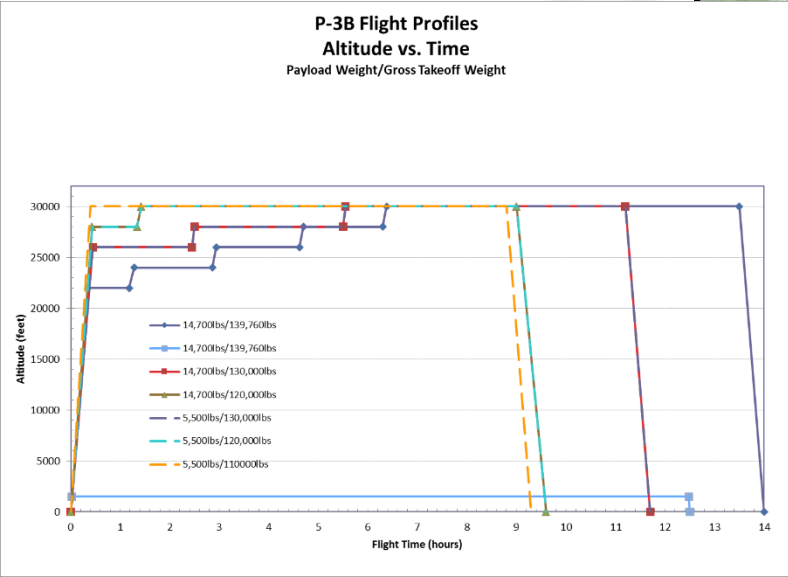
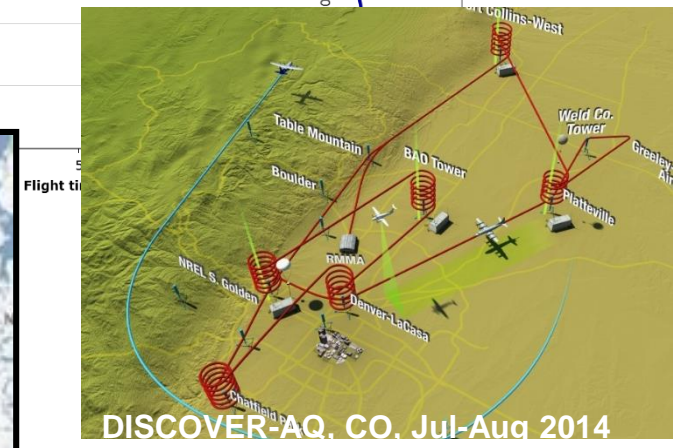
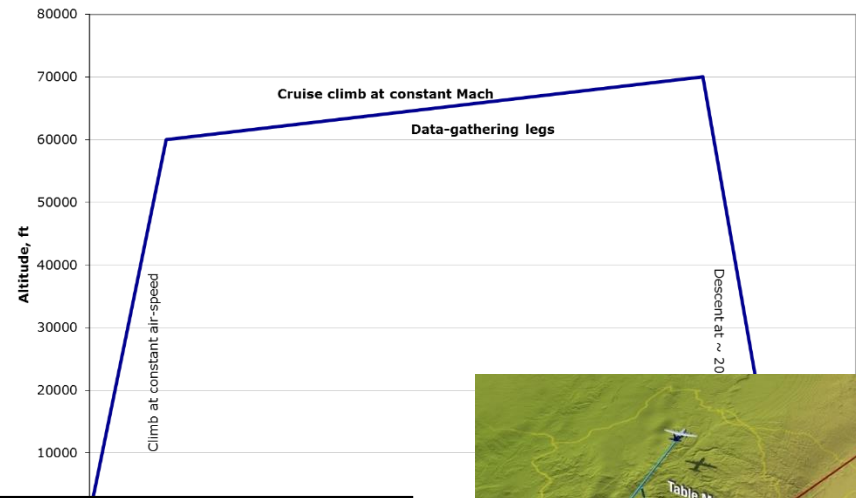
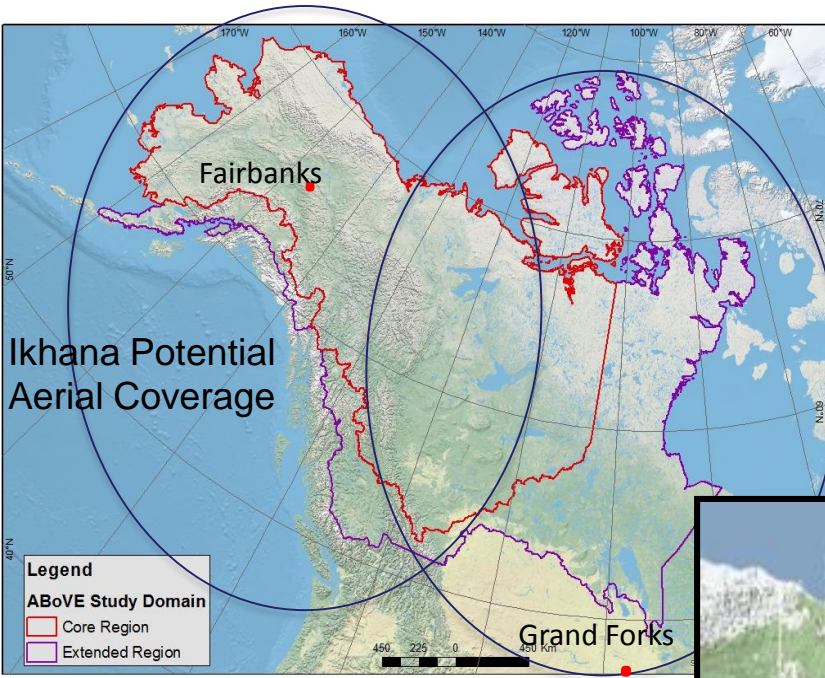


TC4 WB-57 Payload
July 2007





Ranges and Profiles

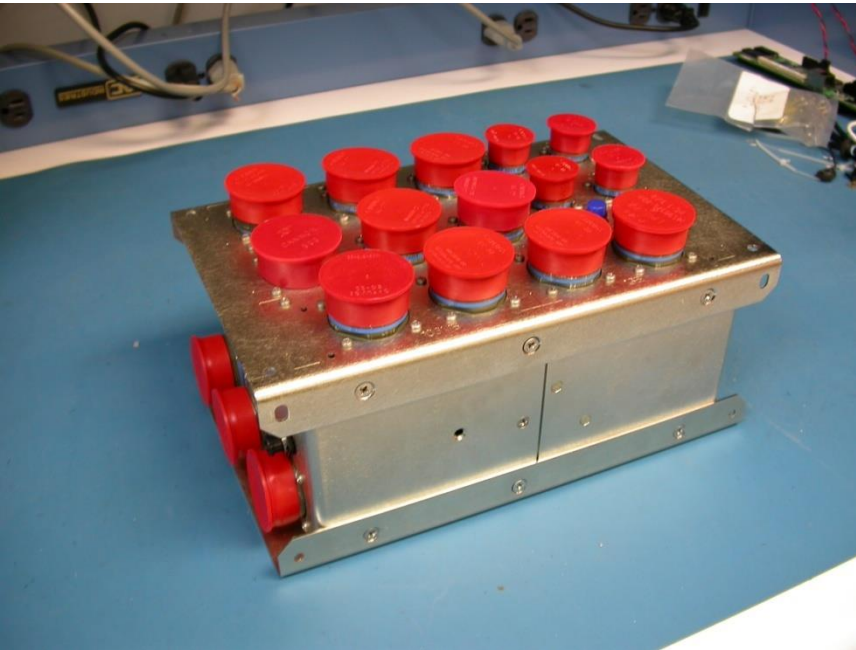




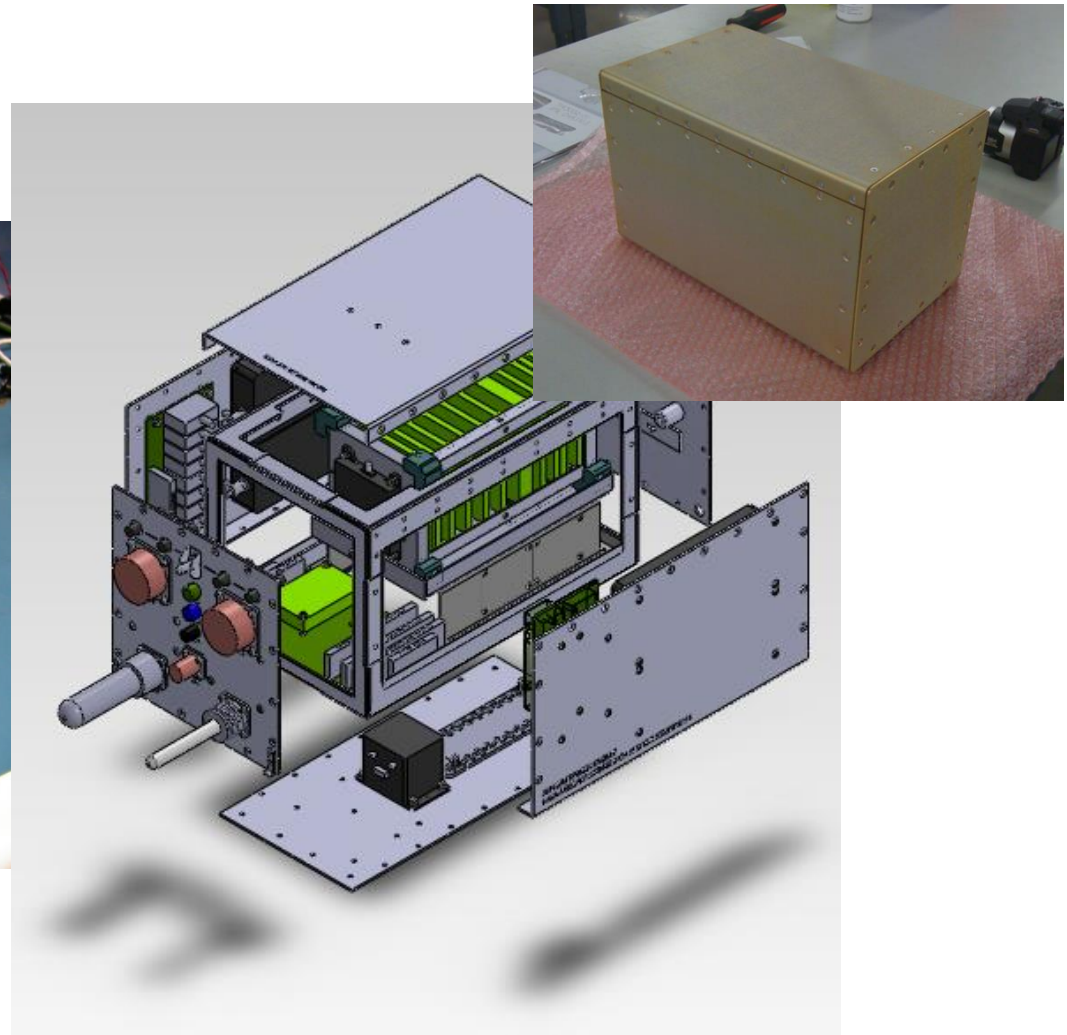
ASP Cross Cutting Infrastructure



NASA Airborne Science Data and Telemetry System (NASDAT) - airborne network server and low bandwidth Iridium gateway which captures navigational data as well as allows scientists to talk to their instruments



Experimenter Interface Panel – science instrument to aircraft interface





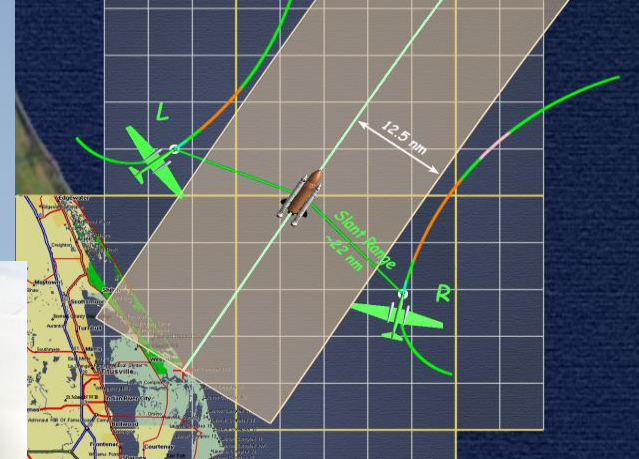
Unique NASA-only Heavy Lift High Altitude Fleet (50k+ feet)



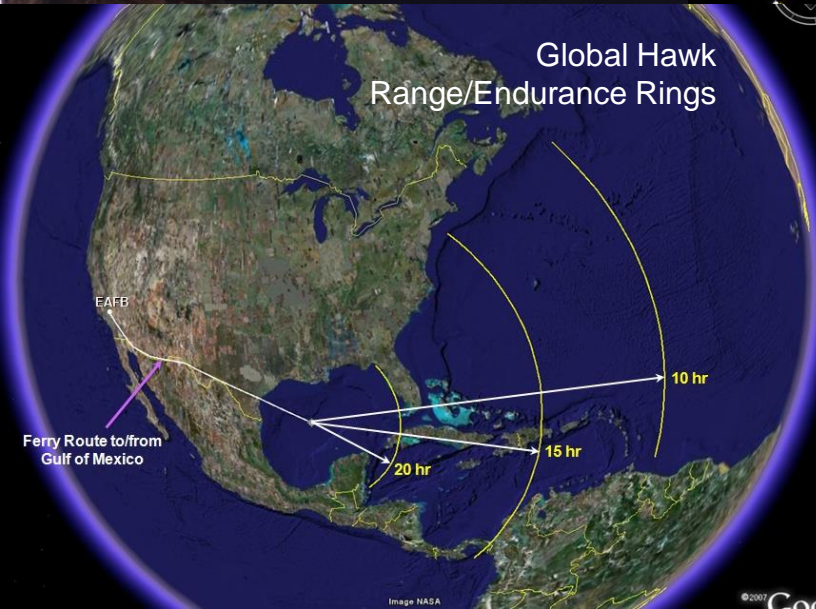
ER-2 (2)



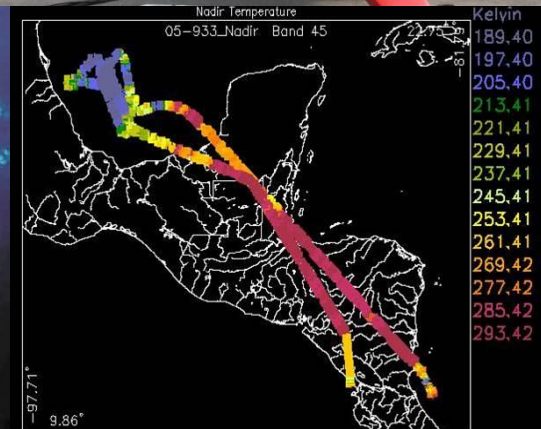
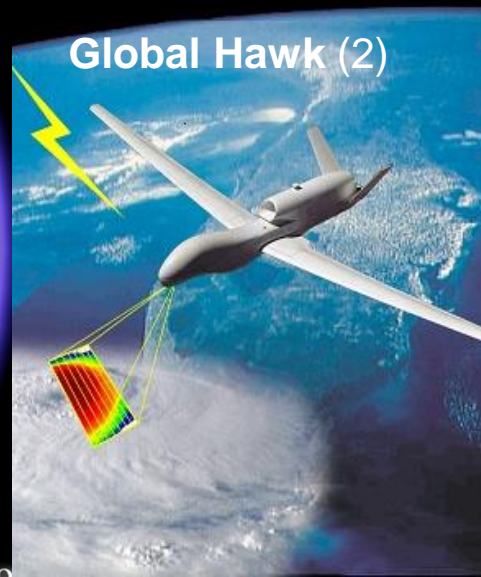
WB-57F (2)



Global Hawk Range/Endurance Rings



Global Hawk (2)



Kelvin	189.40
	197.40
	205.40
	213.41
	221.41
	229.41
	237.41
	245.41
	253.41
	261.41
	269.42
	277.42
	285.42
	293.42



Unique NASA-only Reconfigurable Large Flying Laboratories



- Internal Comm and Data Networks
- Onboard satcom sensor web networks
- Dropsonde Ejectors
- Specialized Racks for quick payload reconfiguration
- Nadir and Zenith ports with sensor attachment provision
- Wing hard points for sensor mounting
- Specialized ports for probe mounts with CFD Analysis
- Common Aircraft State data to Sensor broadcast





Airborne Sensors



Compellation of previously integrated sensors:
<https://airbornescience.nasa.gov/instrument/all>

Program | Platforms | Instrumentation | Mission Tools | Flight Request | PI Support

Log in to Airborne Science | Create New Account

Search

NASA Airborne Science Program

Home > Instrumentation > Airborne Science Instrument Database

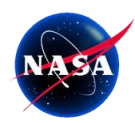
The Airborne Science Instrument Database provides details on the science instruments that have been used as part of NASA-funded airborne research.

To search the database, use any of the following filters to limit the displayed results. To scroll through the results, use the links at the bottom of the page. Clicking on any instrument name will take you to a page providing full information on that instrument.

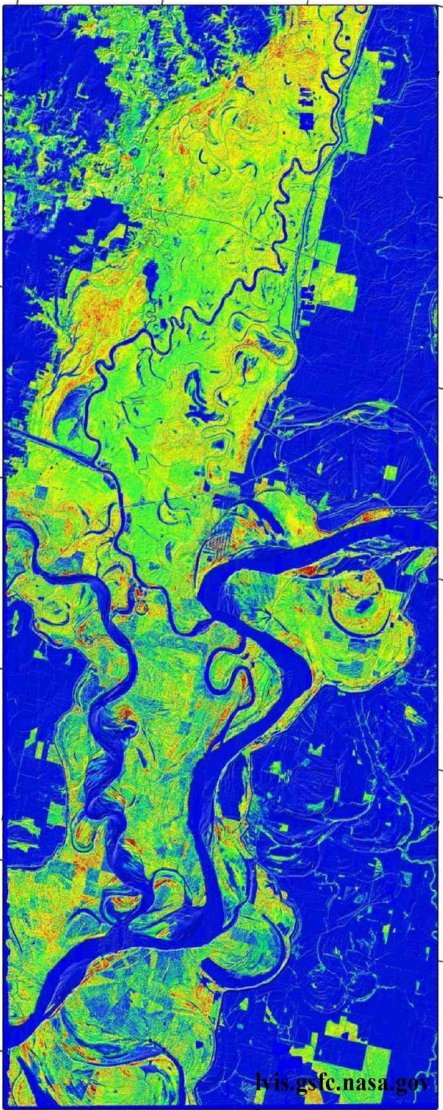
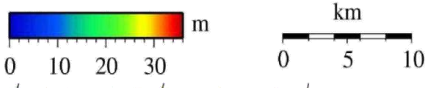
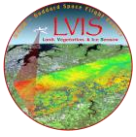
Currently displayed: instruments 1 - 20 of 300.

Title or Acronym:
 PI / Manager:
 Aircraft:
 Type:
 Measurements:

Title	Acronym	Contact Person	Aircraft	Type	Measurements
14-channel NASA Ames Airborne Tracking Sunphotometer	AATS-14	Philip B. Russell (PI)	DC-8, J-31, P-3 Orion, Convair-580, Twin Otter International	Photometer	Aerosol, H2O, O3, Optical Depth, NO2
2 Channel Selected Ion Chemical Ionization Mass Spectrometer	SI/CIMS-2	Fred Eisele (PI)	C-130H Hercules, P-3 Orion	CIMS	OH, H2SO4, CH4SO3, DMSO, NH3, Aerosol
2D-S Stereo Probe	2DS	Paul Lawson (PI)	DC-8, WB-57, Global Hawk, P-3 Orion	Particle imager	Particle size distribution, Particle concentration, Particle Extinction



LVIS Airborne, Swath-mapping Lidar Facility

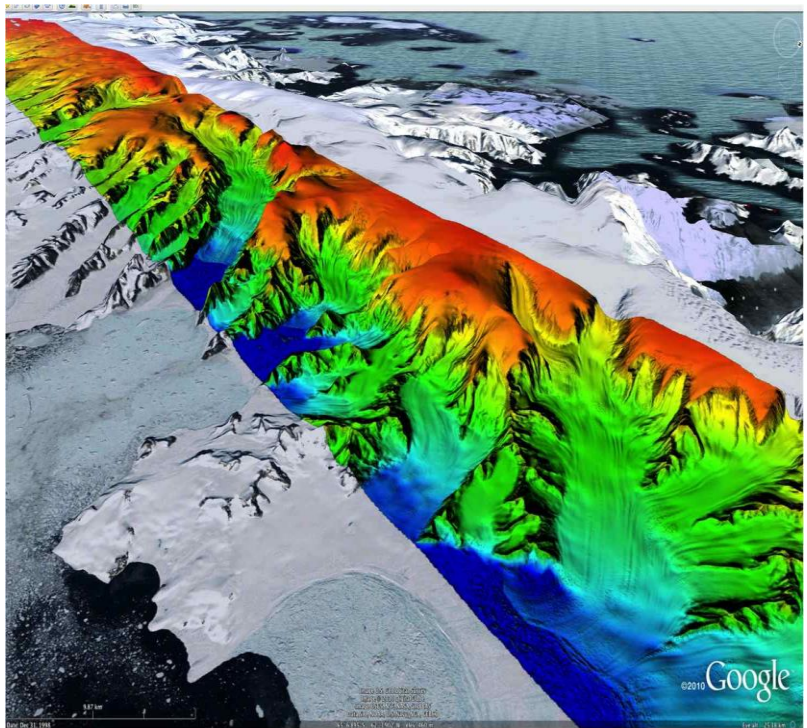


Wide-swath, Full-waveform, High-accuracy Laser Altimeter for large area mapping

- Mature instrument & measurement concept
- Serves multiple science measurement goals (Terrestrial Eco, Cryo, Carbon Cycle, Biodiversity, Natural Hazards,..)
- Capable of mapping 100,000's of sq. km
- Proven capability
- 10 cm vertical and 1 m horizontal accuracy
- Multi-aircraft support
- Initial Operations begin in mid/late-2016

<http://lvis.gsfc.nasa.gov/>
Contact: Bryan Blair, (301) 614-6741
Code 694, Laser Remote Sensing Laboratory
NASA/GSFC

LVIS maps Vegetation Height (Left) and Ice Surface Topography over the Antarctic Peninsula (below)

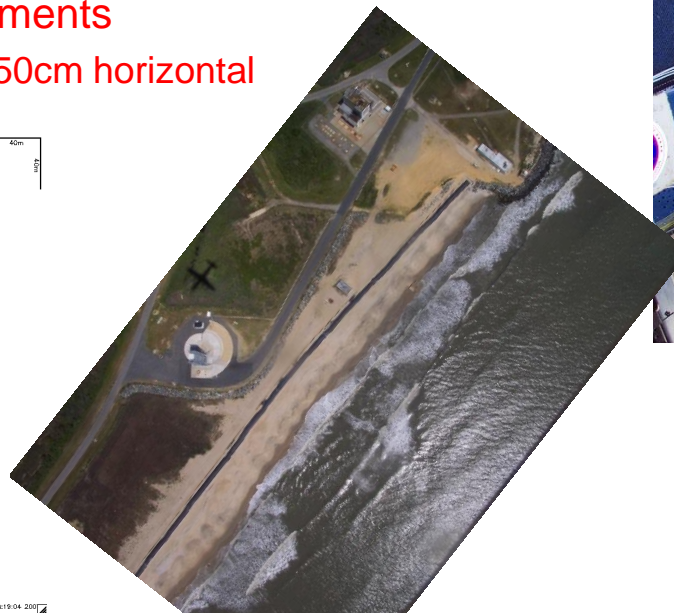
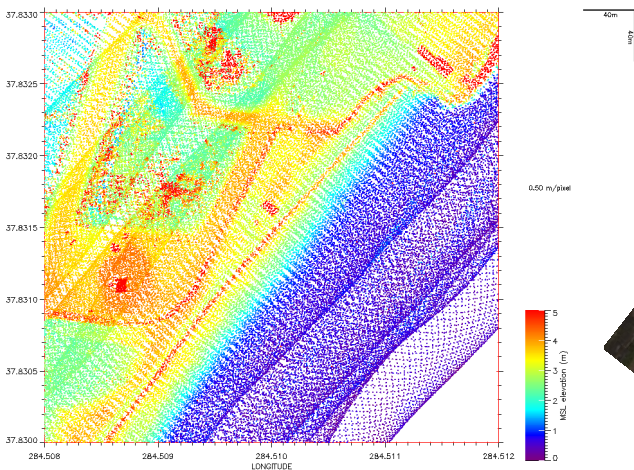
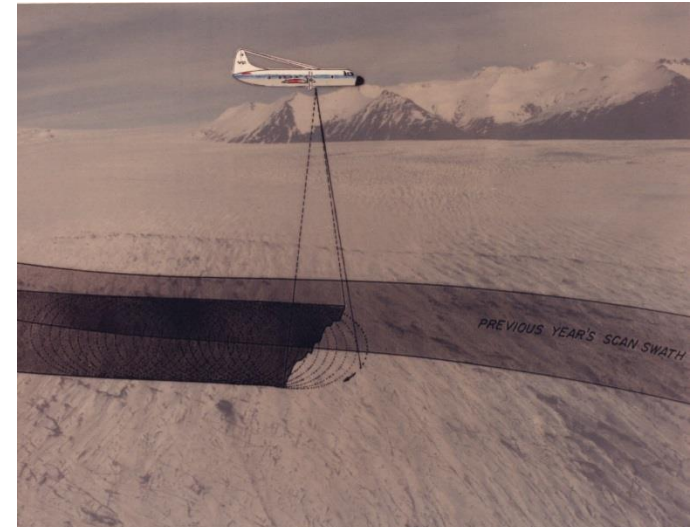




Airborne Topographic Mapper



- Laser
 - 5000 pulses per second, 2-nanosecond wide pulse
 - Rotating scan mirror sweeps beam around a cone @20Hz
 - Gives range to ground ~5cm accuracy
- GPS
 - Ground-based receiver gives reference
 - Airborne receiver
 - Dual-frequency carrier-phase solution gives ~5cm accuracy
- Inertial navigation system (INS)
 - Aircraft attitude (pitch, roll, heading) to ~.04 degrees
- Post-flight processing produces (x,y,z) coordinates of individual ground measurements
~15cm elevation accuracy, ~50cm horizontal





Airborne Facility Sensors



<https://airbornescience.nasa.gov/instrument/facility>

The screenshot shows the NASA Airborne Science Program website. The main navigation bar includes Program, Platforms, Instrumentation, Mission Tools, Flight Request, and PI Support. The left sidebar has a menu with Program, Platforms, Instrumentation (selected), Mission Tools, Flight Request, and PI Support. The Instrumentation sub-menu includes Instrument Database, Facility Instruments, Instrument TRL levels, and Engineering Support. The main content area features the NASA Airborne Science Program logo and a banner image of several aircraft in flight. Below the banner is a breadcrumb trail: Home > Instrumentation > Facility Instruments. A paragraph of text explains that several large remote sensing systems are considered as NASA facility instruments, supported by managers in the ESD Research and Analysis program and/or the EOS Project Science Office. A table lists these systems with columns for Title, Acronym, Contact Person, Aircraft, Type, and Measurements.

Program Platforms Instrumentation Mission Tools Flight Request PI Support

Log in to Airborne Science | Create New Account

Search

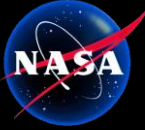
NASA Airborne Science Program

Home > Instrumentation > Facility Instruments

Several large remote sensing systems are considered as NASA facility instruments, in part because they support multiple science disciplines, and a variety of NASA science objectives. They are supported by managers in the ESD Research and Analysis program, and/or the EOS Project Science Office, and are made available to the wider NASA science community via the flight request process. In most cases, instrument operating and data processing costs are recovered from the requesting individual or their sponsors.

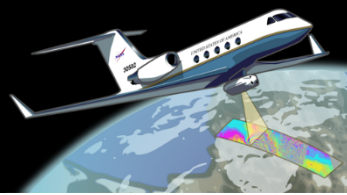
The systems described here reside at either Ames Research Center or the Jet Propulsion Laboratory (noted as ARC or JPL, respectively.)

Title	Acronym	Contact Person	Aircraft	Type	Measurements
Airborne Visible/Infrared Imaging Spectrometer	AVIRIS	Robert O. Green (PI)	ER-2, Proteus, Twin Otter, WB-57	Spectrometer	Imagery
Digital Camera System	DCS	Jeffrey Myers (Mgr)	B200 - LARC, DC-8, ER-2, Twin Otter, WB-57	Camera	Imagery
Digital Mapping System	DMS	Jeffrey Myers (Mgr)	DC-8, P-3 Orion, C-130H Hercules	Camera	Imagery
MODIS Airborne Simulator	MAS	Jeffrey Myers (Mgr)	ER-2	Spectrometer	Imagery
MODIS/ASTER Airborne Simulator	MASTER	Jeffrey Myers (Mgr)	B200 - LARC, Caravan, Cessna 402B, DC-8, ER-2, J-31, WB-57	Spectrometer	Imagery
Next-Generation Airborne Visible/Infrared Imaging Spectrometer	AVIRISng	Robert O. Green (PI)	ER-2, Proteus, Twin Otter, WB-57	Spectrometer	Imagery
Uninhabited Aerial Vehicle Synthetic Aperture Radar	UAVSAR	Yunling Lou (PI)	C-20A (G-III) - Armstrong	Radar	Imagery



UAVSAR Products in the 2015 May CA Capstone/So Cal NLE/Argent Sentry Exercises

JPL, CA Earthquake Clearinghouse

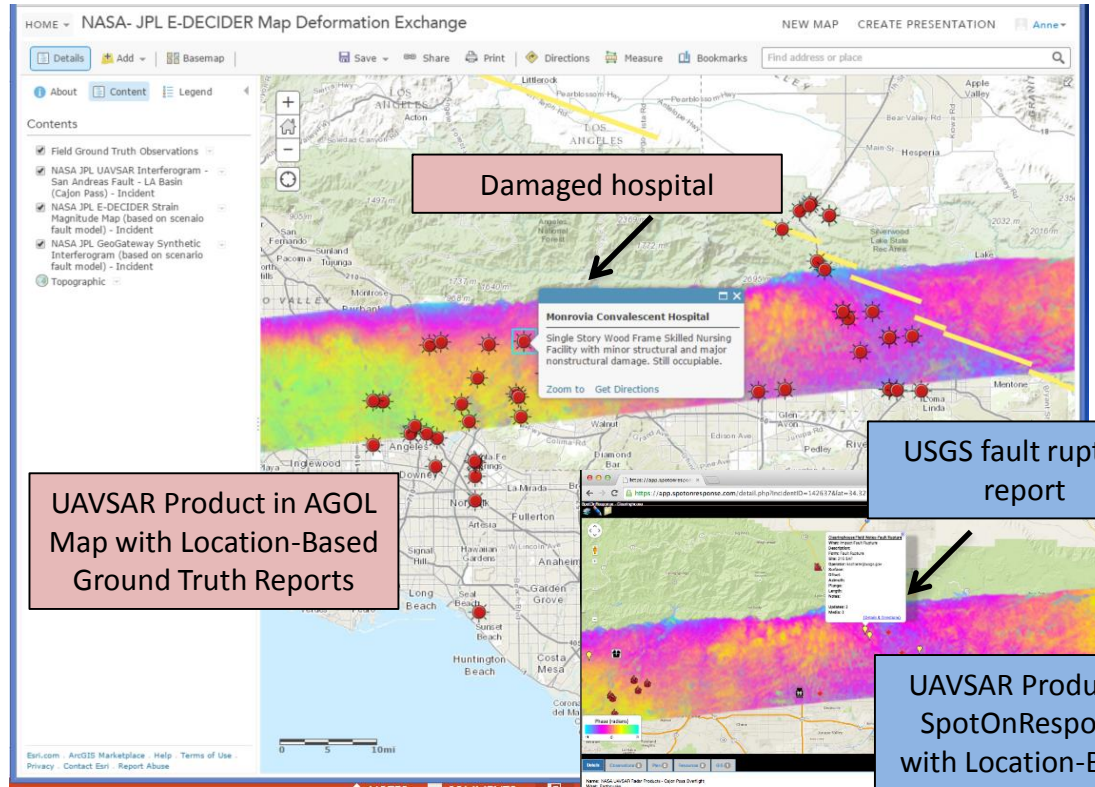
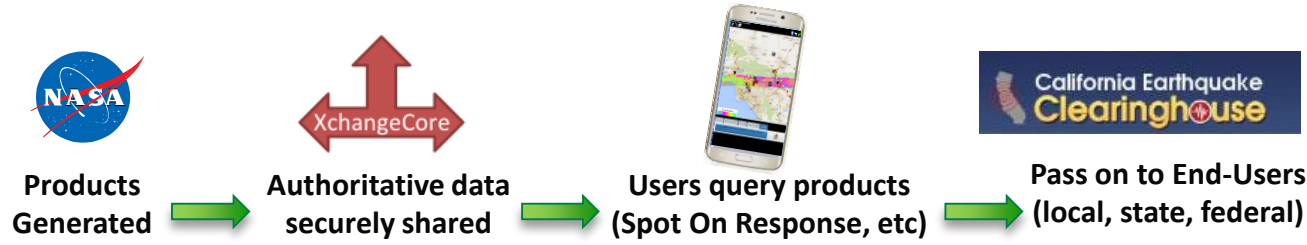


UAVSAR scene acquired across Cajon Pass, northern Los Angeles Basin on May 10; processed and posted to NASA XchangeCore on May 14

The May 2015 CA Capstone/So Cal NLE/Argent Sentry Exercises were a combined 5-day response scenario based on a catastrophic M 7.8 event on the San Andreas fault that occurred May 10-15, 2015.

UAVSAR imagery were collected and posted for distribution to Clearinghouse participants as part of field validation efforts as well as integration into combined map data products.

Successful demonstration of data layers with ground truthing and import into GIS layers for integrated data products.



Clearinghouse After Action Debrief: <https://www.youtube.com/watch?v=aLPW-85b2M8>

Clearinghouse Capstone Website: <http://www.californiaeqclearinghouse.org/exercises/2015-national-level-exercise/>



JPL Airborne Sensors



<http://airbornescience.jpl.nasa.gov/instruments>

The screenshot shows the JPL Airborne Instruments website. At the top, there is a navigation bar with links for JPL HOME, EARTH, SOLAR SYSTEM, STARS & GALAXIES, and SCIENCE & TECHNOLOGY. Below this is the Jet Propulsion Laboratory logo and the text "California Institute of Technology". The main heading is "Earth Science Airborne Program" with the subtitle "JPL's Suborbital Earth Science Instruments & Measurements". A grid of images shows various aircraft and sensors. On the left, there is a "Navigation" sidebar with links for Home, About, Airborne Campaigns, JPL's Airborne Instruments, News, Monthly Highlights, and Contact. Below the navigation is a "Search This Site" box. The main content area is titled "Instrument Summary" and includes a "View" button and "Revisions" link. It states "Submitted by administrator on April 15, 2013 - 12:38". Below this is a section titled "Instrument Observing Frequencies" which features a spectral plot showing transmission for a 1 km path. The plot is divided into VISIBLE, INFRARED, and MICROWAVE regions. The x-axis represents wavelength in micrometers (10 to 1000) and centimeters (0.1 to 100). The y-axis represents transmission. Various atmospheric gases are labeled, including O₂, H₂O, CO₂, and O₃. Below the plot, several instruments are listed with their operating wavelengths: CILS (43 μm), CO2LAS (2.05 μm), ULH (1.37 μm), PRISM (35-1.05 μm), AVIRIS NGIS (.38-2.5 μm), ETS, FTS, ALIAS (3.4-8 μm), HyTES (7.5-12 μm), SLS (.042-.05 cm), A-SMLS (468 μm, 0.13 cm), GLISTIN-A (0.84 cm), AirSWOT (0.84 cm), HAMSr (.16, .25, .60 cm), MTP, ACR (0.32 cm), PALS UAVSAR (24 cm), AirMOSS (0.68-1.07 m), WISE (4.3-7.5 m), and 12-300 m.



JPL Airborne Snow Observatory



Megan Richardson, JPL, (818) 354-8407,
megan.richarson@jpl.nasa.gov

http://airbornescience.jpl.nasa.gov/news/aso-airborne-snow-observ... ASP Mission Tools Suite | NAS... Armstrong Flight Research Ce... NASA Airborne Science Progr... JPL's Earth Science Airborne P... ASO - Airborne Snow Obs...

NASA (4) WeatherBug Display NASA NASA Armstrong Xnet NASA Airborne Science Pr...

Jet Propulsion Laboratory
California Institute of Technology

JPL HOME | EARTH | SOLAR SYSTEM | STARS & GALAXIES | SCIENCE & TECHNOLOGY
BRING THE UNIVERSE TO YOU: JPL Email News | RSS | Mobile | Video

Earth Science Airborne Program

JPL's Suborbital Earth Science Instruments & Measurements

Navigation

- Home
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- Airborne Campaigns
- JPL's Airborne Instruments
- News
- Monthly Highlights
- Contact

Search This Site

Search

Home > News

ASO - Airborne Snow Observatory

Friday, September 25, 2015

Since the ASO team deployed for summer surveys on September 10 we have covered a lot of survey area. We've flown about 56 flight hours, collected data over Devil's Golf course in CA, Rio Grande and Conejos basins in CO for snow baseline data, and about half of our CO Floodplain mapping areas which include Sam Miguel, Ouray, parts of Montrose and San Juan counties in CO (also includes the Gold King Mine spill area).

Floodplain

- Completed Areas:
 - 2, 4, 6
 - 5 (lines 1-47)
- Remaining
 - 1, 3
 - 5 (lines 57-62)

CO Flood Plane Mapping Zones

1. 17,000-20,000 m²
2. 20,000-25,000 m²
3. 25,000-30,000 m²
4. 30,000-35,000 m²
5. 35,000-40,000 m²
6. 40,000-45,000 m²

8:23 AM
10/1/2015



How to Access

- Solicited and Unsolicited Proposals
 - Research Opportunities in Space and Earth Science (ROSES)
 - Technology infusion
 - Satellite support
- Science Operations Flight Request System (SOFRS):
<https://airbornescience.nasa.gov/sofrs/>
 - Details of what, where, when, how much, payload, sponsor/funding source, etc.
 - Means to acquire cost estimates, mission planning
 - Report progress and access status
- Process:
 - Investigators fill out flight requests for each research activity
 - ASP analyzes for implementation (cost, schedule resources)
 - HQ's program scientists analyze for science merit and alignment
 - Many times to minimize our flight costs for data collection we are able to incorporate multiple flight requests into one mission.



Program

Platforms

Instrumentation

Mission Tools

Flight Request

My account Log out

Search

NASA Airborne Science Program



- SOFRS
 - New Flight Request**
 - Flight Requests
 - User Control Panel
 - How To Submit a Flight Request**

[Home](#) > Science Operations Flight Request System (SOFRS)

Science Operations Flight Request System (SOFRS)

Accessing NASA Airborne Science Platforms and Instruments

The Airborne Science Program (ASP) maintains aircraft and sensor assets to support the Science Mission Directorate (SMD). The Science Operations Flight Request System (SOFRS) manages and tracks the allocation of the ASP aircraft and facility sensors. The aircraft ([platform](#)) as well as facility sensor ([instrumentation](#)) information is accessible through the Airborne Science Program website.

Requests for scheduling these assets shall be submitted through SOFRS. This system was designed to allow researchers to have access to unique NASA aircraft, as well as some commercial aircraft with which NASA has made contracting arrangements.

The only way to schedule the use of NASA SMD platform and instrument assets is to submit a Flight Request through SOFRS.

Step by step instructions for submitting a Flight Request are at this link:

[HOW TO SUBMIT A FLIGHT REQUEST](#)

User Fees

The assets of the program are available on a fee-for-service basis, although, because the SMD maintains a base capability, only the marginal cost of the actual missions are borne by experiments given NASA HQ science concurrence. User fees are based on the flight hour cost (e.g. pilots, in-flight engineer, fuel, etc.), mission-specific costs (engineering and deployment costs) and any ancillary support costs (satellite communication requirements, facility instrument data and operations costs).



Proposals



- Relates to NASA need

- Need to respond to NASA science plan

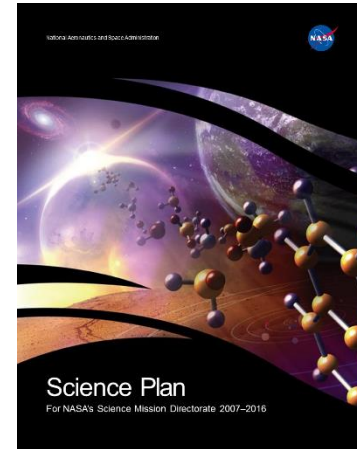
- How is the global earth system changing?

- What are the sources of change in the Earth system and their magnitudes and trends?

- How will the Earth system change in the future?

- How can Earth system science improve mitigation of and adaptation to global change?

- http://science.nasa.gov/media/medialibrary/2010/03/31/Science_Plan_07.pdf



- Scientific merit

- Adequately addresses measurement approach

- Implementability

- Can be done within available resources/schedule

- Doesn't require "Unobtainium"

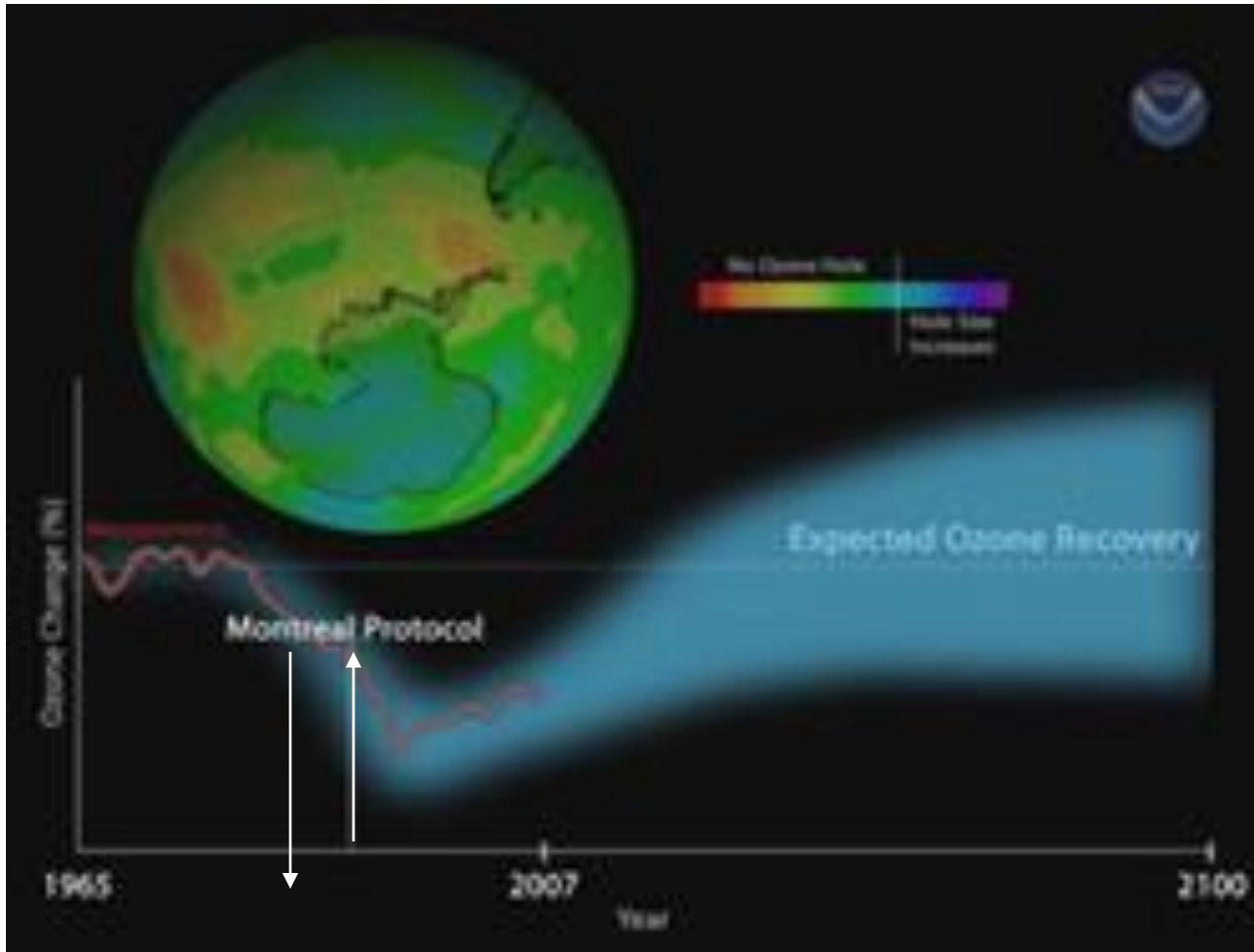


- NRA/Cooperative Agreement Notice Proposers' Guidebook

- <http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2015.pdf>



How Can Airborne Data and Policymakers Benefit Society



How policy has protected our planet

Using Airborne Science facilities scientists collect the data that led to the determination that CFC's are the main contributor to ozone hole formation



Summary



- ASP Objectives
 - Satellite Cal/Val
 - New Sensor and Algorithm development
 - Process Studies
 - Next Generation of Scientist and Engineers
- Science Aircraft
 - Modified and capable
- ASP Provides the infrastructure and personnel to conduct these investigations in accordance with NASA, national and international policies and regulations
- Numerous sensors have been integrated
- Support National Science Objectives to provide the policymakers with the information to benefit society