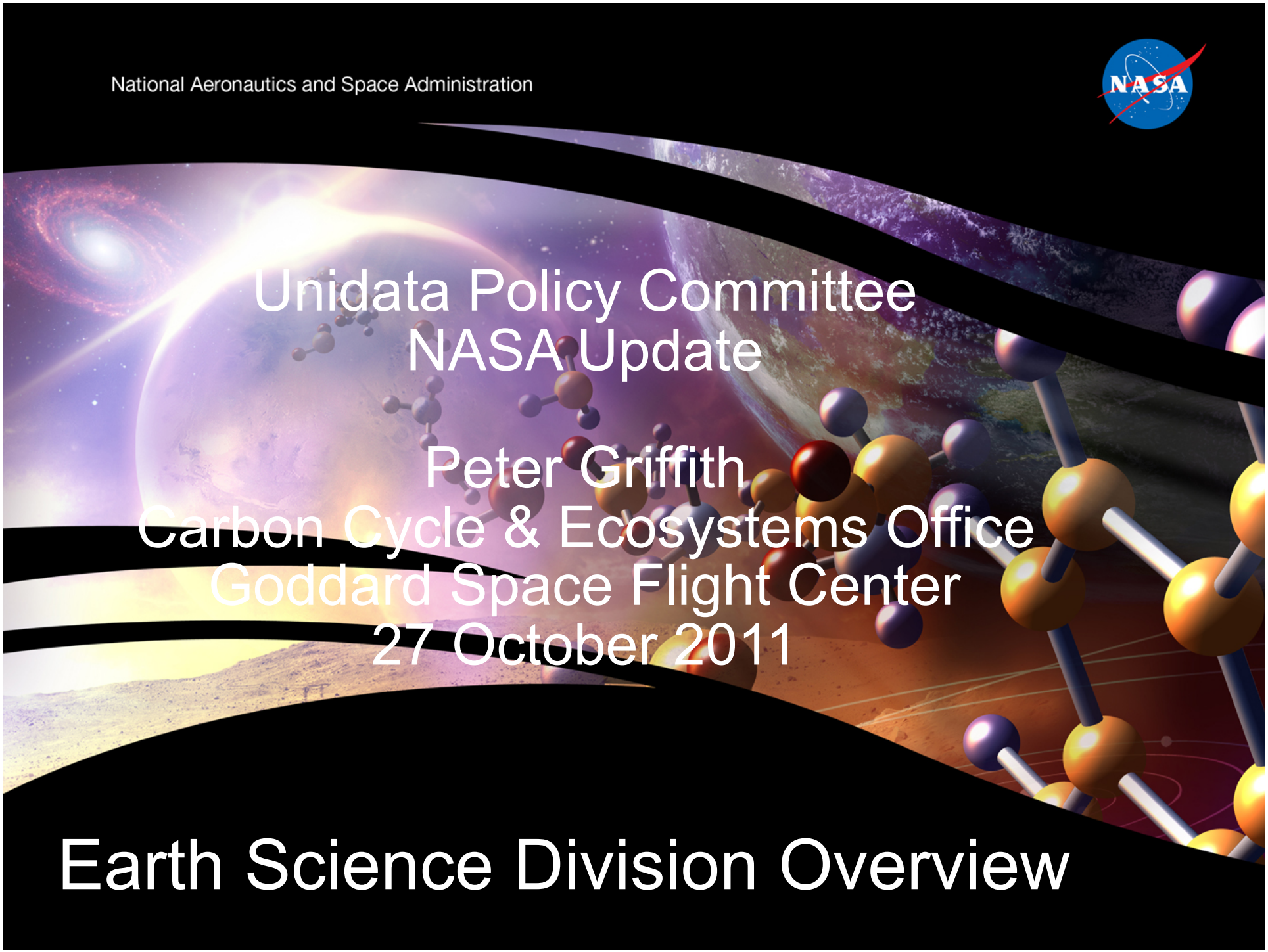
National Aeronautics and Space Administration

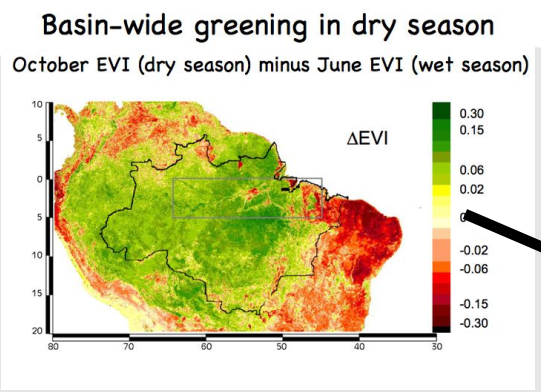


Unidata Policy Committee
NASA Update

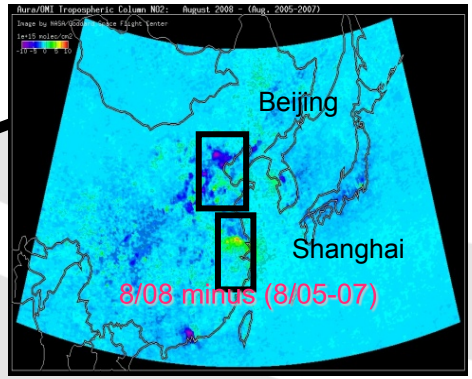
Peter Griffith
Carbon Cycle & Ecosystems Office
Goddard Space Flight Center
27 October 2011

Earth Science Division Overview

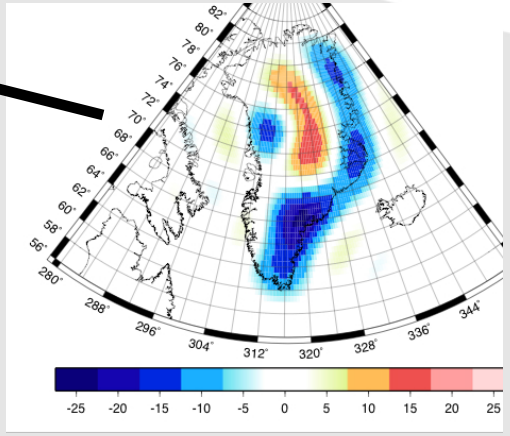
Earth Science Division Focus Areas



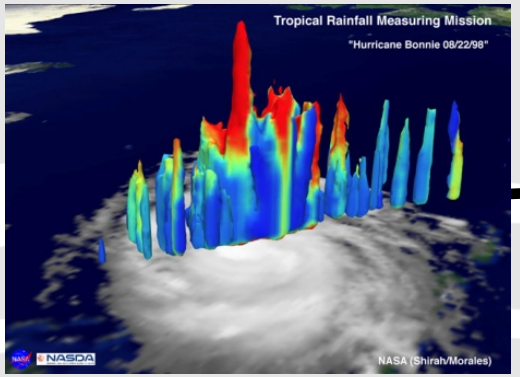
Atmospheric Composition



Carbon Cycle and Ecosystems

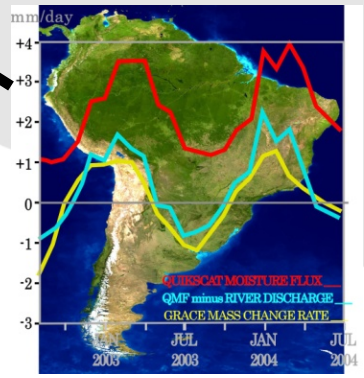


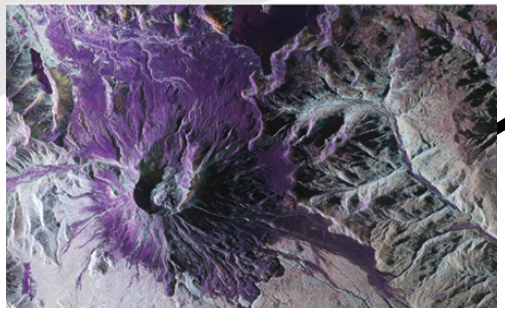
Climate Variability and Change



Weather

Water and Energy Cycle





Earth Surface and Interior

USGCRP NACP: North American Carbon Program
http://www.nacarbon.org

NEX- NASA Earth Exchange at Ames Research Center
https://c3.nasa.gov/nex/

NASA's Carbon Monitoring System
http://carbon.nasa.gov/index.html

ABoVE- Arctic Boreal Vulnerability Experiment
http://cce.nasa.gov/terrestrial_ecology/scoping.html

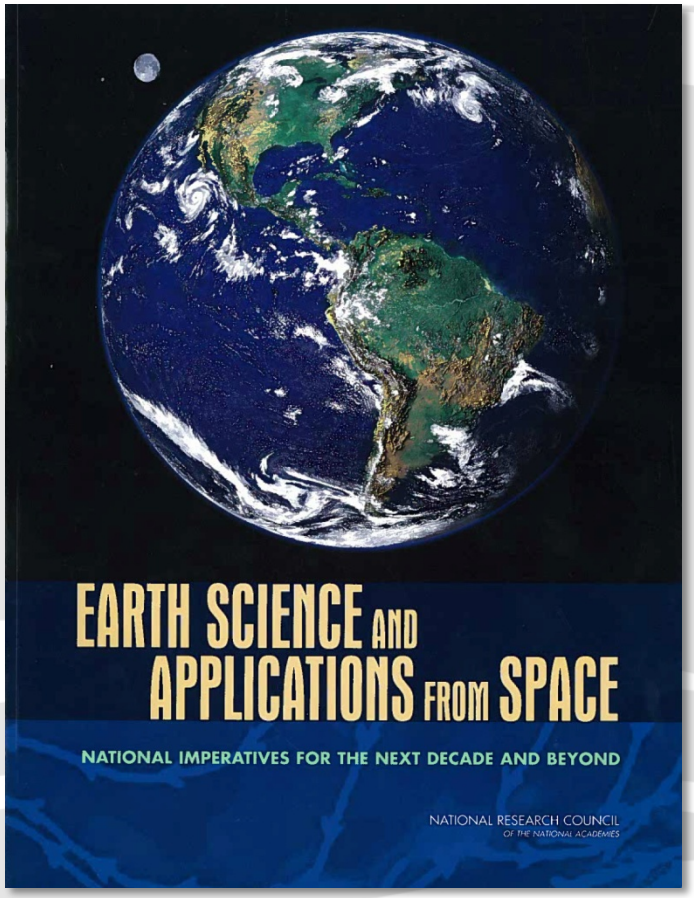
Carbon Crisis in 90 Seconds video
http://www.youtube.com/watch?v=85TQHzS88L4

FYI:

USGCRP Strategic Plan open for public comment

USGCRP "A Carbon Cycle Science Plan" released in October

Guiding Recommendation Documents



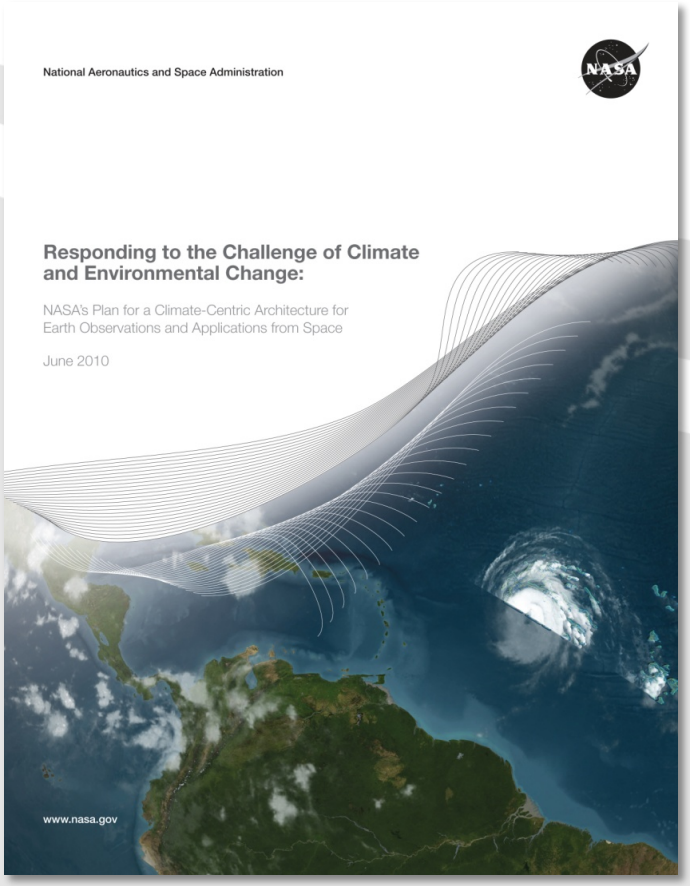
2007 Decadal Survey

- Research and Applications communities priorities
- No realistic budget constraint (calls for $2B funding [FY06 constant $$ beginning in FY10)

Administration priorities and constraints

Decadal survey, OCO-2, climate continuity missions, balanced program

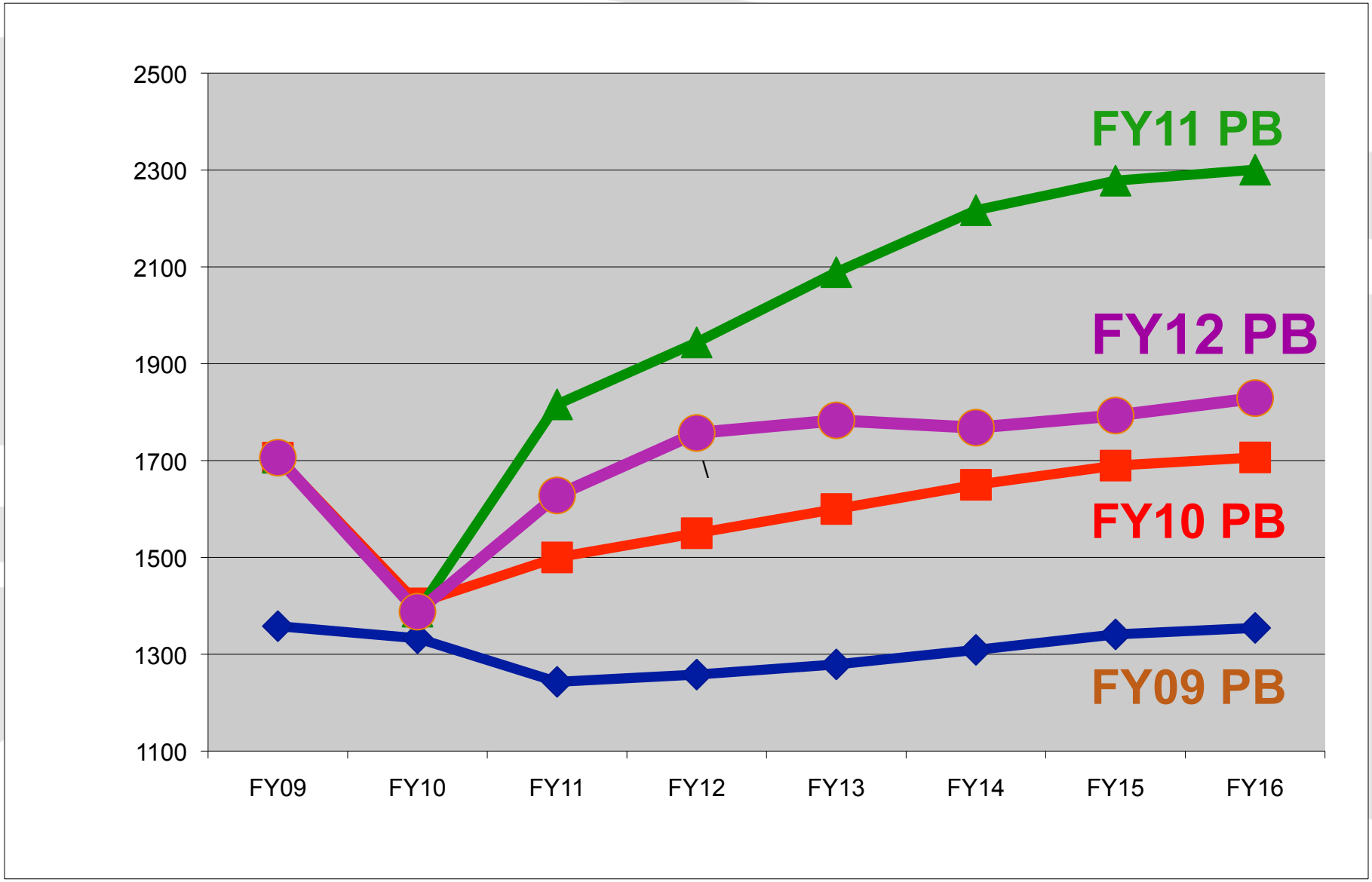
Integrated Program



http://science.nasa.gov/media/medialibrary/2010/07/01/Climate_Architecture_Final.pdf

- Dec Surv + Administration priorities
- Executable for FY11 Pres. Bud.
- OSTP, USGCRP, OMB approval

BUDGET OUTLOOK (incl. FY11 Appropriation)



End-to-end Support in a Globally Integrated Program

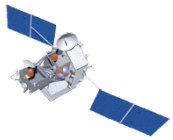
Airborne Sensors

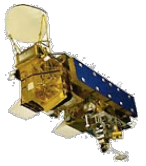
Research Balloons

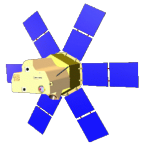
Uninhabited Aerial Vehicles

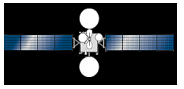
Field Campaigns

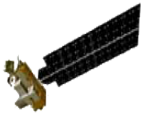
Space-based: Sensors & Data Relay

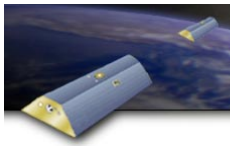












Ground Networks

Buoys

Research Vessels

Ground Stations

Ground Stations

Research Balloons

NASA's & Partners' ground, sea, air and in-situ measurements augment space-based observations to validate science results and provide complimentary measurements

ESD Has Missions in Every Phase of Development

Project Life Cycle

Project Pre-Formulation	Project Formulation		Approval (For Implementation)	Project Implementation		
Pre-Phase A	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F

NASA:
DESDynI-R
CLARREO
SWOT
ASCENDS
ACE
GEO-CAPE
HyspIRI
PACE
QuikSCAT FO

LIST
GACM
PATH
3D-WINDS
GRACE II
SCLP

15

NASA:
SAGE III (soon)
GRACE FO (soon)

2

NASA:
SMAP
ICESat-2

2

NASA:
NPP
GPM
LDCM
OCO-2
EV-1

5

NASA Prime:
Aquarius

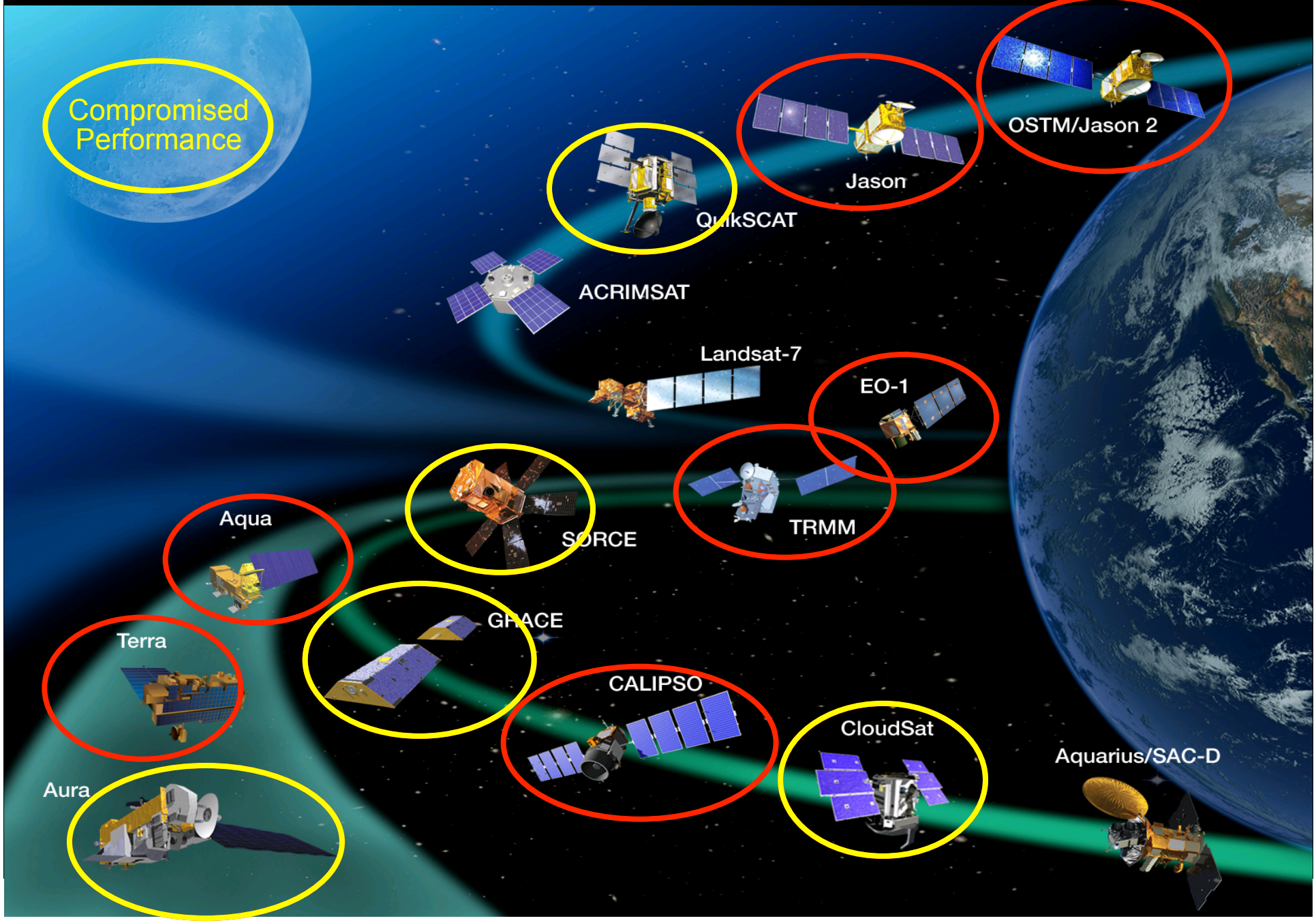
Extended:
Aura
OSTM
Aqua
Terra
TRMM
Jason
EO-1
QuikSCAT
SORCE
Acrimsat
CALIPSO
CloudSat
GRACE

14

Includes Data systems to support all these missions, current and planned

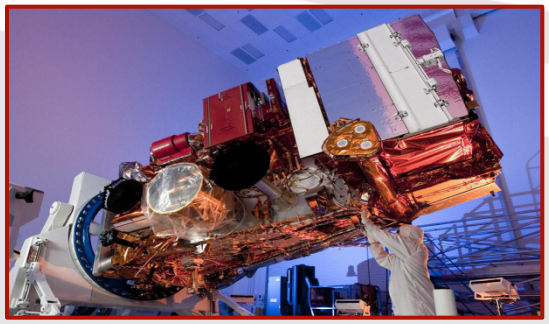
JPSS-1, Jason-3, TSIS, CERES/ERBS are all now managed for NOAA by the new JASD at HQ

NASA Operating Missions (Included in Senior Review)

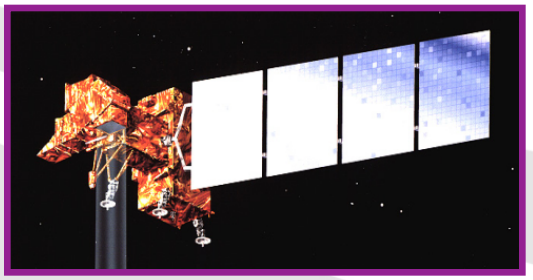


Missions in Formulation and Implementation

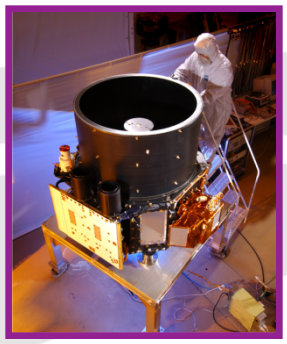
AQUARIUS
6/10/2011
w/CONAE; SSS



NPP
10/25/2011
w/NOAA
EOS cont., Op Met.



LDCM
12/2012
w/USGS; TIRS



ICESat-2
April 2016
Ice Dynamics

SMAP*
Late CY2014
w/CSA
Soil Moist., Frz/Thaw

GPM
7/2013 (TBR)
w/ JAXA; Precip

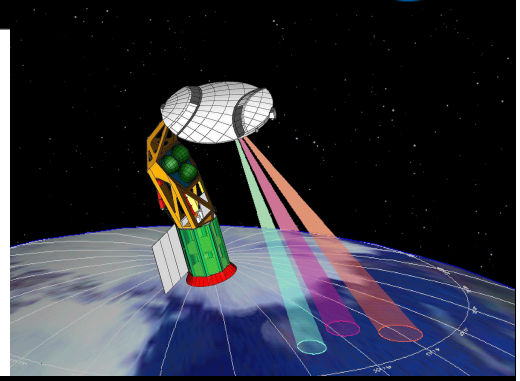
OCO-2
2013*
Global CO_2

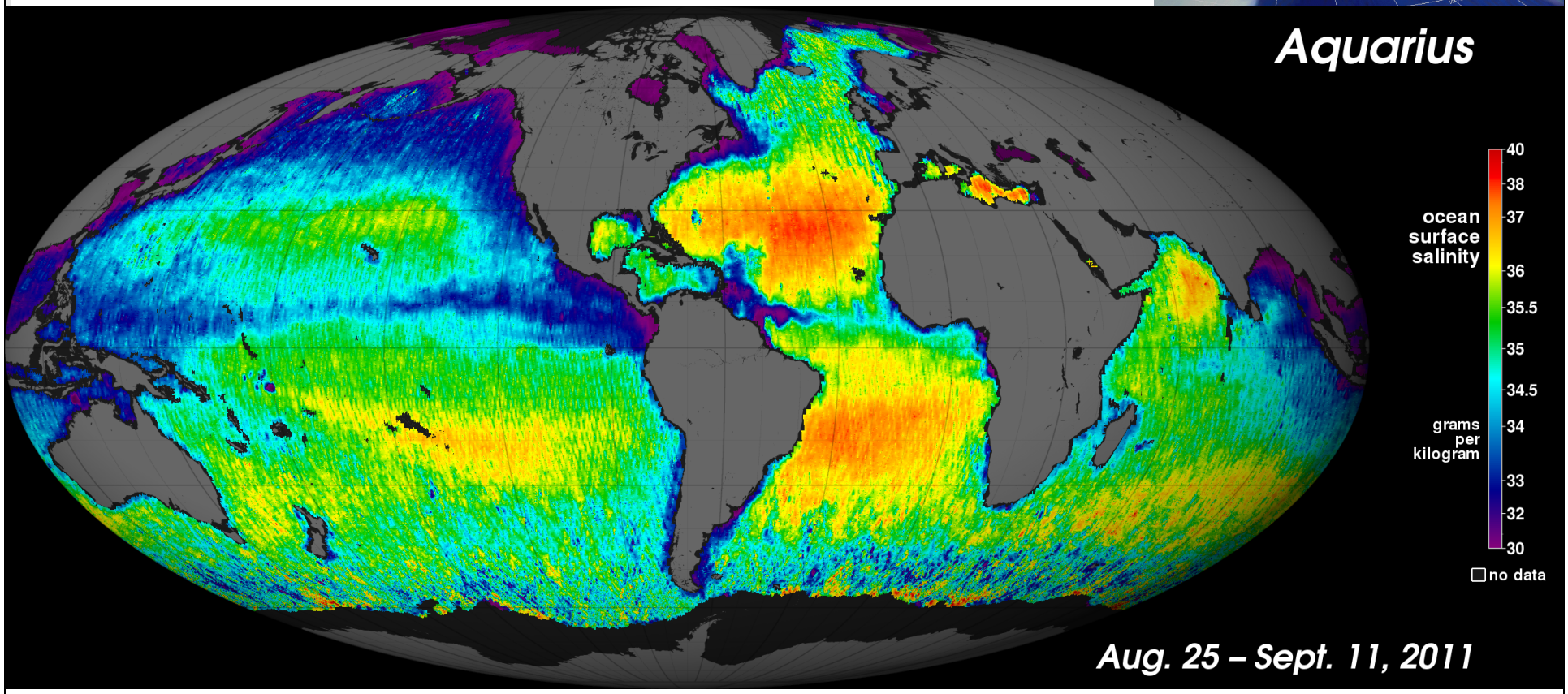
*** LRDs in flux because of launch vehicle failures**

Temporal Sampling after 100 years of in situ Sea Surface Salinity (SSS) measurements

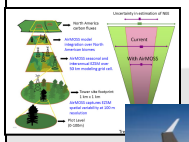
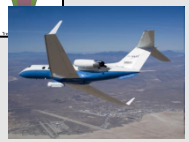
Fig. A4-1. Annual salinity (PSS) standard deviation at the surface .

Temporal Sampling with 17 days of Aquarius SSS measurements



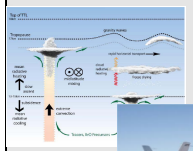


Earth Venture-1 Investigation Summaries

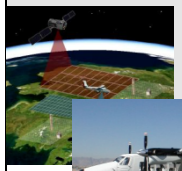
Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) - Univ Mich/JPL

North American ecosystems are critical components of the global exchange of the greenhouse gas carbon dioxide and other gases within the atmosphere. To better understand the size of this exchange on a continental scale, this investigation addresses the uncertainties in existing estimates by measuring soil moisture in the root zone of representative regions of major North American ecosystems. Investigators will use NASA's Gulfstream-III aircraft to fly synthetic aperture radar that can penetrate vegetation and soil to depths of several feet.




Airborne Tropical Tropopause Experiment (ATTREX) - ARC

Water vapor in the stratosphere has a large impact on Earth's climate, the ozone layer and how much solar energy the Earth retains. To improve our understanding of the processes that control the flow of atmospheric gases into this region, investigators will launch four airborne campaigns with NASA's Global Hawk remotely piloted aerial systems. The flights will study chemical and physical processes at different times of year from bases in California, Guam, Hawaii and Australia.

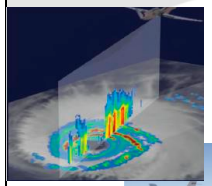



Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) - JPL

This investigation will collect an integrated set of data that will provide unprecedented experimental insights into Arctic carbon cycling, especially the release of the important greenhouse gases such as carbon dioxide and methane. Instruments will be flown on a Twin Otter aircraft to produce the first simultaneous measurements of surface characteristics that control carbon emissions and key atmospheric gases.


Deriving Information on Surface Conditions from COlumn and VERtically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) - LaRC

The overarching objective of the DISCOVER-AQ investigation is to improve the interpretation of satellite observations to diagnose near-surface conditions relating to air quality. NASA's B-200 and P-3B research aircraft will fly together to sample a column of the atmosphere over instrumented ground stations.




Hurricane and Severe Storm Sentinel (HS3) – GSFC/ARC

The prediction of the intensity of hurricanes is not as reliable as predictions of the location of hurricane landfall, in large part because of our poor understanding of the processes involved in intensity change. This investigation focuses on studying hurricanes in the Atlantic Ocean basin using two NASA Global Hawks flying high above the storms for up to 30 hours. The Hawks will deploy from NASA's Wallops Flight Facility in Virginia during the 2012-14 Atlantic hurricane seasons.

12

New mission: IceBridge

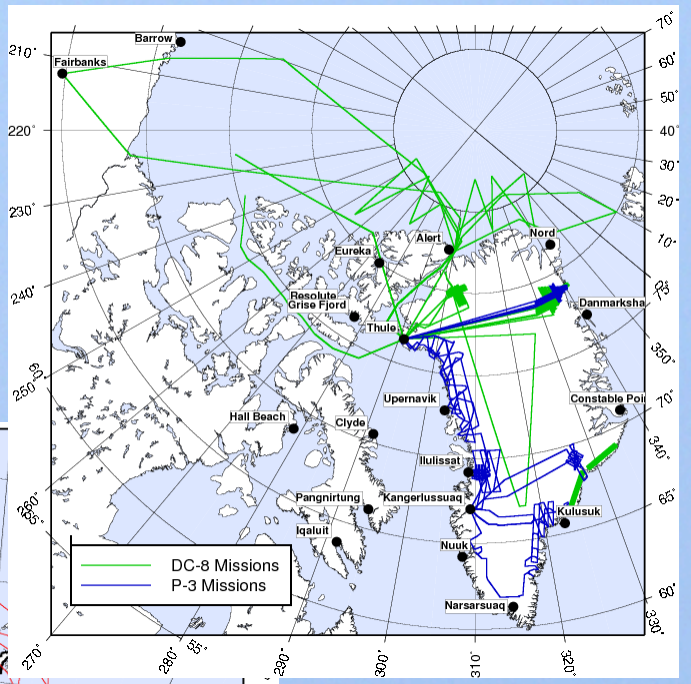
Using aircraft to bridge gap in data collection between ICESat & ICESat-2; linking to CryoSat 2; making key measurements for predictive models involving ice

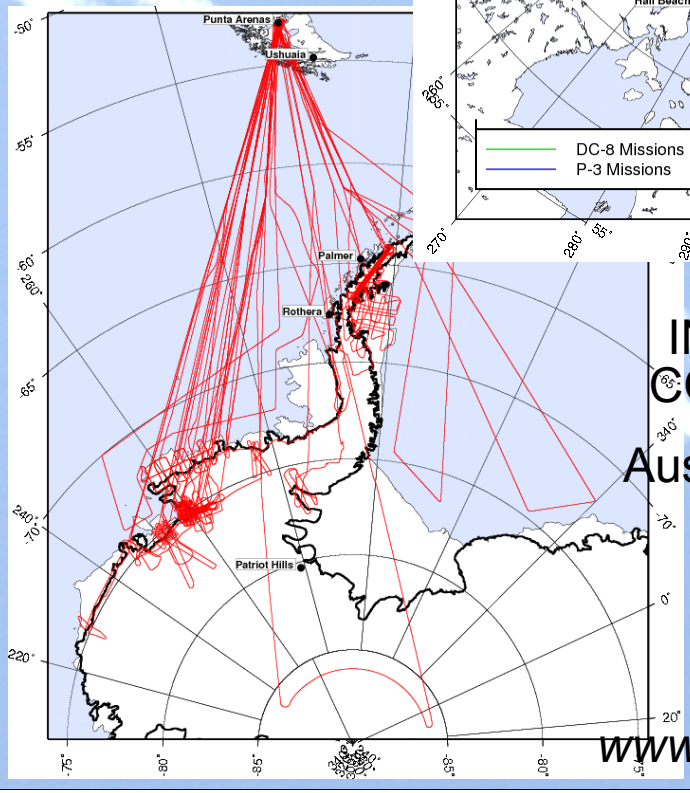
Campaigns completed
Arctic 2009 (Greenland, sea ice, Alaska)
Antarctic 2009 (Peninsula & East Antarctica)
Arctic & Antarctic 2010
Arctic 2011

Instruments
Lidar
•ATM/NASA-GSFC
•LVIS/NASA-GSFC
•Photon counting/Sigma-U. Texas

Radar
•Accumulation&snow radars/Kansas
•MCoRDS/U. Kansas
•HiCARS&WISE /U. Texas,-JPL

Gravimeter/LDEO & U.Texas
Magnetometer-U. Texas
DMS-High res camera/NASA ARC





INTERNATIONAL COLLABORATION!

Australia, UK, France, Denmark

www.nasa.gov/icebridge

DISCOVER-AQ: The July 2011 EV-1 campaign over Baltimore/Washington

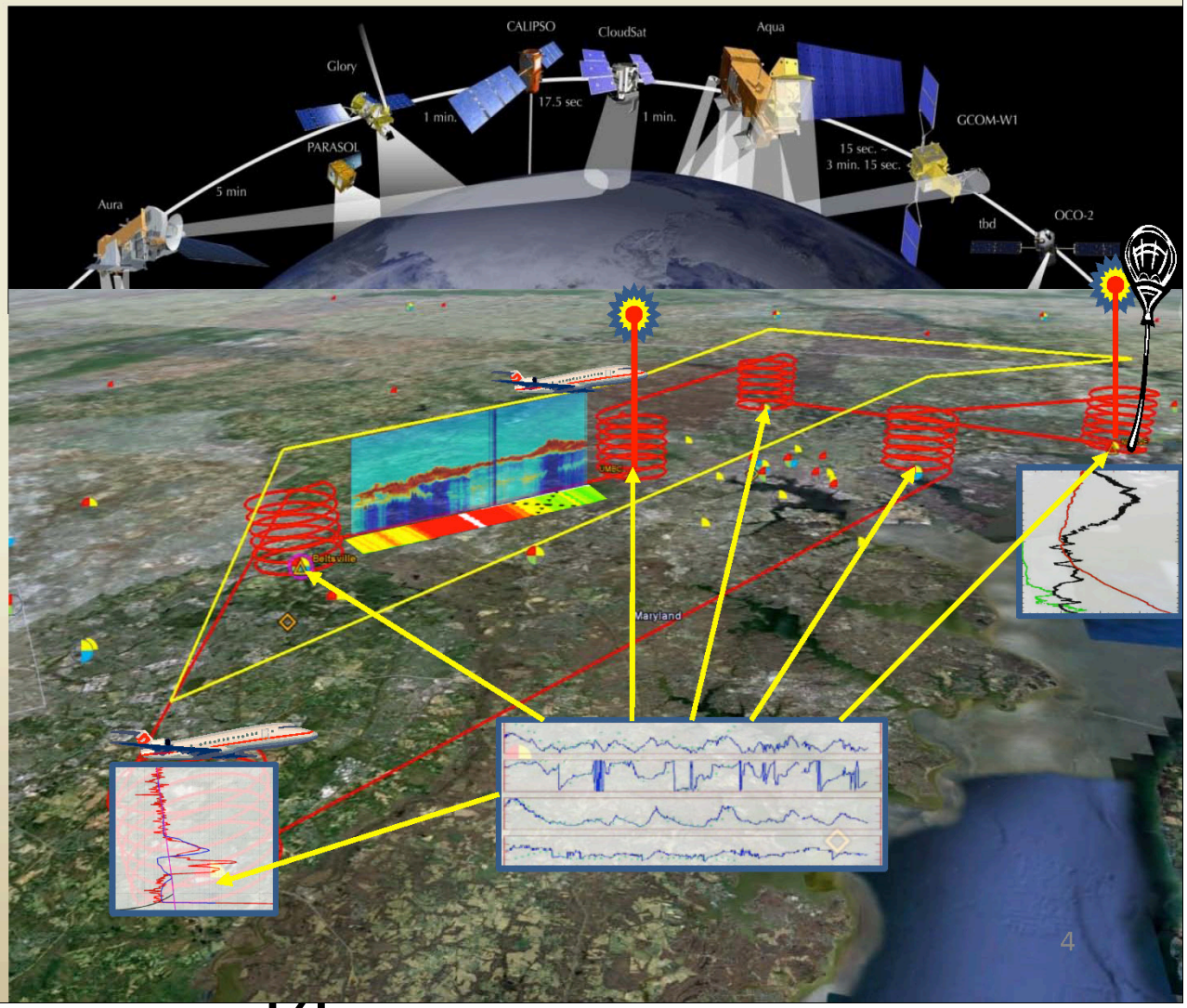
Systematic and concurrent observation of column-integrated, surface, and vertically-resolved distributions of aerosols and trace gases relevant to air quality as they evolve throughout the day.

Three major observational components:

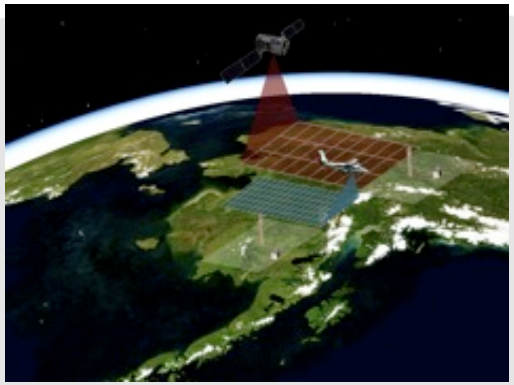
NASA UC-12 (Remote sensing)
Continuous mapping of aerosols with HSRL and trace gas columns with ACAM

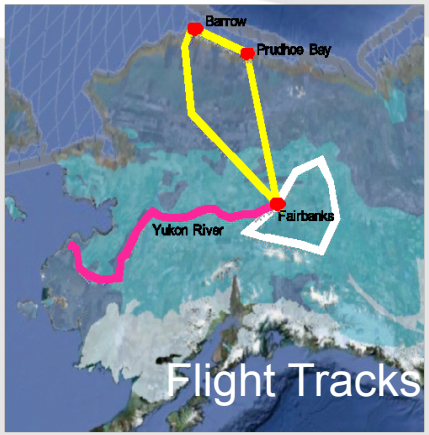
NASA P-3B (in situ meas.)
In situ profiling of aerosols and trace gases over surface measurement sites

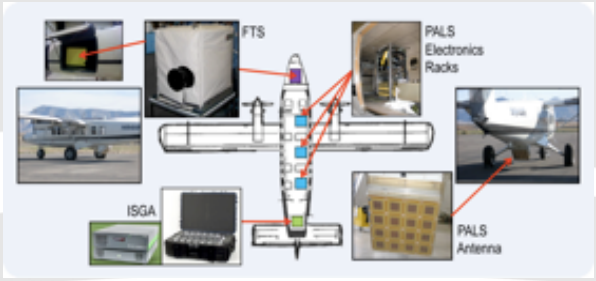
Ground sites
In situ trace gases and aerosols
Remote sensing of trace gas and aerosol columns
Tethered Balloons
Ozonesondes
Aerosol lidar observations

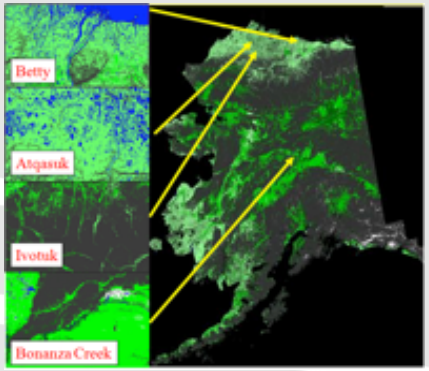


Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE): An EV-1 Investigation









Principal Investigator : Charles Miller
Project Manager: Steve Dinardo
Implementation Center: JPL

CARVE bridges critical gaps in our knowledge and understanding of Alaskan Arctic ecosystems, linkages between the terrestrial carbon and hydrologic cycles, and the feedbacks from fires and thawing permafrost.

Instrument Payload

- L-band radar/radiometer
- Nadir viewing Fourier transform spectrometer
- Continuous in CO_2, CH_4 and CO
- Programmable flask packages (whole air sampling)

Measurements

- Surface parameters controlling carbon emissions: soil moisture, freeze/thaw state, inundation state, surface temperature
- Total atmospheric columns of CO_2, CH_4 and CO
- Atmospheric concentrations of CO_2, CH_4 and CO
- Ground-based measurements of $^{14}CO_2$ and $^{14}CH_4$

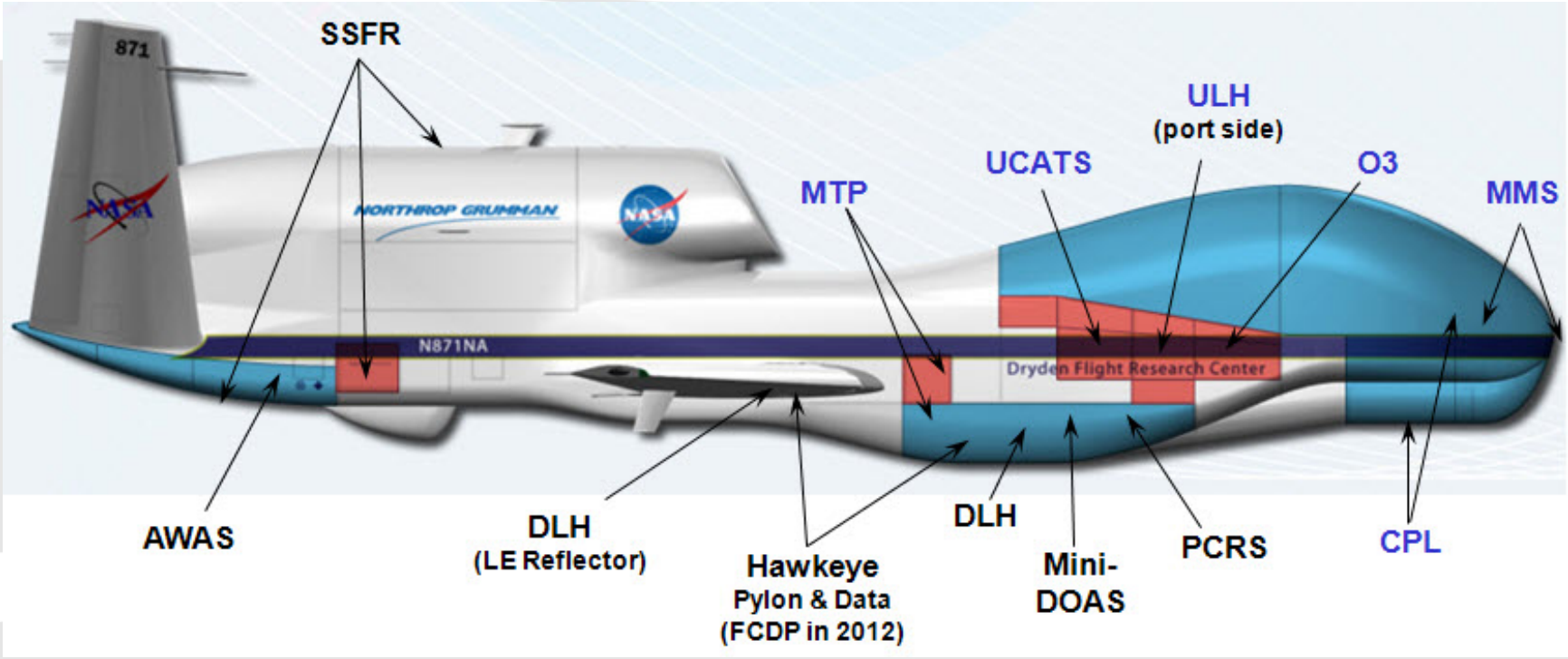
Earth Science Relevance

- High priority objectives across NASA's Carbon Cycle & Ecosystems, Atmospheric Composition, and Climate Variability & Change focus areas
- Air Quality and Ecosystems elements of Applied Sciences Program

Flights

- Platform: De Havilland DHC-6 Twin-Otter
- Engineering test flights start in April 2011
- Science Operations: Regular spring, summer and fall deployments annually 2012 – 2014 when arctic carbon fluxes are large and change rapidly

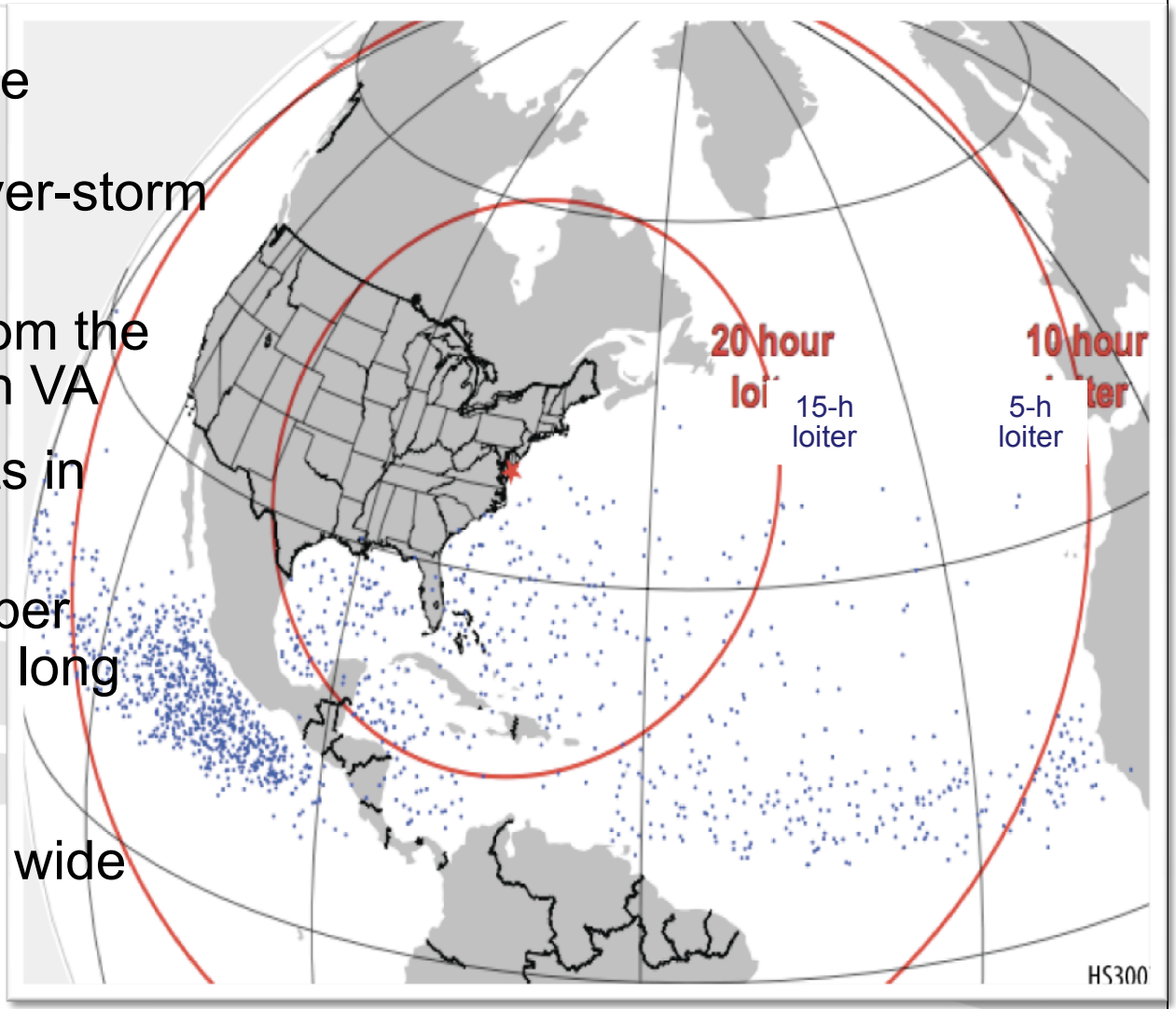
Airborne Tropical Tropopause EXperiment (ATTREX)



- High spatial-resolution sampling of clouds, water vapor, and tracers in a region with sharp vertical gradients that limit the value of satellite measurements
- Suite of instruments will provide unique information about Tropical Tropopause Layer (TTL) cloud formation, dehydration, and transport − complements satellites, which provide full global, seasonal, interannual information
- Long-range Global Hawk flights spanning the Pacific during multiple campaigns
- Integration and first flights: September - October, 2011

HS3 Mission Summary

- **Two Global Hawks**, one equipped for the storm environment, one for over-storm flights
- Deployments of GHs from the Wallops Flight Facility in VA
- One-month deployments in 2012, 2013, and 2014
- ~275 science flight hrs per deployment (~11 x 25-h long flights)
- 3-year mission ensures adequate sampling of a wide variety of conditions



Dots indicate genesis locations.
Range rings assume 25-h flights.