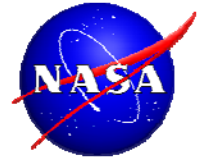# Earth Science Data and Information System (ESDIS) Project Update
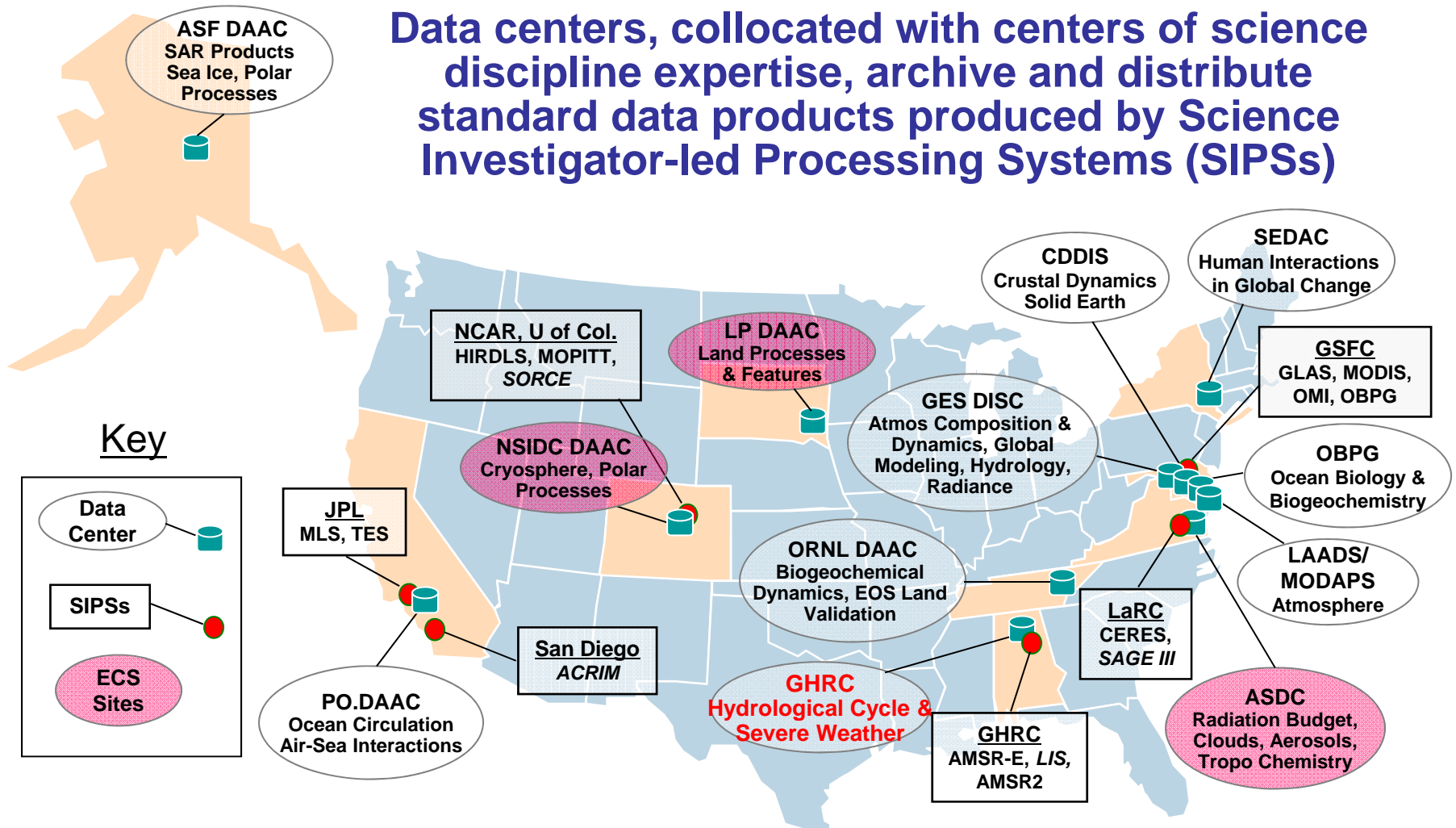
Stephen Berrick
NASA ESDIS Project Status
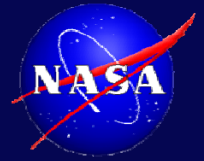**GHRC UWG Meeting**
September 25-26, 2014

EOSDIS Facilities

Data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by Science Investigator-led Processing Systems (SIPSs)

ASF DAAC
SAR Products
Sea Ice, Polar Processes

CDDIS
Crustal Dynamics
Solid Earth

SEDAC
Human Interactions
in Global Change

NCAR, U of Col.
HIRDLS, MOPITT, SORCE

LP DAAC
Land Processes & Features

GSFC
GLAS, MODIS, OMI, OBPG

GES DISC
Atmos Composition & Dynamics, Global Modeling, Hydrology, Radiance

OBPG
Ocean Biology & Biogeochemistry

NSIDC DAAC
Cryosphere, Polar Processes

Key

Data Center

SIPSs

ECS Sites

JPL
MLS, TES

ORNL DAAC
Biogeochemical Dynamics, EOS Land Validation

LAADS/
MODAPS
Atmosphere

San Diego
ACRIM

LaRC
CERES,
SAGE III

PO.DAAC
Ocean Circulation
Air-Sea Interactions

GHRC
Hydrological Cycle &
Severe Weather

GHRC
AMSR-E, LIS,
AMSR2

ASDC
Radiation Budget,
Clouds, Aerosols,
Tropo Chemistry

Earth Science Data Operations

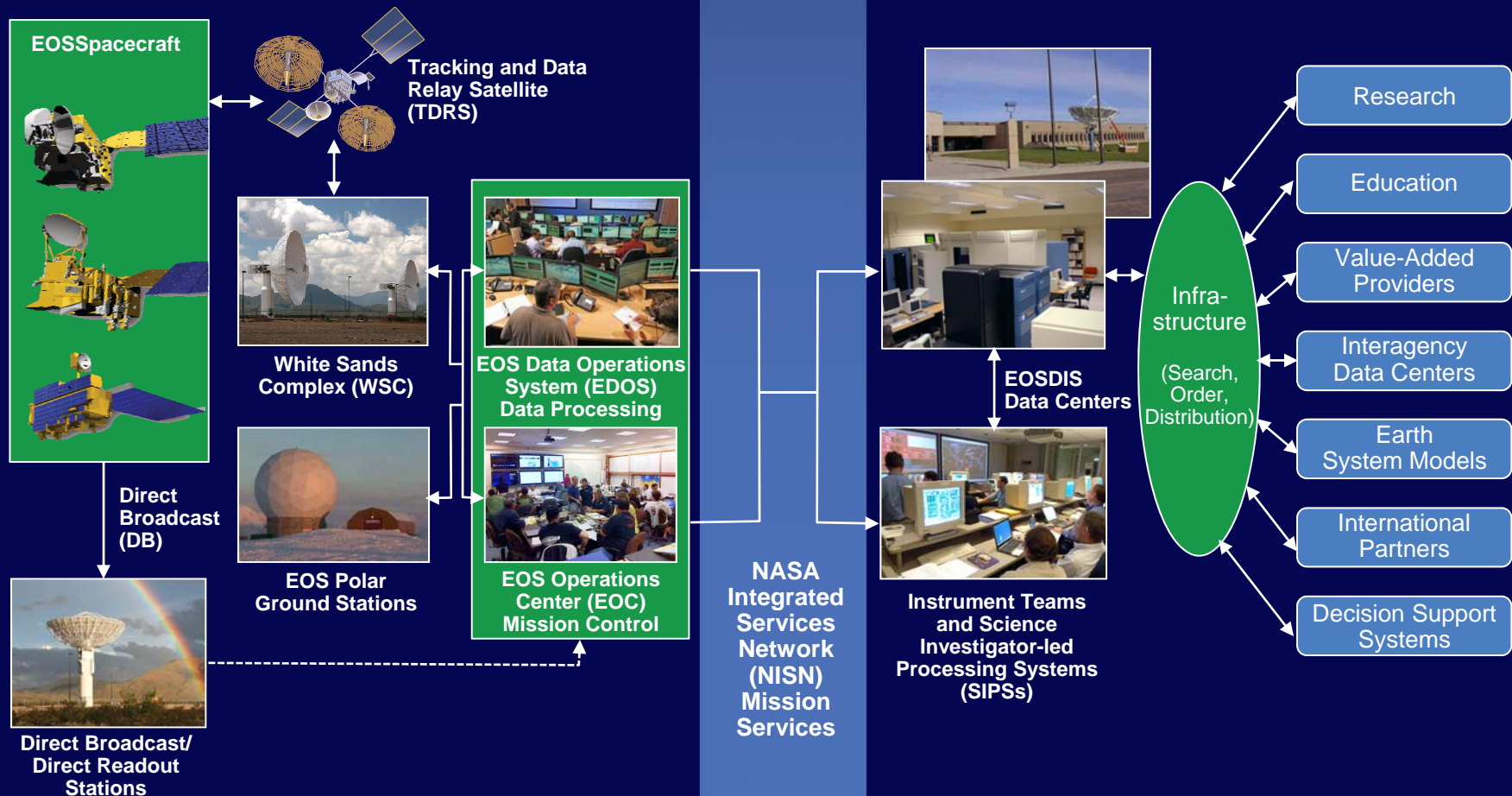## Mission Operations

Science Operations

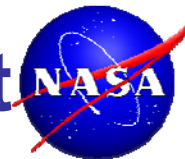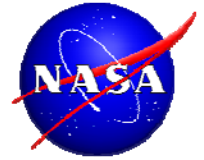| Data Acquisition | Flight Operations, Data Capture, Initial Processing, Backup Archive | Data Transport to Data Centers/ SIPSs | Science Data Processing, Data Management, Interoperable Data Archive, and Distribution | Distribution and Data Access |

EOSSpacecraft

Tracking and Data Relay Satellite (TDRS)

White Sands Complex (WSC)

EOS Data Operations System (EDOS) Data Processing

EOS Polar Ground Stations

EOS Operations Center (EOC) Mission Control

Direct Broadcast (DB)

Direct Broadcast/ Direct Readout Stations

NASA Integrated Services Network (NISN) Mission Services

EOSDIS Data Centers

Instrument Teams and Science Investigator-led Processing Systems (SIPSs)

Infra-structure (Search, Order, Distribution)

Research

Education

Value-Added Providers

Interagency Data Centers

Earth System Models

International Partners

Decision Support Systems
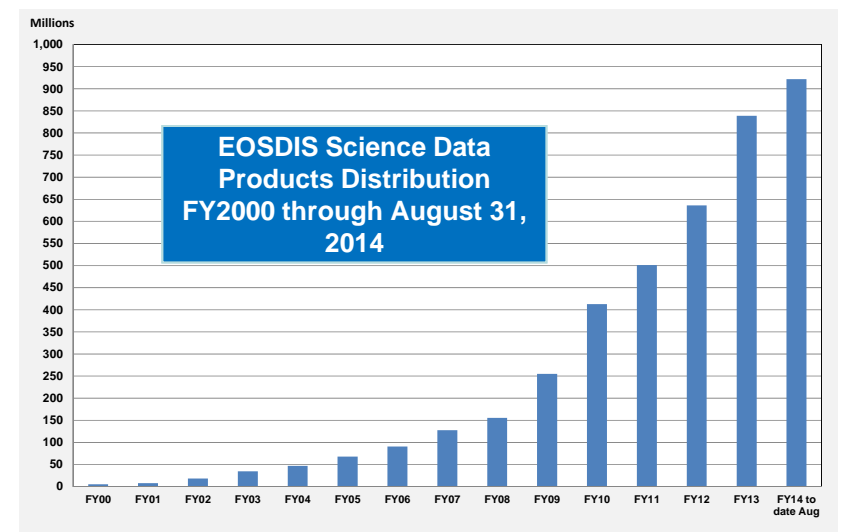
Current NASA EO Satellite Family Portrait

As of 16 Sep 2014

EOSDIS Key Metrics

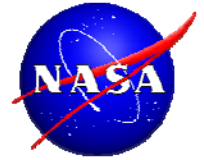| EOSDIS Metrics FY2013 (Oct 1, 2012 to Sept 30, 2013)		GHRC
Unique Data Products	6,861	245
Distinct Users of EOSDIS Data and Services	1.7 M	7.6 K
Average Daily Archive Growth	8.5 TB/day	7.0 GB/day
Total Archive Volume	9.8 PB	9.5 TB
End User Distribution Products	839 M	4.4 M
End User Average Daily Distribution Volume	22 TB/day	19.5 GB/day

Distribution by Discipline Product Counts (M)
(Oct 2012- Sep 2013)

- Radiance/Geolocation, 50.8
- Raw Data, 21.9
- Terrestrial Ecology, 51.4
- Others, 83.4
- Hydrology, 83.6
- Ocean, 93.0
- Land, 109.4
- Atmosphere, 224.2
- Geodesy/Solid Earth, 121.7

Multi-year Total Archive Volume (PBs) Trend

EOSDIS Science Data Volume Growth

EOSDIS Science Data Products Distribution FY2000 through August 31, 2014
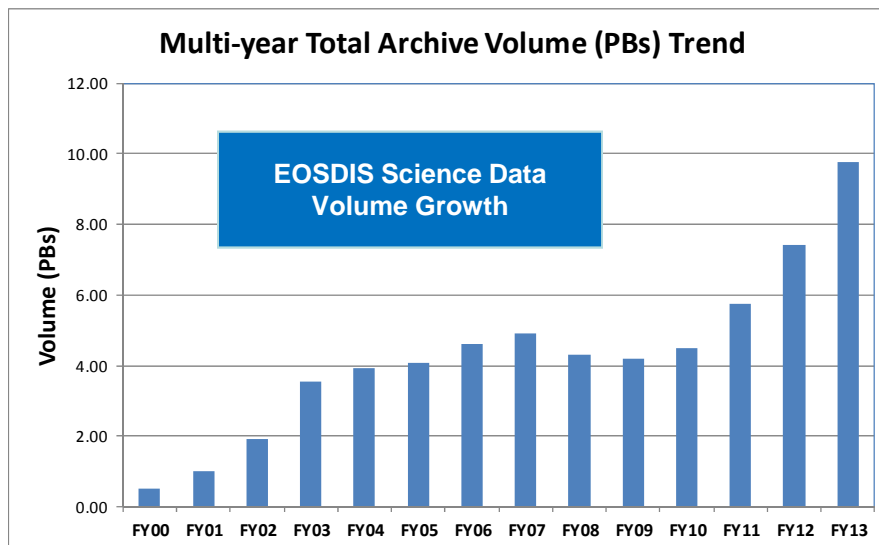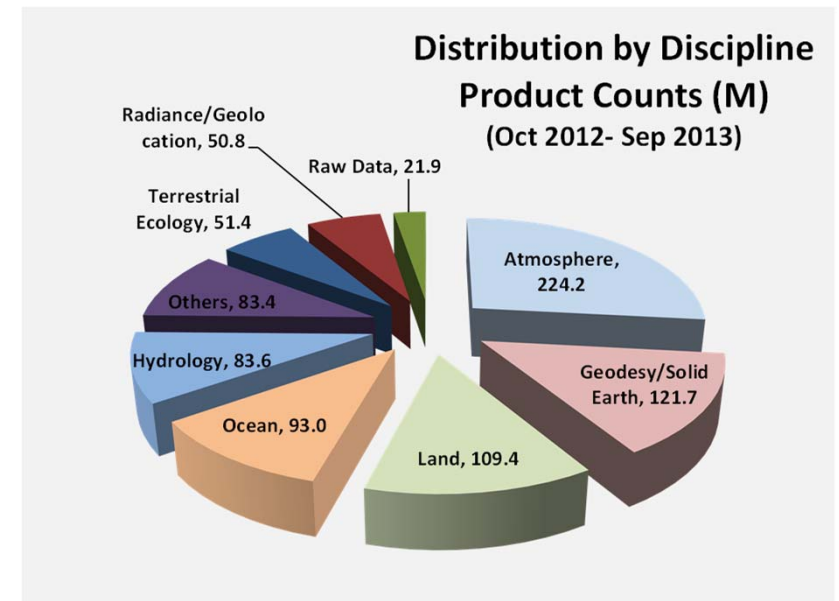
Earth Science Data and Information System (ESDIS) Project - Code 423

Project Manager
Dawn Lowe

Deputy Project Manager/Operations
Jeanne Behnke

Deputy Project Manager/ Technical
Jeff Walter

Deputy Project Manager/Resources
Diane Hronek

Assistant Project Manager
vacant

System Security
Clayton Sigman

System Manager
Karen Michael

Financial Manager
Chikia Barnes
Resource Analyst
Brian Thomas

System Architect
Kevin Murphy

Science Systems Development Office
Manager - Dan Marinelli
Deputy - Andy Mitchell

SNPP Science Data Segment
Alfreda Hall
Eunice Eng
Evelyn Ho

Science Operations Office
Manager - Jeanne Behnke
Deputy - Drew Kittel

Systems Engineering
Steve Berrick

Development & Sustaining Engineering
Luther Lighty
Ryan Boller

Network System Engineering
Kevin Kranacs
Rachel Adolphus

DAAC Operations
Nate James
Dave Batchelor
vacant (2)

September 2014

6

User Working Group (UWG)

- UWGs were conceived by the NASA HQ Program Executive for the Earth Science Data Systems Program (Martha Maiden) to provide community input into the operation of the DAACs and EOSDIS
- UWGs are to be convened for each DAAC
  - DAACs are to set aside funds for holding each meeting. Funds should cover travel for UWG members and the cost of a meeting facility (if necessary).
  - Charters are established for each UWG and should be reviewed annually for any changes. There is no standard UWG charter, they are customized per DAAC.
  - UWG members comprise users, data providers, scientists, NASA HQ, DAAC members, and ESDIS
  - Recommendations from UWGs should be folded into DAAC work plans

Role of UWGs
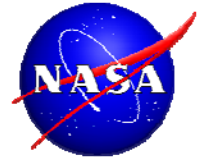
1. Assist in defining and accomplishing the DAAC's science goals

2. Provide guidance on DAAC data management priorities

3. Provide oversight and guidance on DAAC activities, including data set acquisition, development of value-added products, user support, development activities, and operational functions

4. Provide recommendations about annual work plans and long-range planning

5. Coordinate science issues with the ESDIS Project staff and Program Scientists.

DAAC UWG Membership

- Suggestions for members should come from UWG, NASA HQ and ESDIS.

- UWG should be no more than 15-20 people

- Invitation to participate is vetted by NASA HQ Program Manager for Earth Science Data Systems, NASA HQ Program Scientists, and ESDIS staff.

- UWGs should each have a chairperson
  - Term for the position should be at least 2 years
  - An active Chairperson is important
    - Good for that person to have experience in developing guidance from volunteer working group members

DAAC UWG Meetings

- Should meet face-to-face at least once per year; should plan at least one telecon per year.

- Minutes and final reports from meetings should be:
  - Sent to Program Executive for Earth Science Data Systems and ESDIS Operations Manager.
  - Posted on the DAAC website

- The primary purpose of the meeting should be to develop recommendations for DAAC and discipline data holdings and services.
  - The DAAC should provide background information (detail as required by the UWG) prior to the meeting.
  - Process for considering new products should be followed to ensure that DAAC can be correctly funded for its core mission.
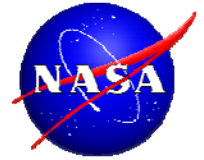
Further Notes
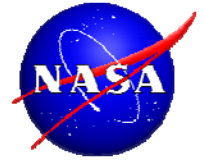
- **Recommend cross-DAAC attendance**
  - UWG chair should be invited to attend a related DAAC's UWG meeting
  - UWGs can meet together (example: joint LPDAAC & ORNL DAAC in October 2010)
  - Think about inviting each other to your meetings:
    - DAAC Managers should be invited to attend a related DAAC's UWG meetings
- **UWG Members can be tapped to participate in:**
  - DAAC status meetings
  - EOSDIS meetings
  - Peer Reviews of NASA research proposals

DAAC Process for Implementing New Data Types and/or Services (As Is)
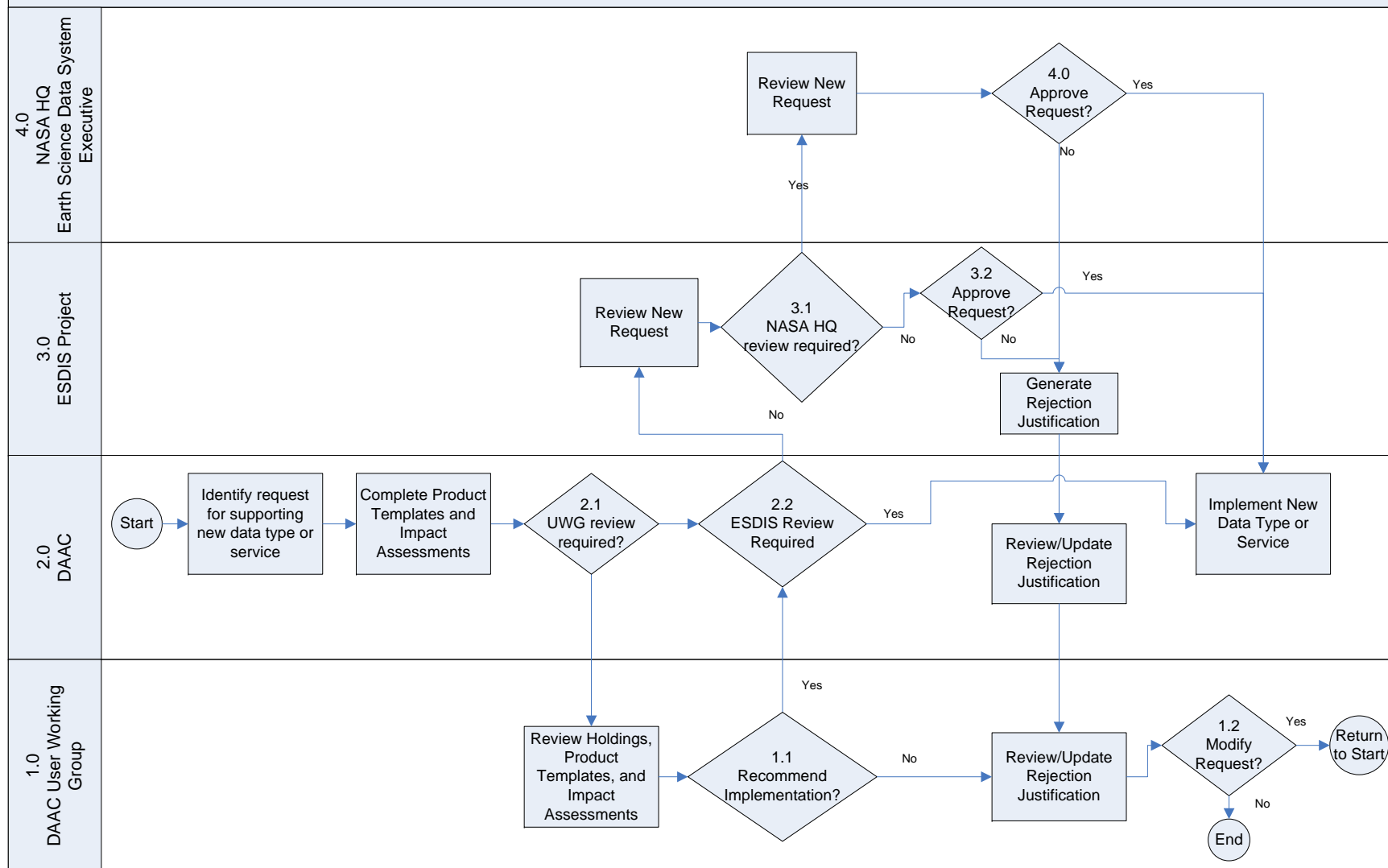
Contacting the ESDIS Project

- Stephen Berrick, ESDIS GHRC Liaison,
  Stephen.W.Berrick@nasa.gov

- Drew Kittel, ESDIS Deputy Manager, Science Operations Office,
  drew.h.kittel@nasa.gov

- Jeanne Behnke, ESDIS DPM/Ops, jeanne.behnke@nasa.gov

- Dawn Lowe, ESDIS Project Manager, dawn.r.lowe@nasa.gov

- Social media
  - We are now on Twitter!
    - https://twitter.com/NASAEarthData
  - @NASAEarthdata
  - Facebook: https://www.facebook.com/NASAEarthData
  - Earthdata YouTube Channel
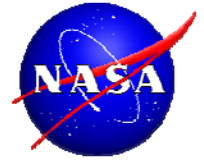
EOSDIS ACSI Customer Satisfaction Survey 2013: Relative Rankings
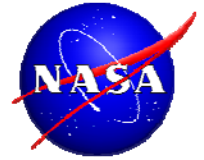
- EOSDIS sponsors an annual independent customer survey in conjunction with the American Customer Satisfaction Index (ACSI)
- EOSDIS consistently exceeds the Federal Government average
- Ratings in the mid to upper 70s are considered "very good" by the rating organization, the CFI Group
- 2013 Survey results based on 4,146 responses (~4.3%)
- Comments in surveys help define system improvements

Category	Score
Federal Government Overall (2013)	66
NASA EOSDIS	76
E-Business Internet News & Information	73
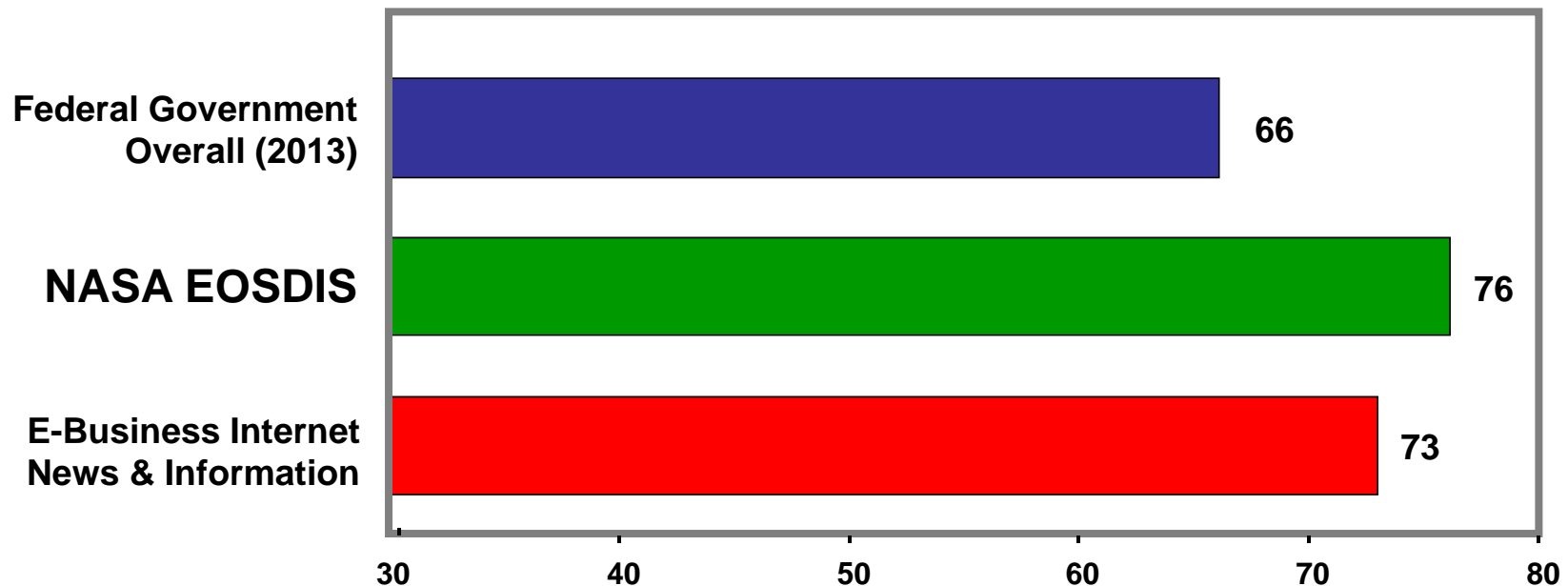
EOSDIS Evolution: Earthdata Website

- **What is the Earthdata Website?**

  - Earthdata was created as a sustainable, evolvable, and reliable Website that represents our community's needs for NASA Earth science data and information.
  - It was designed to support collaboration within and between organizations, and for development and integration of new applications.
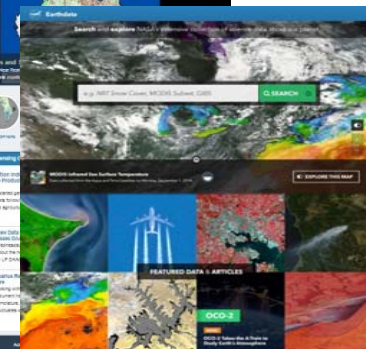 - It addresses the need for a coherent and comprehensive Web presence of the Earth Science Data Systems Program.
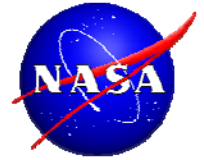 - See Earthdata at https://earthdata.nasa.gov/.
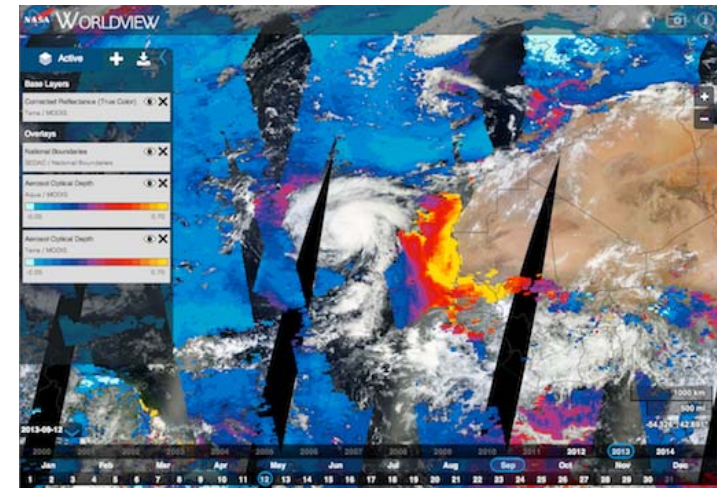
- **Benefits of the Earthdata Website:**

  - Better represents EOSDIS programmatic investments and capabilities.
  - Presents data centers more clearly as elements within a larger system of systems.
  - Facilitates multidisciplinary research and data integration.
  - More quickly responds to emerging technologies
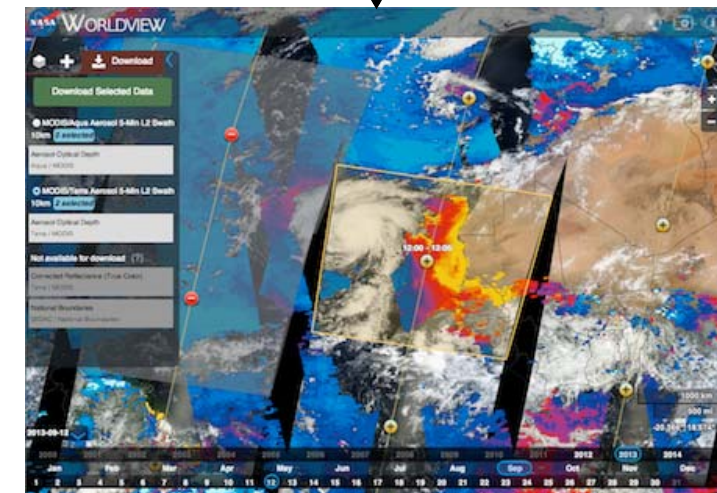 - Provides a platform for demonstration of interoperability throughout all of our systems.

2011

2012

2013

2014
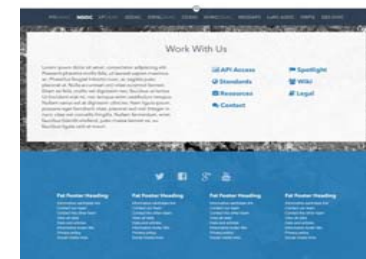
EOSDIS Evolution: Global Browse Imagery Service

- What is the Global Imagery Browse Service (GIBS)?

  - GIBS supports high performance, *full resolution* imagery browse services for EOSDIS.
  - GIBS' vision is to transform how end users interact and discover EOSDIS data; make it visual.
  - GIBS provides open access to its imagery; easily connect through mapping clients, GDAL-based scripts, and some GIS clients.
 - Worldview is the EOSDIS (reference) client for GIBS (https://earthdata.nasa.gov/labs/worldview/).

- Benefits of GIBS:

  - Improves "approachability" of data – a picture is worth a thousand words.
  - Leverages science expertise to generate authoritative, science based visualization products (quality, image generation, etc.).
  - Facilitates full-resolution, "no boundaries" interaction patterns (as opposed to granule-based, reduced-resolution browse).
  - Widens usage of NASA Earth Science data to new communities – non-experts.

Visually discover "interesting" imagery as served by GIBS

When found, query EOSDIS/ECHO for underlying files and download data from DAACs

EOSDIS Evolution: User Registration Service
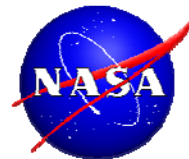
- **What is the User Registration System (URS)?**

  - Account management for all EOSDIS system components. Authorization is managed by the respective application, not URS.
  - End users may register and edit their account information in one location allowing them access to a wide array of EOSDIS data and services.
  - Single Sign-on for EOSDIS applications and websites.
  - For more info: https://urs.eosdis.nasa.gov

- **Benefits of URS:**

  - Consolidation of existing similar registration systems.
  - Improved user experience.
  - Standardized method for metrics collection & reporting to better understand our users.
  - Enables user notifications on data and services (e.g. data updates or data issues).
  - Establishes framework for future advanced capabilities (e.g. customized views, order management).

EOSDIS Evolution: Common Metadata Repository
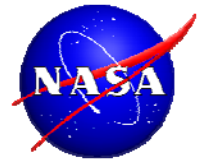
- **What is the Common Metadata Repository (CMR)?**

  - CMR will be the authoritative management system for all EOSDIS metadata for all EOSDIS data holdings.
  - CMR is a common middleware replacement for for the ECHO backend and GCMD's backend. The GCMD frontend, however, will *not* change and users of GCMD should see no impact.
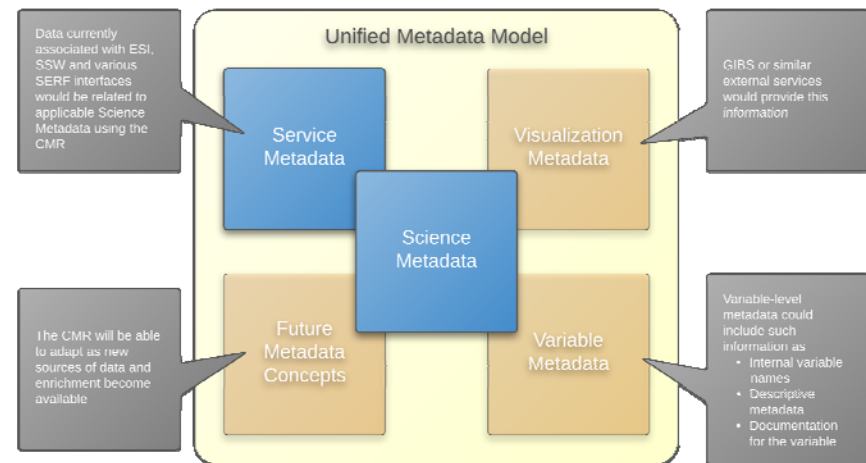
- **Benefits of CMR:**

  - CMR is designed to handle metadata at the Concept level beyond just Collections and Granules to Visualizations, Parameters, Documentation, Services, and more.
  - CMR is designed around an evolvable Unified Metadata Model (UMM).
  - CMR is designed to handle hundreds of millions of metadata records; making them available through high performance, standards compliant, temporal, spatial, and faceted search.
  - CMR incorporates both human and machine metadata assessment features that work to ensure the highest quality metadata possible.
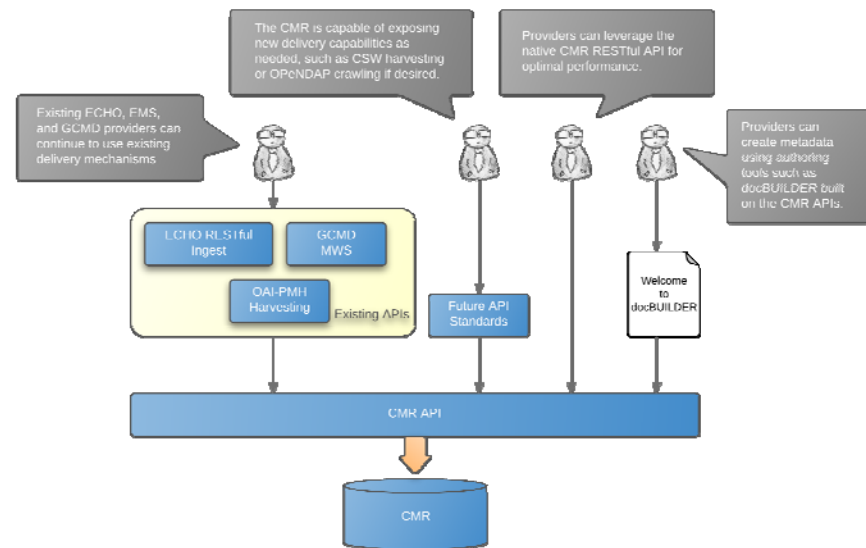
EOSDIS Evolution: Earthdata Code Collaborative
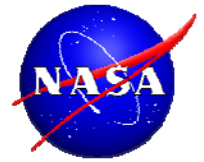
- **What is the Earthdata Code Collaborative (ECC)?**

  - The ECC provides a ready-to-use collaborative framework for designing, developing, testing, deploying, and managing projects for the Earthdata website and other EOSDIS applications.
  - ECC supports the full life cycle of agile software development: code repository, requirements management, bug tracking, deployment management and a Wiki for information sharing.
  - For more info: https://ecc.earthdata.nasa.gov/
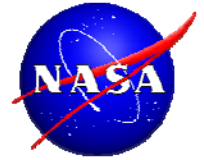
- **Benefits of ECC:**

  - Encourages improved integration of tools and applications within and within EOSDIS.
  - Enhances discovery, sharing, and reuse of existing software and increases the likelihood for successful technology infusion across EOSDIS.
  - Technical support is available for all users and projects using ECC.
  - ECC is available now to any user or project funded through ESDIS to support EOSDIS.

EOSDIS Evolution: Earthdata Search Client

- **What is the Earthdata Search Client?**

  - The Earthdata Search Client provides users with cross-DAAC search, discovery, and access for all EOSDIS data.
  - It showcases the advanced features of the Common Metadata Repository, the Global Imagery Browse Service, OPeNDAP, and more.
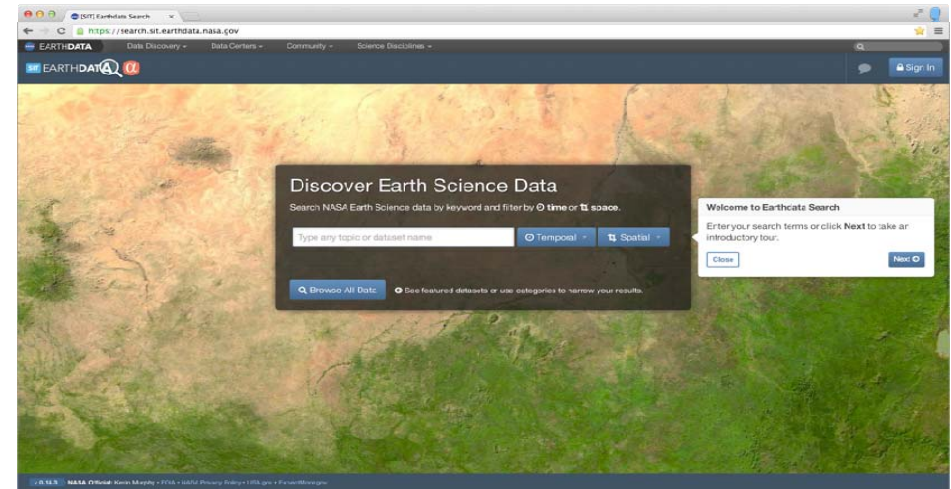
- **Benefits of the Earthdata Search Client:**

  - Improved user experience for search, discovery, and access.
  - Provides granule visualization.
  - Allows for cross dataset comparisons.
  - Provides services for format conversion and subsetting.
  - Supports saving and sharing of data projects.
  - Has Streamlined data access workflows.
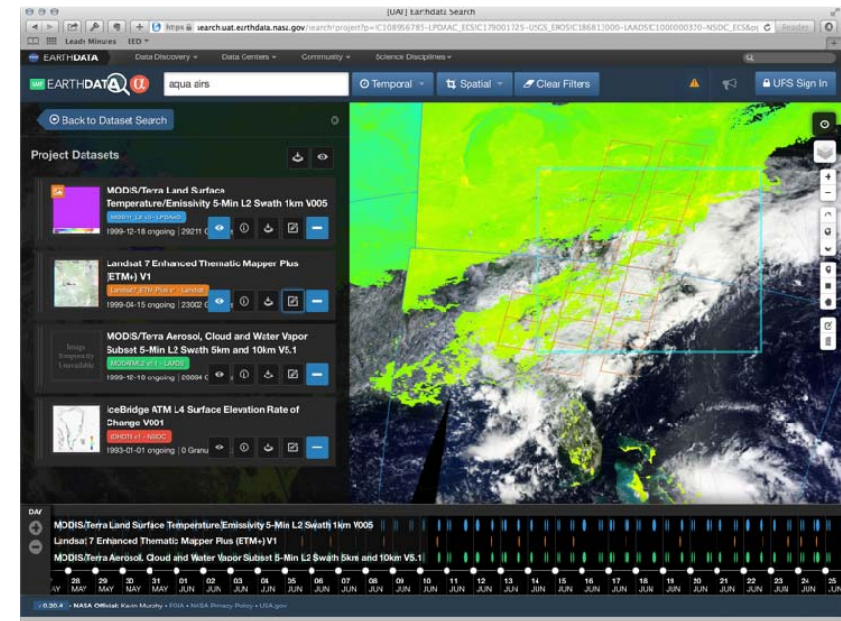
Backup

New Missions Relevant to EOSDIS
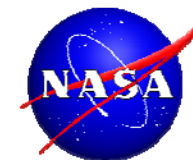
Mission	Launch Date*	DAAC
GCOM-W1 (Shizuku)	May 2012	GHRC / NSIDC
S-NPP	Oct 2012	Multiple
GPM	Feb 2014	GES DISC
OCO-2	Jul 2014	GESDISC
ISS-RapidSCAT	Jun 2014	PO.DAAC
ISS-CATS	Sep 2014	ASDC
SAGE III on ISS	2014	ASDC
SMAP	Oct 2014	ASF / NSIDC
DSCOVR	Jan 2015	ASDC
CYGNSS (EV-M)	Oct 2016	PO.DAAC
OCO-3 on ISS	Dec 2016	GES DISC
ICESat-2	2016	NSIDC
GRACE FO	Aug 2017	PO.DAAC

* NASA launch dates from NASA HQ Web page at http://science.nasa.gov/earth-science/missions/

Green – Recent launches
Black – Planned launches

EOSDIS User Registration System (URS)

- Consolidation of Similar Registration Systems into an EOSDIS Wide User Registration System

- Improve the User Experience
  - Simplified and Consistent User Registration & Authentication
  - Integrated with Coherent Web (Earthdata.NASA.gov)
  - https://urs.eosdis.nasa.gov/

- Standardized Method of Metrics Collection & Reporting (via EOSDIS Metrics System - EMS)
  - Understand User Demographics and Access Patterns

- Enable Status Change Notifications to Users
  - By access pattern, data product, site, application, etc.

- Establish Framework for Future Capabilities
  - User Tailoring, Customized Views
  - Saved Queries, Order Management

- Will be in use by all DAACs by December 2015
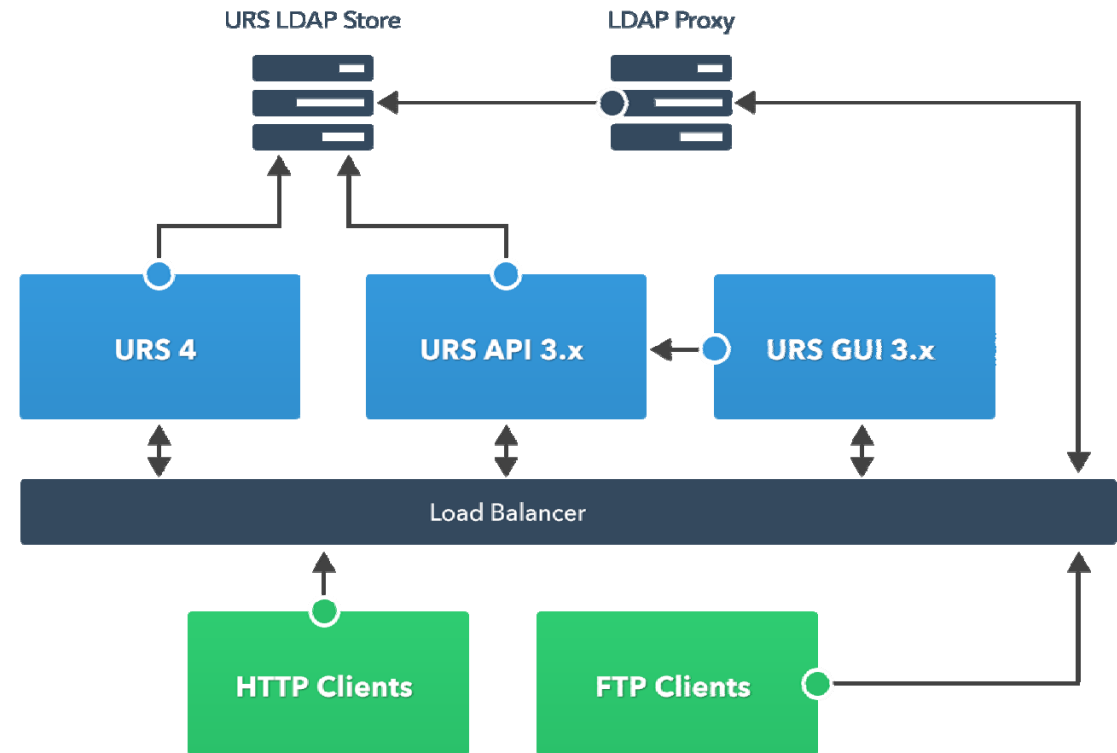
URS Technical Architecture

Role of EOSDIS

- "Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet." -- *2014 NASA Strategic Plan*
  - NASA's Earth Science Data Systems directly support this objective by providing end-to-end capabilities to deliver data and information products to users
- NASA's Earth Science Data Policy promotes usage of data by the community
  - No period of exclusive access
  - Data available at no cost to all users on a non-discriminatory basis, except where agreed upon with international partners
- EOSDIS provides:
  - Interoperable Distributed Data Archives
  - Science Data Processing
  - Data Management
  - On-Line Data Access Services
  - Earth Science Discipline-Oriented User Services
  - Network Data Transport to distributed System Elements

Extensive Data Collection

- EOSDIS data collection includes over 3500 data types
  - Land
    - » Cover & Usage
    - » Surface temperature
    - » Soil moisture
    - » Surface topography
  - Atmosphere
    - » Winds & Precipitation
    - » Aerosols & Clouds
    - » Temperature & Humidity
    - » Solar radiation
  - Ocean Dynamics
    - » Surface temperature
    - » Surface wind fields & Heat flux
    - » Surface topography
    - » Ocean color
  - Cryosphere
    - » Sea/Land Ice & Snow Cover
  - Human Dimensions
    - » Population & Land Use
    - » Human & Environmental Health
    - » Ecosystems
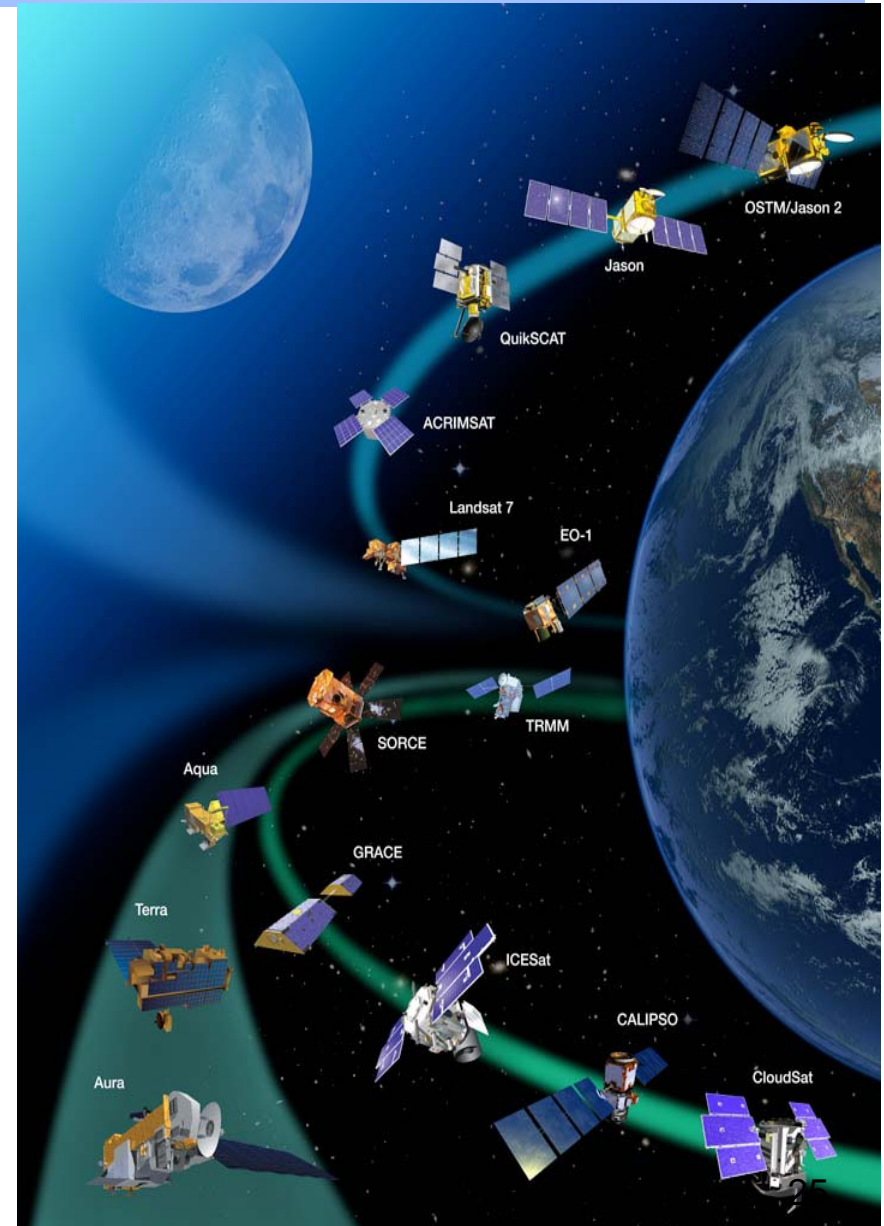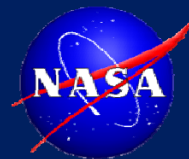
Science Processing Systems for EOSDIS

Advanced Spaceborne
Thermal Emission
and Reflection
Radiometer (ASTER)
at LP DAAC

Ocean Data
Processing System
(OCDPS) SIPS

MODIS Adaptive
Processing System
(MODAPS) SIPS

Measurements of
Pollution in the
Troposphere
(MOPITT) SIPS

Solar Radiation
and Climate
Experiment
(SORCE) SCF

Ozone Monitoring
Instrument
(OMI) SIPS

Atmospheric
Infrared
Sounder (AIRS)
at GES DISC

Microwave
Limb Sounder
(MLS) SIPS

Clouds and the Earth's
Radiant Energy System
(CERES) at ASDC

Stratospheric
Aerosol and Gas
Experiment
(SAGE III) SCF

Lightning Imaging
Sensor (LIS) SCF

Active Cavity
Radiometer
Irradiance
Monitor
(ACRIM) SCF

Multi-angle
Imaging
Spectro-
Radiometer
(MISR)
at ASDC

Tropospheric
Emission
Spectrometer
(TES) SIPS

Advanced
Microwave
Scanning
Radiometer
for EOS
(AMSR2) SIPS

**EOSDIS science processing systems
(SIPSs, SCFs, and DAAC-based)
perform forward processing of standard
products, and reprocess data to
incorporate algorithm improvements.**

**Production
Data for ECS
DAACs**

EOSDIS Role and Evolution in New Missions

- For Terra, Aqua, Aura, ESDIS was responsible for the development and operations of the entire ground segment known as the EOS Core System (ECS)
- During the year of Aura launch, the operations of the mission systems of EOSDIS transitioned to ESMO
- Since Aura launch, ESDIS and ESMO have played various roles in new missions
    - EDOS has supported multiple new and upcoming missions. Ex: EO-1, ICESat-2, SMAP, OCO-2
    - Many missions are transitioning their control center operations (MOC's) to ESMO shortly following launch. Ex: GPM, ICESat-2
    - The SNPP Science Data Segment operations transitioned to ESDIS at launch
    - Many of the EOSDIS SIPS have supported similar instruments on new missions. Ex: OMI SIPS supports both OMI and OMPS, MODAPS supports both MODIS and VIIRS
    - Many of the EOSDIS DAAC's are supporting the archive and distribution for new missions. Ex: GES DISC will archive GPM and OCO-2 data, ASDC will archive SAGE III and DCCOVR data

Working together to meet the needs of NASA Earth science data systems for the future

- ***ESDIS** pulls together a consistent approach to EOSDIS data management* that allows integrated view of all data
  - Single User Registration/Authentication system that all DAACs can use
  - Code repositories to all better software sharing among DAACs
  - Standardized access to browse imagery for all datasets
  - Establishment of standards for use across program
  - Access point to all NASA Earth Science datasets
- **SEDAC** is unique among the EOSDIS DAAC family - focus is not a physical discipline but rather *on facilitating the analysis and portrayal of the "human dimensions of global change"*
  - Managing and preserving the archive of and access to relevant socioeconomic data sets
  - Function as the information gateway between the physical sciences and the social sciences - socializing the pixels of physical science data and bringing the information content of the physical science observations into the socio-economic domain
  - Enhancing direct access to land science data through websites, services and tools

NASA Earthdata Webinars

- NASA Earthdata webinars are held every fourth Wednesday of each month at 2pm ET.
- Key general message:
  - We have data, services and tools you can use! Learn more about NASA data sets and how you can discover, access and use these data.
  - Each month a different EOSDIS data product(s) and/or data discovery or data access tool is showcased
- Recorded and all archived webinars can be accessed at: http://tinyurl.com/earthdatawebinars

Earth Science & Data Systems

NASA Headquarters Science Mission Directorate (SMD)
J. Grunsfeld

- Astro-physics
- Helio-physics
- **Earth Science** M. Freilich
  - Applied Science L. Friedl
  - Research J. Kaye
    - Program Scientist for EOS L. Tsaoussi
    - Program Executive for Operating Missions C. Yuhas
  - Flight Programs S. Volz
- Planetary

Applications • C. Dobson

Socioeconomic Data & Applications Center

SAR Systems • C. Dobson

ASF SAR Data Center

Application Scientists

Land Processes • W. Turner

Land Processes DAAC

Program Scientists

Earth Surface and Interior • J. LaBrecque

Crustal Dynamics DIS

Atmospheric Dynamics • R. Kakar

Global Hydrology Resource Center

Upper Atmosphere Research • K. Jucks

GSFC Earth Sciences DISC

Atmospheric Radiation • H. Maring

Atmospheric Sciences Data Center

Program Executive for Earth Science Data Systems
M. Goodman (Acting)

Earth Science Data and Information System (ESDIS) Project 423
D. Lowe

Goddard Space Flight Center (GSFC)
C. Scolese

- **Flight Projects** G. Morrow 400
  - Earth Science T. McCarthy 420
  - Planetary Science 430
  - Astro-physics 440
- Appl. Eng. & Technology 500
- Sciences & Exploration 600

Science Operations Management
J. Behnke
Drew Kittel

Data Center Operations

L1 and Atmos. Data • TBD

L1 Atmosphere Archive & Distribution System

Physical Oceanography • E. Lindstrom

Terrestrial Ecology • D. Wickland

Ocean Biology & Biogeochemistry • P. Bontempi

Cryosphere Science • T. Wagner

National Snow and Ice Data Center

Physical Oceanography DAAC

ORNL DAAC

Ocean Biology Processing Group

02/26/2014

Recent & Upcoming UWG meetings
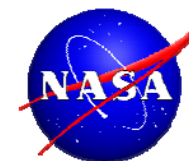
DAAC	Date	Location
PO.DAAC	Apr 8-9, 2014	Pasadena, CA
LPDAAC	Apr 22-23, 2014	Sioux Falls, SD
ASF DAAC	May 6-7, 2014	Fairbanks, AK
GES DISC	May 6-7, 2014	Greenbelt, MD
SEDAC	Jun 12-13, 2014	New York, NY
ORNL DAAC	Jun 17-18, 2014	Washington, DC
ASDC DAAC	Jun 24-25, 2014	Hampton, VA
GHRC DAAC	**Sep 25-26, 2014**	**Huntsville, AL**