EOSDIS Evolution in Support of Measurement Needs/Science

LP.DAAC Science Advisory Panel Meeting
February 8, 2006
GSFC

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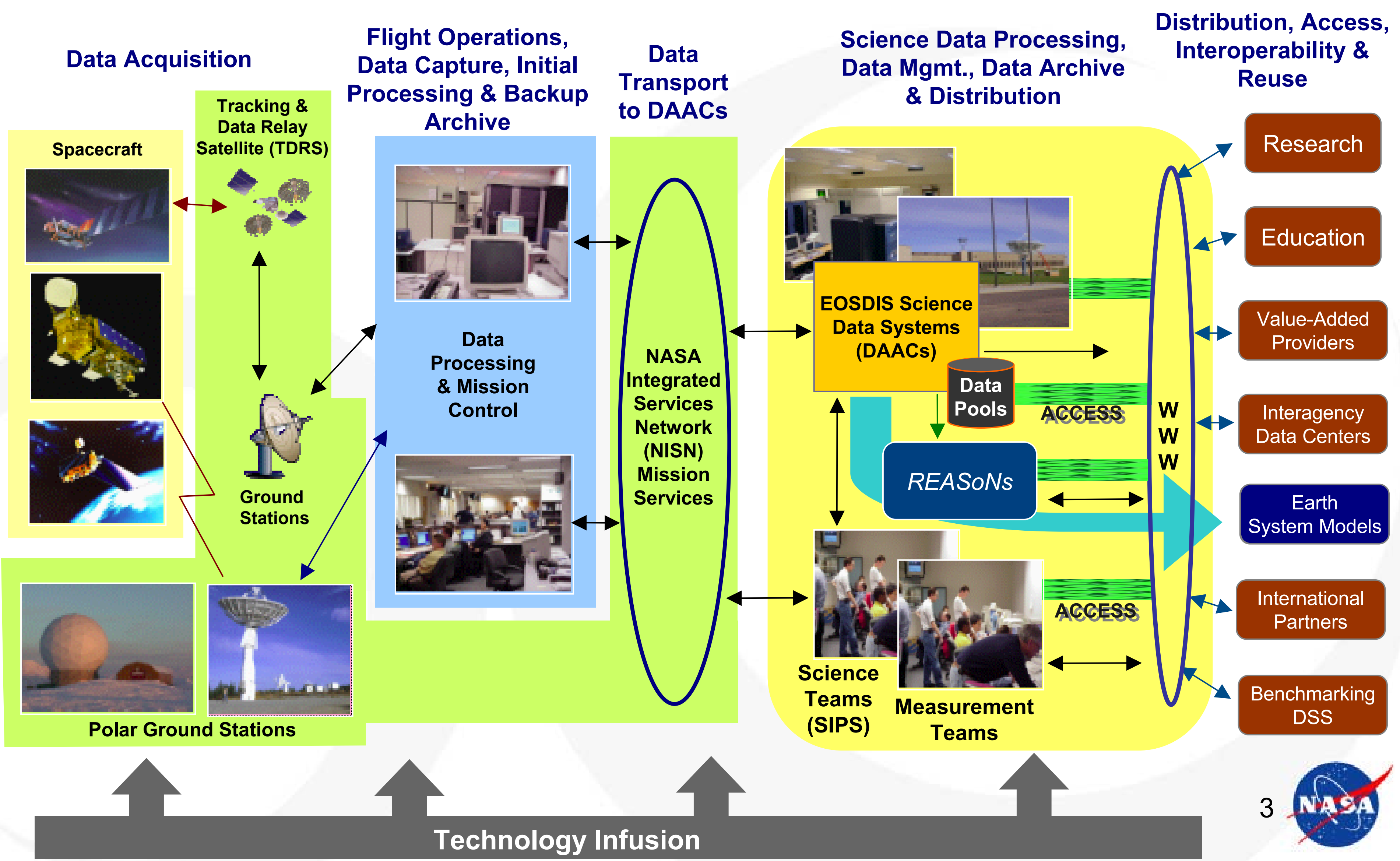
NASA Headquarters

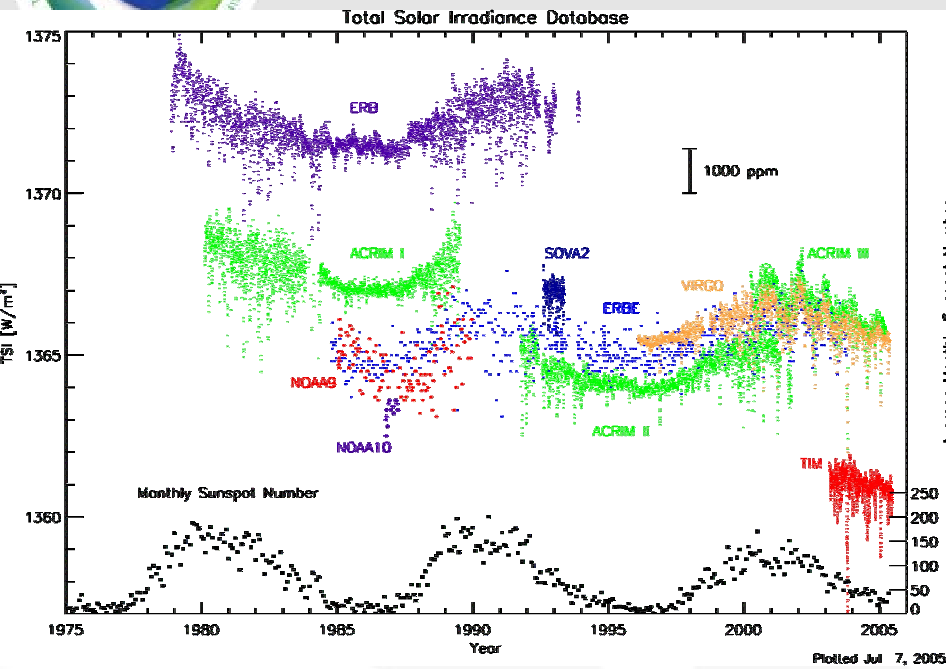
Overview of Presentation

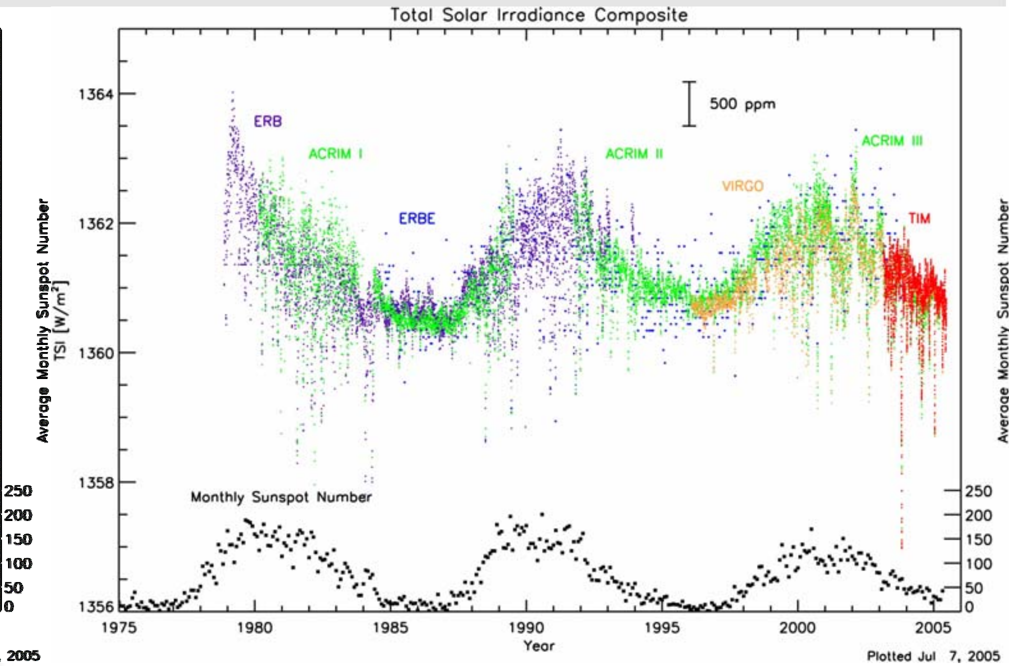
- Next generation NASA Earth Science Data and Information Systems.
- Update on Evolution of EOSDIS Elements Study.
- ACCESS projects.
- REASoN continuation.

Earth Science Data System Architecture

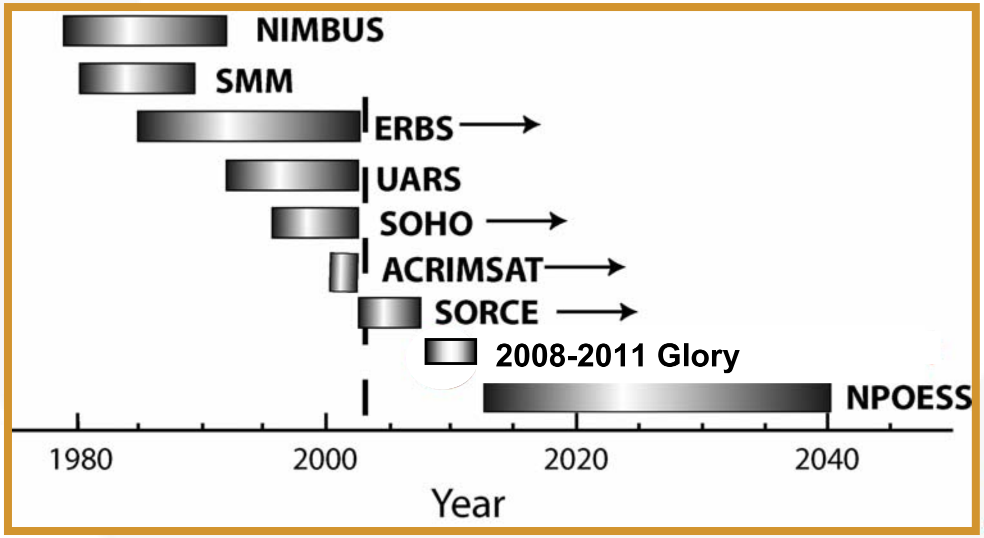


NASA Earth Missions Moving to Measurements Focus

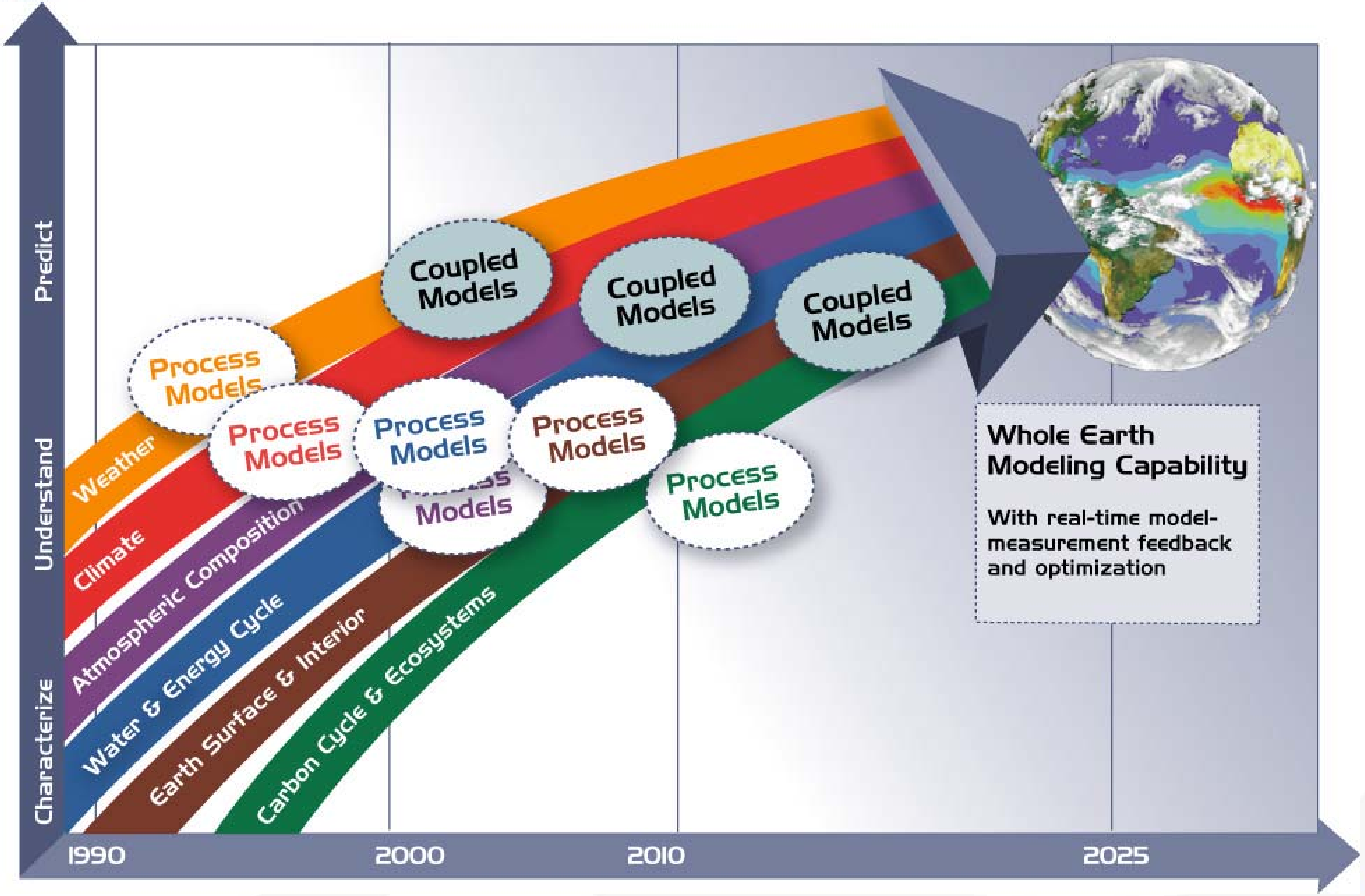




Total Solar Irradiance (TSI) measurements shown are existing 26 year record - precise data records from multiple sensors have been corrected for accuracy through data overlaps.



Earth System Science Today & Tomorrow: Linking Missions-Measurements-Models To Improve Scientific Impact



Data System Evolution

- NASA has an irreplaceable data set created by the Earth Science Enterprise over the last 15 years. Continuing analysis of this data set is consonant with the three Presidential initiatives:
  - 1. Climate Change Research Initiative,
  - 2. Global Earth Observation, and
  - 3. Vision for Space Exploration.

- NASA systems will evolve and support integrated, open and easy access to the data for the purpose of supporting NASA research and shared decision support systems across other federal and state agencies.
- NASA is moving focus from free-standing mission data systems to create distributed interoperable systems providing measurements availability to support its research programs and focus areas.
- NASA will evolve its EOSDIS over the next several years, and will continue to procure new data systems assets through new missions, REASoN and ACCESS, to support our Earth research and to benchmark science applications

EOSDIS Evolution Progress

- HQ chartered an “Evolution of EOSDIS Elements” Study team, led by Moshe Pniel (JPL), to provide guidance to the Technical Team, led by Mary Ann Esfandiari (GSFC).
  - Scope included: DAACs, ECS/SDPS, SIPSs, Middleware for Search and Order, Interoperability
- The Study Team developed a vision for the 2015 timeframe to guide conduct of the evolution process. This vision was presented to the Earth Science HQ Steering Committee on February 3, 2005 and was endorsed and approved.
- Technical Team has progressed to formulate a Step 1 plan (concurred by the Study Team), which was approved by NASA Headquarters Steering Committee, Chaired by Mary Cleave in early November.
- Technical team is developing detailed implementation and transition plans, and proceeding with Step 1.
- NASA will continue EOSDIS evolution process as “proven” steps toward fulfillment of Vision. Technical Team, Study Team and HQ Programs will work together to plan future evolution in “missions to measurements”, interoperability, and measurement teams processing improvements

EOSDIS Evolution 2015 Vision Tenets

Vision Tenet	Vision 2015 Goals
Archive Management	▪ NASA will ensure safe stewardship of the data through its lifetime. ▪ The EOS archive holdings are regularly peer reviewed for scientific merit.
EOS Data Interoperability	▪ Multiple data and metadata streams can be seamlessly combined. ▪ Research and value added communities use EOS data interoperably with other relevant data and systems. ▪ Processing and data are mobile.
Future Data Access and Processing	▪ Data access latency is no longer an impediment. ▪ Physical location of data storage is irrelevant. ▪ Finding data is based on common search engines. ▪ Services invoked by machine-machine interfaces. ▪ Custom processing provides only the data needed, the way needed. ▪ Open interfaces and best practice standard protocols universally employed.
Data Pedigree	▪ Mechanisms to collect and preserve the pedigree of derived data products are readily available.
Cost Control	▪ Data systems evolve into components that allow a fine-grained control over cost drivers.
User Community Support	▪ Expert knowledge is readily accessible to enable researchers to understand and use the data. ▪ Community feedback directly to those responsible for a given system element.
IT Currency	▪ Access to all EOS data through services at least as rich as any contemporary science information system.

MODIS-related Features of Step 1 Plan

- Transfers responsibility for MODIS atmosphere data archive and distribution and MODIS Level 1 processing from GSFC DAAC to MODAPS.
- Features include:
  - *Processing on demand for Level 1*
  - *Uses commodity-based systems for processing, on-line data storage and access.*
  - *Based on extension to existing MODAPS science team production systems.*
- Benefits:
  - *Reduction in archive growth through on-demand processing*
  - *Faster access to products, reduced reprocessing time from all on-line storage*
  - *Reduced costs due to use of commodity disks, reduction in operations at DAAC*
    - *Resulting changes to GES DAAC include: 10% fewer products; 90% reduction in total volume and similar reductions in archive growth/day*
  - *Closer involvement and control by science community, more responsive to science needs, products, tools, processing*

Key Benefits

✓ Substantial Cost Savings

✓ Maximize Science Value

- Data access easier and data products quickly available to science community
- MODIS data more closely integrated with science community
- Pathfinder for migration of other data into science communities

✓ Manageable Risk

- Builds upon existing system – not a “blank paper” new development
- GES DAAC provides risk mitigation for MODAPS development effort
- Utilizes growth in community capability to decentralize

EOSDIS Data Products Workshops

- EOSDIS Evolution action involving the research community
- The NSIDC DAAC Product Workshop (January 11-12 at GSFC) was the first of a series of DAAC Product Workshops (or by disciplinary collections), which will examine and provide priority recommendations for the products held at the DAACs.
- Each DAAC will be asked to write a proposal responding to the recommendations of the review team, discussing how the DAAC would assimilate or implement these recommendations.
- Plan is for a rich set of discussions and possible product disposition recommendations (e.g. keep, change level of service, ready to move to long-term archive, delete from the DAAC).
- Review of science data products in the rest of the DAACs planning begun, will be scheduled in very near future.
- This exercise in the near-term is a vital element in the Evolution of EOSDIS.
- In the mid-and long-term we expect it to facilitate moving from mission to measurement focus and incorporation of community consensus feedback into the NASA PI-led algorithms and data production.

Template: Product Developers

- Title for specific data set (ESDT) or group of datasets
- Brief Narrative Description
- Product Algorithm Theoretical Basis
- Science Need (justification)
- Quality and Accuracy Information

  (cal/val, relative and absolute uncertainty, stability, maturity of algorithm)
- Intended or Appropriate Product Use

  (also including limitations on use where appropriate)
- Science Value

  (use of product for science, papers written, breakthroughs, multidisciplinary use)

Template: DAAC, ESDIS-Science Ops Office

- Title for specific data set (ESDT) or group of datasets
- Heritage
  - Rationale for DAAC involvement in the data set(s)
  - Where data came from
  - Authorization or agreement for DAAC to manage these data
    - (EOS Program, DAAC User Working Group, MOUs, requests, other)
- Descriptive Metrics (as described in SOO metrics presentation)
  - Size (e.g. data volume, number of granules, etc)
  - Activity levels
- Level and Type of Service(s)
  - Characterization of Services from DAAC
- Current Involvement/Responsibility
  - DAAC developed and/or managed
  - DAAC provided infrastructure
  - Shared responsibility with other institutional or external programs
  - Brokered with other institutions
    - (meaning they are hosted at other institutions, with web presence on DAAC website)

Template: Science Community Participants

- Title for specific data set (ESDT) or group of datasets

- Proposed recommendations
  - Science research value: Comments on potential designation as Climate Data Record/Earth Science Data Record.
  - NASA management priority:
    - Keep, move to other center, move to long term archive, other
  - Suggestions on Level and Type of Service desired

2015 Vision Goals Addressed by Step 1 Plan

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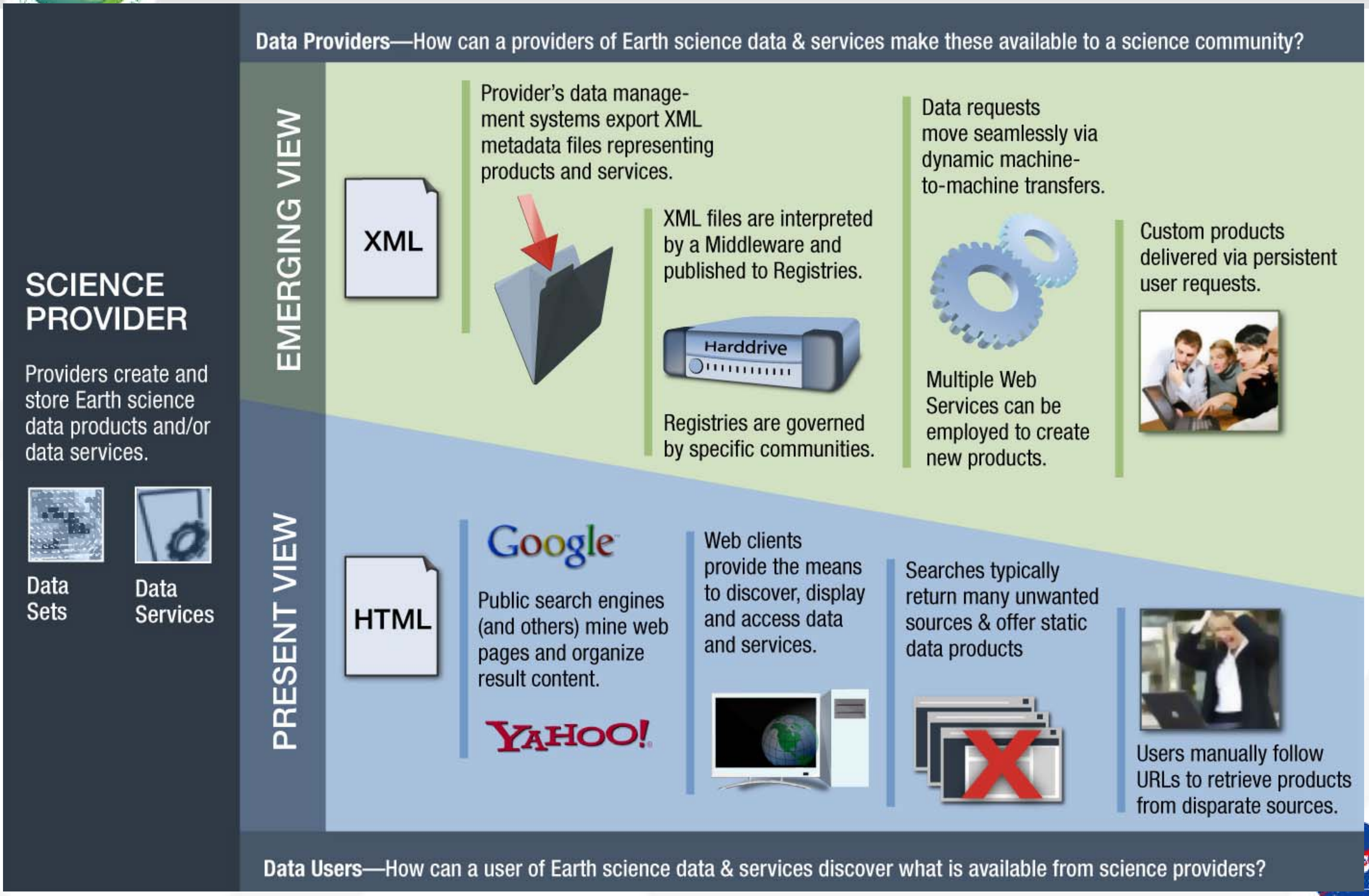
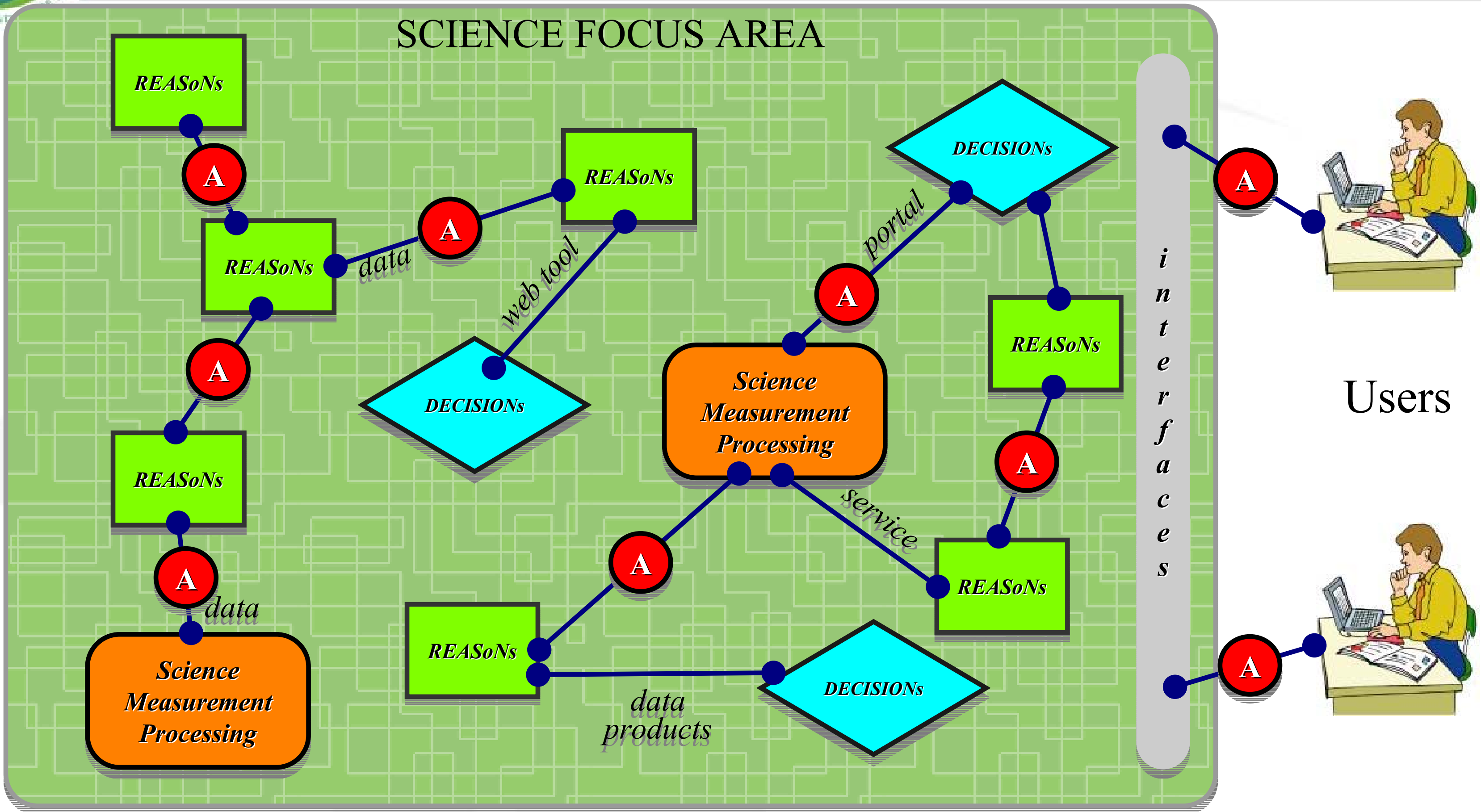
Interoperability and the Promise of Middleware



ACCESS Overview

- ACCESS is intended to provide strategic, near-term improvements in NASA's Earth science data and information systems that support Earth science communities.
- Goals of ACCESS Announcement:
  - •Enhance or create tools and services to support evolution to science measurement processing systems.
  - •Tools and services to support and/or enhance NASA's Science Focus Area (SFA) communities.
    - In that section a special articulated focus on data system needs of the atmospheric composition SFA communities following Aura launch.
- Solicitation seeks improvements for data systems using existing technologies.
- Selected projects receive Cooperative Agreement funding for 2 year award periods with a possibility of a 3rd year extension.

ACCESS Data System Context



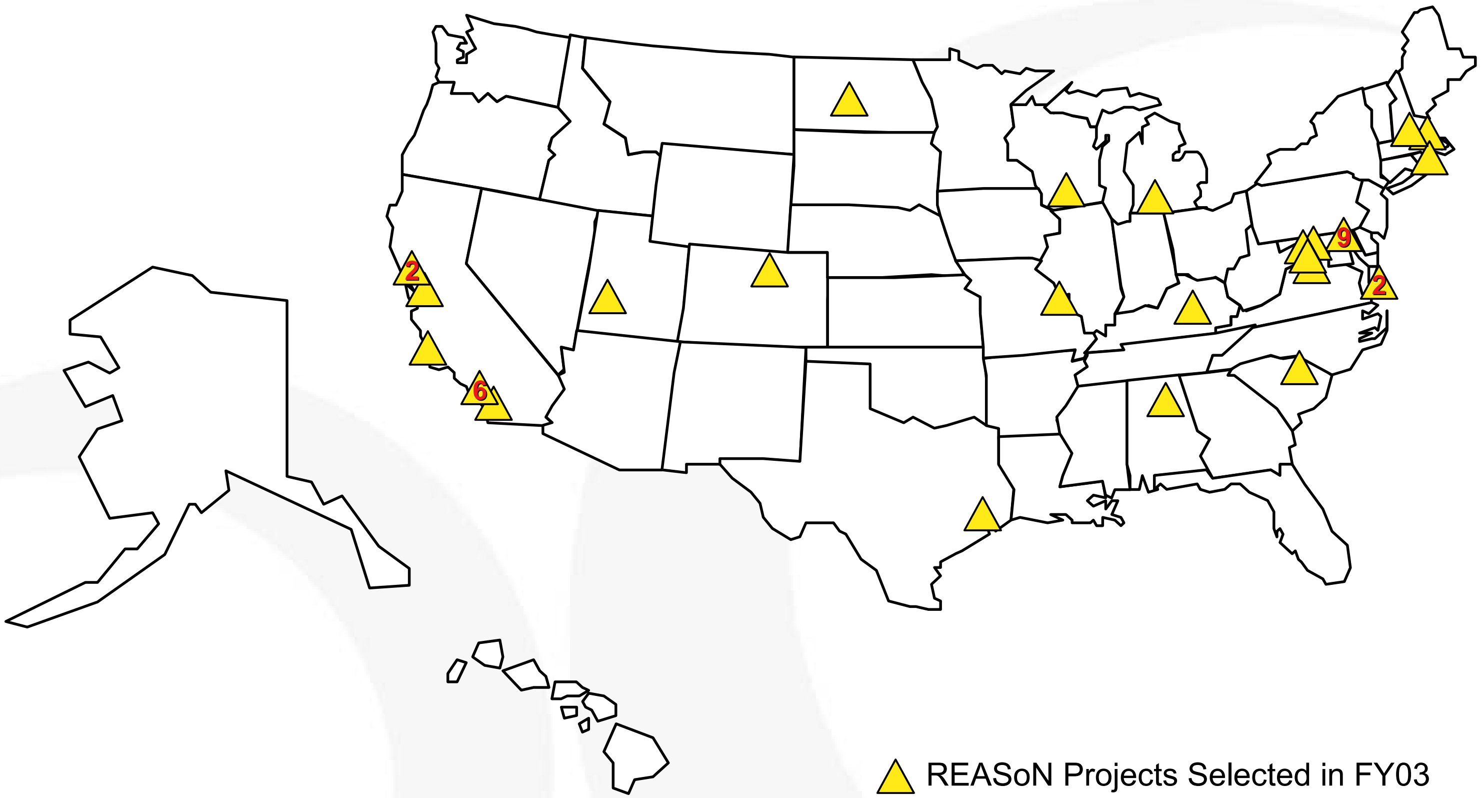
REASoNs (FY03, FY06) solicitation adding needed activities in research, education and applied science.
DECISIONs (FY05) enhances development of cross-cutting solutions and Integrated Systems Solutions work.

AIST-ESTO (ongoing solicitation) information systems technology develops and matures IT.

ACCESS 2005

PI	Affil.	Title
Barry	U of Colorado	Discovery, Access, and Delivery of Data for the International Polar Year (IPY) (DADDI)
Bingham	JPL	Earth Science Datacasting: Informed data pull and visualization
Bock	Scripts	Modeling and On-the-fly Solutions in Solid Earth Science
Braverman	JPL	AMAPS: An Aerosol Measurement and Processing System
Caron	New Media Studio	Data and Information Application Layer (DIAL): Enabling Rapid NASA Data-Rich User Software Application Development
Graves	U of Alabama	Deployable Suite of Data Mining Web Services for Online Data Repositories
Kempler	GSFC	A-Train Data Depot: Integrating Atmospheric Measurements Along the A-Train Tracks Utilizing Data from the Aqua, Cloudsat and Calipso Missions
Leptoukh	GSFC	NASA Earth Sciences Data Support System and Services for the Northern Eurasia Earth Science Partnership Initiative
Masek	GSFC	Building a Community Land Cover Change Processing System
McDonald	GSFC	The Development and Deployment of a CEOP Satellite Data Server
Morisette	GSFC	Improving access to Land and Atmosphere science products from Earth Observing Satellites: helping NACP investigators better utilize MODIS data products.
Rowlands	GSFC	High Spatial and Temporal Resolution Continental Water Mass Anomaly Fields from GRACE: Improving Accessibility for Hydrological Research and Applications
Tilmes	GSFC	Atmospheric Composition Processing System (ACPS)
Yang	The HDF Group	Software to Access HDF5 Datasets via OPeNDAP's Data Access Protocol (DAP)

REASoNs - Distributed and Heterogeneous



42 projects projects producing data and information and/or services competitively selected through the Research, Education and Applications, Solutions Network Cooperative Agreement Notice (REASoN CAN) for development of next-generation architectures.

REASoN in ROSES 2006

- The (late) 2006 REASoN call will be focused on particular Earth science research information system needs, in the two areas of Earth Science Data Records and Climate Data Records.
- ESDRs are records needed for community to accomplish research strategy, as outlined in NASA Earth Science Research Strategy
- Attributes to guide the definition of CDRs
  - Key characteristics

    Critical parameters, multi- sensor and platform, redundancy
  - Purpose

    Identify trends (spatial &temporal scales), validate models, improve predictions
  - Influence observing & data systems

    Absolute and relative uncertainty, access and distribution
  - "as only NASA can"

    Space data records, dependency on situ networks, combined data records
- REASoN projects to be closely linked to cal/val and algorithm research.

NASA's Earth Science Data Systems and Services

- NASA now has evolved to a system with "core" and "community" components, which can work flexibly and in concert, and both capable of evolving to meet science needs and to take advantage of a changing information technology environment.
- Traditional satellite mission data systems are seen in the larger context of providing data records of Earth measurement needed for Earth science.
- Continuous optimization of the distributed system so that activities can be relocated allows for the most efficient use of scarce resources, management of science data maturation, etc.
- To ensure the 'flow' of data through this distributed, heterogeneous data system, the interfaces between the pieces become even more critical.