Data Preservation, Information Preservation, and lifecycle of information management at NASA GES DISC

NASA/Goddard Earth Sciences Data and Information Services Center (GES DISC)

An open source solution for document preservation to enable information generation from data for future generations of researchers

Fall 2014 AGU Meeting
San Francisco, CA Dec. 15-20

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The case for document preservation

Many NASA Earth Observing System (EOS) missions have either reached the end of their active life or are nearing it. In order to ensure that future users can draw maximum benefit from this data for years to come, it is necessary for us not only to ensure preservation of the data proper, but also the preservation of all associated metadata, calibration/validation data, and important documentation or other artifacts. Missing any information that could hamper the Data-Information-Knowledge chain takes away from the ability of future generations of researchers to draw value from our data. Preservation of data products is a fairly well defined task for the NASA EOS Data Centers. However, supporting documentation and other artifacts from these missions are also critical to the long-term studies of our planet's climate. To be successful in this goal, we need to shift our focus from strict Data Lifecycle Management, to the lifecycle management of information and what enables knowledge into the future. A break in that chain, like having incomplete documentation, can be deleterious for legacy missions especially when original investigators or people most familiar with the data have long moved on or are no longer accessible.

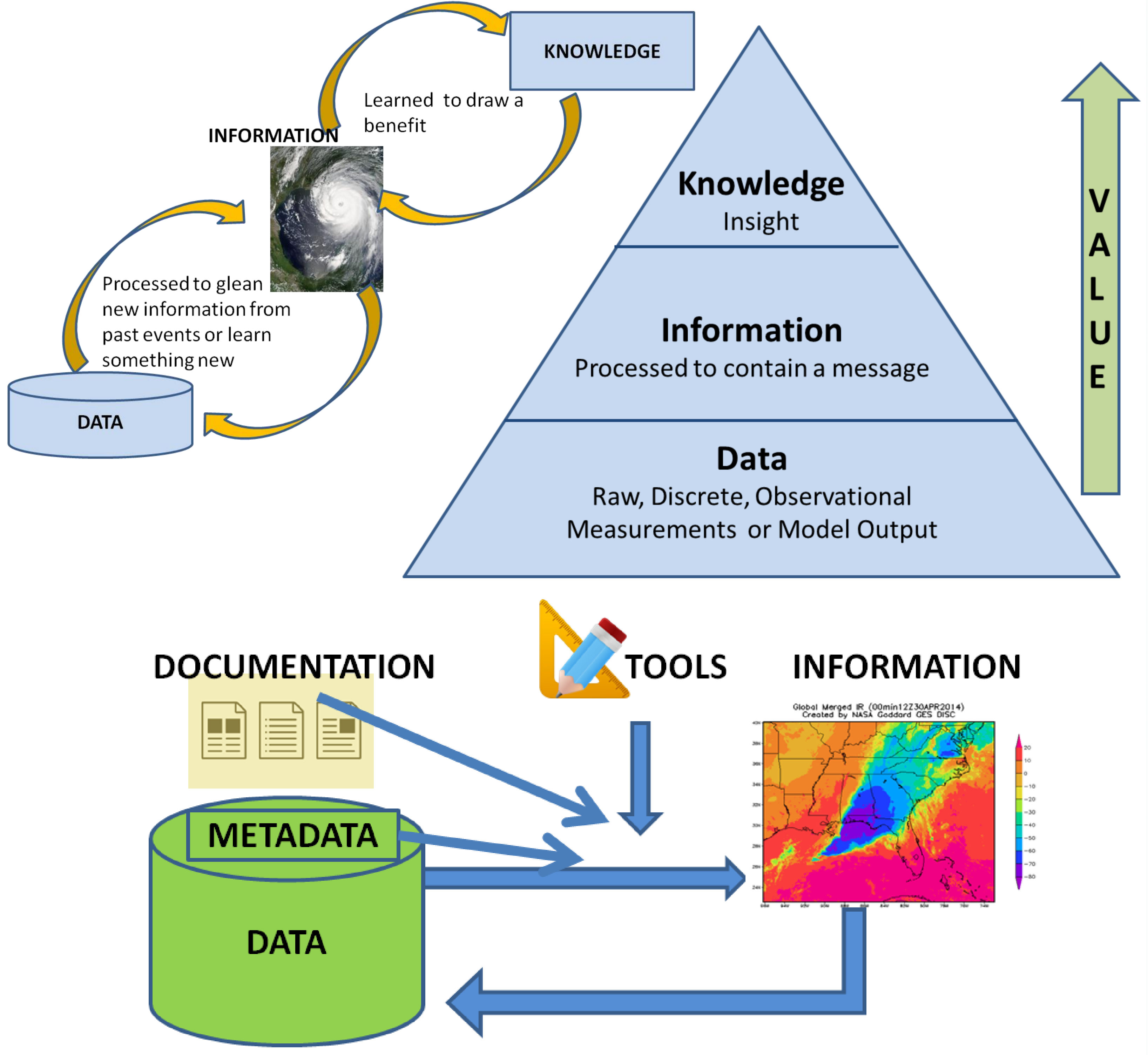

KNOWLEDGE
Learned to draw a benefit
INFORMATION
Processed to glean new information from past events or learn something new
DATA
Knowledge
Insight
Information
Processed to contain a message
Data
Raw, Discrete, Observational Measurements or Model Output
VALUE
DOCUMENTATION
TOOLS
INFORMATION
Global Merged IR (00min12Z30APR2014)
Created by NASA Goddard GES DISC
METADATA
DATA

Figure 1. Data to Knowledge pathway requires information that may be contained in documents created throughout the life of a mission. Loss of such documentation could potentially deprive future generation of derived values from these data.

The Need for Documentation Preservation at NASA GES DISC

Given that NASA is not legislatively mandated to preserve data permanently, unlike agencies like USGS, NOAA and NARA, we have a challenge to develop a low cost solution that meets our data center needs and that of our users. The Goddard Earth Sciences Data and Information Services Center (GES-DISC) has implemented a Repository System to facilitate the long-term archiving of documentation artifacts and other associated digital content. The GES-DISC designed this system based on Fedora Commons, an open-source repository management software, for cost savings and flexibility.

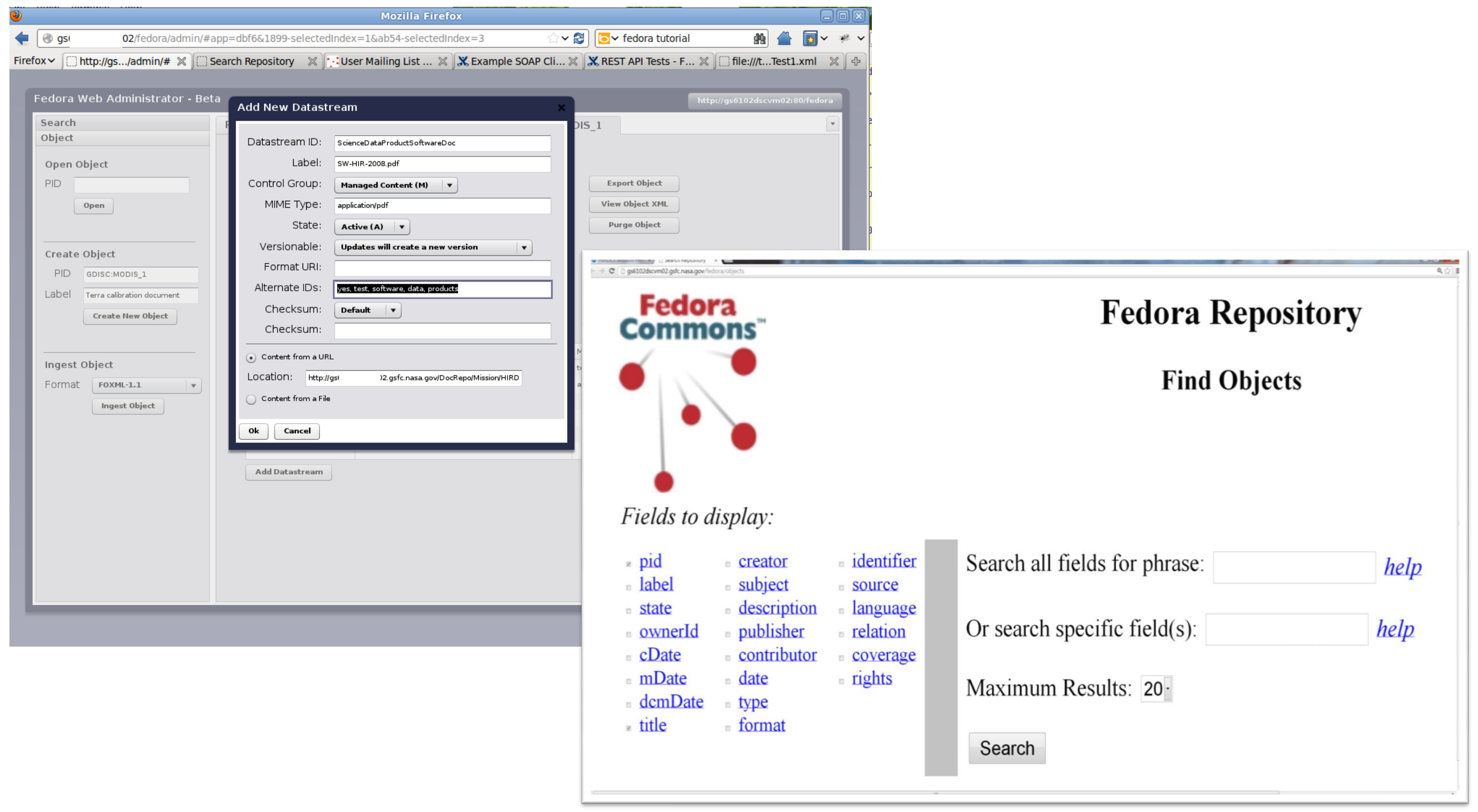
The first mission to utilize the GES-DISC Repository System was the High Resolution Dynamics Limb Sounder (HIRDLS) on the Aura spacecraft. Data and documentation from the Upper Atmosphere Research Satellite (UARS) and the Total Ozone Mapping Spectrometer (TOMS), and Nimbus have also been added. The GES-DISC is negotiating the transfer of data preservation items from the current Microwave Limb Sounder (MLS) on Aura, and the Atmospheric Infrared Sounder (AIRS) missions before they end.

Fall 2014 AGU Meeting, Poster No. IN53C-3816

Fedora Commons Interface

The GES-DISC used Fedora Commons, an open-source repository management system that is used in many universities, research centers, and libraries. It comes with a simple web-based GUI interface which provides for easy administration of the system. The GUI also allows one to enter objects or datastreams (these can be of any type document, image, source code, binary data, etc.) into the system. The system uses XML to manage the objects. The GES-DISC has also developed a command line script to allow batch ingest of objects into the Fedora Repository.

Figure 2. Internal GUI used to ingest and archive records into the repository (left), and internal GUI used to search and retrieve records from the repository (right).



gs 02/fedora/admin/#app=dbf6&1899-selectedIndex=1&ab54-selectedIndex=3

PID: GDISC:MODIS_1
Label: Terra calibration document
Format: FOXML-1.1

Datastream ID: ScienceDataProductSoftwareDoc
Label: SW-HIR-2008.pdf
Control Group: Managed Content (M)
MIME Type: application/pdf
State: Active (A)
Versionable: Updates will create a new version
Format URI:
Alternate IDs: yes, test, software, data, products
Checksum: Default
Checksum:
● Content from a URL
Location: http://gs 2.gsfc.nasa.gov/DocRepo/Mission/HIRD
○ Content from a File

gs6102dscvm02.gsfc.nasa.gov/fedora/objects

Fedora Repository

Find Objects

Fields to display:

☑ pid ☐ label ☐ state ☐ ownerId ☐ cDate ☐ mDate ☐ dcmDate ☑ title
☐ creator ☐ subject ☐ description ☐ publisher ☐ contributor ☐ date ☐ type ☐ format
☐ identifier ☐ source ☐ language ☐ relation ☐ coverage ☐ rights

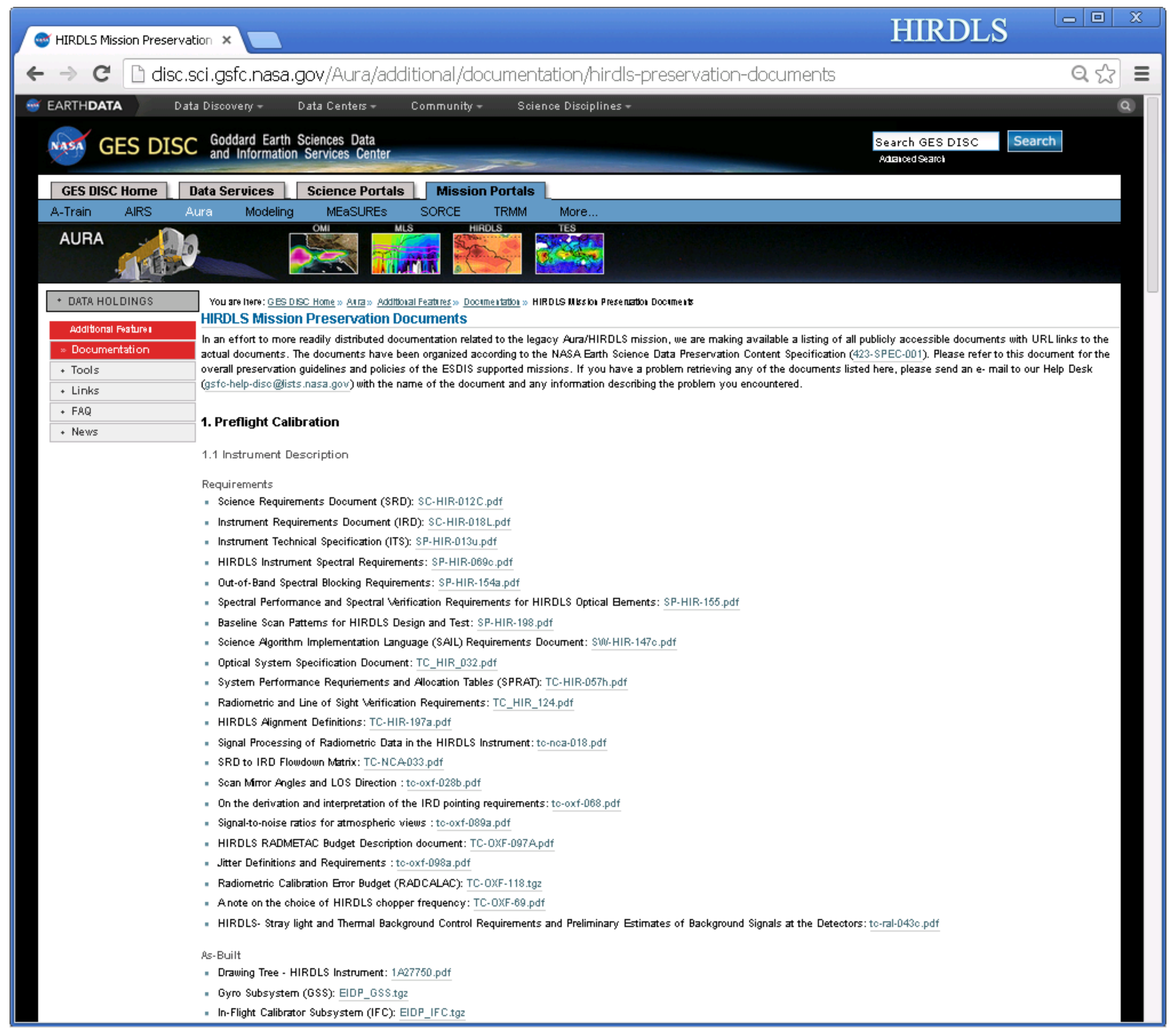
Search all fields for phrase: help
Or search specific field(s): help
Maximum Results: 20

Public Access of Preservation Documents

External users access the publicly available documents by visiting the mission specific documentation page for that instrument. The Fedora repository system is at the backend and makes access to the linked documents possible. Note that restricted objects (ITAR, proprietary, or software) are not accessible through the public interface. Three missions are now public:

HIRDLS	http://disc.sci.gsfc.nasa.gov/Aura/additional/documentation/hirdls-preservation-documents
TOMS	http://disc.sci.gsfc.nasa.gov/acdisc/documentation/toms-mission-preservation-documents
UARS	http://disc.sci.gsfc.nasa.gov/acdisc/documentation/uars-mission-preservation-documents

Figure 3. Example of the public web sites for the HIRDLS Mission showing preservation documents available to GES-DISC users.



disc.sci.gsfc.nasa.gov/Aura/additional/documentation/hirdls-preservation-documents

You are here: GES DISC Home » Aura » Additional Features » Documentation » HIRDLS Mission Preservation Documents

HIRDLS Mission Preservation Documents

In an effort to more readily distributed documentation related to the legacy Aura/HIRDLS mission, we are making available a listing of all publicly accessible documents with URL links to the actual documents. The documents have been organized according to the NASA Earth Science Data Preservation Content Specification (423-SPEC-001). Please refer to this document for the overall preservation guidelines and policies of the ESDIS supported missions. If you have a problem retrieving any of the documents listed here, please send an e- mail to our Help Desk (gsfc-help-disc@lists.nasa.gov) with the name of the document and any information describing the problem you encountered.

1. Preflight Calibration

1.1 Instrument Description

Requirements

- Science Requirements Document (SRD): SC-HIR-012C.pdf
- Instrument Requirements Document (IRD): SC-HIR-018L.pdf
- Instrument Technical Specification (ITS): SP-HIR-013u.pdf
- HIRDLS Instrument Spectral Requirements: SP-HIR-069c.pdf
- Out-of-Band Spectral Blocking Requirements: SP-HIR-154a.pdf
- Spectral Performance and Spectral Verification Requirements for HIRDLS Optical Elements: SP-HIR-155.pdf
- Baseline Scan Patterns for HIRDLS Design and Test: SP-HIR-198.pdf
- Science Algorithm Implementation Language (SAIL) Requirements Document: SW-HIR-147c.pdf
- Optical System Specification Document: TC_HIR_032.pdf
- System Performance Requriements and Allocation Tables (SPRAT): TC-HIR-057h.pdf
- Radiometric and Line of Sight Verification Requirements: TC_HIR_124.pdf
- HIRDLS Alignment Definitions: TC-HIR-197a.pdf
- Signal Processing of Radiometric Data in the HIRDLS Instrument: tc-nca-018.pdf
- SRD to IRD Flowdown Matrix: TC-NCA-033.pdf
- Scan Mirror Angles and LOS Direction : tc-oxf-028b.pdf
- On the derivation and interpretation of the IRD pointing requirements: tc-oxf-068.pdf
- Signal-to-noise ratios for atmospheric views : tc-oxf-089a.pdf
- HIRDLS RADMETAC Budget Description document: TC-OXF-097A.pdf
- Jitter Definitions and Requirements : tc-oxf-098a.pdf
- Radiometric Calibration Error Budget (RADCALAC): TC-OXF-118.tgz
- A note on the choice of HIRDLS chopper frequency: TC-OXF-69.pdf
- HIRDLS- Stray light and Thermal Background Control Requirements and Preliminary Estimates of Background Signals at the Detectors: tc-ral-043c.pdf

As-Built

- Drawing Tree - HIRDLS Instrument: 1A27750.pdf
- Gyro Subsystem (GSS): EIDP_GSS.tgz
- In-Flight Calibrator Subsystem (IFC): EIDP_IFC.tgz

GES DISC Preservation Implementation

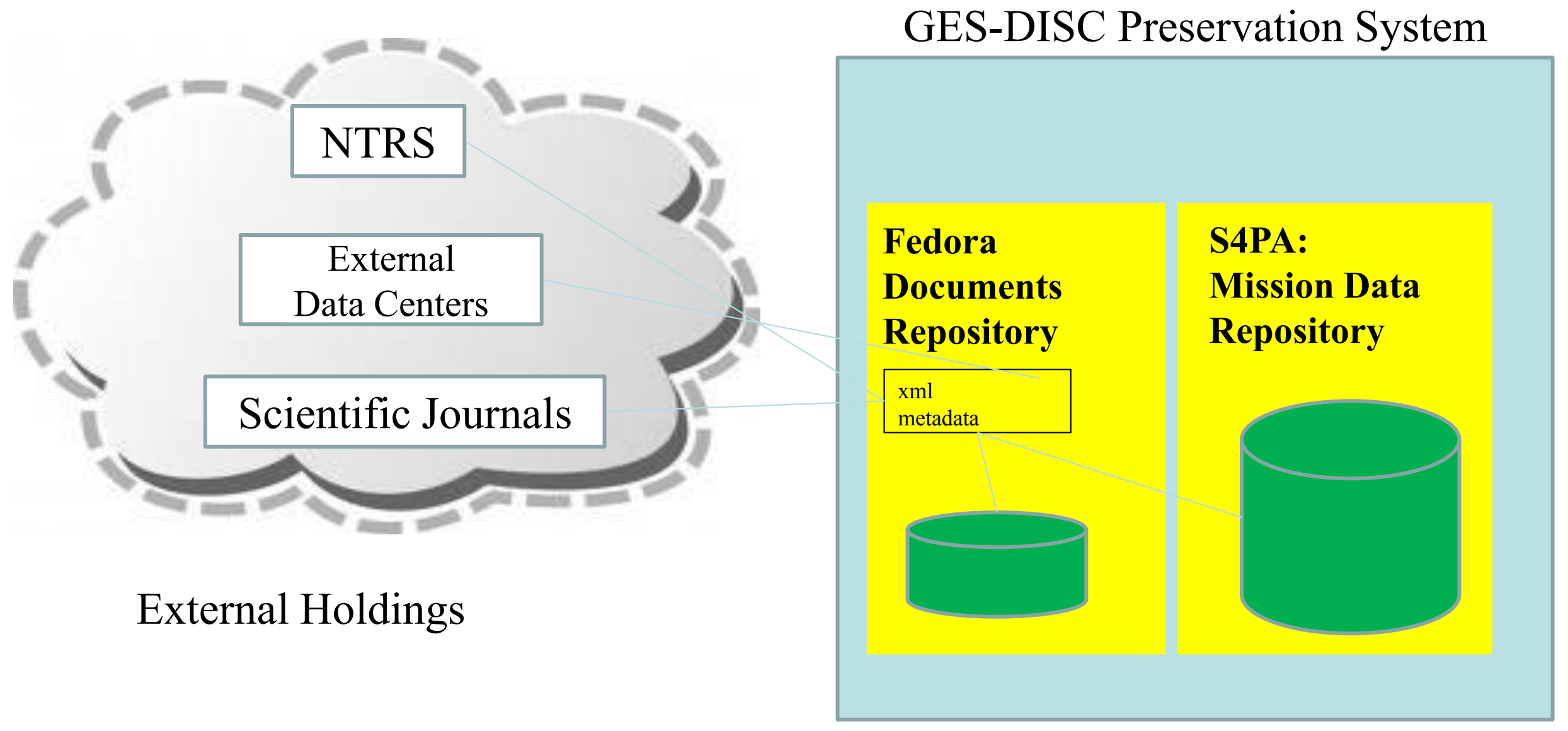
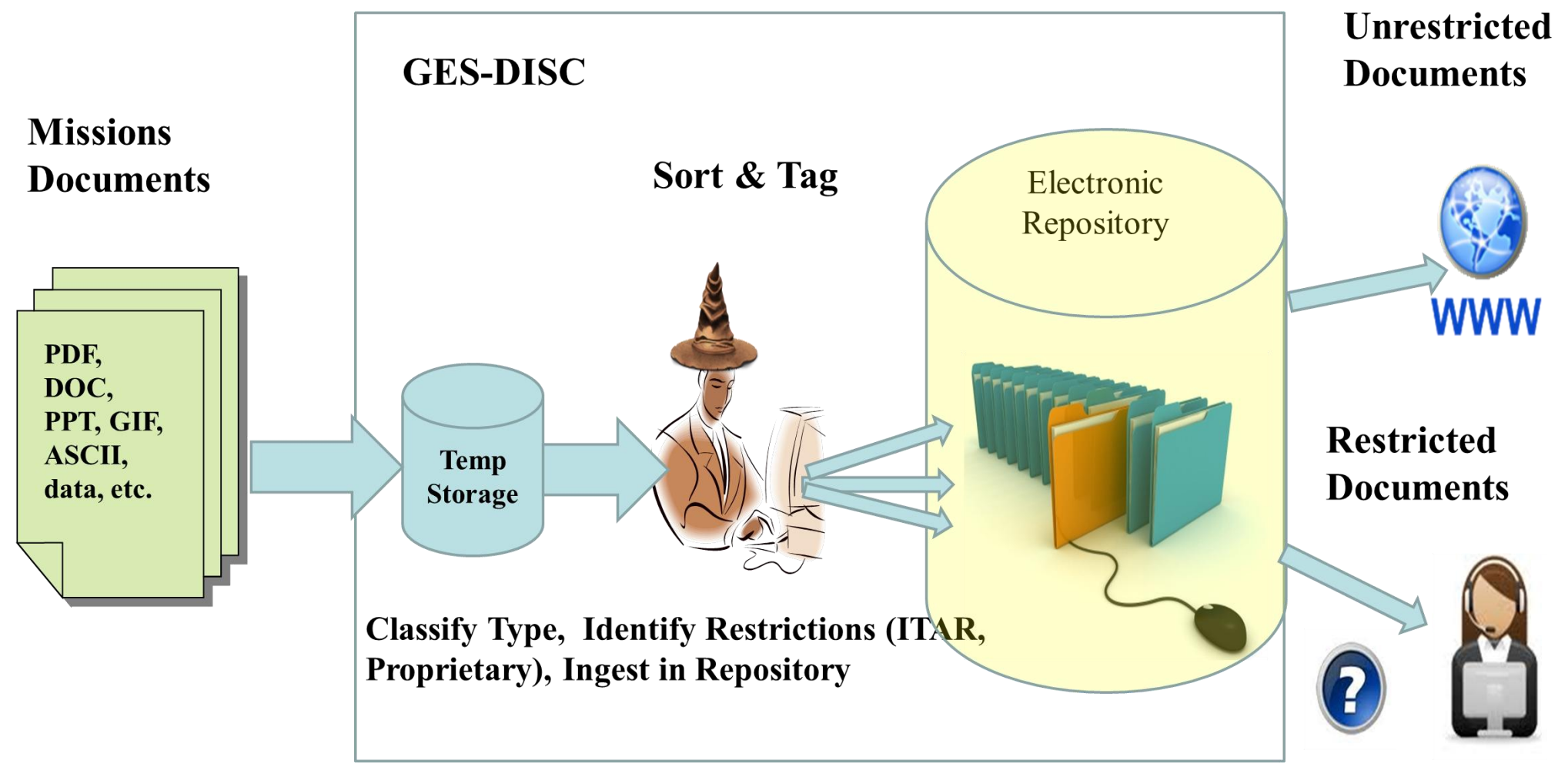

GES-DISC Preservation System
NTRS
External Data Centers
Scientific Journals
External Holdings
Fedora Documents Repository
xml metadata
S4PA: Mission Data Repository

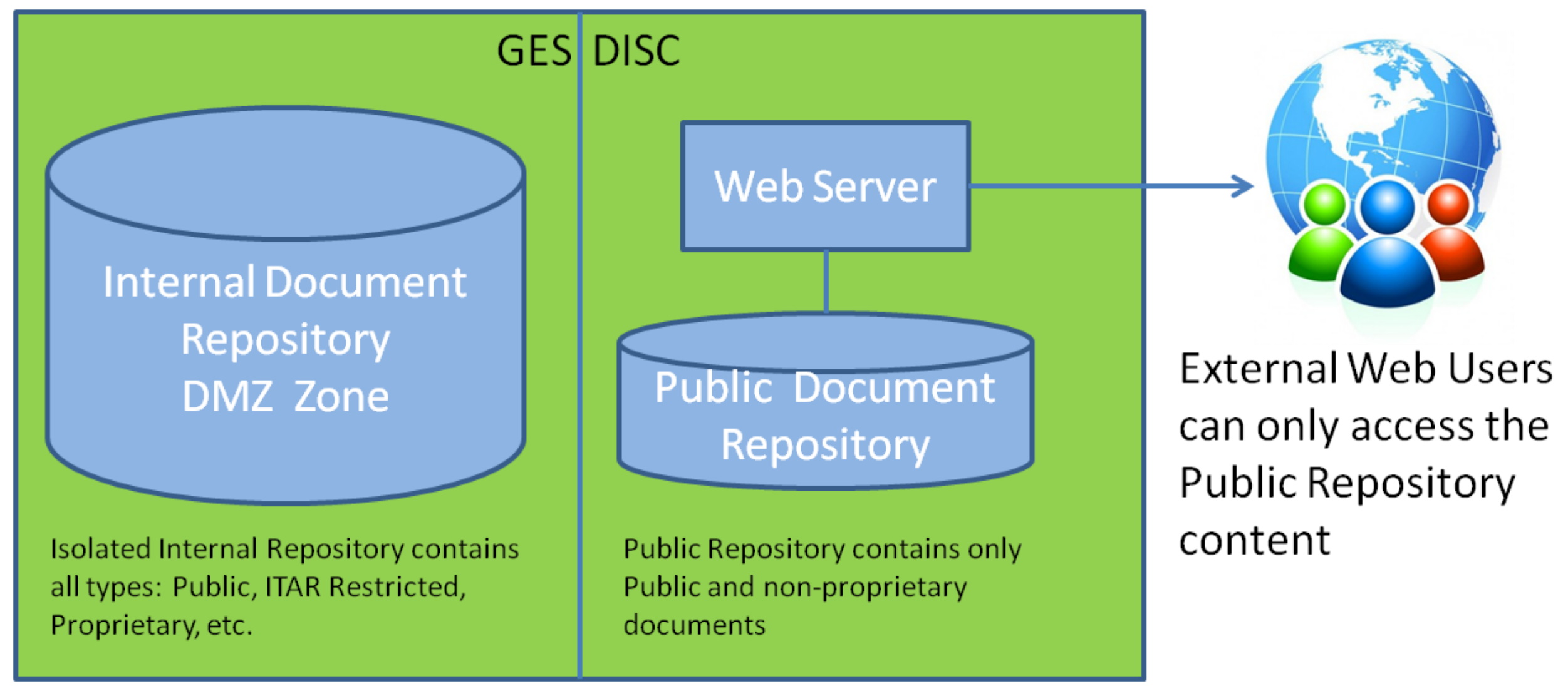
Figure 4 - Overview of the GES DISC data and documentation preservation systems. Artifacts may reside at the GES DISC or be external, (e.g. NASA Technical Reports Server (NTRS), another Data Center, or in a scientific or technical journal

1. Identify documentation
2. Specify and implement preservation environment
3. Retrieve documentation
4. Implement retrieval and distribution services
   1. *Access for internal GES-DISC users*
   2. *External Access via WWW for unrestricted documents*
   3. *External Access for restricted documents (ITAR) via User Services contact*
   4. *External Access for restricted documents via User Services contact*

Figure 5 - Overview of the physical objects sorting, tagging, storage in archive and distribution system. (Right)

Restricted documents are isolated on an internal GES DISC accessible network only. (Below)


Missions Documents
PDF, DOC, PPT, GIF, ASCII, data, etc.
GES-DISC
Temp Storage
Sort & Tag
Electronic Repository
Classify Type, Identify Restrictions (ITAR, Proprietary), Ingest in Repository
Unrestricted Documents
WWW
Restricted Documents
?


GES DISC
Internal Document Repository DMZ Zone
Isolated Internal Repository contains all types: Public, ITAR Restricted, Proprietary, etc.
Web Server
Public Document Repository
Public Repository contains only Public and non-proprietary documents
External Web Users can only access the Public Repository content

Lessons Learned, Challenges, and Future Plans

- Heritage missions require extensive work to identify and classify documents
- Restricted (ITAR or Proprietary) vs. Unrestricted requires special handling on a case-by- case basis (subject to export control rules)
- Limited ability to use NASA infrastructure like NTRS which are set to accept all Science and Technical Information (STI) that missions generate.
- Incorporate DOI metadata into repository (future plan)
- Upgrade from current Fedora Commons 3 to version 4 (planned release in 2015)

References

NASA Earth Science Data Preservation Content Specification (423-SPEC-001) H. K. Ramapriyan, EOSDIS Project Office, NASA GSFC
https://earthdata.nasa.gov/sites/default/files/field/document/423-SPEC-001_NASA%20ESD_Preservation_Spec_OriginalCh01_0.pdf

Evolution of Information Management at the GSFC Earth Sciences (GES) Data and Information Services Center (DISC), IEEE Transactions on Geoscience and Remote Sensing, Volume 47, Issue: 1, 2009