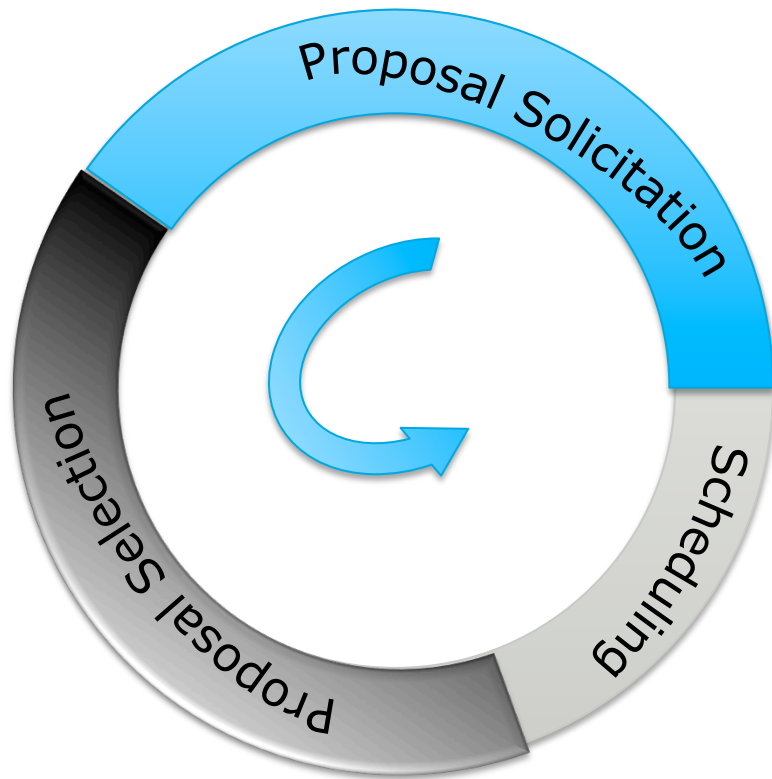


Processing and Distribution of JWST data

ELIXIR SCHOOL

- ESTEC 26-27 September 2012

M. Sirianni



You nicely prepared your program with APT and it has been selected by the TAC



Your program will be part of a long-range observing plan (up to 1 year's duration).

If no further iterations are needed, when the times come, STScI will notify you on when your data will be acquired.

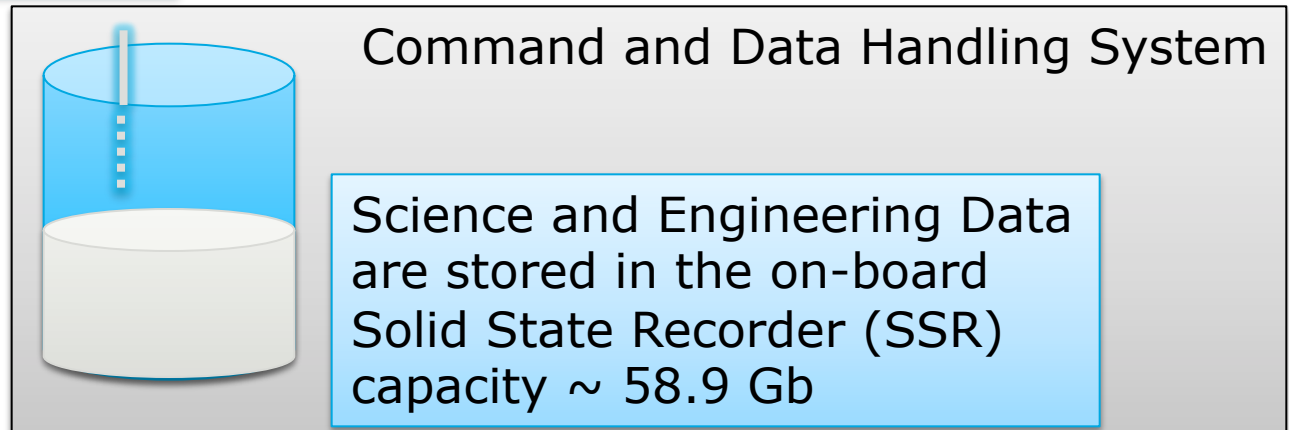
- During the acquisition of the data, some on-board Data processing (instrument dependent) is possible and it is completely transparent to the user and it is irreversible (ex: frame averaging – more later)
 - Data compression
 - Data compression is often used to limit the on-board data storage need and/or limit need of contact time with the DSN
 - Lossless compression is sometimes very inefficient (for JWST is the ration is only 1.1:1 due to large scale Pixel-to-Pixels variation in the NIR detector).
- Contact time has been doubled (4 hours every 12 hours)
- more frequent monitoring of the Observatory state
 - data will be available 12 hours earlier
 - faster response to Target of Opportunity

On Board Command and Data Handling System

After any on-orbit processing data are stored and the following exposure/observation will start.



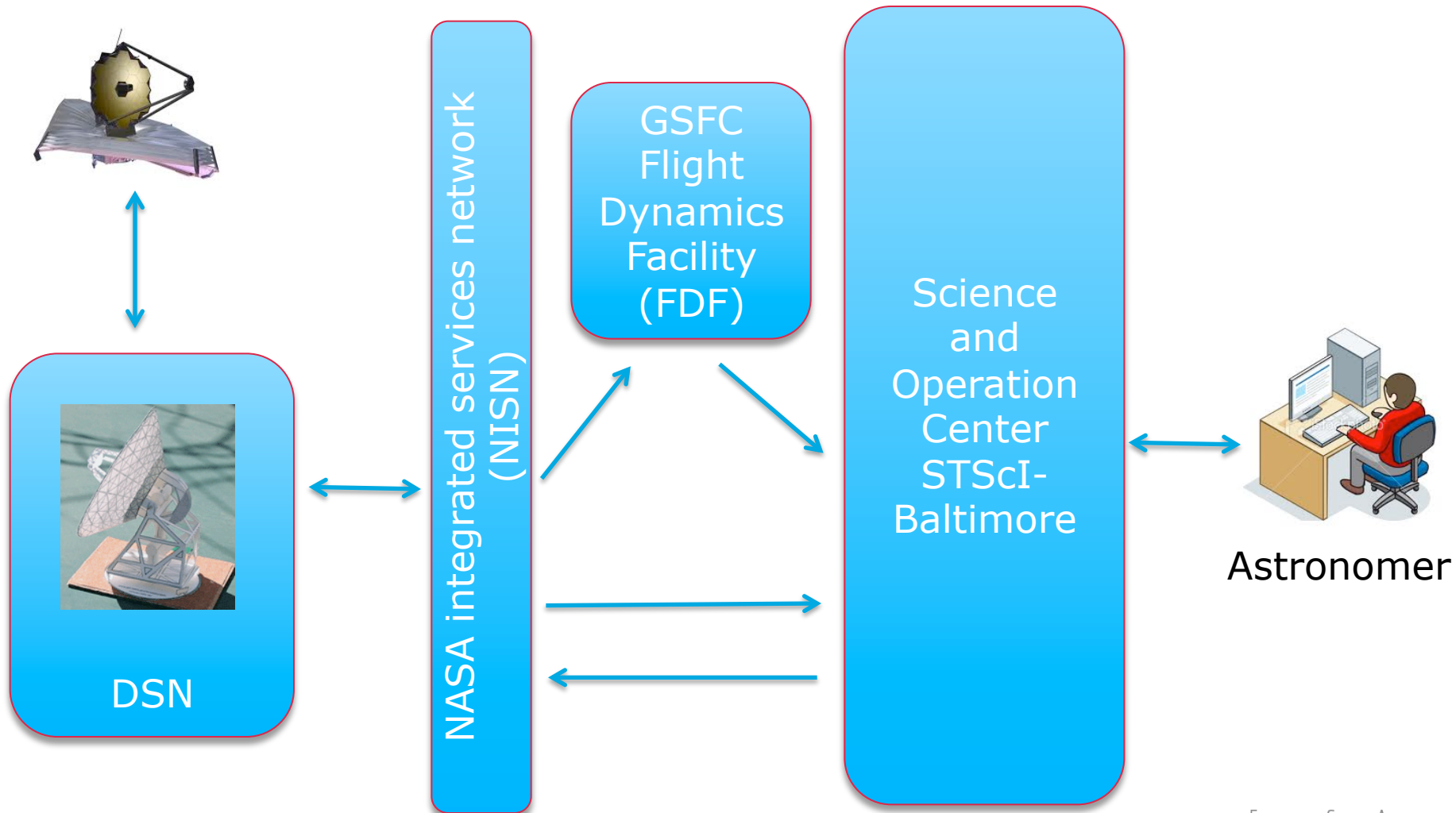
JWST @ L2



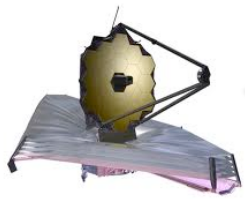
Raw Data is downloaded to ground during a four-hour window every 12 hr

Receiving center is NASA Deep Space Network

JWST Ground System



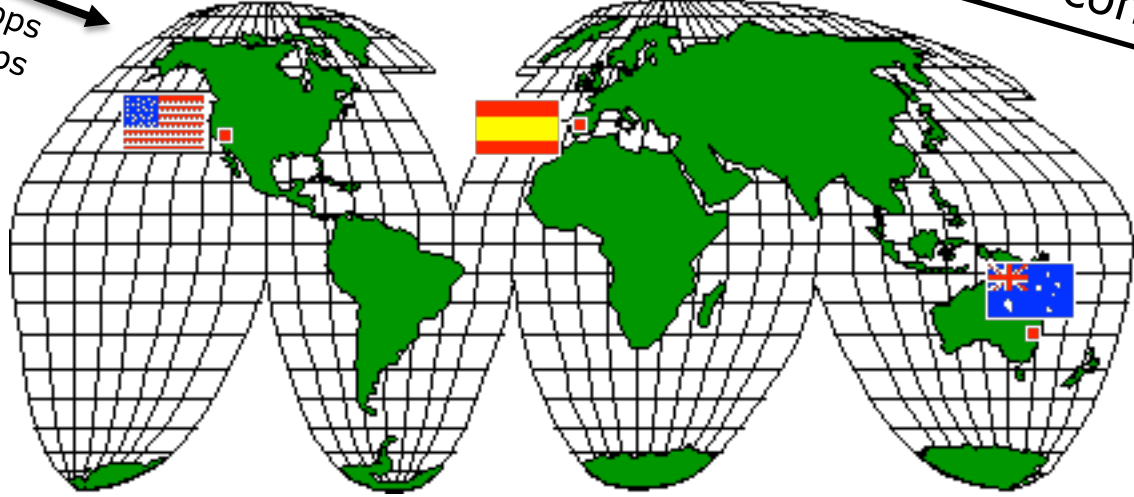
NASA/JPL Deep Space Network (DSN)



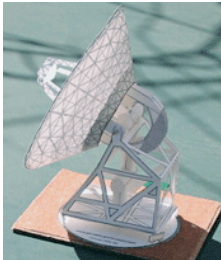
S-Band
u.16 kbps
d.40 kbps

Ka-Band
d.28mbps

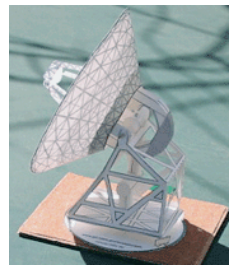
NORMAL OPERATION:
2 x 4-hour contacts per day



downlink of up to 235 gbits or recorded telemetry (science+eng) data per day



Goldstone (CA)



Madrid

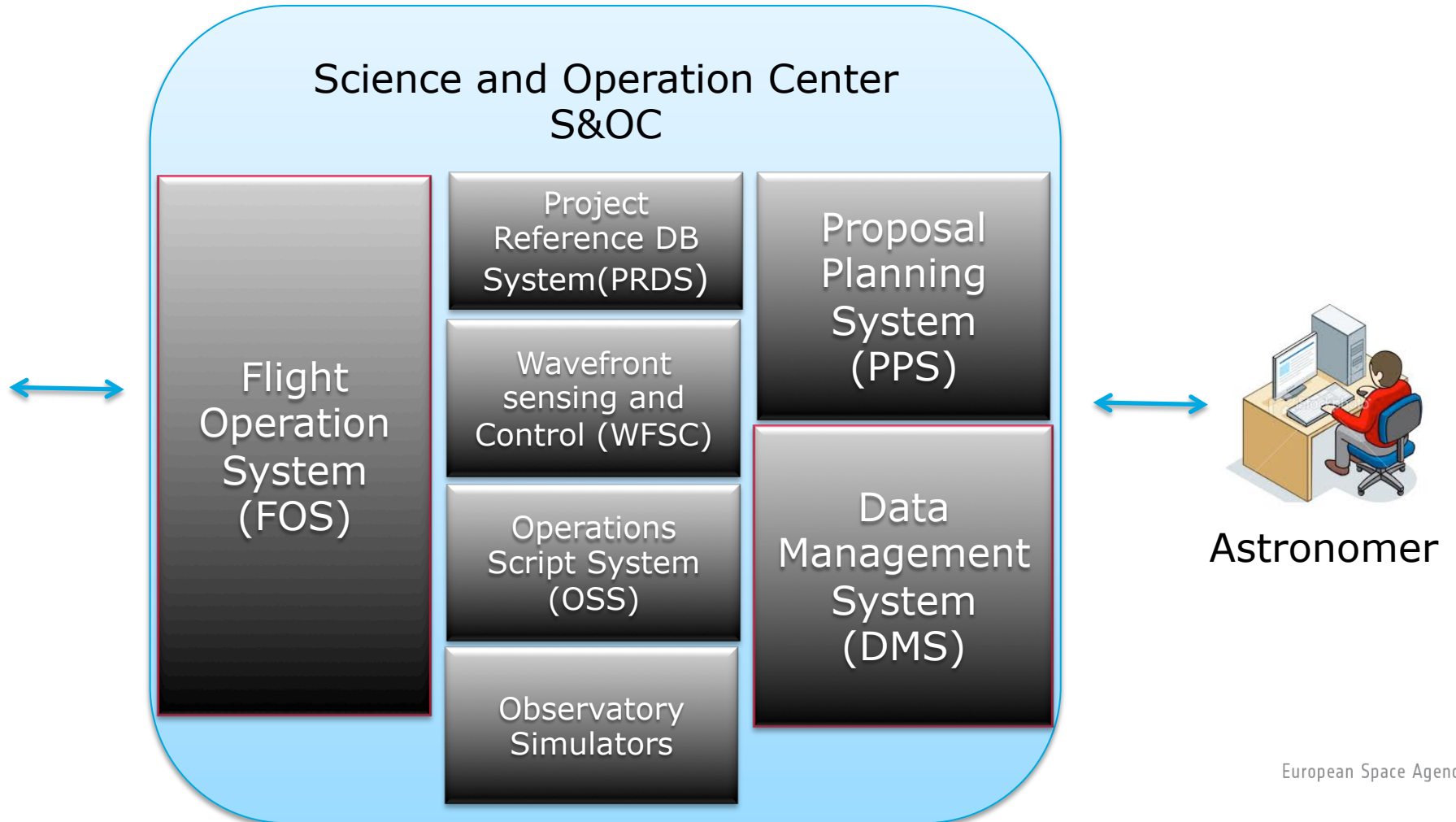


Canberra



~ 120° apart in longitude provides continuous coverage

JWST RAW data are transferred to the S&OC



RAW DATA FROM JWST

stream of interleaved
Real Time engineering data
and Recorded Engineering
+ Science data

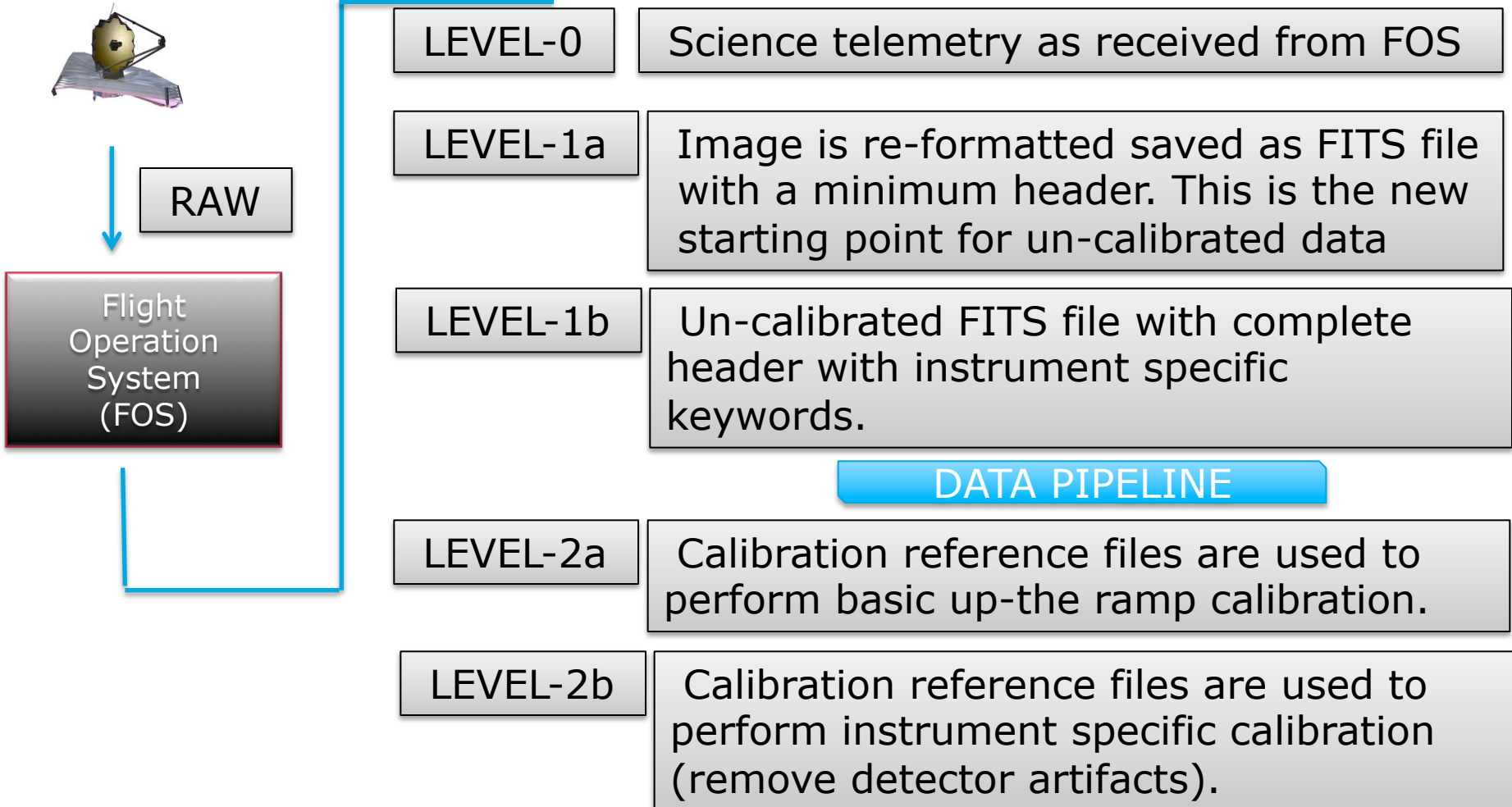


Your data will be “tagged” with an unique identifier that is used to “extract” them from the stream.

Typically the tag will include, proposal ID, visit ID and exposure ID within the visit.

The “Level 0 Science telemetry packet files’ are extracted from the RAW data by the Flight Operation System[FOS] and handed to the Data Management System [DMS]

1. Reformat and process science and engineering telemetry
2. Perform calibration of science data and generate standard products
3. Build and populate data archive and database which stores and retrieve data and data products
4. Provide users access to JWST data
5. Deliver tools to the community for data analysis



DATA PIPELINE

LEVEL-3

Calibrated and associated FITS files.
(details on pipeline steps in Stephan's presentation)



All data levels are stored in the archive

However, a JWST user will receive from the Archive Level 1b, 2a,b and 3 data

LEVEL-4

For certain programs products of data analysis will also be ingested in the science data archive

- DMS Estimated Archive Data Volume
 - Level 0 20.9 TB/Year
 - Level 1a 20.9 TB/Year
 - Level 1b 20.9 TB/Year
 - Level 2a (c 2:1) 1.0 TB/Year
 - Level 2b (c 2:1) 1.0 TB/Year
 - Level 3 (c 2:1) 1.0 TB/Year

- ~ 66 TB/Year
- Nominal Mission (5.5Yr) 363.7TB
- 10Yr Mission 661.1TB

Access to JWST data



The MAST archive at STScI and possible mirrors will be the access point to the JWST Data.

Data are in general protected for 12 months. After such a period anyone can retrieve them.

What happens when you request JWST data from the archive?

The screenshot shows the MAST website interface. At the top, it says "Barbara A. MIKULSKI ARCHIVE FOR SPACE TELESCOPES". Below this is a navigation bar with links for MAST, STScI, Tools, Mission_Search, Tutorial, and Site Search. A secondary navigation bar includes "About MAST" and "Getting Started".

On the left is a vertical menu with the following items: FAQ, High-Level Science Products, Software, FITS, Archive Manual, Related Sites, NASA Datacenters, MAST Services, MAST and the VO, Newsletters & Reports, Data Use Policy, Dataset Identifiers, and Acknowledgments. At the bottom of this menu is a logo of a person looking through a telescope.

The main content area features several announcements:

- Batch retrievals of HST and FUSE data will be down from COB Tuesday, September 25 until the afternoon of Wednesday, September 26.** Batch Kepler retrievals will be down from 7 PM Tuesday, September 25 until the morning of Wednesday, September 26. The [HSTonline](#) and [Kepler public](#) data will be available for download.
- ACS data processing will be delayed while reference files are updated.** It should be available by late afternoon on Thursday, September 27th.

Below the announcements is a paragraph: "The Mikulski Archive for Space Telescopes (MAST) is a NASA funded project to support and provide to the astronomical community a [variety of astronomical data archives](#), with the primary focus on scientifically related data sets in the optical, ultraviolet, and near-infrared parts of the spectrum. MAST is located at the Space Telescope Science Institute (STScI)."

There is also a link: "Check out the beta release of the new MAST Discovery portal: <http://mast.stsci.edu/explore>".

At the bottom of the main content area is a search box titled "Search MAST for a Target or Mission". It includes a text input field for "Enter Target name (or Coordinates):", a "Resolver:" section with radio buttons for SIMBAD (selected), NED, and Don't Resolve, and a section for "and/or Band/Data Type(s):" with a "more options" link. The band/type selection is a grid of checkboxes:

	Extreme UV	Far UV	Near UV	Optical	Near IR	Radio
Images	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spectra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Buttons for "Search", "Reset", and "Help" are located below the grid.

On the right side of the page is a "News" section with a list of dates and events:

- September 11, 2012:** High-Level Science Products for RXJ2129+0005 delivered by the CLASH Team
- August 30, 2012:** CLASH Team delivers data
- August 28, 2012:** WGET script option added for downloading Kepler TPF Files
- August 15, 2012:** Public Kepler Target Pixel files are now online
- August 10, 2012:** CANDELS team releases epoch 2 of the COSMOS field

Below the news is a "Missions" section with a list of mission names: Hubble, Hubble Legacy Archive, HSTonline, DSS, GALEX, JWST, KEPLER, SwiftUVOT, XMM-OM, BEFS (ORFEUS), Copernicus, EPOCH, EUVE, and FUSE.

1. By Requirement DMS will provide to the user initial data product (Level 2b) to the PI within 5 days of the receipt of the corresponding Level 0 data (95% of the time).

2. Reprocessing is however the norm:
 - a. Optimal calibration reference files are often not available until few weeks after the observation executes
 - b. Calibration improves over time (algorithm, reference files, etc)
 - c. Pipeline software correction/improvement over time

Every time an user request processed data from the archive the Level 1 data are retrieved from the archive and reprocesses with the best available:

pipeline version

set of reference files

Instrument calibration pipeline is also available for offline usage, for the subset of users who want to adapt the pipeline to their purposes, however the majority of users will not need to reprocess the data at their home institutions.

A “SMALL” army of dedicated NASA and ESA and CSA scientists and engineers will stand behind the data handling and processing.

They are providing support not only during the proposal preparation but also during the data processing and data reduction.

Although there is a big effort to make the life of JWST users as easy as possible, it is the user responsibility to know what type of reduction and manipulation the data went through in order to assess reliability of the science results he/she will publish.

**... SAID THAT,
LET'S THE FUN BEGIN !**

