James Webb Space Telescope Status and ERS Program

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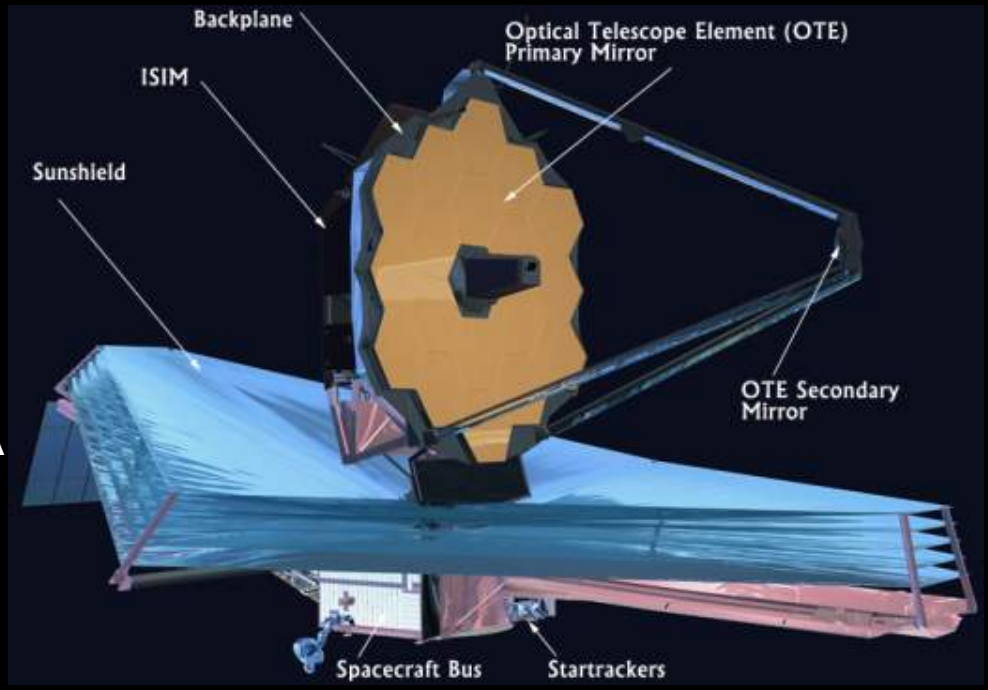
James Webb Space Telescope (JWST)



Organization

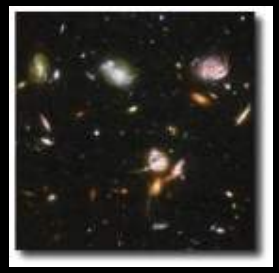
- Mission Lead: Goddard Space Flight Center
- International collaboration with ESA & CSA
- Prime Contractor: Northrop Grumman Aerospace Systems
- Instruments:
  - Near Infrared Camera (NIRCam) – Univ. of Arizona
  - Near Infrared Spectrograph (NIRSpec) – ESA
  - Mid-Infrared Instrument (MIRI) – JPL/ESA
  - Fine Guidance Sensor (FGS) – CSA
- Operations: Space Telescope Science Institute

Description

- Deployable infrared telescope with 6.5 meter diameter segmented adjustable primary mirror
- Cryogenic temperature telescope and instruments for infrared performance
- Launch on an ESA-supplied Ariane 5 rocket to Sun-Earth L2
- 5-year science mission (10-year goal)

www.JWST.nasa.gov

JWST Science Themes



End of the dark ages: First light and reionization

The assembly of galaxies

Birth of stars and proto-planetary systems

Planetary systems and the origin of life

JWST Vital Stats

- General Observatory: 5 years required; 10 years goal
- Primary mirror: 21.3 feet (6.5 meters), in 18 segments
- Sunshield: 5 layer, 69.5 feet by 46.5 feet (21.2 meters by 14.2 meters
- Orbit: 930,000 miles (1.5 million kilometers) from Earth around (and avoiding) L2 point
- Operating temperature: Below 50 Kelvin (–370° Fahrenheit)
- Four Science Instruments covering 0.6–28.5 microns (diffraction limited at 2 microns)
  - Filtered Imaging
  - Spectroscopy – Slit, Integral Field, Grism/Prism
  - Coronagraphy – Traditional Lyot + Four Quadrant Phase Masks
  - Aperture Mask Interferometry – Non-Redundant Mask (NRM)

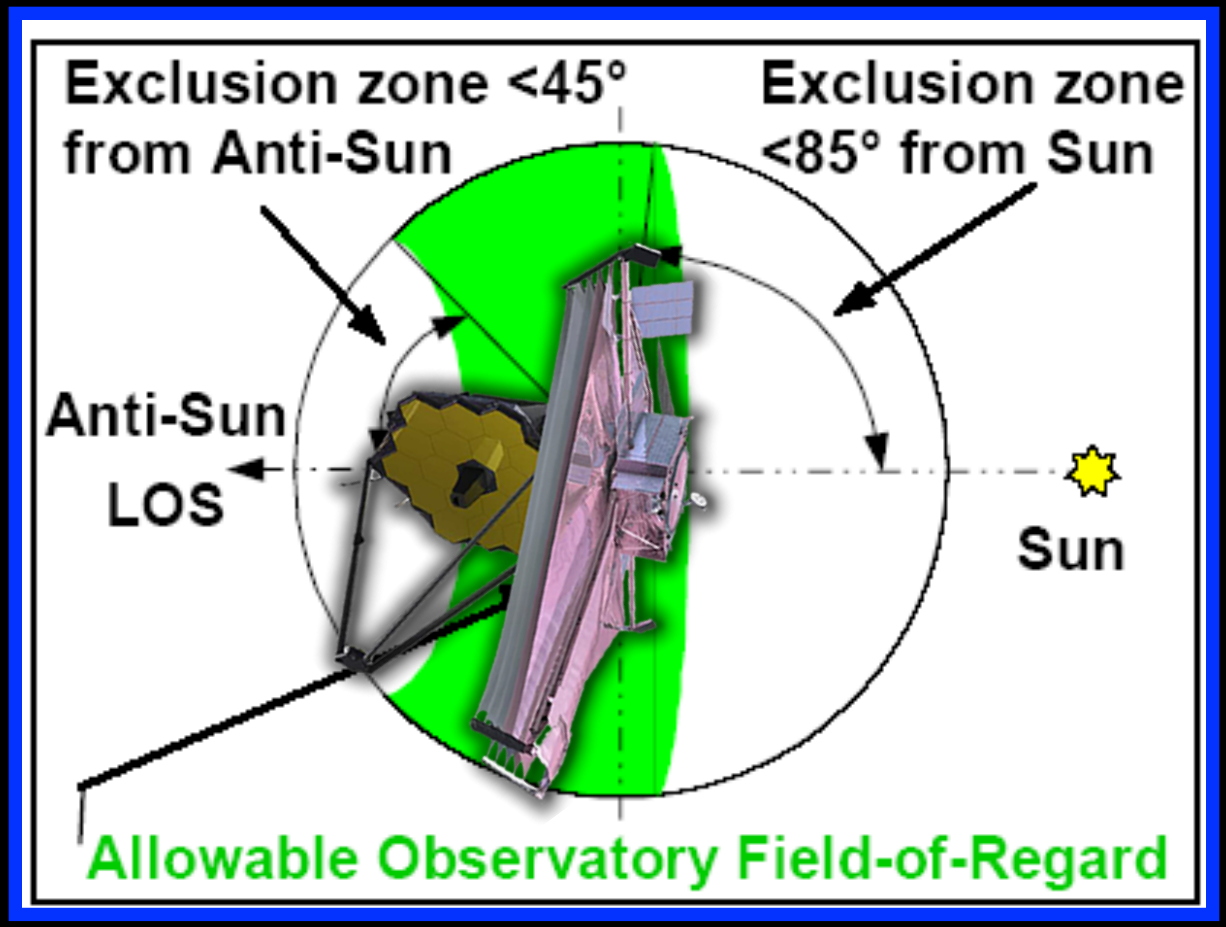
JWST Operations in one slide

- Annual call for proposals. Vast majority guest observers
- Non-sidereal tracking implemented, up to 30 mas/s
- Data pipelines will produce science-quality data
- Time-critical observations in special mode
- Targets of opportunity, with <2 day response
- Data archive
- GO funding
- Anticipated high over-subscription rate
- No Earth occultations.
- Targets available 2x/yr. 35% of sky available at a time.
- Antisun region is not observable.
- Very rich spectral datasets (MOS, IFU). Tools!

JWST Solar System Observing

- JWST **will** fully support Solar System observations
  - Planets, satellites & rings (Mars outward)
  - Asteroids, KBOs, and comets
- Non-sidereal tracking implemented
  - Rates up to 30 mas/sec (108 "/hr) for Cycle 1 (maybe higher for Cycle 2)
    - Covers everything except fastest NEOs, comets
  - Ephemeris represented as 5th O polynomial, 0.4 mas accuracy
  - Jitter ~7 mas over 1000 sec

JWST Field of Regard

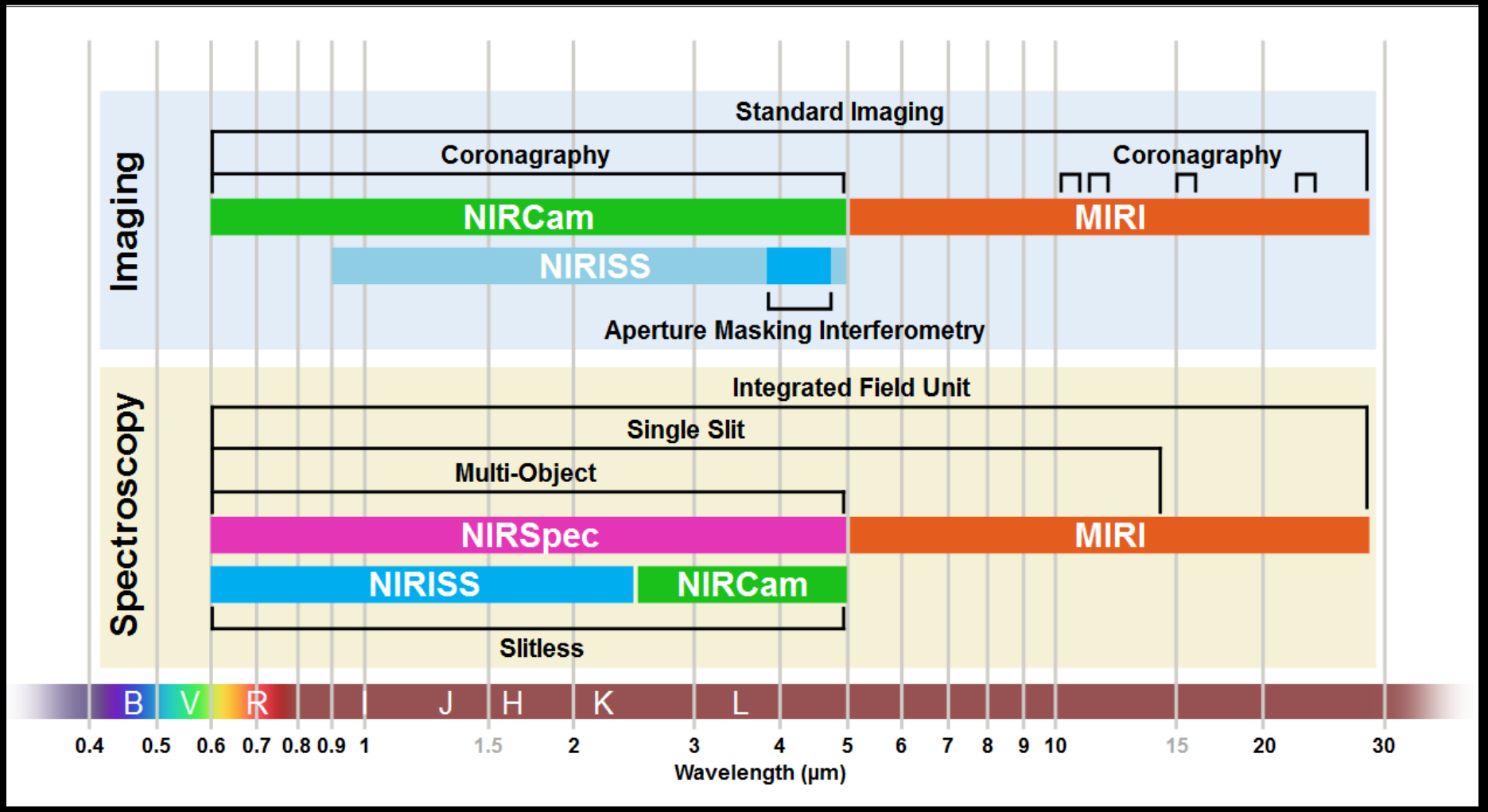


JWST's optics must always be fully shaded

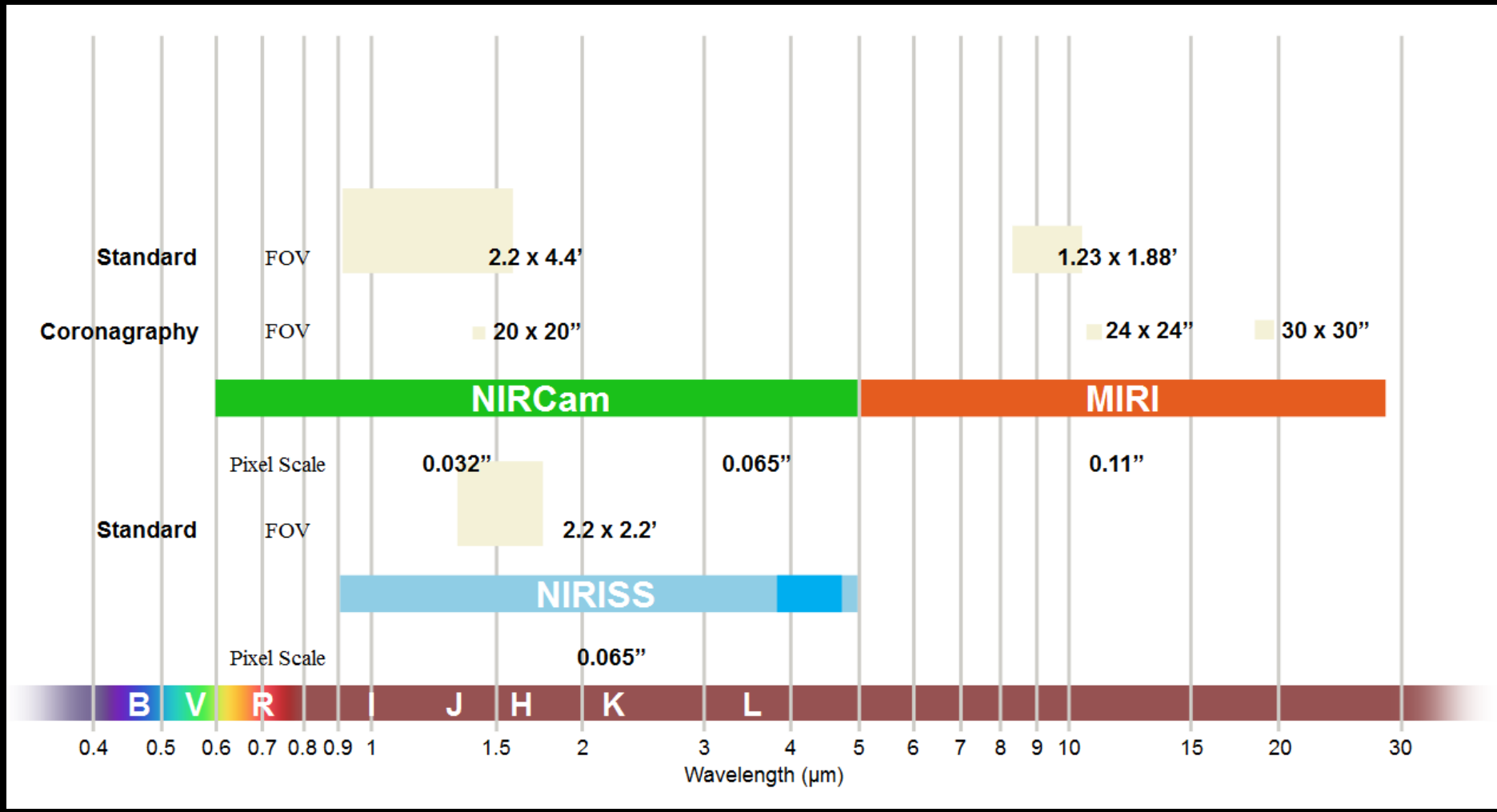
*Solar-system observations will be made near quadrature

Similar to Spitzer and Herschel observatories

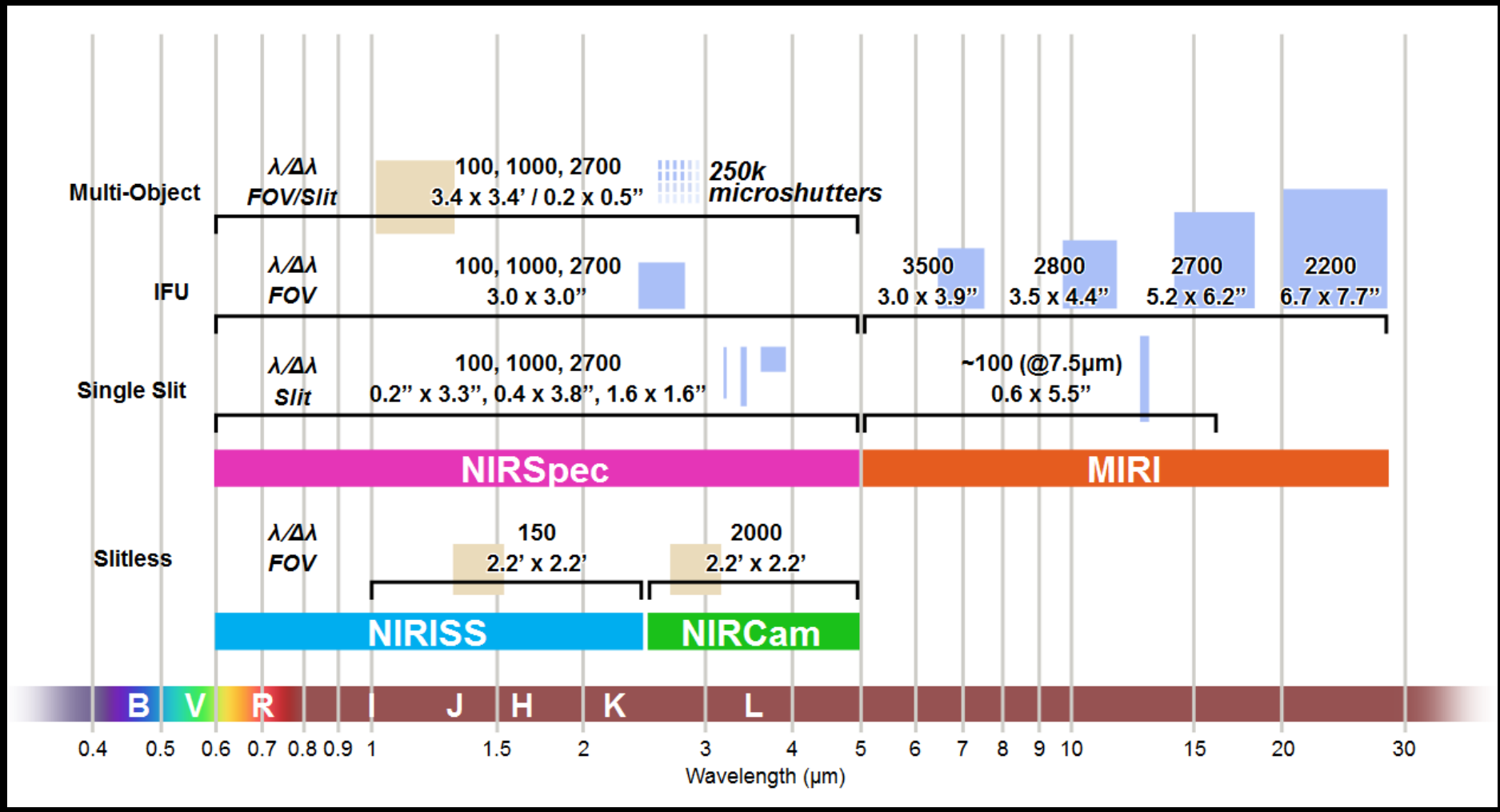
JWST Instrumentation



Imaging Modes



Spectroscopic Modes



PASP Special Issue

(Jan 4, 2016)

Innovative Solar System Science with the James Webb Space Telescope

Stefanie Milam, Special Ed.

http://iopscience.iop.org/1538-3873/128/959.

JWST Status (February 2017)

Yearly Themes

2013: Instrument Integration: The Science instruments will be finished and begin their testing as an integrated science payload

2014: Manufacturing the Spacecraft: Construction will commence on the spacecraft that will carry the science instruments and the telescope

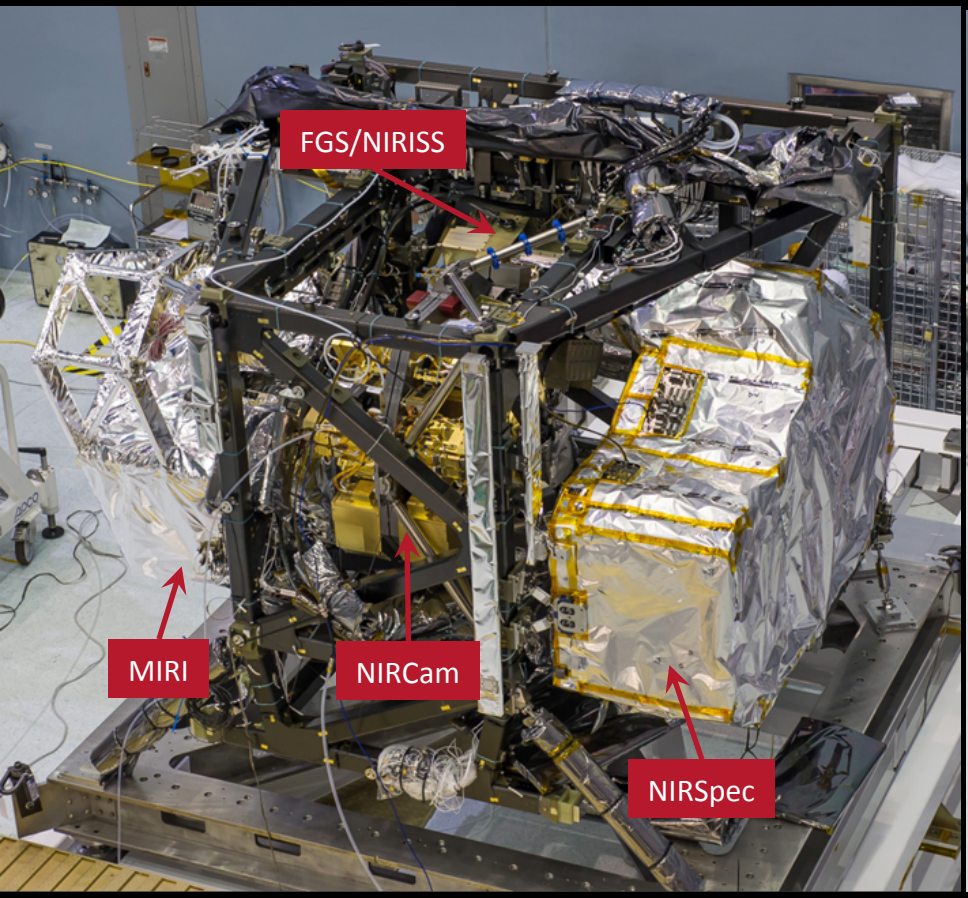
2015: Assembling the Mirror: The mirror segments, secondary mirror and aft optics will all be assembled into the telescope

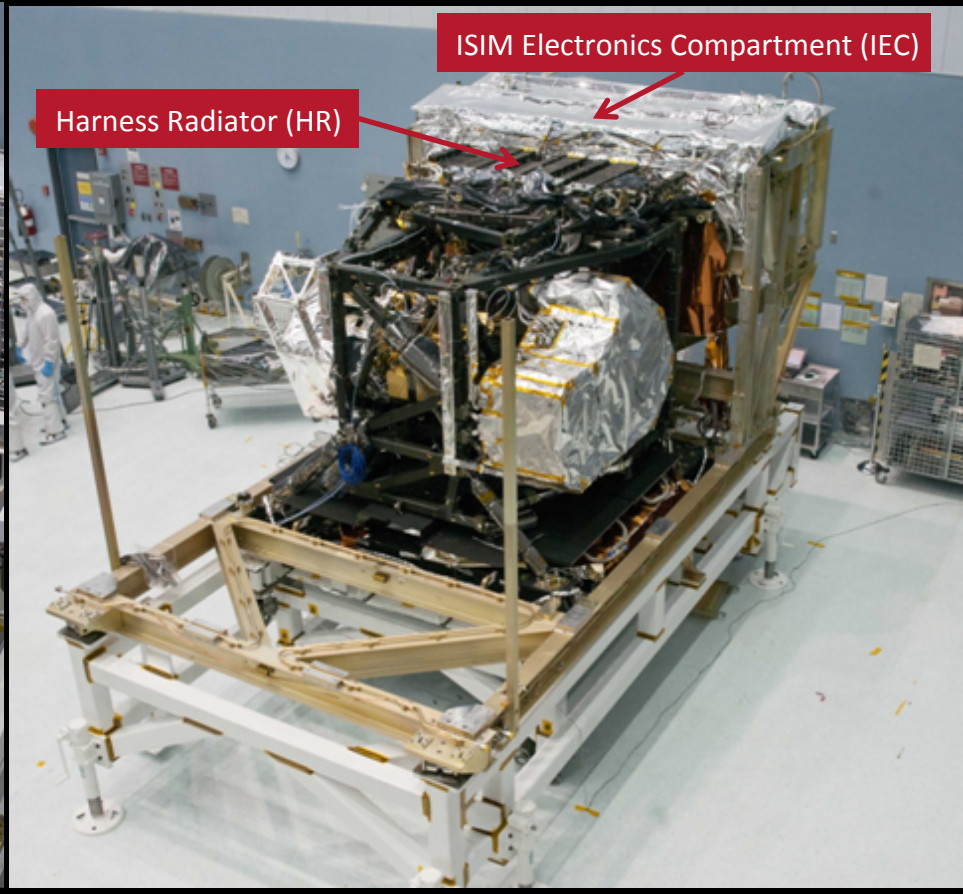
2016: Observatory Assembly: The three main components of the observatory will be completed (instruments, telescope, spacecraft)

2017: Observatory Testing: The three main components of the observatory will be tested and readied for assembly (instruments, telescope, spacecraft) into a single unit

2018: Kourou Countdown: All parts of the observatory will be brought together, tested and readied for launch in Kourou, French Guiana

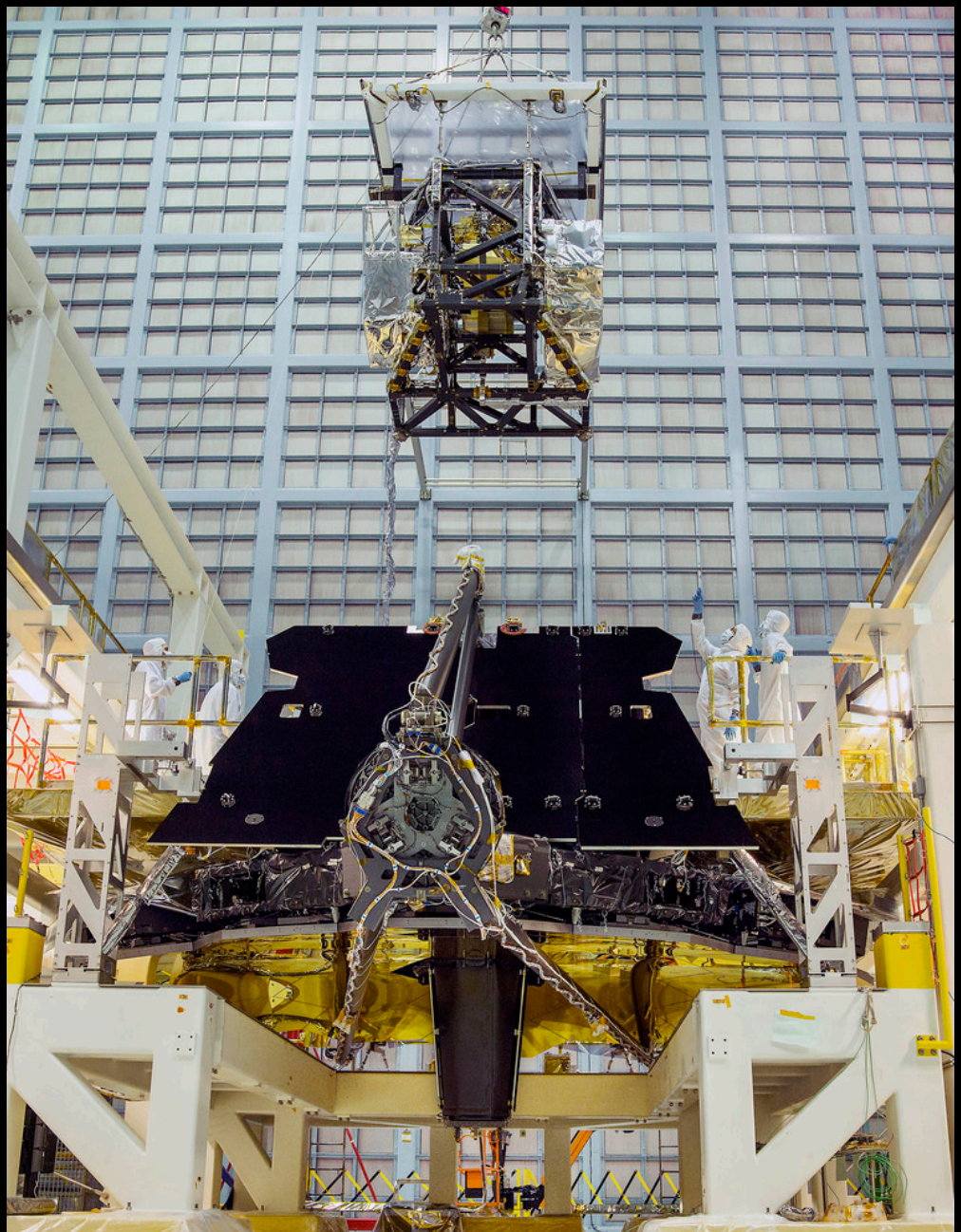
Flight ISIM test configuration





Mirror Installation #MirrorSeason

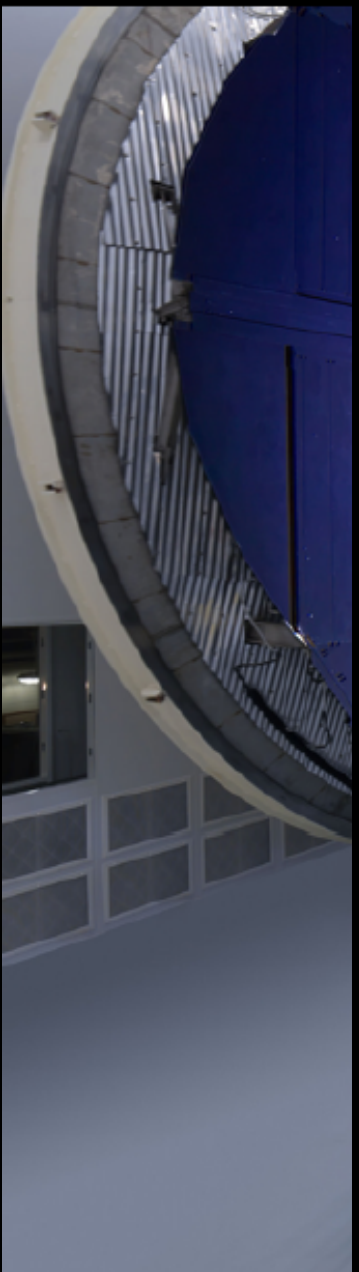
ISIM Installation



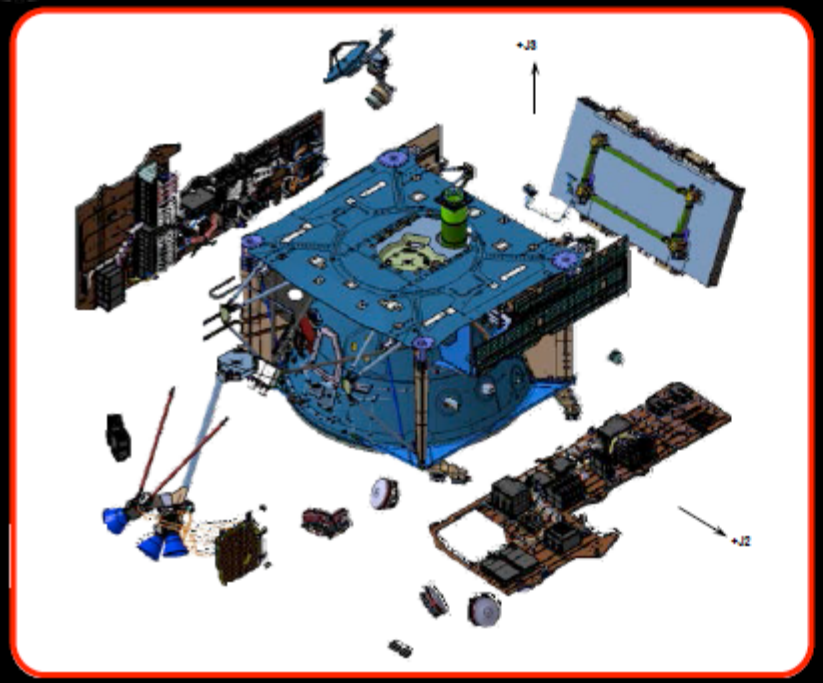
- Acoustic and Vibration tests at GSFC early 2017.
- Currently underway.

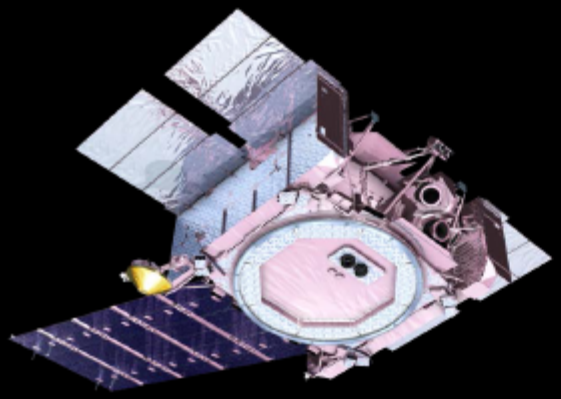
2017: Obse

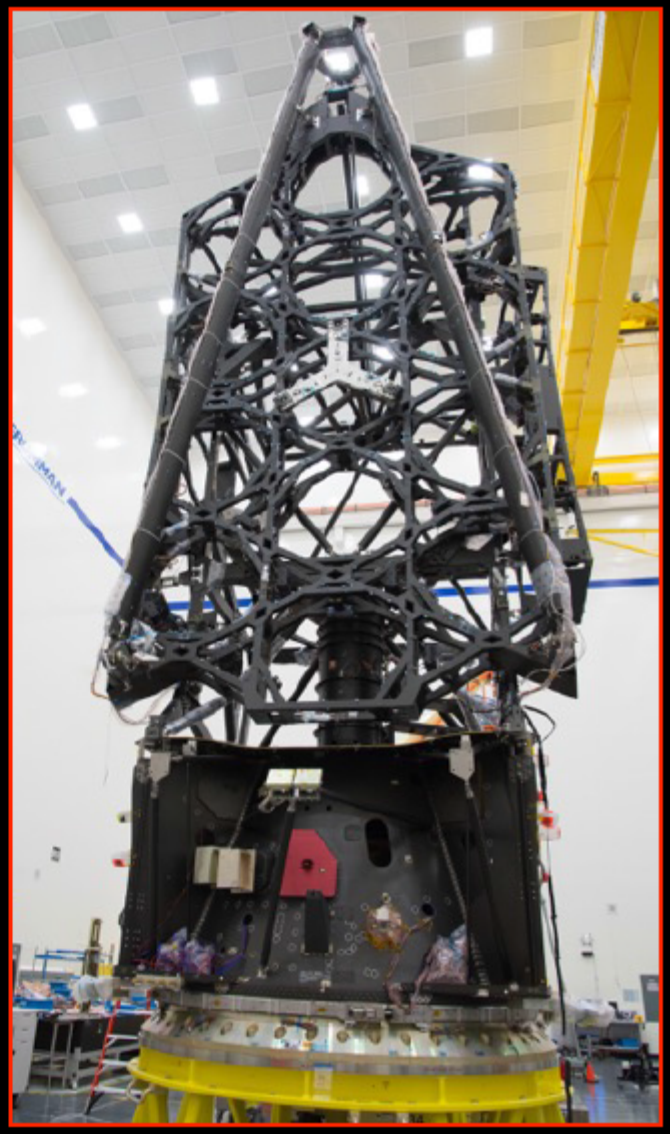
Chamber A



Spacecraft Bus - Complete



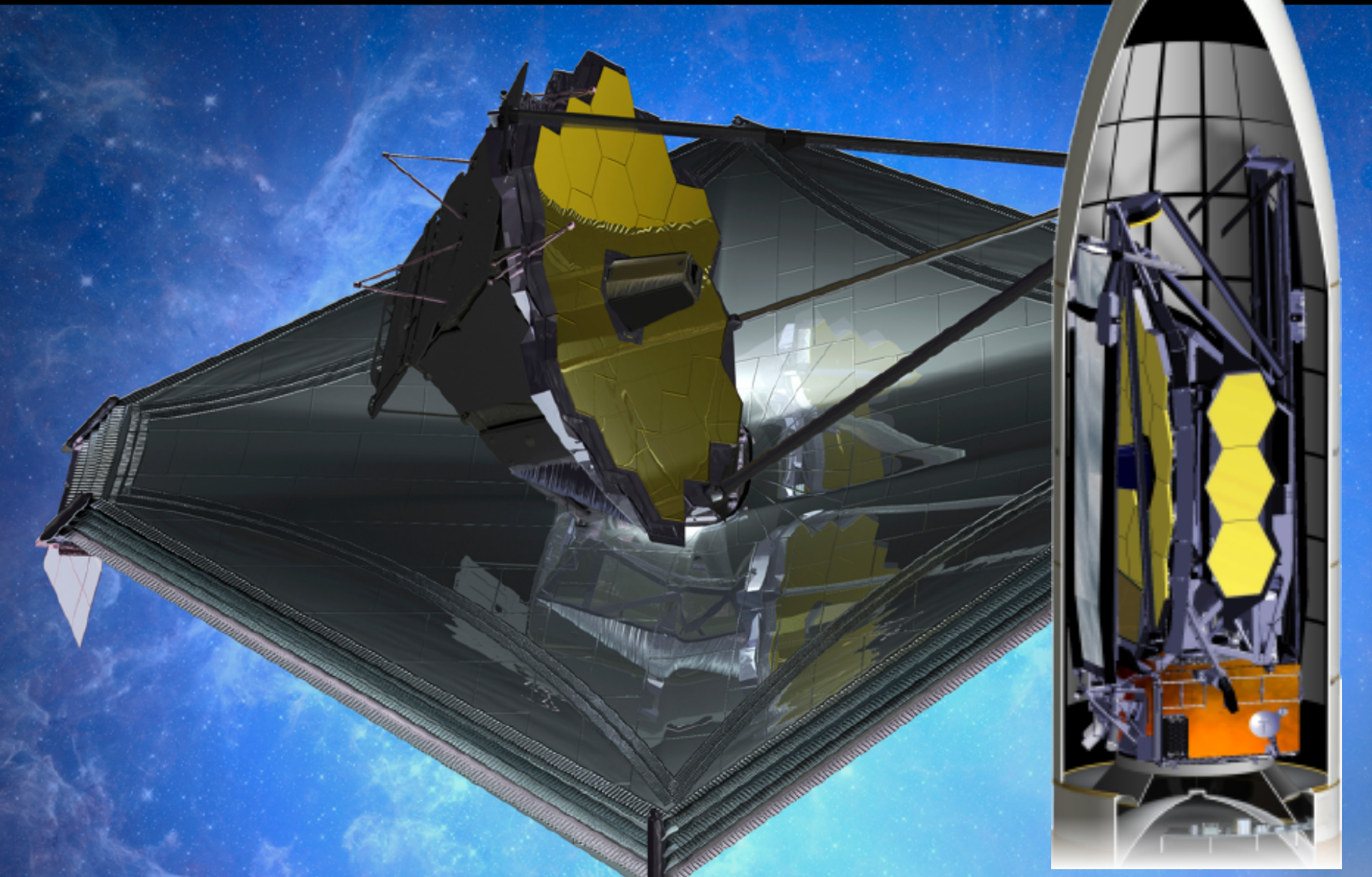




Sunshield Full Deployment Test

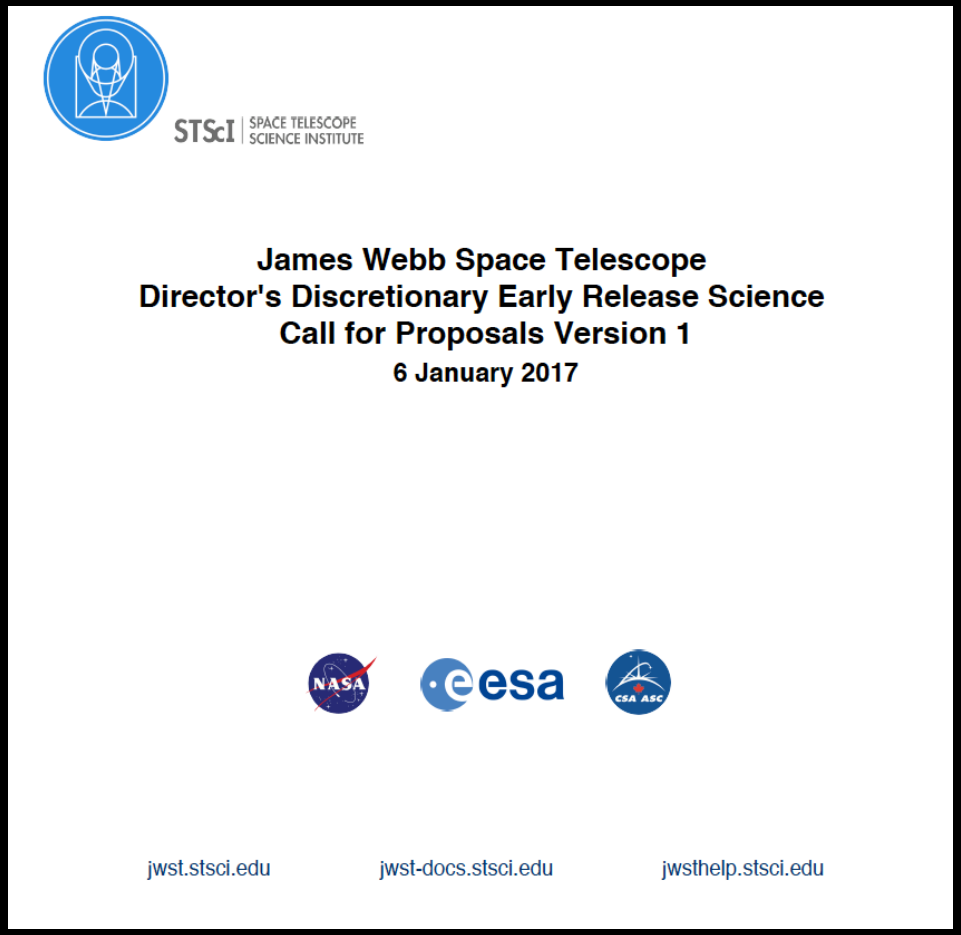
2018: Observatory integration and launch

sunshield + spacecraft + observatory



JWST Early Release Science

The JWST Director's Discretionary Early Release Science Program (DD ERS)



The DD ERS Call for Proposals is now available at jwst-docs.stsci.edu

DD ERS Motivation and Goals

Science Timeline Realities

04-2019	Cy1 science obs begin
07-2019	GTO Cy2 deadline
09-2019	GO Cy2 CP released
12 (early)-2019	GO Cy2 deadline
04-2020	Cy2 science obs begin

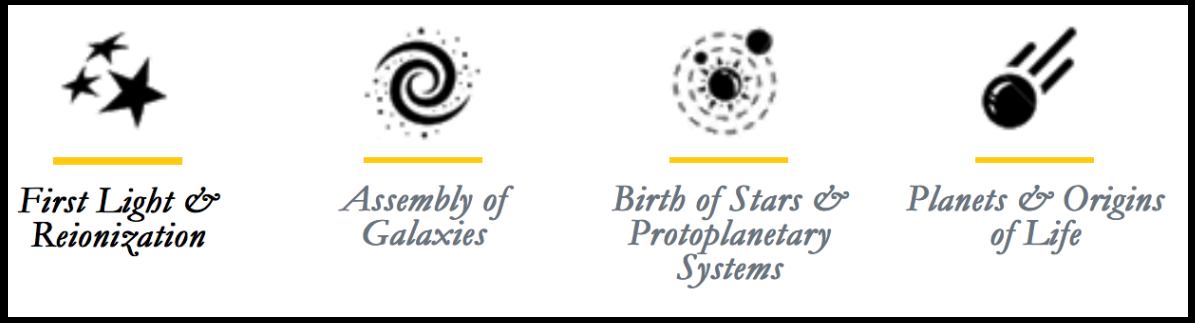
Availability of non-proprietary data is quite limited at time of Cy2 proposal preparation.

DD ERS Motivation and Goals

- *Ensure open access to representative datasets in support of Cy 2 proposal preparation.*
- *Engage broad cross-section of astronomical community in familiarizing themselves with JWST data and scientific capabilities.*

STScI Director Ken Sembach will allocate up to 500 hrs of DD time, and resources for up to 15 teams.

A multi-disciplinary committee of experts will recommend a suite of proposals that fulfills the goals of the DD ERS; makes optimal use of the available time; and spans JWST's science themes.



DD ERS Motivation and Goals

The DD ERS program is guided by the following five principles:

1. Projects must be substantive science demonstration programs that utilize key instrument modes to provide representative scientific datasets of broad interest to researchers in major astrophysical sub-disciplines.

2. Projects must design, create, and deliver science-enabling products to help the community understand JWST's capabilities.
   - Initial products must be delivered by release of Cy 2 GO CfP (Sep 2019).
   - Each project must define a core team to be responsible for timely delivery of products according to a proposed project management plan, with performance subject to periodic review.

DD ERS Motivation and Goals

The DD ERS program is guided by the following five principles:

3. Early execution
   - All observations schedulable within first 5 months of Cy 1 (expected Apr-Aug 2019), AND
   - a substantive subset of observations schedulable within first 3 months.
   - Target lists must be flexible to accommodate possible changes to scheduled start of science observations.

4. Data will have no proprietary time
   - Both raw and pipeline-processed data will enter public domain immediately after processing and validation at STScI

DD ERS Motivation and Goals

The DD ERS program is guided by the following five principles:

5. STScI recognizes and supports the benefits of having diverse and inclusive scientific teams involved in the formulation of ERS proposals.
    - Programs with diverse representation of community members in a given sub-discipline helps ensure that the investigations will be of broad interest.
    - Broad involvement facilitates the dissemination of JWST expertise through a more extensive network, and promotes more equitable participation in JWST scientific discovery.

DD ERS Evaluation Criteria

Assess potential of proposal to achieve goals of DD ERS.

1. *Extent to which project will improve community understanding of JWST science capabilities and guide subsequent JWST observations.*

2. *Effectiveness in providing deliverables which include quantitative, data-related measurements that will support development of Cy 2 proposals.*

3. *Extent to which science-enabling products will be developed to enrich overall scientific return of mission.*

4. *Credibility of management plan for achieving project goals in a timely manner, particularly development and delivery of science-enabling products for community.*

5. *Overall scientific merit; significance to major astrophysical sub-disciplines, and astronomy in general.*

DD ERS: Key Dates

Jan 6, 2017: Release of DD ERS Call for Proposals VERSION 1

- *Establishes DD ERS goals, requirements, and policies*
- *intended to enable researchers to gauge whether they have sufficient interest to submit NoI to propose.*

May 19, 2017: Release of DD ERS Call for Proposals FINAL VERSION

- *all details on proposal and budget submission process, with supporting documentation:*
  - *instructions for Astronomer's Proposal Tool (APT) to specify observations*
  - *special considerations for successful early execution of observations,*
  - *overview of STScI pipeline data products, processing and analysis software, and anticipated availability to inform development of science-enabling products*

DD ERS: Key Dates

Mar 3, 2017: Notice of Intent Deadline

Enables STScI to identify community members for review (appropriate expertise, w/o conflict).

NoI submission is required step. Material will be kept confidential:

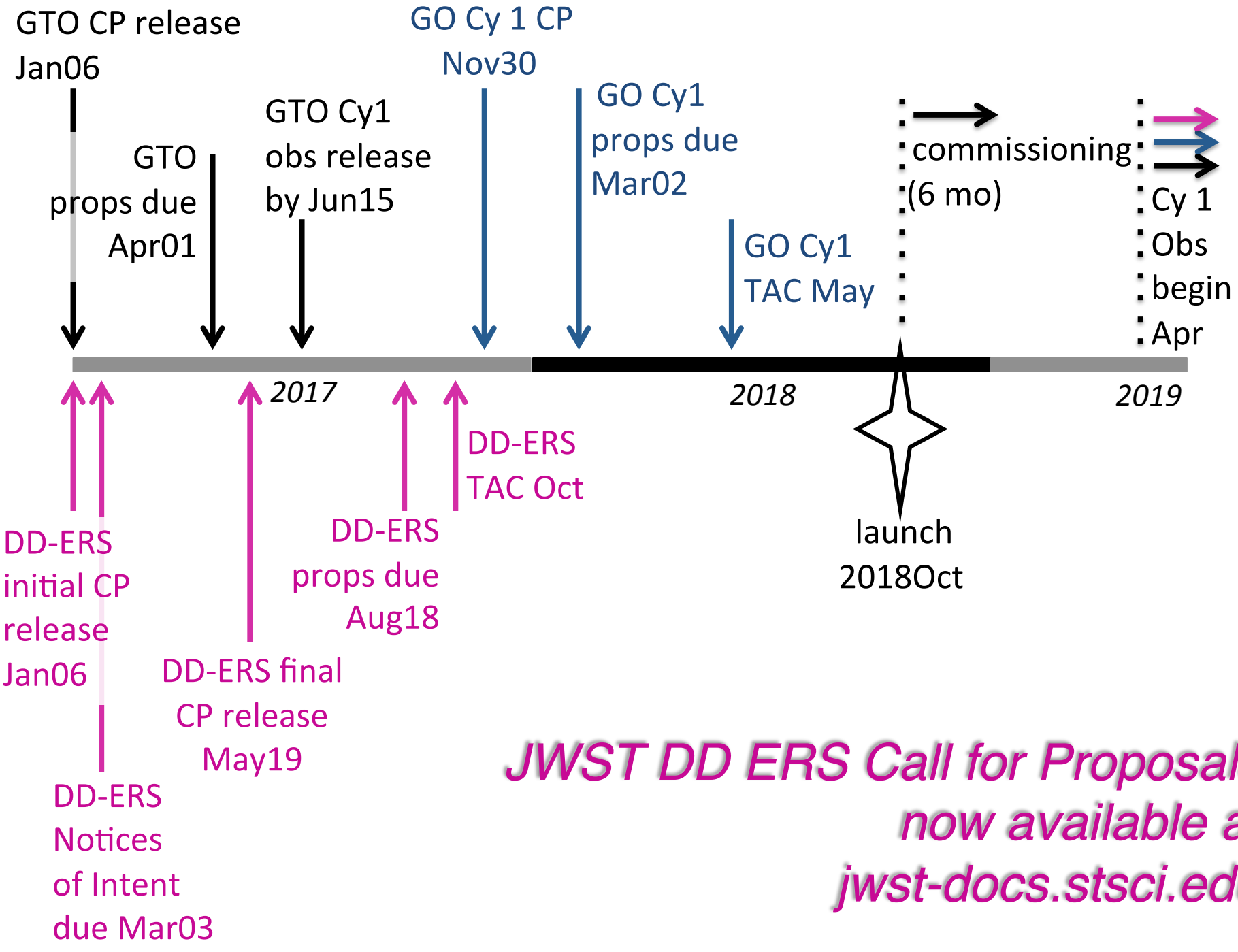
- *proposal title,*
- *name(s), email address(es), and affiliation(s) of*
  - *PI and up to two Co-PIs,*
  - *as many Co-Is as known at time of NOI submission,*
  - *as many Science Collaborators as known at time of NOI submission,*
- *overview of anticipated proposal (<300 words):*
  - *proposed types of JWST observations and science goals,*
  - *how proposed project supports DD ERS goals and principles*

DD ERS: Key Dates

Aug 18, 2017: Proposal Deadline

Observing plan specified in APT templates and proposal narrative (11 pages for items 1-4)

1. *Rationale for selection as a DD ERS program*
2. *Science Justification*
3. *Description of the Observations*
4. *Data Processing, Analysis, and Products Delivery Plan*
5. *Project Management Plan*
6. *Preliminary Budget*



JWST DD ERS Call for Proposals now available at jwst-docs.stsci.edu

JWST Solar System GTO

- Preliminary list of targets and observations released in the next few weeks to public.
- Full official target list released June 15, 2017.

- If you have specific questions regarding targets or observations please feel free to get in touch with Milam or Stansberry.

More Details

https://jwst.stsci.edu/science-planning/early-release-science-program

Notice of Intent DUE March 3, 2017!

JWST Proposal and Planning Workshop

May 15 - 17, 2017

Baltimore, MD

JWST Supporting Observations

- HST Cycle 24 explicitly called for JWST preparatory observations.
  - Expect next two calls will.
  - Proposals due in April.
- Keck Observatory – NASA call
  - Pre-JWST observations (target selection) encouraged
  - Proposals due in March

Current ERS Teams

- Jovian System
  - de Pater and Fouchet
- TNOs
  - Pinella Alonso and Mueller
- Others?

Thank you.

Contact: Stefanie Milam
stefanie.n.milam@nasa.gov