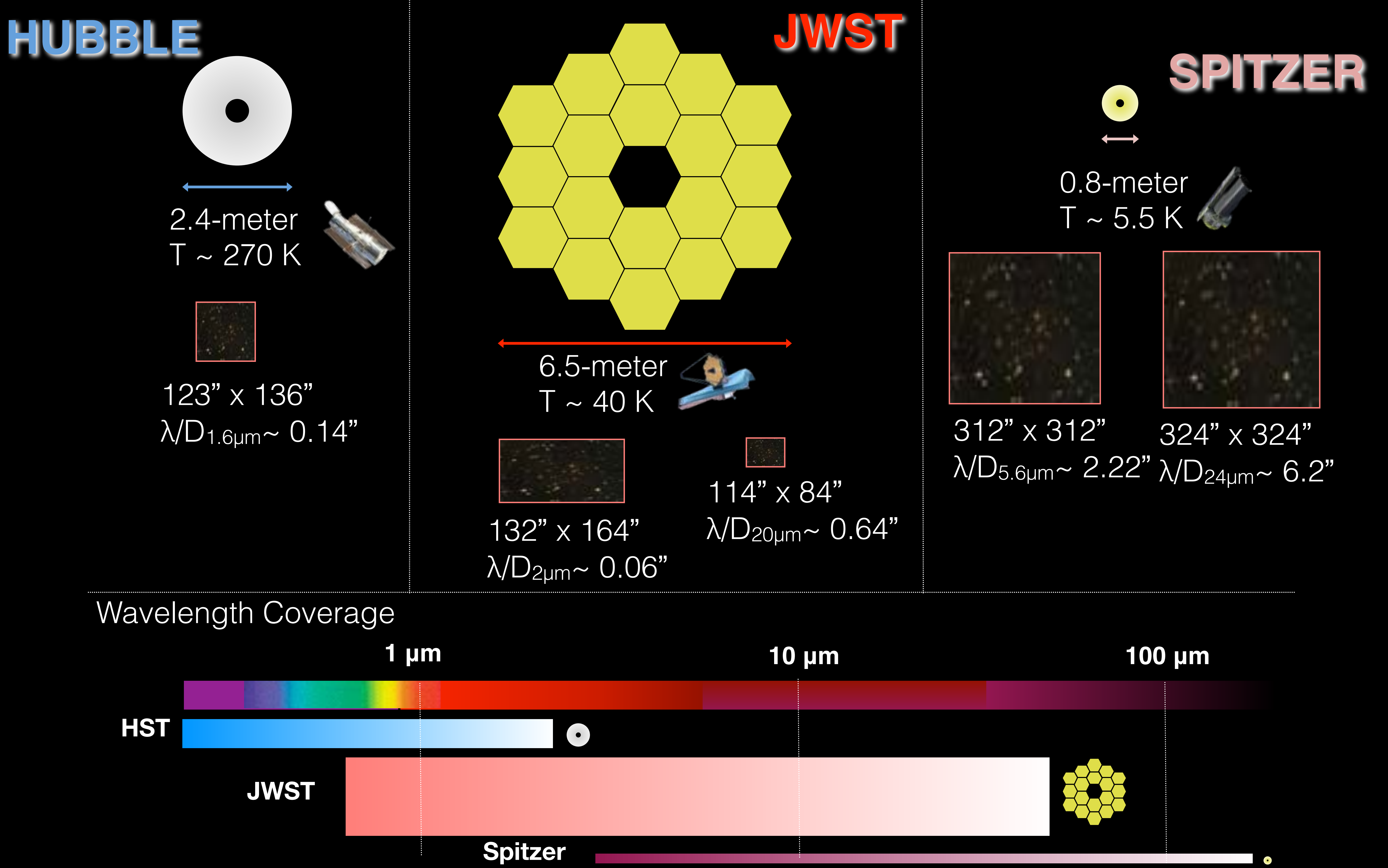
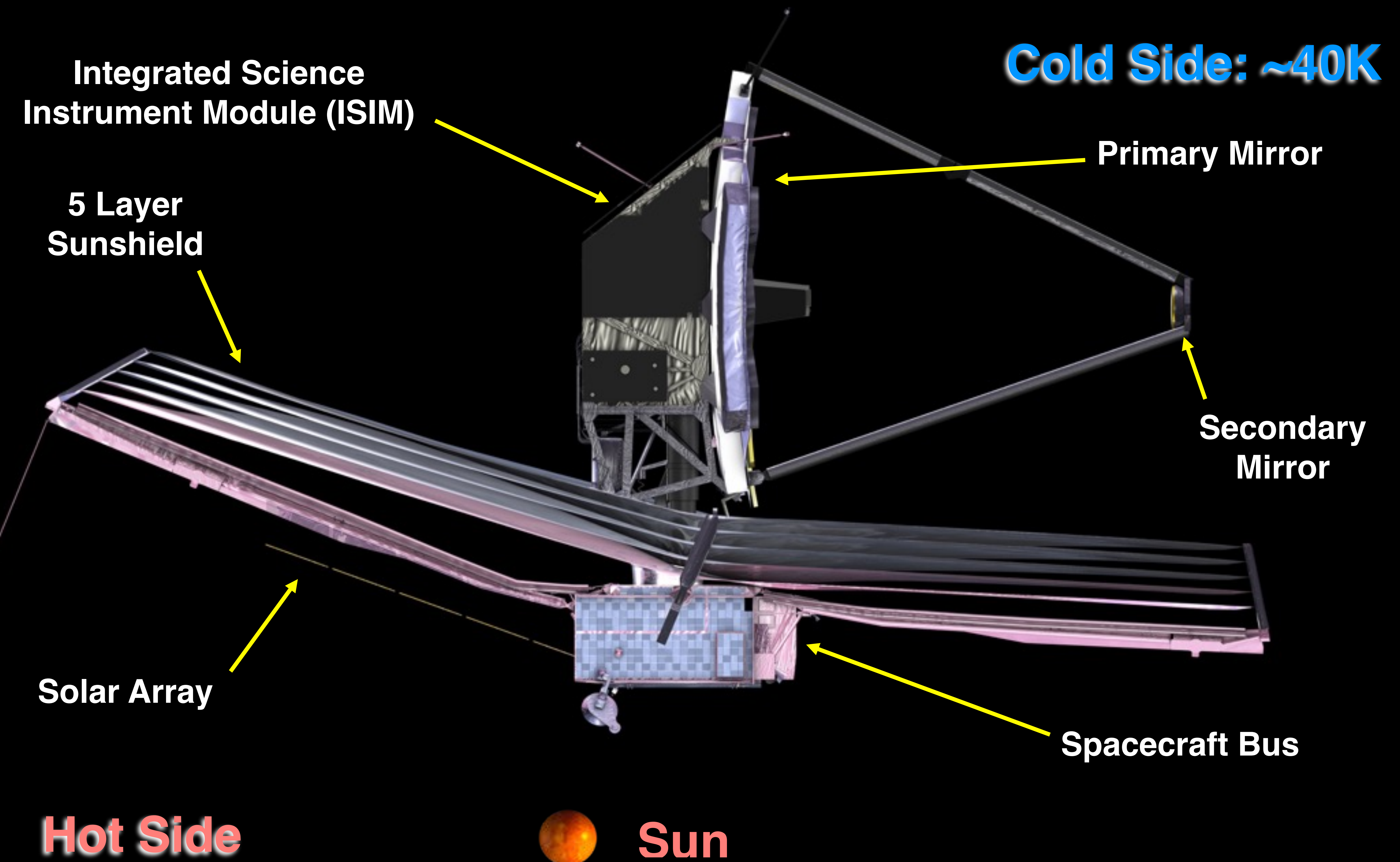
Status of the James Webb Space Telescope (JWST) Observatory

ESTEC
Mark Clampin
JWST Observatory Project Scientist
mark.clampin@nasa.gov
Goddard Space Flight Center

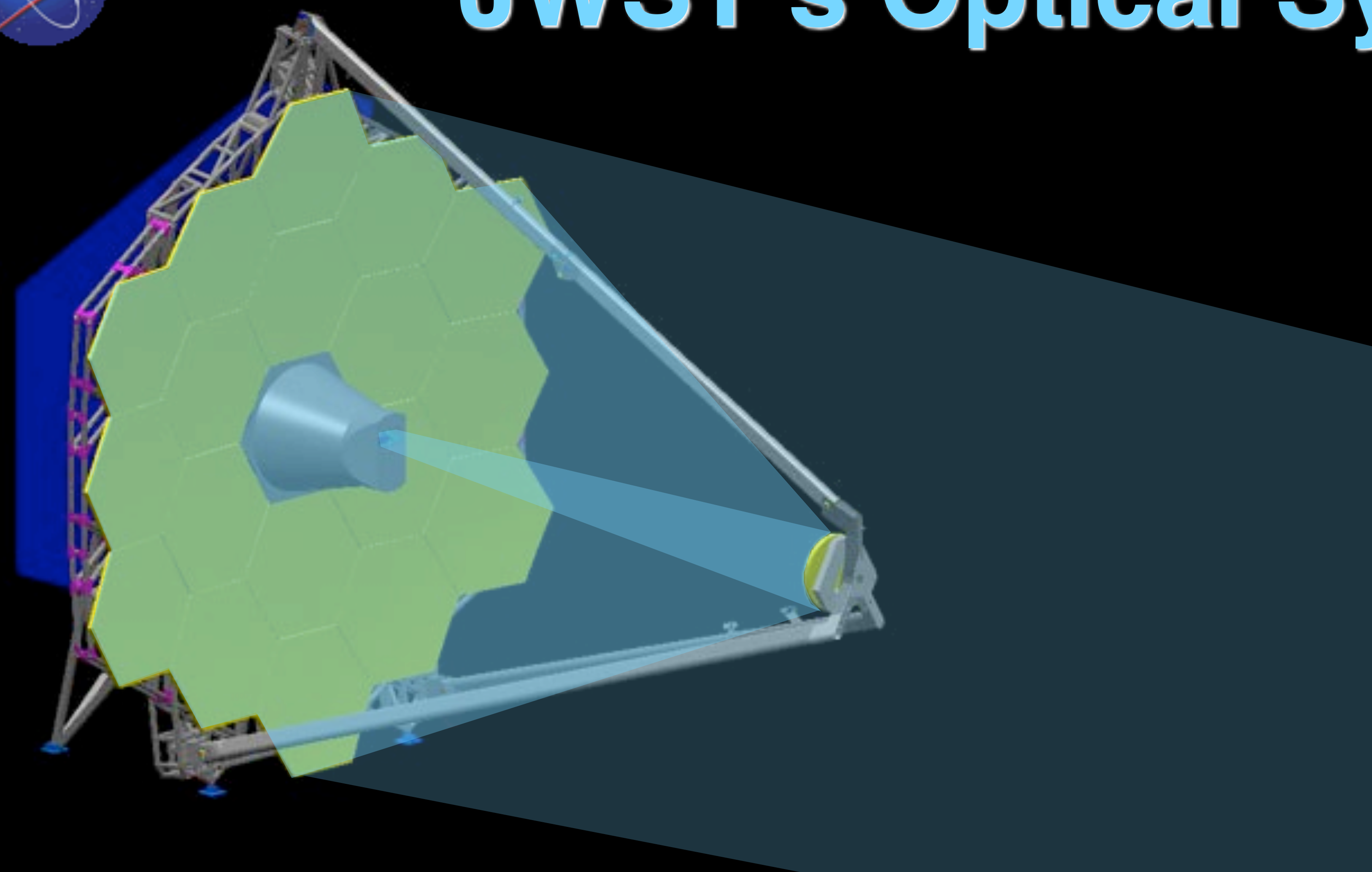
JWST and its Precursors



JWST: How It Works

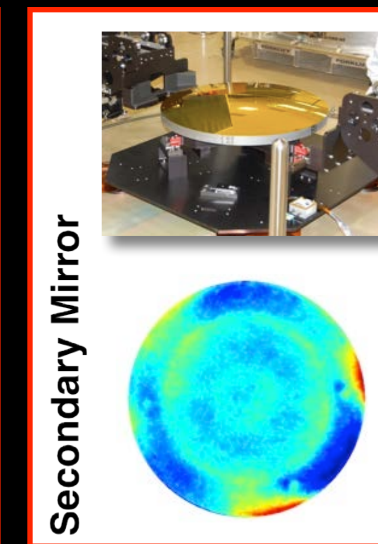


JWST's Optical System

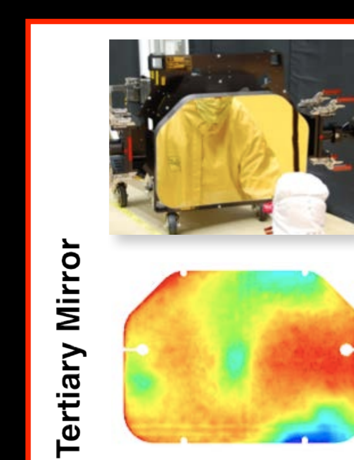


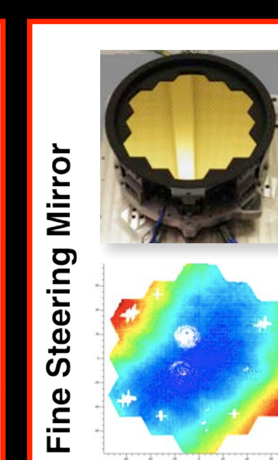
Mirror	Measured (RMS SFE)	Uncertainty (RMS SFE)	Total (RMS SFE)	Requirement (RMS SFE)
18 PM Segments (Composite Figure)	23.6	8.1	25.0	25.8
Secondary	14.7	13.2	19.8	23.5
Tertiary	18.1	9.5	20.5	23.2
FSM	13.9	4.9	14.7	18.7

Telescope Optics



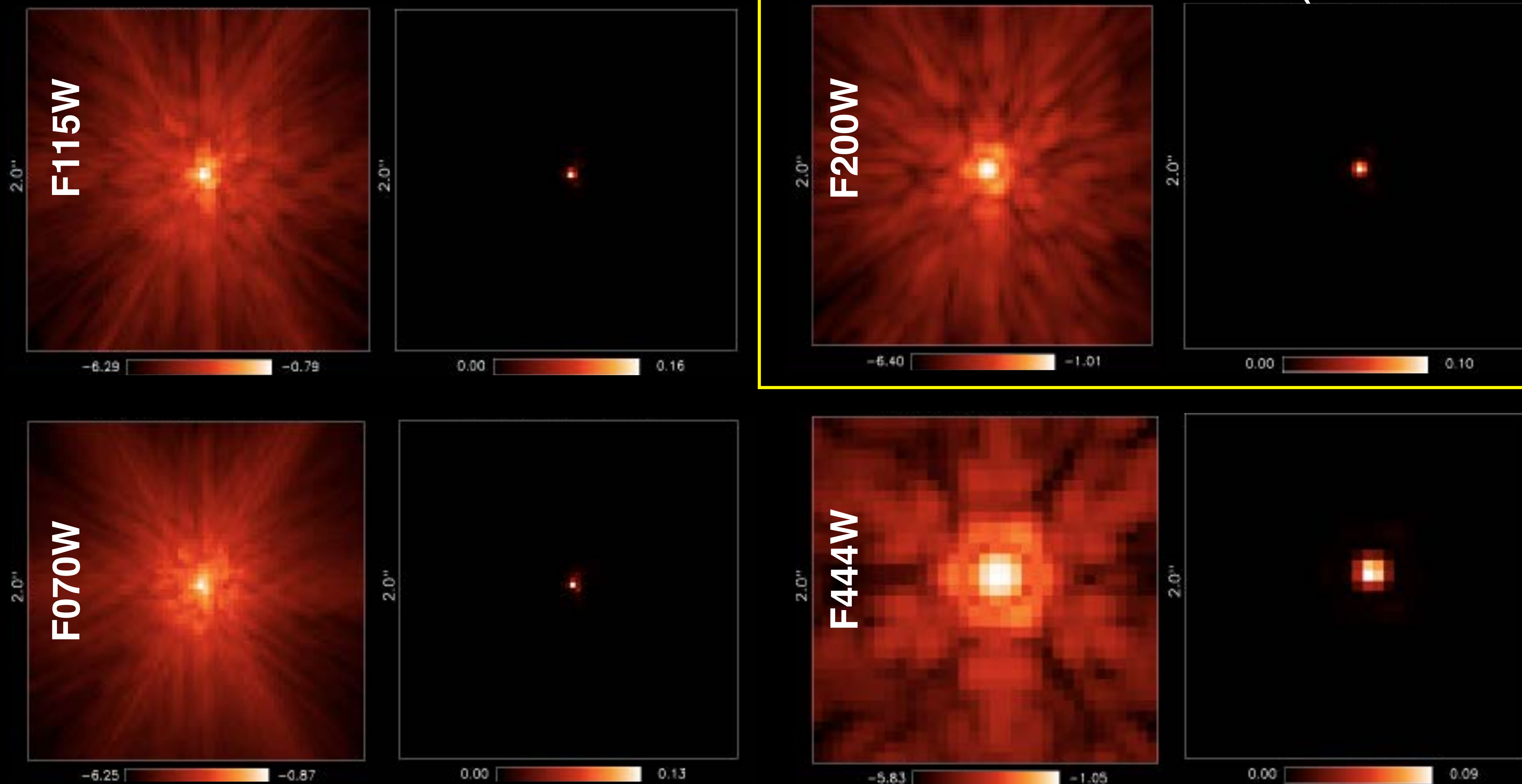
Aft-Optics System





Predicted Image Quality

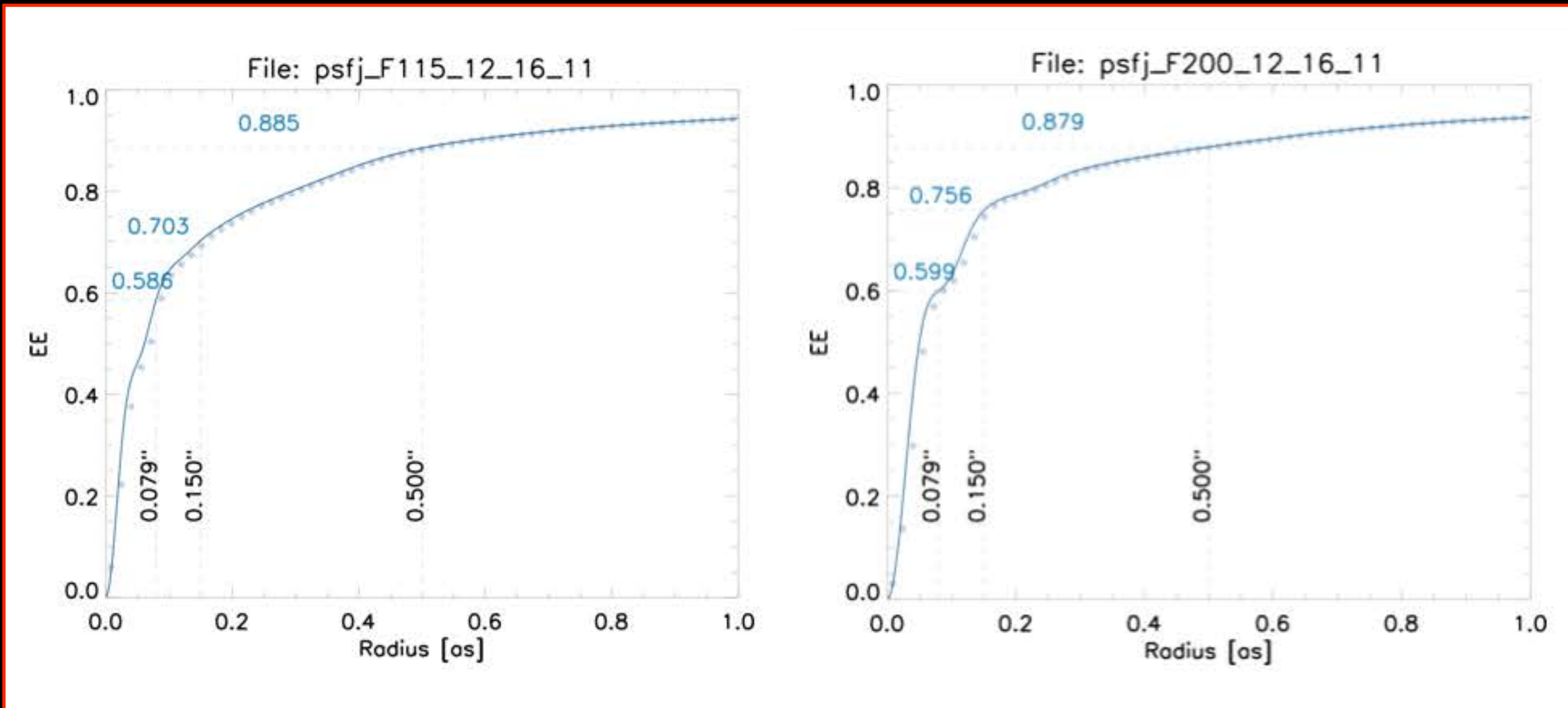
Diffraction Limited: Strehl > 0.8 (WFE ≤ 150 nm)



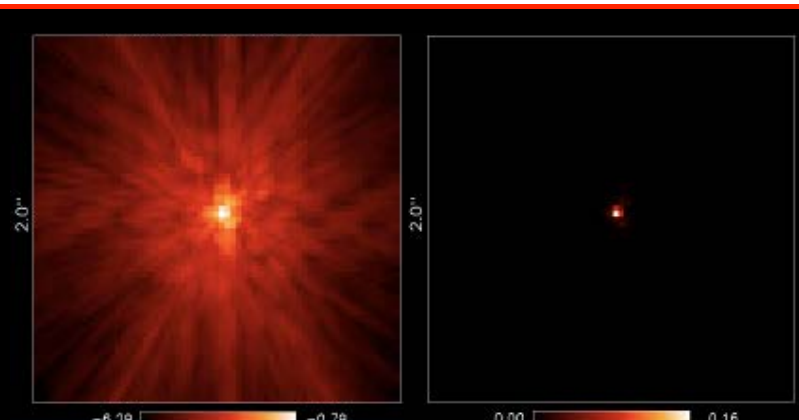
Log Scale

Linear Scale

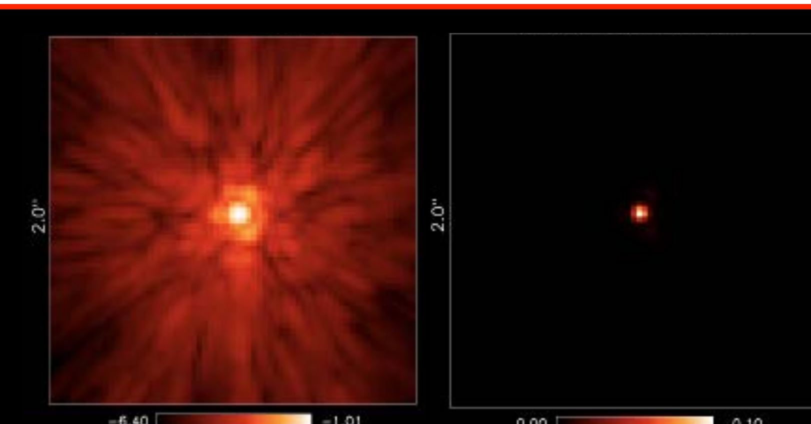
Encircled Energy



- **F115W**

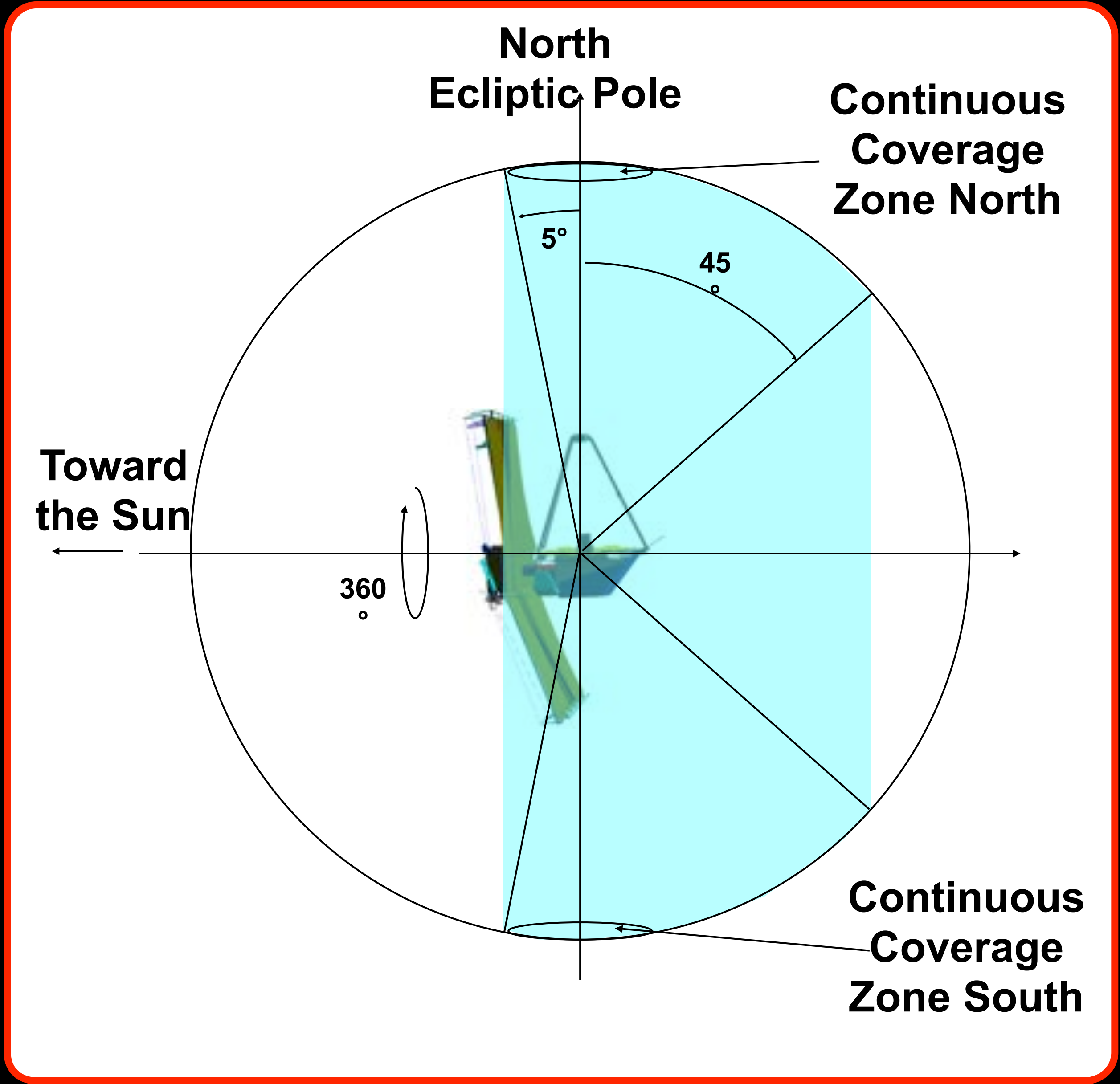


- **F200W**



Observing Constraints

- Field of Regard is an annulus with rotational symmetry about the L2-Sun axis, 50° wide
- Sun angle constraints yield 35% instantaneous sky coverage
  - ➡ Full sky coverage achieved over a sidereal year
- Observations interrupted for:
  - ➡ Orbit maintenance
    - ➡ station-keeping burns
  - ➡ Momentum management
    - ➡ reaction desaturation burns



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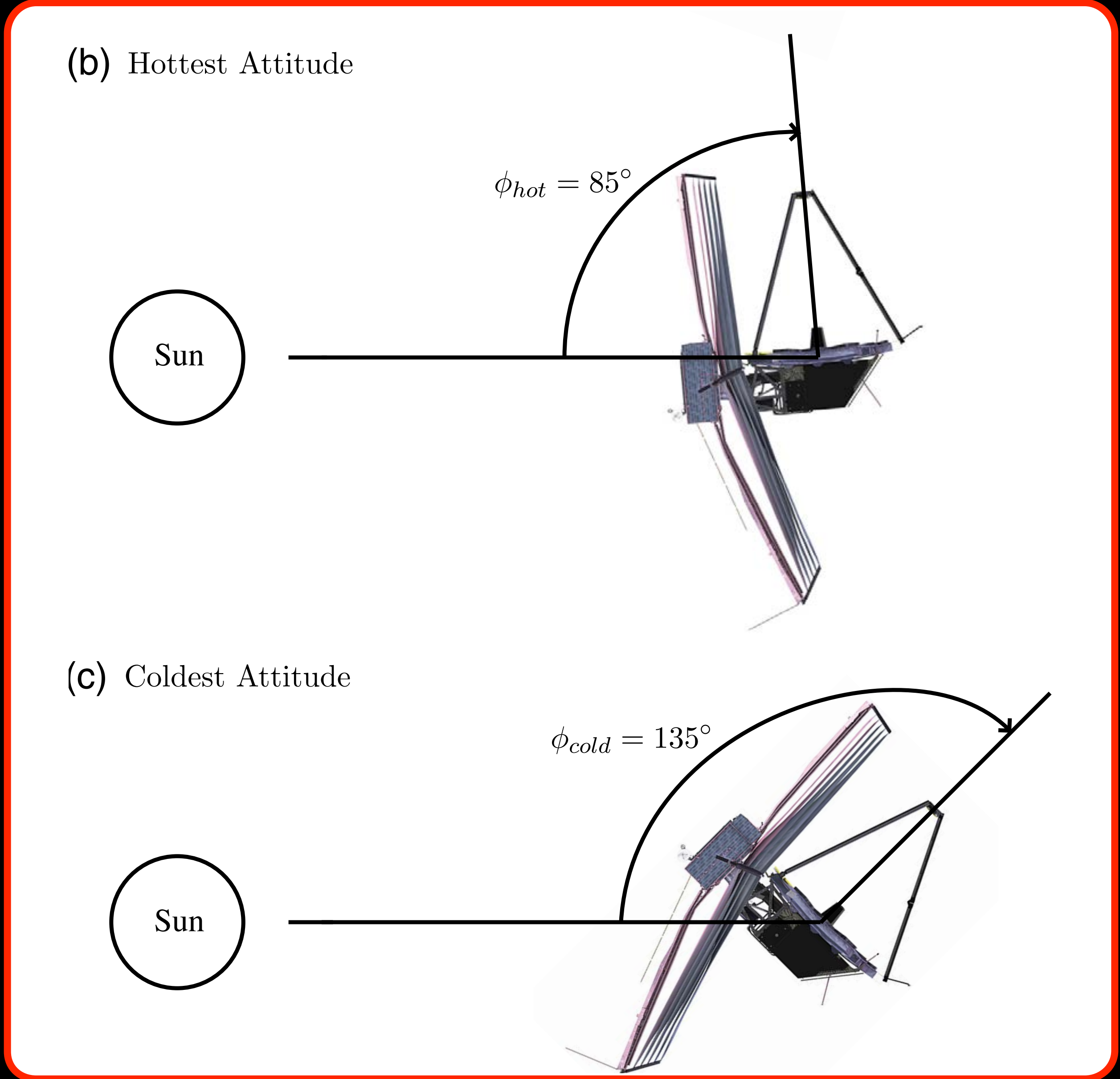
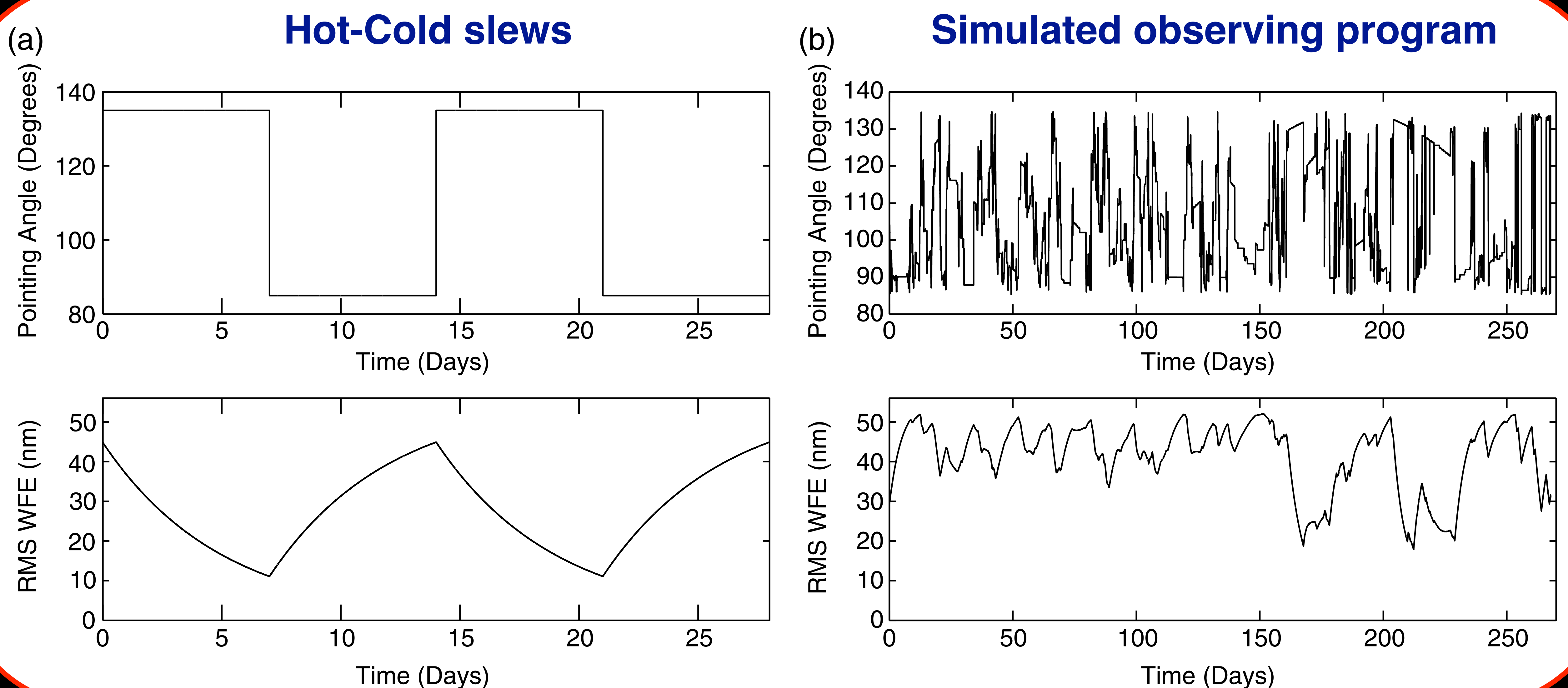


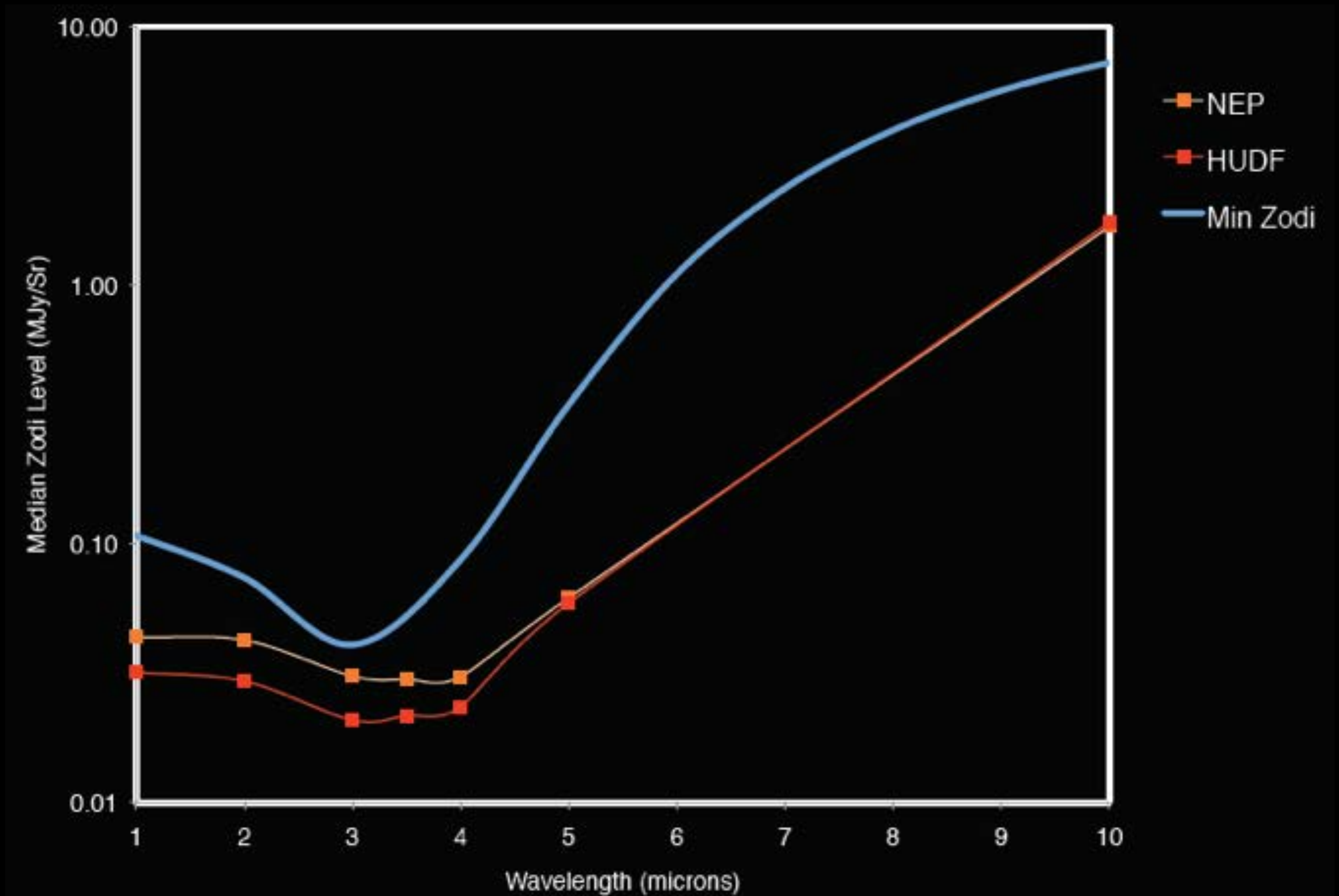
Optical Stability

- Optical stability modeling based on worst case hot-cold slew
- Wavefront error changes will be smaller when the telescope executes a real observing program.
  e.g. Gersh-Range and Perrin (2015)



Sky Background

- JWST should be zodi-limited at λ < 10 μm
  - ➡ Background levels will include contribution from stray light
  - ➡ Meet requirements @ 20 μm: 174 MJy/Sr vs 200 MJy/Sr req.



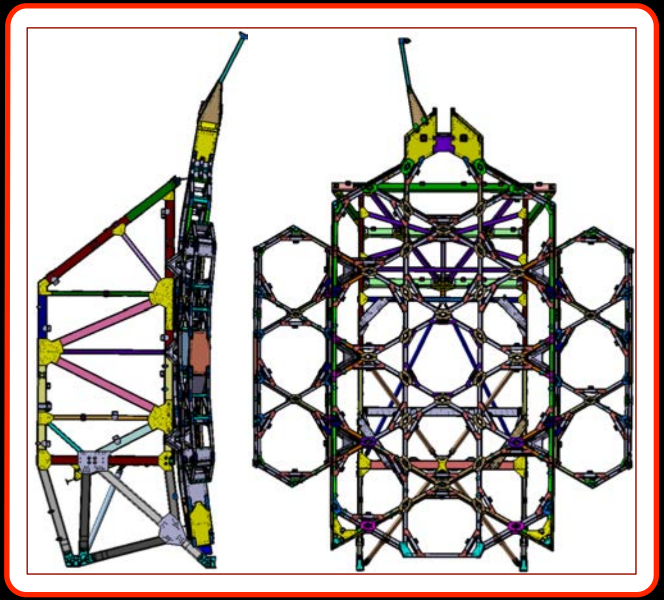
Pointing

- Predicted performance for offset precision
  - ➡ from 0 - 45” currently expecting < 5.3 mas

- Fine steering mirror offsets will be employed for offsets of <60 mas to deliver ~mas precision
  - ➡ Pixel response function mapping
  - ➡ Coronagraphy
  - ➡ Slit mapping

Telescope Structure

Pathfinder Backplane

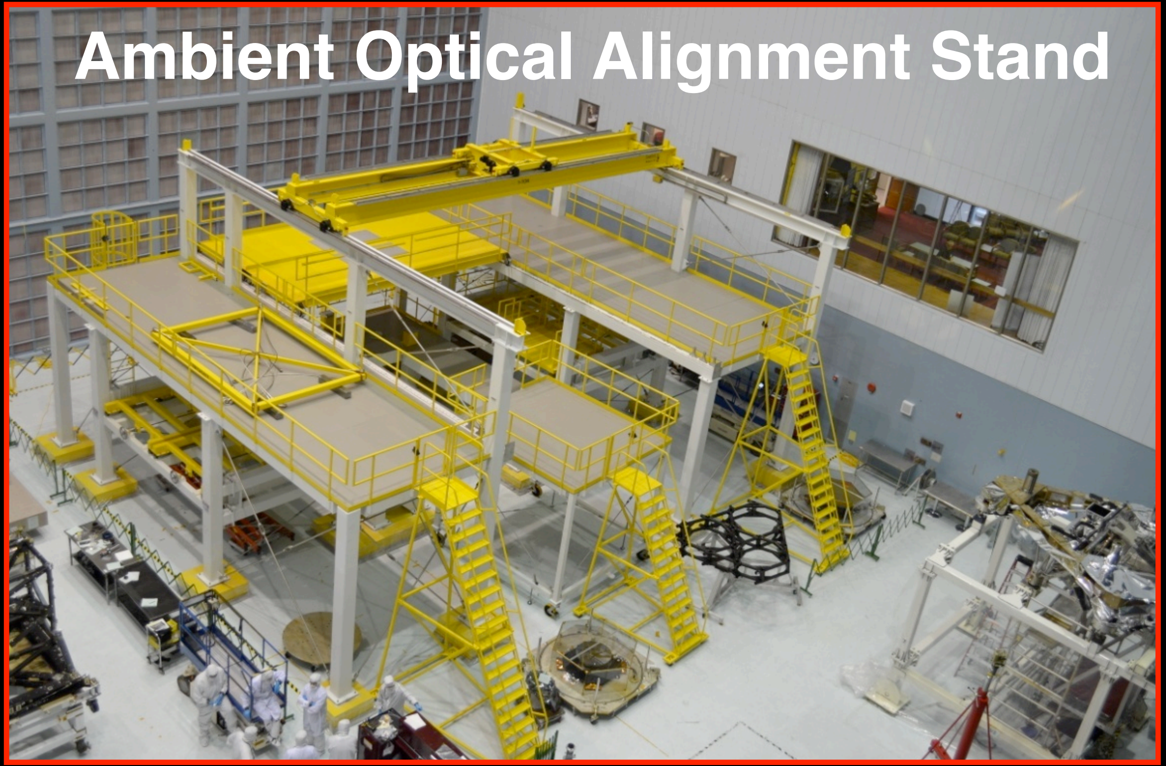


Flight Backplane

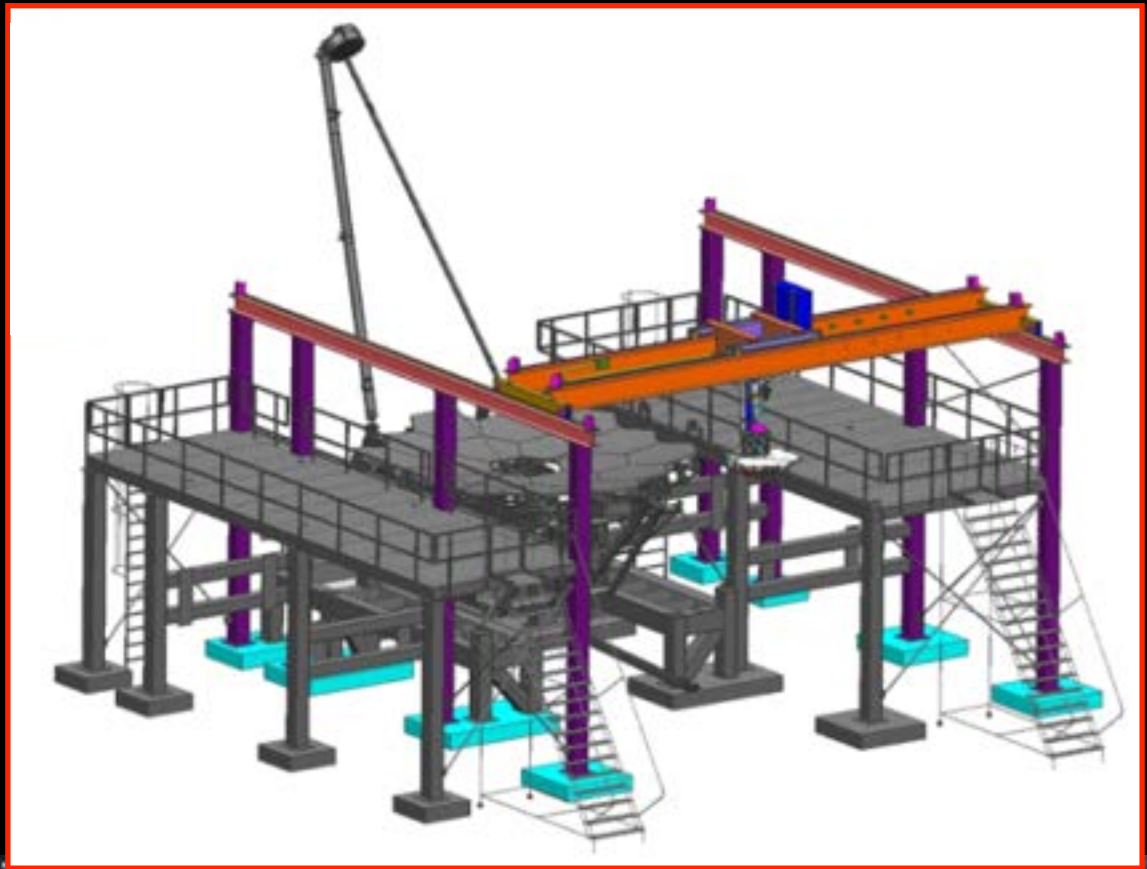
Pathfinder Backplane

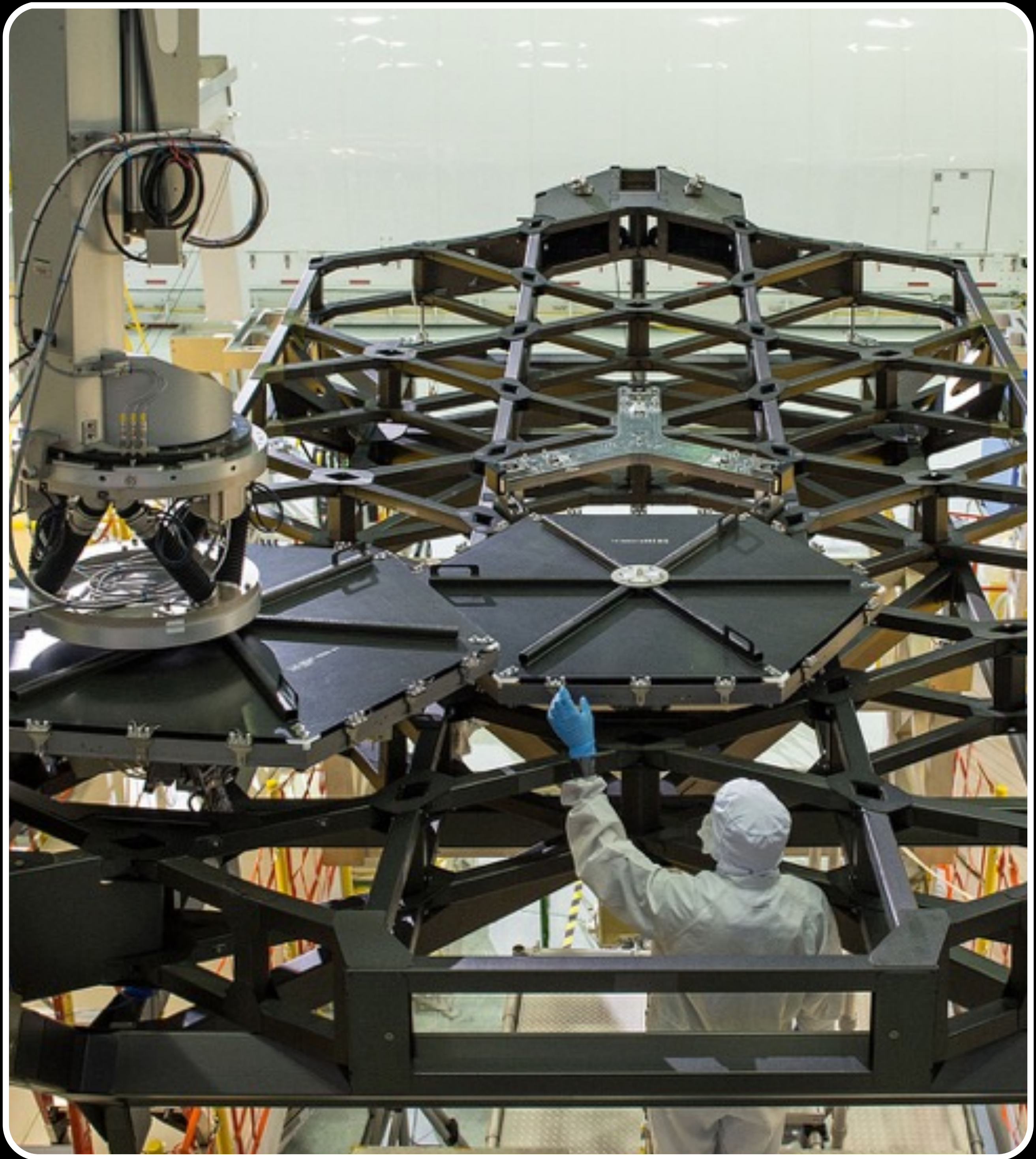
- **The pathfinder is a backplane section with a secondary mirror support structure (SMSS)**
  - ➡ Verify SMSS deployment
- **Tests integration of primary mirror segment installation with two flight spare mirror segments, plus flight-spare secondary mirror**
- **Pathfinder is scheduled for three cryogenic tests during 2015 in Chamber-A at JSC**
  - ➡ Verify optical test equipment

Primary Mirror Integration

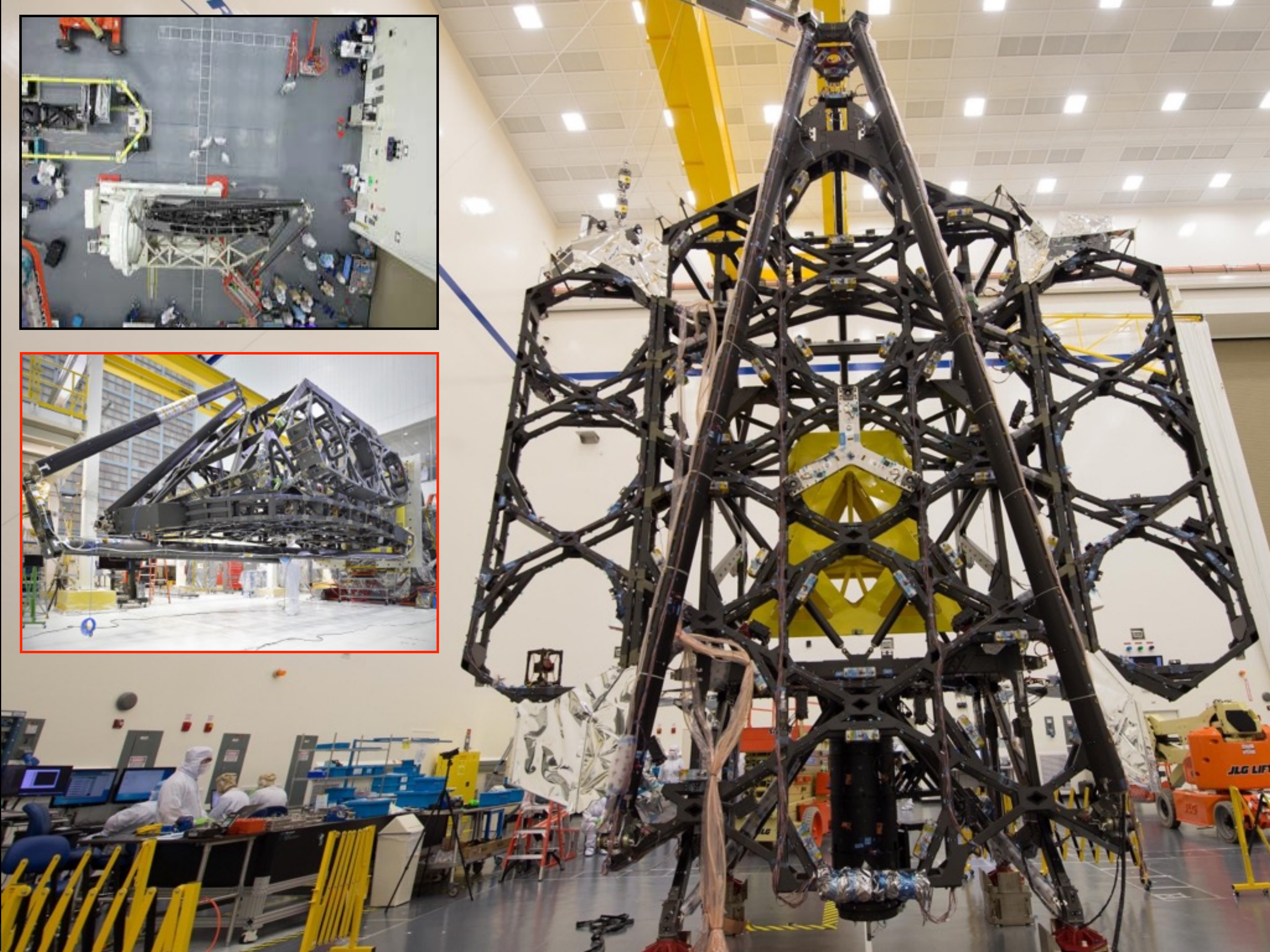


Ambient Optical Alignment Stand





Mirror Installation dry-run

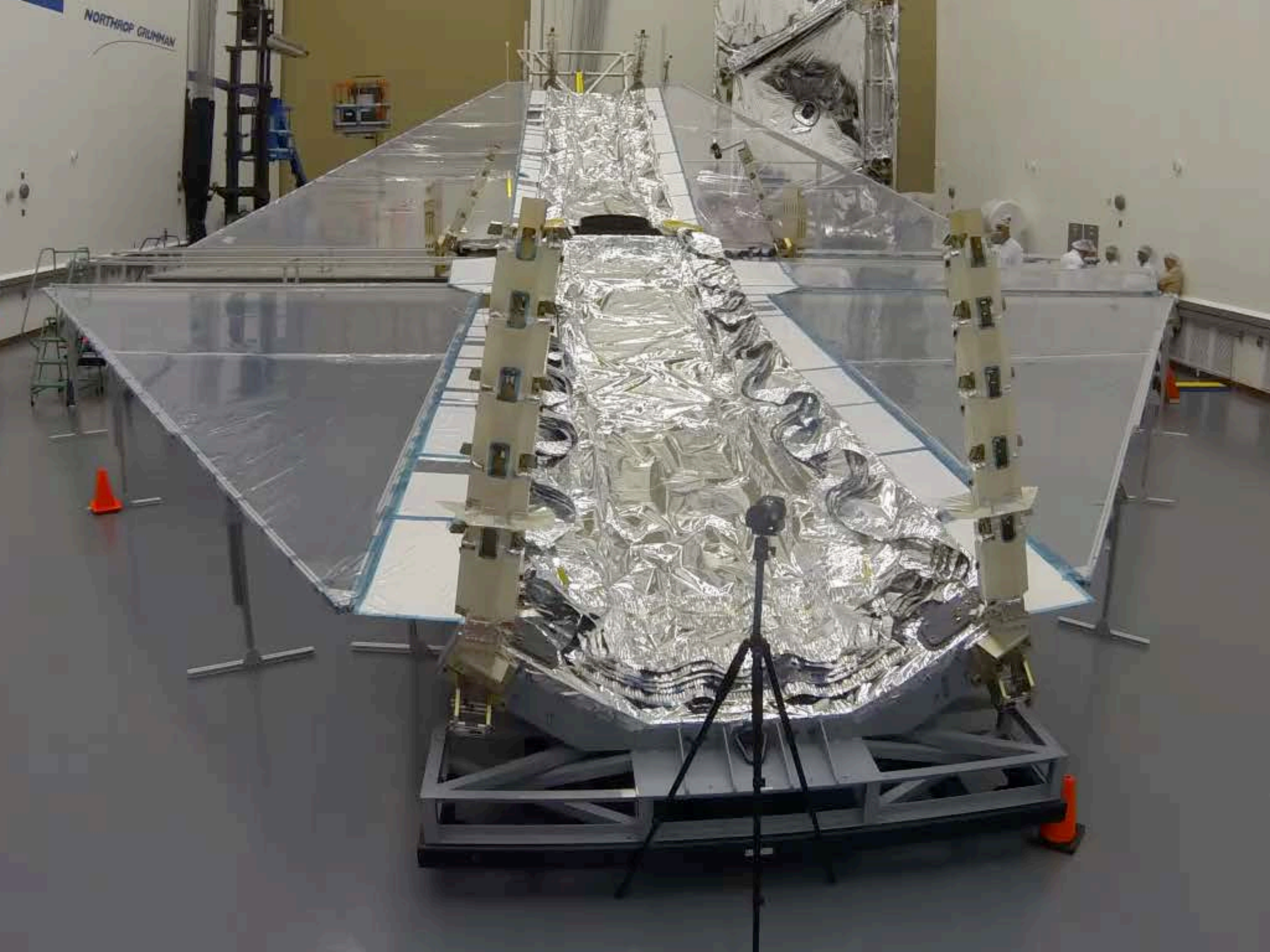


Sunshield Membranes

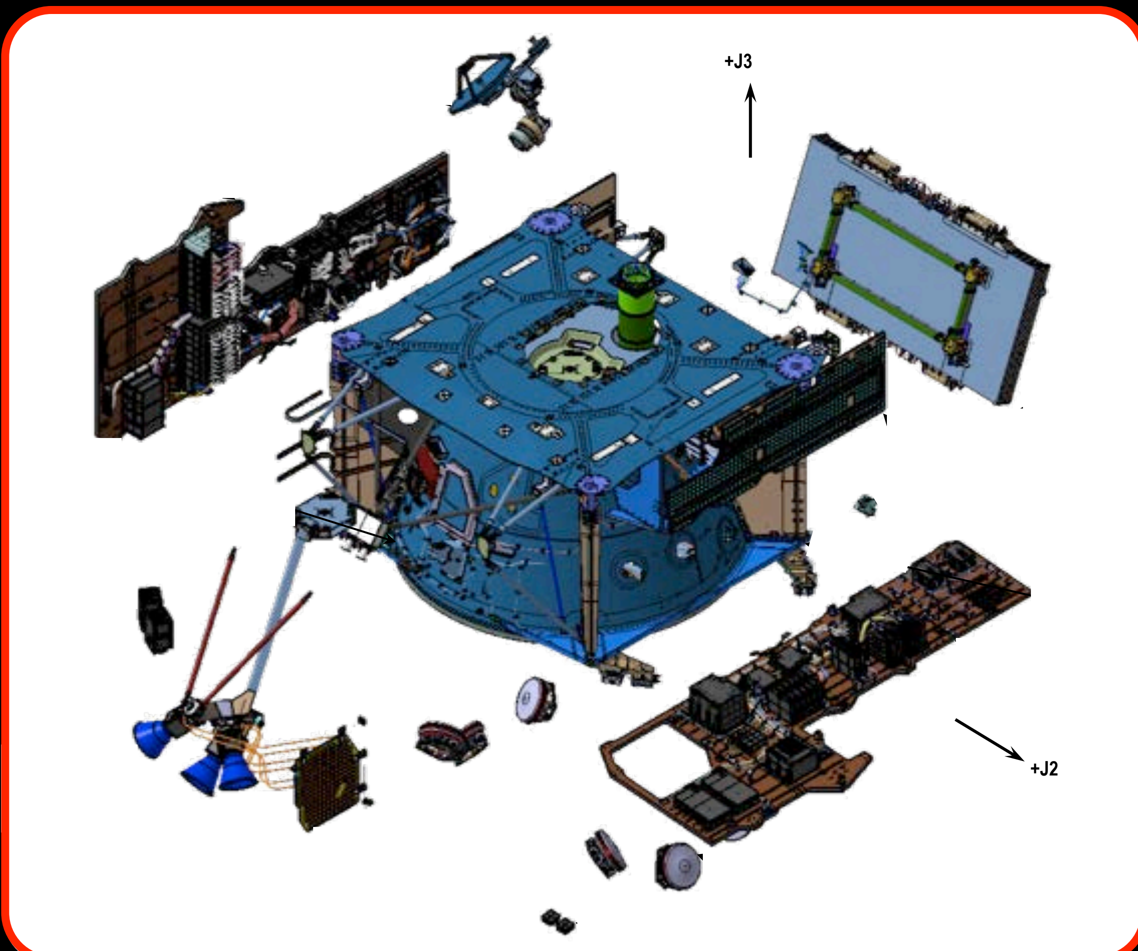
- Five flight-like Template Membrane layers manufactured
  - ➡ Template layers tensioned to flight-like configuration
    - 3-D membrane shapes measured by Lidar
    - Critical for layer-to-layer spacing ➡ thermal performance
    - Edge alignment ➡ thermal performance & stray light
- Flight membranes under construction (#3 completed)

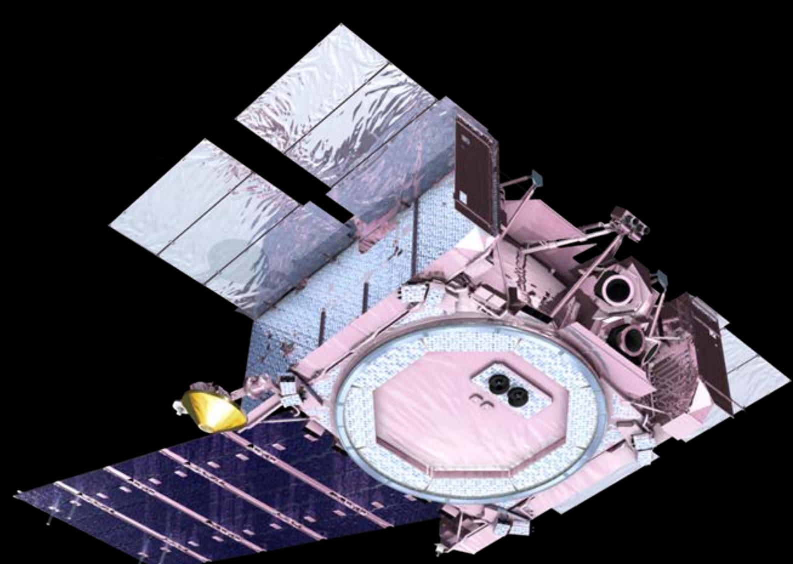
Tensioned to 3x flight tension for shape measurement by Lidar

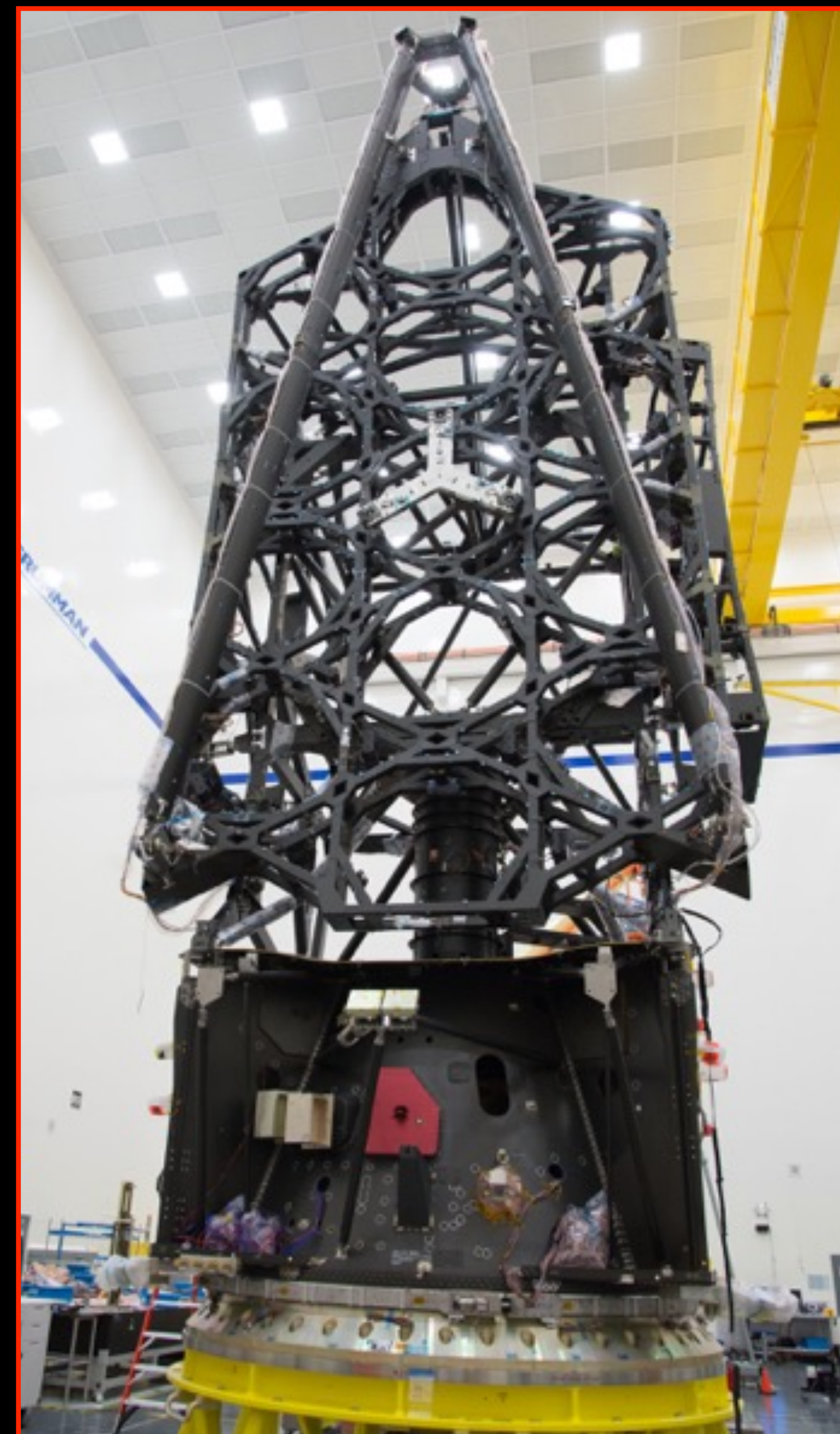
(3x tension counteracts gravity sag)


NORTHROP GRUMMAN

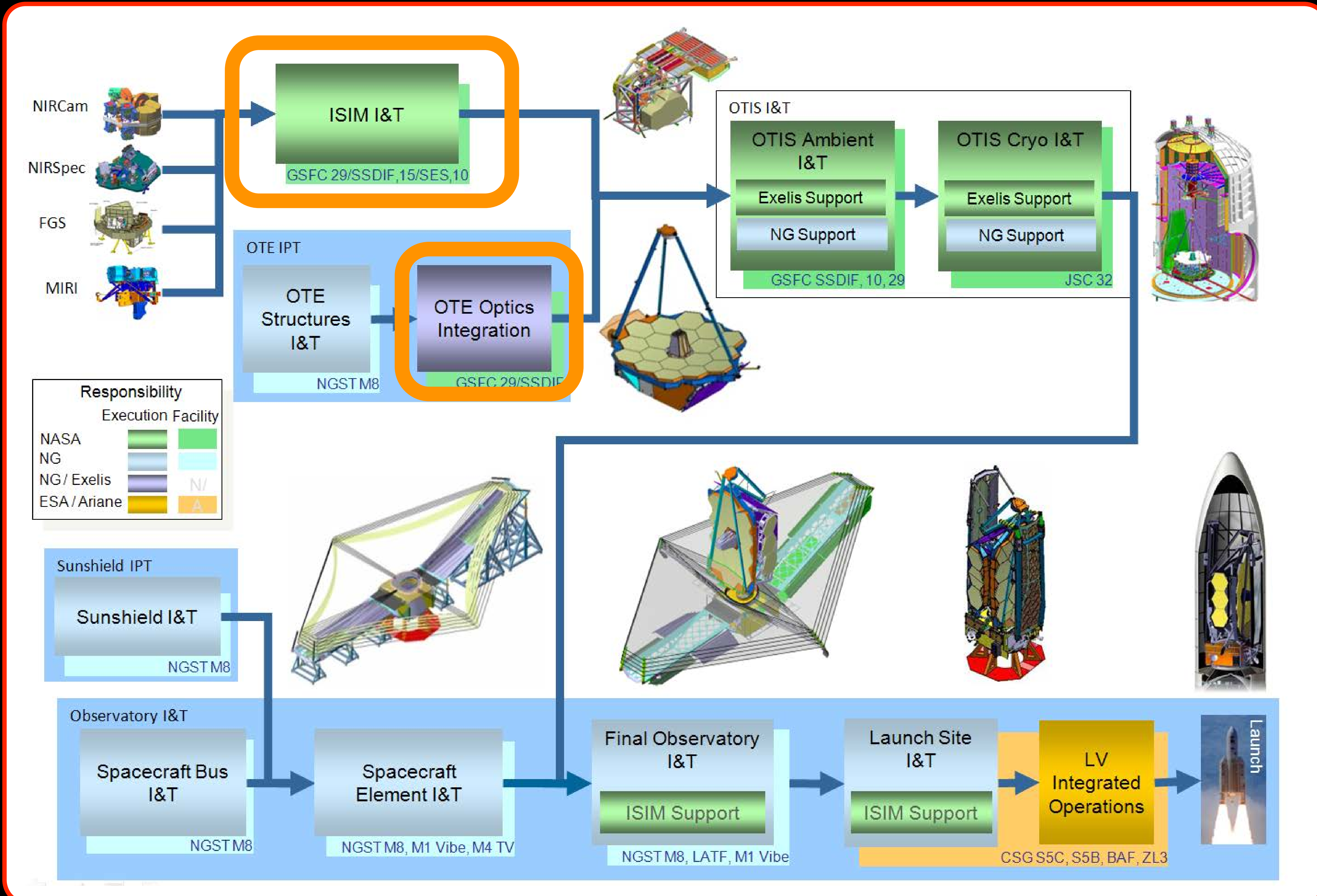
Spacecraft Bus Structure Complete







JWST Integration: Path to Launch



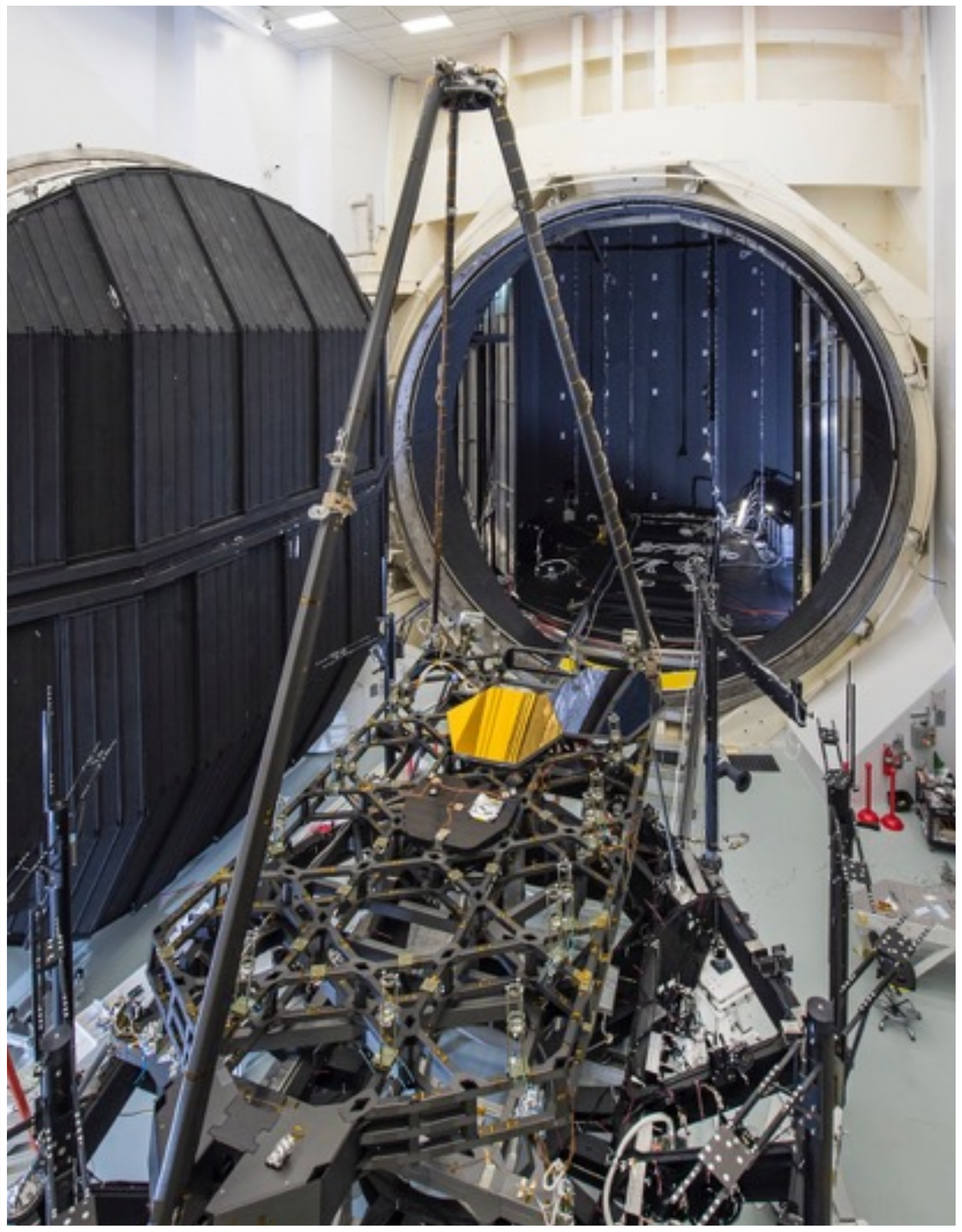
How Do We Test the Telescope ?

- Cryogenic Optical Test will be conducted at JSC's Chamber A
- Goals of Cryogenic Optical Test

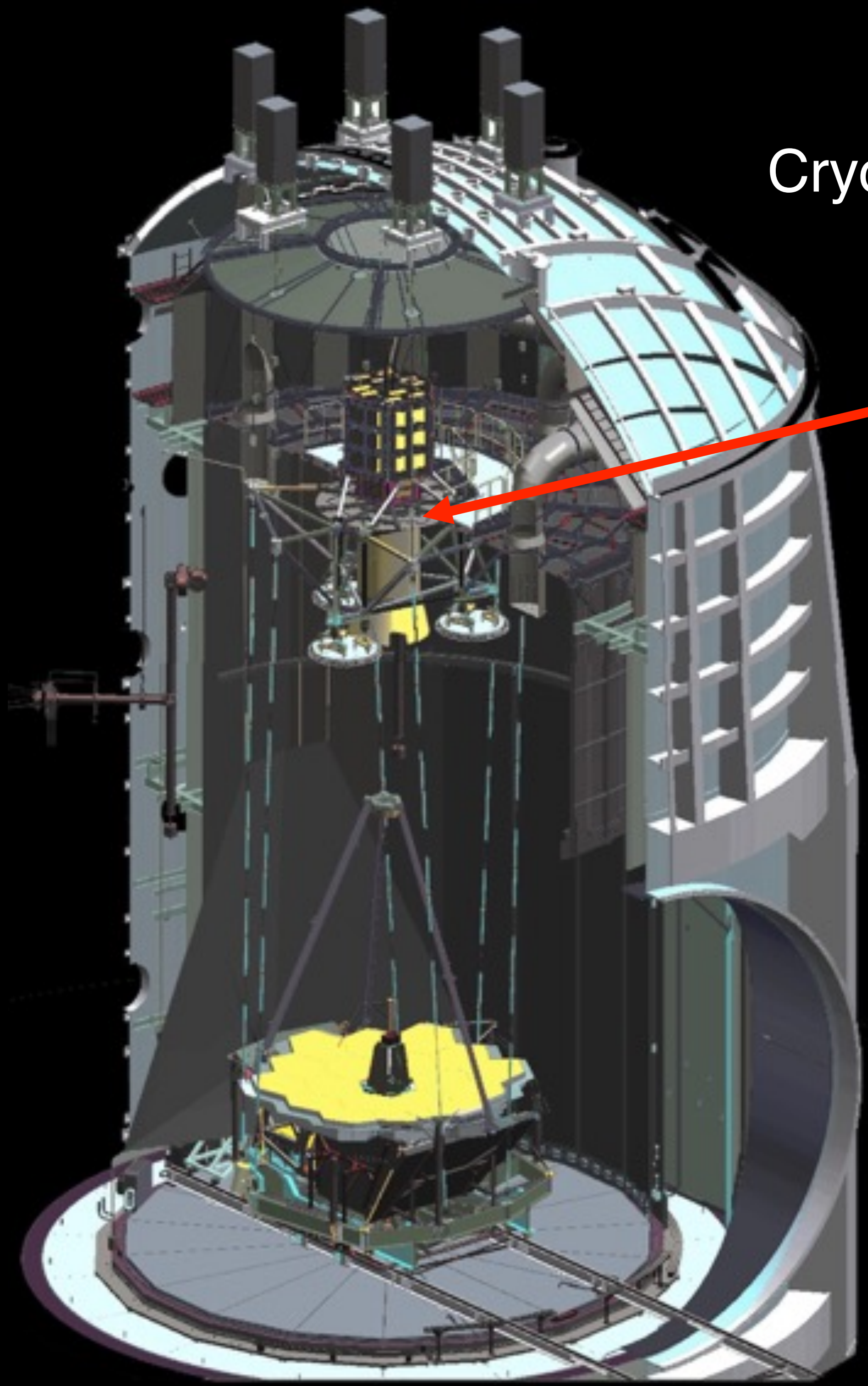
➡ **Optical workmanship** - check on assembly of the telescope e.g. mechanical interference

➡ **Optical alignment** - are we inside the capture range of the telescope's active optics ?

➡ **Thermal balance** - will the telescope cool to 40K ?

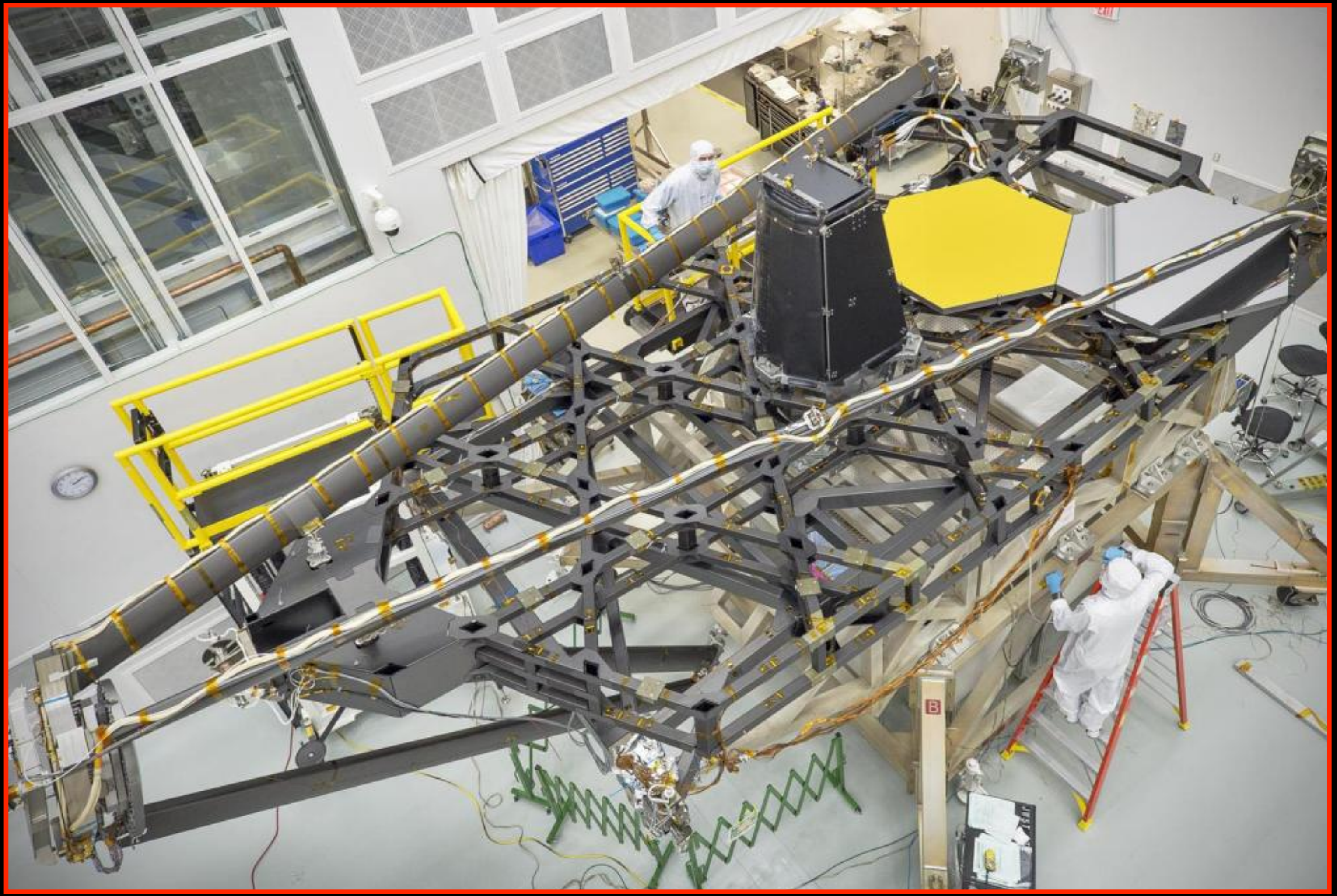


OTIS Test Preparations



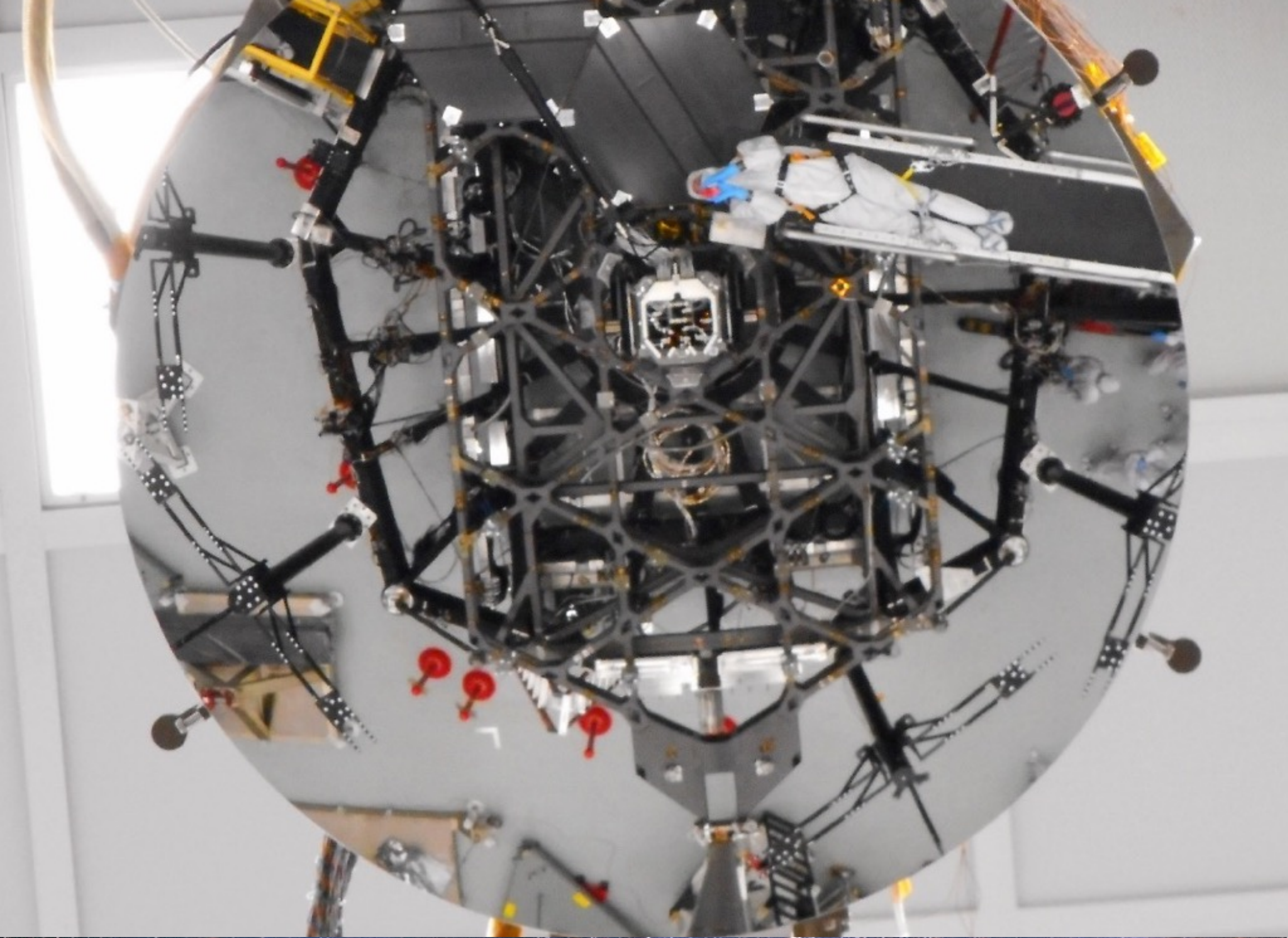
Dry Run testing w/Chamber-A

➡ 1) Dry run test- phasing two mirrors on pathfinder ✔



➡ 2) Dry run imaging with AOS ✔

➡ 3) Test thermal monitoring equipment



Overall Commissioning Schedule

Month 1	Month 2	Month 3	Month 4	Month 5	Month 6

Observatory Deployments

Telescope Phasing

Observatory& Instrument Commissioning

- Phased Instrument power-on with Temp.
- Observatory check-out & calibrations
  ➡ Attitude control, acquisition, thermal ....
- Instrument check-out and calibration

JWST will do transformational science and change our view of the Universe

JWST ➠ Launch 2018

JAMES WEBB SPACE TELESCOPE:

DEPLOYMENT SEQUENCE

Where To Follow JWST

Web pages

www.jwst.nasa.gov

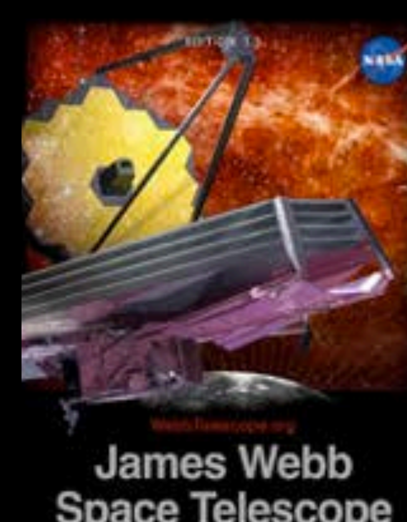
webbtelescope.org

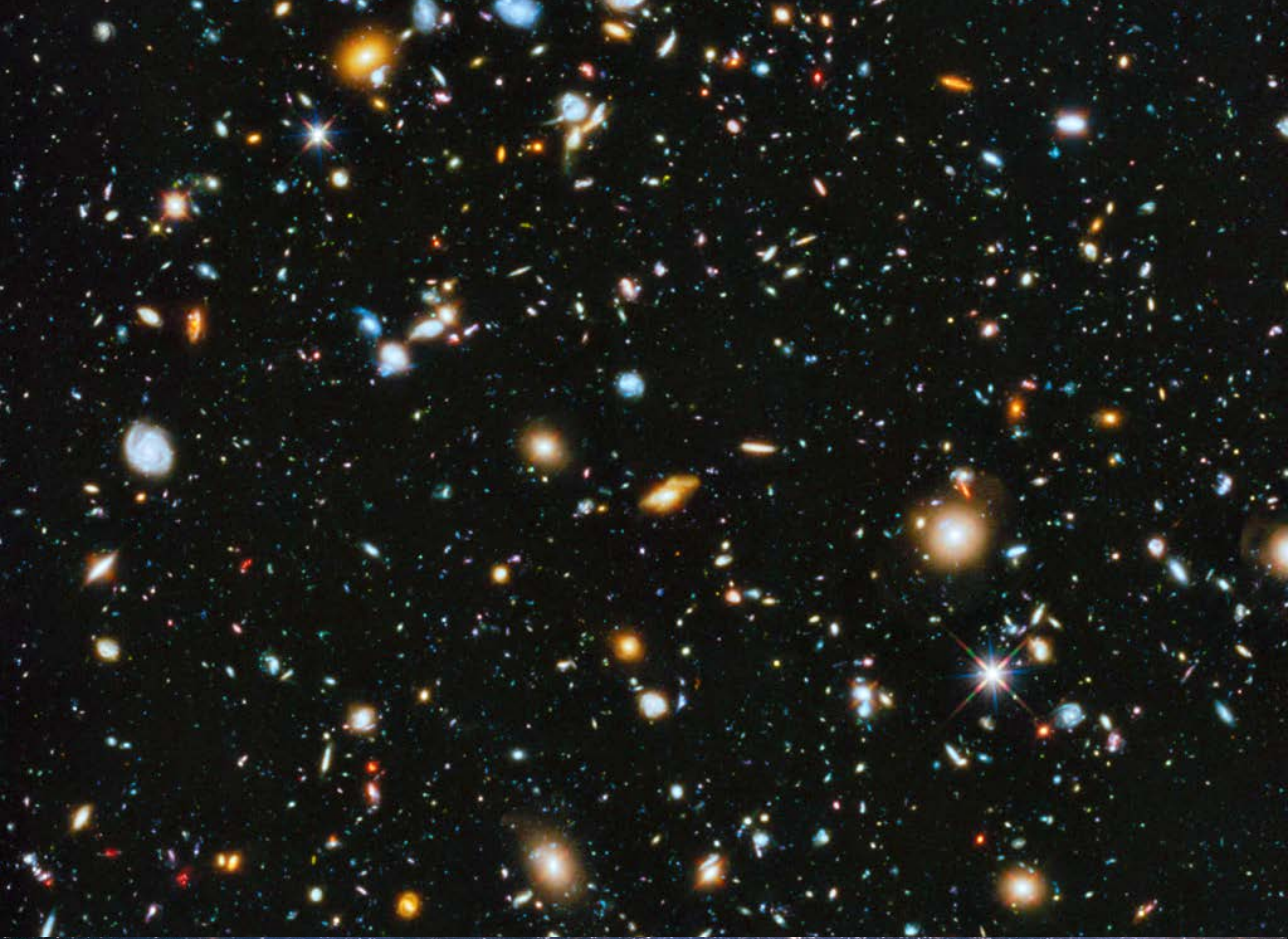
Social Media

Webcam

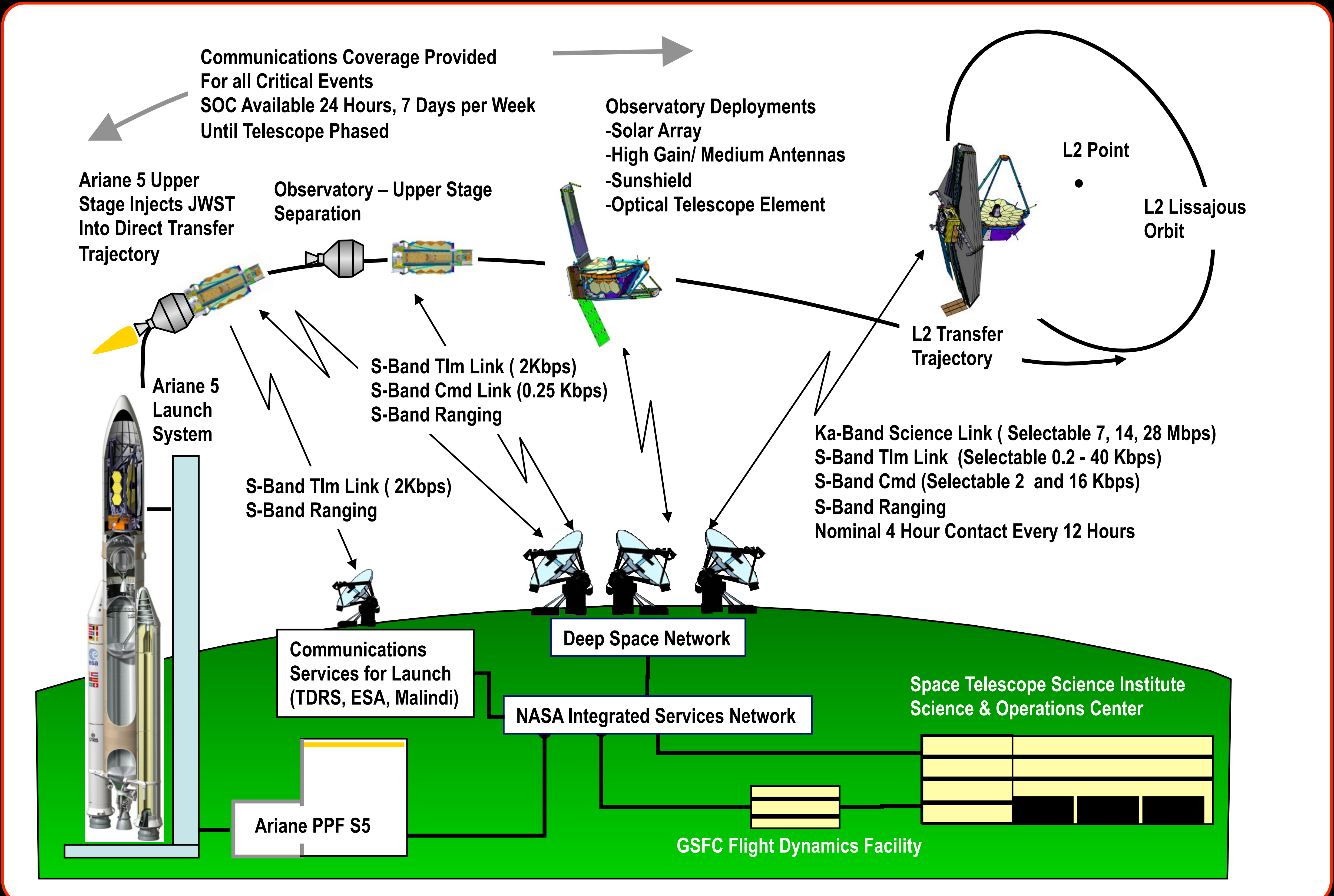
www.jwst.nasa.gov/webcam.html

ibook ➠ itunes





JWST Operations



Phasing the Telescope