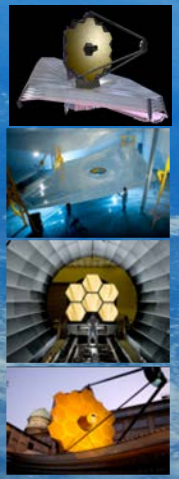
JWST is an international partnership between NASA, ESA and the CSA.

More and more branded as “Webb”.

The JWST mission status overview

Pierre Ferruit (ESA JWST project scientist)

Symposium “Early Science with JWST”
EWASS 2018 / 04-05 April 2018



Contents of the presentation

Brief, generic overview of the JWST

(the mission, European contribution, main elements, instruments and observing modes)

Mission status

(launch date, hardware status, the path to launch)

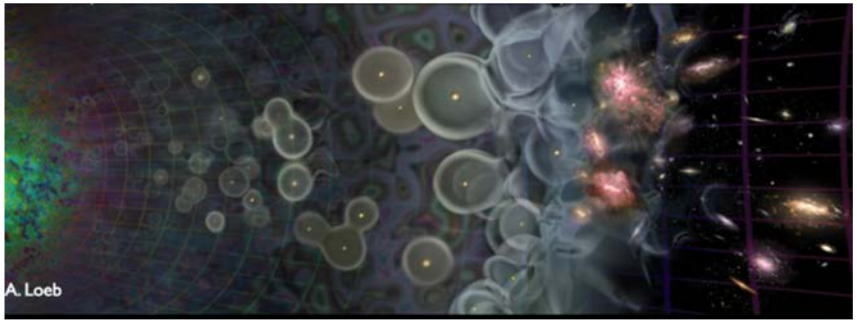
Conclusions

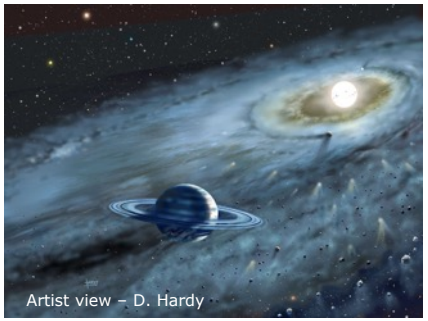
The JWST mission in one slide…

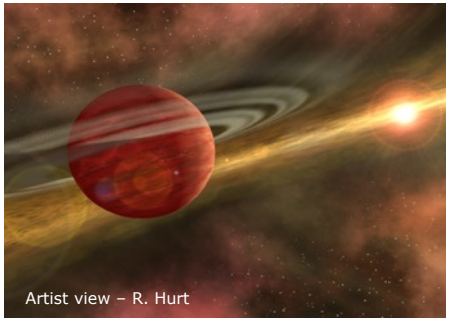
JWST is a NASA flagship mission and is a partnership between NASA, ESA and the Canadian Space Agency.

- It is a general purpose near and mid-infrared observatory.
- It will be the largest visible or infrared astronomical telescope ever flown.
- It will be observing objects ranging from planets and bodies of our Solar System to some of the most distant galaxies.
- It is now scheduled for launch in 2020.

The JWST mission - Introduction







JWST will provide ground-breaking data to scientists. During this symposium, you will see various examples of exciting science programmes that will or could be executed in the first year of JWST's scientific life.

See Gardner et al., 2006, Space Science Reviews,123, 485

The JWST mission - Introduction

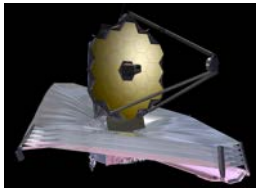
As already stated, JWST is a partnership between NASA, ESA and CSA.

ESA (and CSA) have been present since the very early phases of the mission.

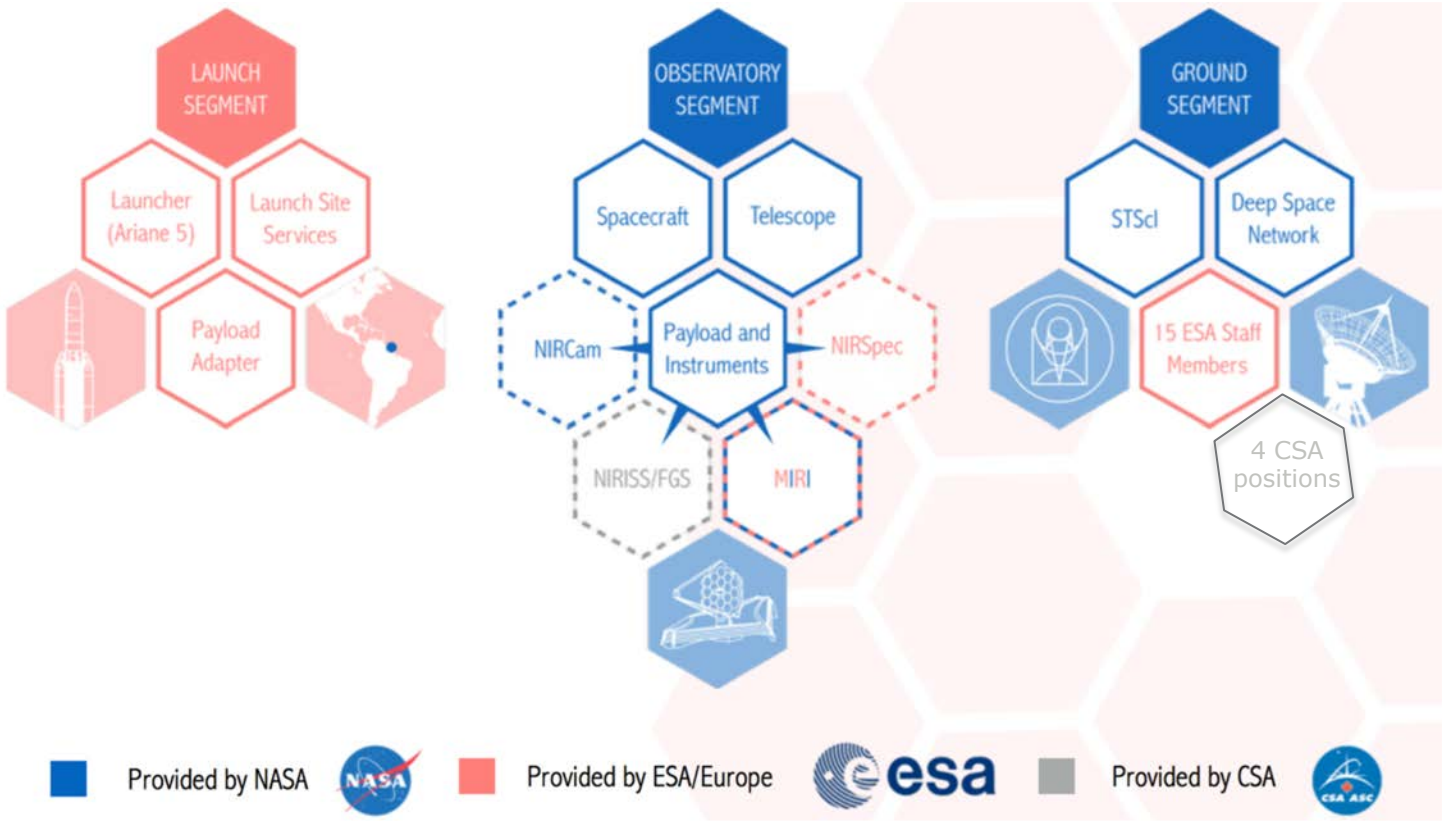
- *They were invited to join the project in 1997 at a time when the telescope was still called the "Next Generation Space Telescope" (NGST).*
- *The contribution of Europe to the mission gets consolidated around 2000.*

In return for this contribution, ESA shall obtain a portion of the observing time on JWST that will be no less than 15% of the observing time on average over the lifetime of the mission.

- *Again, following the same scheme than the one successfully applied to HST.*



The European participation to JWST



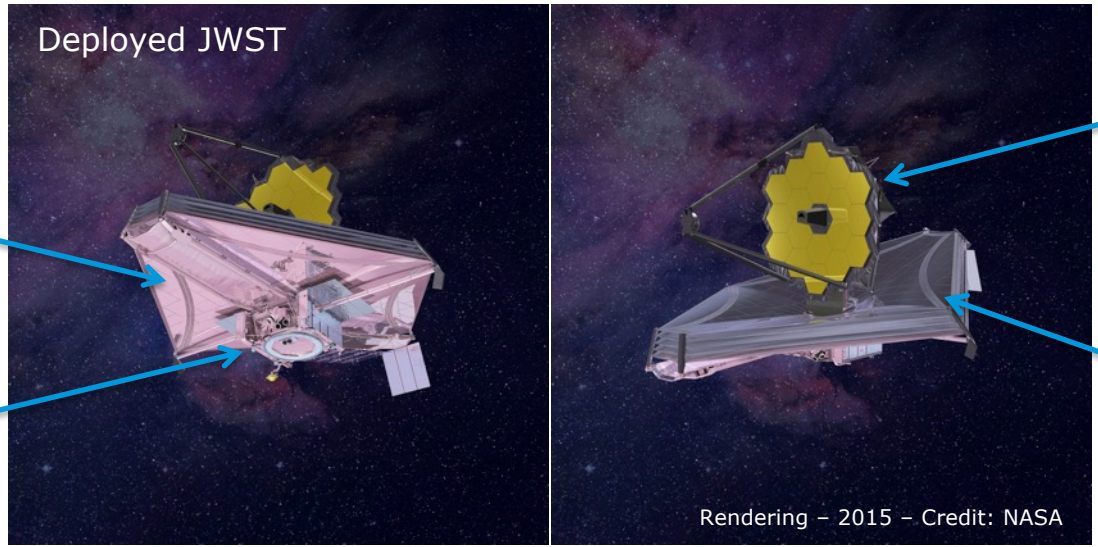
Important and visible participation involving ESA as well as European institutes and industry.

Credit for the figure:
Nora Lützgendorf

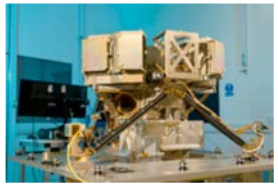
JWST – the observatory

At this stage of the integration, all JWST elements have been integrated in two big sub-systems:

- **The telescope and its instruments (this sub-system is called OTIS).**
- **The spacecraft and the sun-shield.**



JWST – the instruments



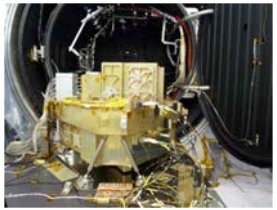
MIRI = Mid-InfraRed Instrument

50/50 partnership between a nationally funded consortium of European institutes (MIRI EC) under the auspices of ESA and NASA/JPL.

PIs: G. Wright and G. Rieke

NIRSpec = Near-infrared Spectrograph

Provided by the European Space Agency. Built for ESA by an industrial consortium led by Airbus Defence and Space.

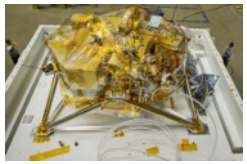


NIRISS = Near-infrared Imager and Slit-less Spectrograph

FGS = Fine Guidance Sensor

Provided by the Canadian Space Agency.

PIs: R. Doyon & C. Willott

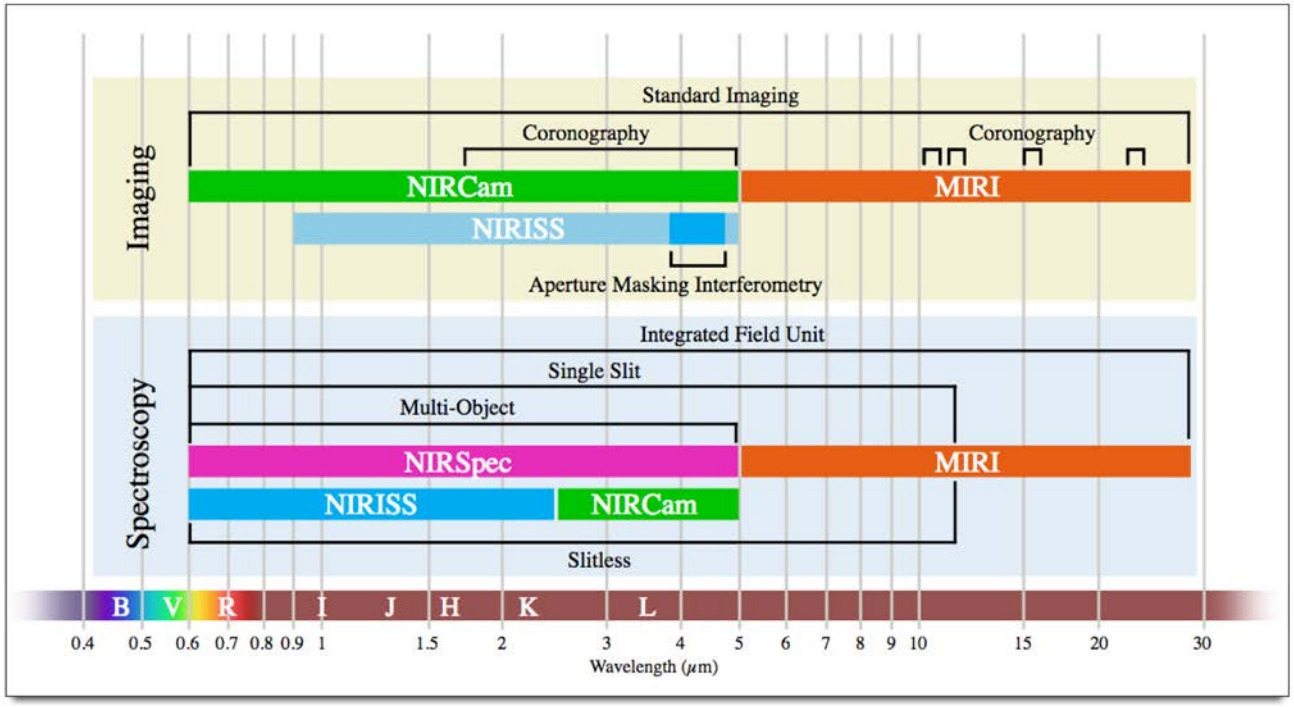


NIRCam = Near-InfraRed Camera

Developed under the responsibility of the University of Arizona.

PI: M. Rieke

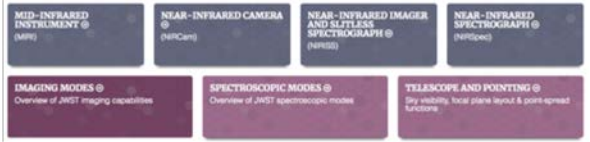
JWST - capabilities



Credit: STScI

Entry point:

https://jwst.stsci.edu/instrumentation/



A very powerful and versatile observatory.

JWST has a moving target tracking capability.

JWST status – launch date

Last week, NASA announced the the launch date was re-scheduled to around May 2020. This follows a review of the mission status and schedule by the NASA standing review board (SRB).

As required, the delay was reported to the US congress. NASA has instituted an Independent Review Board to evaluate all factors and will provide a full report to congress in June.

The revised schedule will be determined based on that report and on discussions with ESA regarding the potential Ariane 5 launch window.

JWST status – launch date

What caused the re-scheduling?

No technical show-stopper but the integration and testing of the spacecraft and the observatory are taking much longer than planned

Some problems encountered on the way with the propulsion system but they have been fixed. Deployment and stowing of the sunshield is really taking a long time.

JWST status – launch date

We understand that this re-scheduling can be disappointing but:

This is a very complex and challenging observatory so the focus is on making sure the telescope and the spacecraft have been carefully integrated and thoroughly tested by the time they launch… NASA is not cutting corners.

No erosion of JWST's performances. JWST remains the very powerful observatory it is meant to be. The science ahead of us is still very exciting! Just listen to the talks of the next two days!

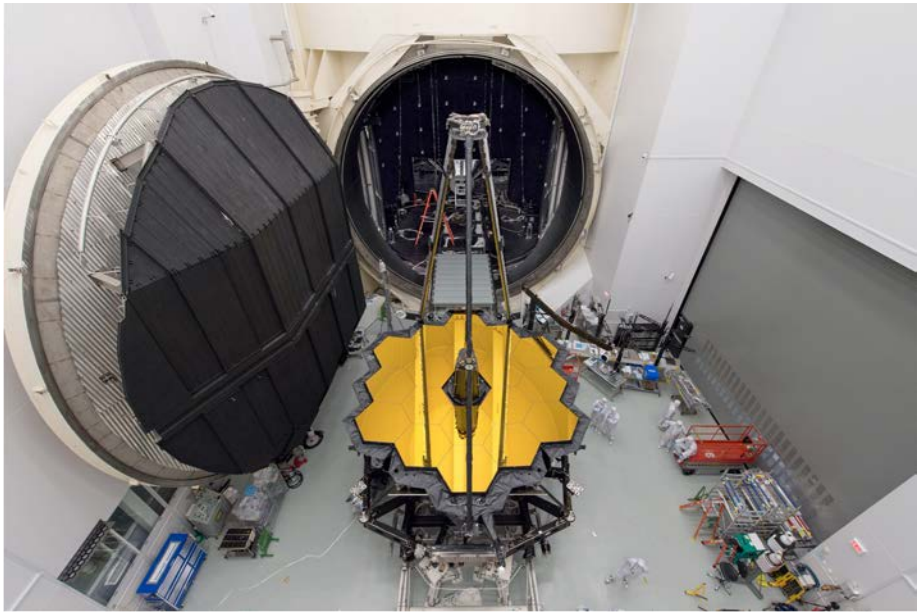
JWST hardware status

The latest news should not make us forget the progress made in the last year.

All the hardware has been manufactured and it is now “only” a matter of putting things together and conducting the associated testing.

JWST hardware status - OTIS

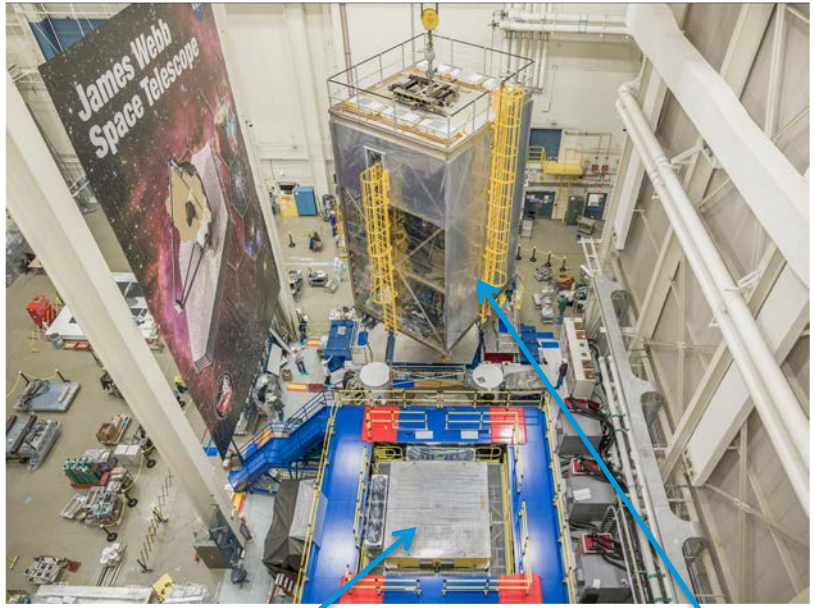
Last year JWST's payload module (telescope + instruments = OTIS) went successfully through an extensive environmental test campaign.



Credits: NASA/Chris Gunn

JWST hardware status - OTIS

Making sure the telescope and the instruments can survive the harsh conditions of a rocket launch: acoustic and vibration testing.



Credits: NASA/Chris Gunn

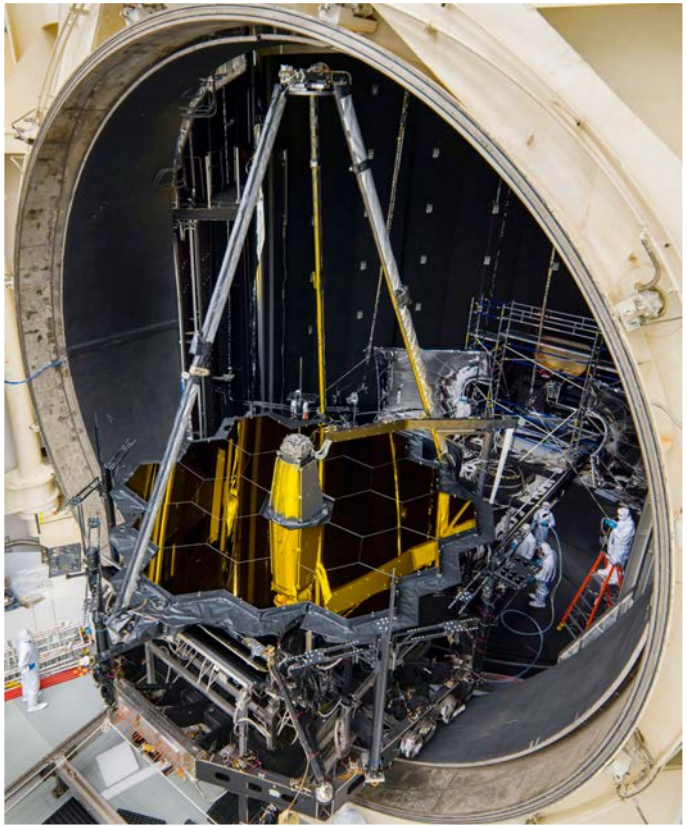
JWST hardware status - OTIS

The last step involved a deployed OTIS and a huge cryogenic test chamber at NASA's Johnson Space Center in Houston, Texas.

The telescope and the instrument were brought down to their operating temperatures and they were thoroughly tested.

This included multiple tests of the performances of the telescope and its mirrors (wavefront errors, stability, phasing…).

All tests completed successfully.



Credits: NASA/Chris Gunn

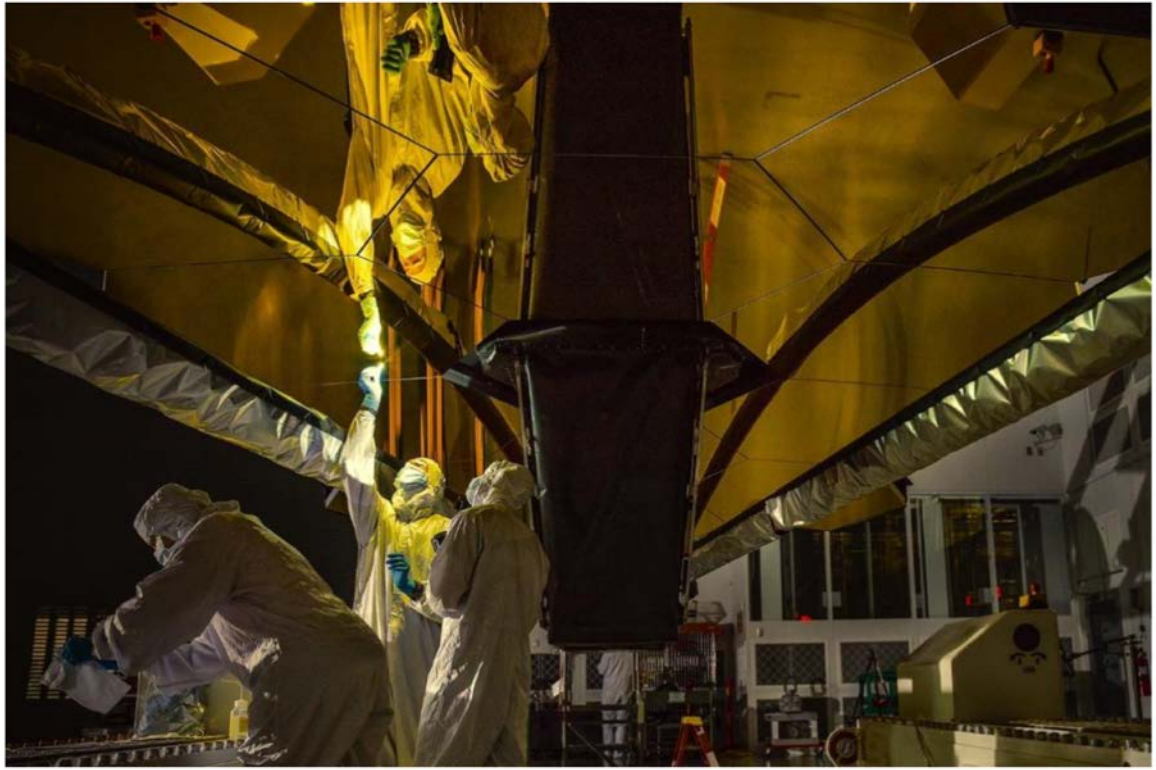
JWST hardware status - OTIS

JWST mirrors have been cleaned.

- All primary mirror segments + secondary mirror.

This resets the clock with respect to particulate contamination. Extremely good results.

Small brushes, small strokes and > 25 m^2 to cover… Robust SiO_X coating on the gold layer.



JWST hardware status - OTIS

OTIS was shipped to California where the rest of the observatory is assembled.

OTIS transport container called STTARS

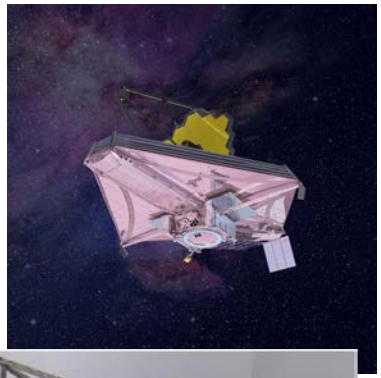
Credits: NASA/Chris Gunn

Military C5 transport plane

OTIS being loaded into its container

Status – spacecraft and sunshield

In parallel, the joint integration of the spacecraft and the sunshield is taking place at Northrop-Grumman's premises.



Forward Sunshield Unitized Pallet Structure Attached to the Spacecraft Bus (Northrop Grumman)

Credits: Northrop Grumman

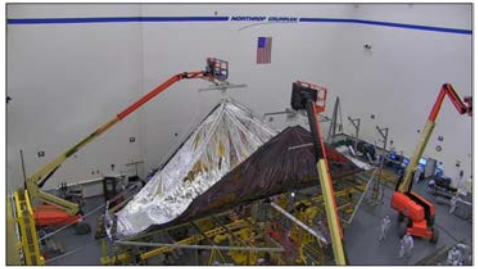
Status – spacecraft and sunshield

As highlighted before, the sunshield is one particularly complex piece of hardware. Manipulating its elements under 1G is never easy or simple. Its integration, folding, unfolding are done meticulously and carefully!

Credits: Northrop Grumman

Status – spacecraft and sunshield

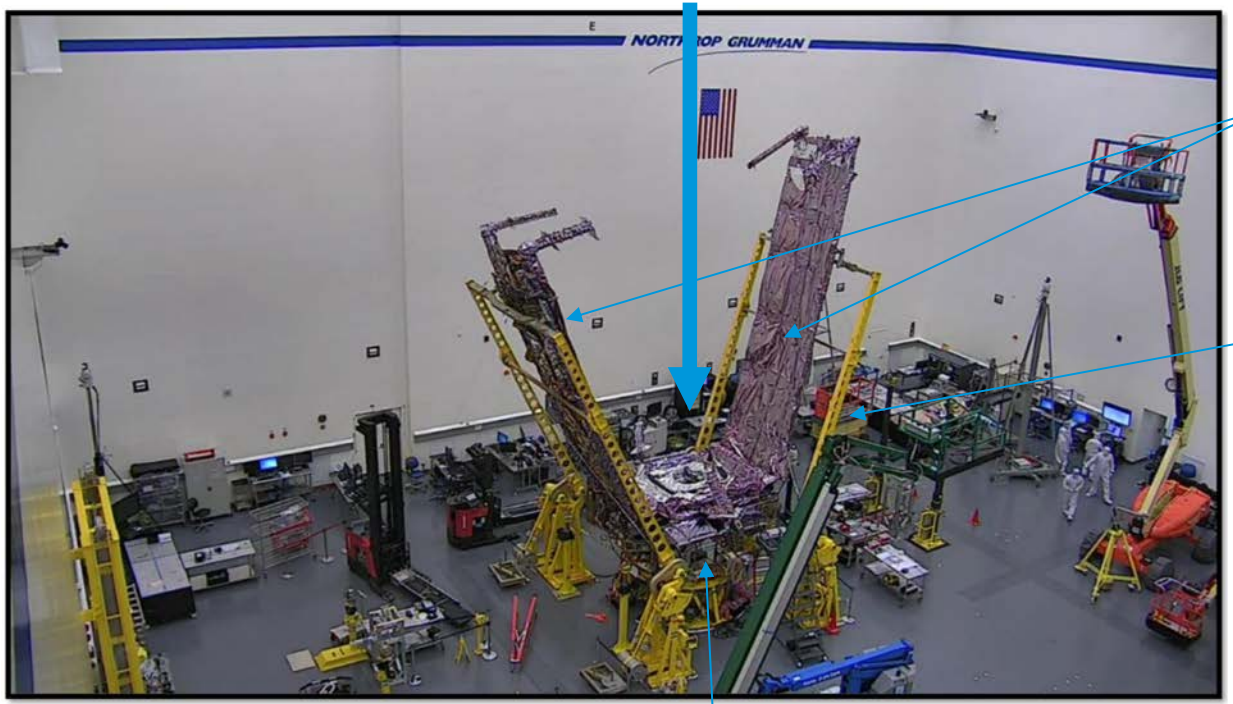
Credits: Northrop Grumman



These activities (in particular the stowing) are taking more time than initially planned but they are getting done without cutting corners.

Status – spacecraft and sunshield

OTIS will go there



Credits: Northrop Grumman

spacecraft

Sunshield folded in the structures that will maintain it in place and protect it during launch.

All the hardware in yellow corresponds to ground-support equipment assisting the deployment or the stowing under 1G conditions.

Installation of release devices and actuators during the stowing.

The path to launch

Science Payload

- OTIS Deployments at NGAS
  (secondary mirror & ISIM radiator)

Spacecraft Element

- ✓ Thruster re-installation
- Acoustics, vibe, and thermal vacuum tests
- Post-Environmental deployment & stow

$\int$(Observatory)dt

- Pre-environmental Observatory deployments
- Observatory fold & stow
- Observatory system (electrical) test
- Observatory vibration, acoustics tests
- Observatory deployment
- Observatory stow for launch
- Observatory final system test

*Top-level tasks to go. Many activities are associated with each of these steps

Very important final steps ahead of us.

Presentation: SWG monthly teleconference – E. Smith NASA HQ

A few words about commissioning.

JWST has a 6-month commissioning period, which includes the time needed to reach the L2 point around which it will orbit.

- Deploying the observatory: approximately from launch (L) to L+3w.
- Traveling to L2: approximately from L to L+1m.
- A complex commissioning for a large cryogenic, deployable telescope with a segmented mirror that will need to be phased once in orbit.
- Telescope phased and aligned at around L+4m.

Observatory ready for science at L+6.

For more details, see the presentation to JWST's users committee in September 2017:
https://jwst.stsci.edu/files/live/sites/jwst/files/home/events/_documents/jstuc-0917-commissioning-friedman.pdf

Conclusion

The launch date has shifted to 2020 but the expected scientific performances of the observatory remain untouched (i.e. good!).

The engagement of the community for JWST is important. We will continue to work to bring you news from JWST as well as to offer training opportunities in Europe and the US. Stay tuned.

Thanks for your attention and have a good symposium and EWASS meeting!