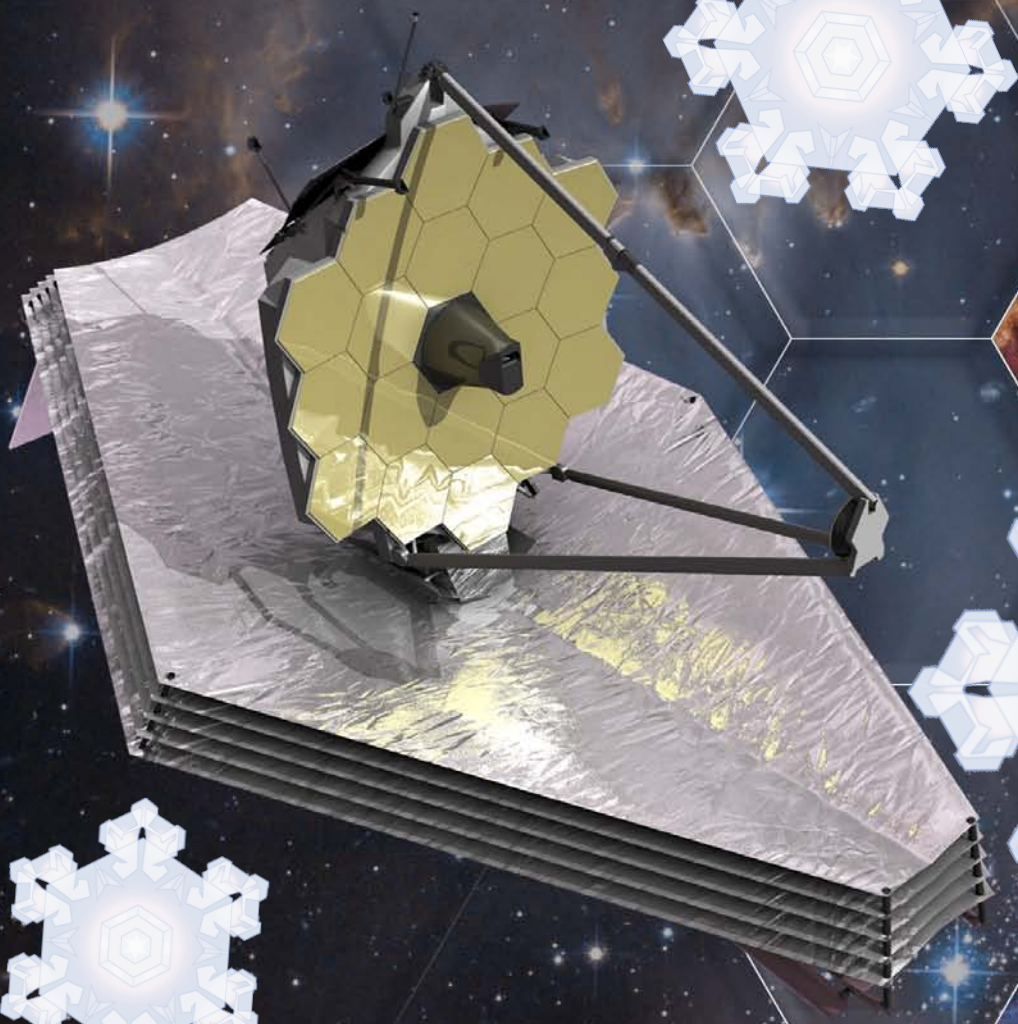
National Aeronautics and Space Administration



Webb

Update

Winter 2016

jwst.nasa.gov

Webb Update

Issue #19, Winter 2016

James Webb Space Telescope

JWST Status Update & Upcoming Milestones Overview

By Eric Smith

The winter of 2015/2016 is a critical period of integration and testing for JWST. Following the highly successful conclusion of the second cryovacuum test of the ground support equipment (and flight Aft Optics System) at the Johnson Space Center, the program is currently concluding its final cryovacuum test of the science instruments at the Goddard Space Flight Center. At the same time, the teams have finished installing primary mirror segments onto the flight Telescope Structure at Goddard. All of this is occurring as the program remains within its 2011 replan budget guidelines and continues to hold slightly more than planned-for schedule reserve to the October 2018 launch date. For more than 4 years now the Project and contractor teams have kept NASA's highest priority science program on schedule and within budget.

While we take time to appreciate the efforts of all involved (and marvel at the fantastic images of the hardware being assembled), we are mindful of the challenges ahead as the program moves further into its Integration and Test phase (see Malcolm Niedner's piece below for more detail on work currently happening at Goddard). The instrument cryovacuum test is an extremely challenging 3 month, round-the-clock sequence of tests that stress not only the science instruments for their final verifications, but also the facilities at Goddard to support the test. All three cyrovacuum tests have been successful, with the third and final on in its final weeks now. Once the instruments are out of their test they will be mated to the telescope to form what, in characteristic NASA speak, is referred to as OTIS (Optical Telescope plus Integrated Science instrument module). OTIS will be tested at the Johnson Space Center in 2017 before it is joined to the spacecraft and sunshield.

Good progress continues on the build up of the spacecraft bus with subsystem components being completed and delivered to Northrop-Grumman in Redondo Beach. Our remaining manufacturing efforts are centered on the completion of the flight sunshield membranes and their assembly into the flight sunshield. Because the sunshield is a unique and challenging engineering effort it will receive lots of attention over the coming year.

On the operations front, the building reconfiguration of the north end of the third floor at STScI for the mission operations control room is almost complete. STScI continues to meet all their milestones for software development and will soon deliver the first build of the proposal planning system that astronomers will employ when planning and proposing their JWST observations.

This rare overhead view of the thermal vacuum chamber at NASA's Goddard Space Flight Center in Greenbelt, Maryland shows engineers readying the Integrate Science Instrument Module (ISIM) that was just lowered into the chamber for its final cryogenic test at Goddard in October 2015. Credit: NASA/Chris Gunn

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The Telescope in JWST is Beginning to Emerge

By Malcolm Niedner

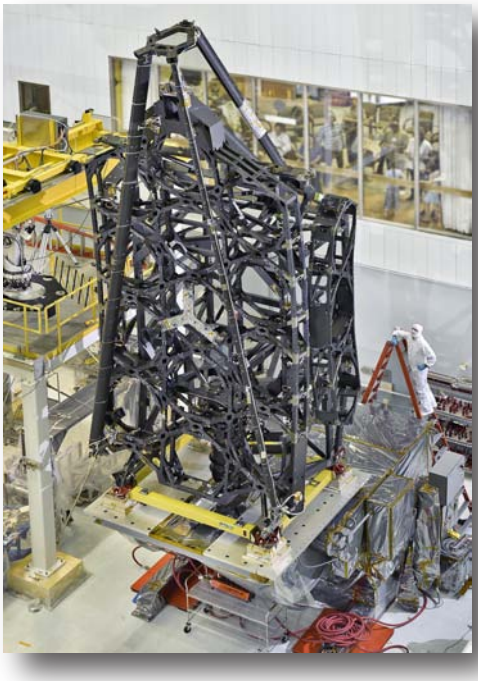
Since the last edition of the Newsletter, the JWST Project has moved inside the 3-year point of its October 2018 launch, a significant milestone. The fact that almost three years remain before JWST sits atop a rocket and blasts into space is explained by its size and complexity: in addition to the many early technology developments that were required, actually "building it" involves a number of hierarchical integrations of smaller units into larger ones, as well as a challenging series of thermal vacuum and other tests throughout the entire assembly process. We are now, and have been for some time, in the very demanding, high precision "integration and test" (I&T) phase of the James Webb Space Telescope. The considerable accomplishments to-date notwithstanding, there is much work ahead of us in the next few years.

We are able to report here that much progress has been made since the Summer 2015 Newsletter, and that it has occurred across the entire Project. Perhaps nowhere is the progress more visible than in the optical integration of the Optical Telescope Element (OTE), which is comprised of: 18 primary mirror segments (or PMSAs, for "primary mirror segment assembly"), the other "primary optics" (secondary, tertiary, and fine steering mirrors), and finally the large backplane structure to which all the optics are mounted. In short, the OTE is the Telescope, and it is now taking shape before our eyes.

The Primary Mirror Backplane Support Structure (PMBSS), made of lightweight carbon fiber composite material (cf. Clampin; Summer 2015 Newsletter), arrived at NASA Goddard Space Flight Center on August 25 after shipment from prime contractor Northrop Grumman Aerospace Systems (NGAS). The eighteen PMSAs and the secondary mirror were already stored at GSFC and shimmed for installation on the PMBSS. Before optical integration could begin in Goddard's Space Systems Development and Integration Facility (SSDIF), however, the electrical harnesses that among other things connect the power system on the spacecraft bus (undergoing I&T at NGAS) to the gear motors and actuators that provide fine positioning of the PMSAs and secondary mirror, had to be installed on the PMBSS. The ability to adjust the mirrors in space is required in order that the primary segments can be "phased" and act as one monolithic mirror. The secondary mirror must also be adjustable in this manner.

Following installation of the harnesses, the two PMBSS "wings," each of which holds three PMSAs, were deployed from their stowed (folded) positions, and the entire deployed backplane was lifted and placed on the Ambient OTE Assembly Stand (AOAS) in SSDIF in November. Seeing the large backplane transit the SSDIF at a considerable height off the floor was an unforgettable sight! It is while PMBSS is on AOAS that the PMSAs are placed and bonded into position on the PMBSS using a high-precision robotic arm. But before that could begin, detailed metrology of the PMBSS position and orientation on the AOAS had to be carried out.

After metrology targets were placed along its hexagonal perimeter, the first PMSA was installed on the backplane on November 22, a true milestone. At the time of this writing, we have just completed installation of all eighteen PMSAs, and the schedule calls for the secondary mirror and the Aft Optics System (AOS, which holds the tertiary and fine steering mirrors), to be in place in February. As the PMSAs were installed on the backplane, their gear motors and actuators were exercised to prove functionality. The same is true of the secondary mirror and the fine steering mirror within AOS (the tertiary mirror is a fixed, unpowered optic).



Clockwise from top left:

The telescope structure upright in the cleanroom at NASA Goddard, wings folded. Credit: NASA/Chris Gunn

The telescope structure is lifted to the assembly stand by crane. Note its wings are now extended. Credit: Maggie Masetti

The telescope structure in the assembly stand, ready for mirror installation. Credit: NASA/Chris Gunn

The first mirror is installed on the James Webb Space Telescope. Credit: NASA/Chris Gunn

All 18 primary mirror segments are installed on the James Webb Space Telescope. Credit: NASA/Chris Gunn.

Looking beyond the OTE's completion, the following is a brief sketch of some of what will happen.

JWST's Integrated Science Instrument Module (ISIM) is currently completing its third and final cryovacuum test in GSFC's Space Environmental Simulator (SES; cf. Kimble, 2015 Summer and previous Newsletters for a description of these ISIM cryovacuum tests). Following the completion of "ISIM CV3" after about 100 days of testing, ISIM and the completed OTE will be ready for integration into the next larger assembly: OTIS. This is currently slated to begin by April 2016, at Goddard. Additional items will be integrated onto OTIS over the next several months, after which the completed OTIS will undergo ambient "environmental testing" (e.g., vibration and acoustic) for a period of about five months. Upon completion of this OTIS test suite at Goddard, OTIS will be shipped in December (2016) to the Johnson Space Center (JSC) for its cryovacuum test in JSC's large "Chamber A."

The test is currently scheduled to run for about 90 days starting by about January, 2017.

The final phase of JWST's I&T flow involves the addition of the sunshield and the spacecraft elements to OTIS. This will take place after OTIS ships to NGAS following the JSC Chamber A test. Additional testing will take place at NGAS, this time of the full Observatory. Launch, telescope commissioning, and the initiation of JWST's exploration of the universe follow in sequence.

But that is getting a little ahead of the story. We have much work to do in the next few years, including—not discussed here—completion of the "Pathfinder" cryovacuum tests (cf. Bowers, 2015 Summer Newsletter). Look to this space for reports of future developments.

In summary, the pace of progress on JWST's path towards launch is strong, and we are witnessing the building of a superb telescope.

The 18th and final James Webb Space Telescope primary mirror segment is installed at NASA Goddard. Credit: NASA/Chris Gunn

The James Webb Space Telescope Science Timeline

By Neill Reid

The James Webb telescope (JWST) is scheduled for launch in October 2018. The first science observations will begin after the six month deployment and commissioning activities, in April 2019. The preparations for those observations, however, begin much earlier, as illustrated in Figure 1, which shows the current science timeline. Observations with JWST are shared between Guaranteed Time Observers (GTOs: the Principal Investigators of the Instrument Teams, Interdisciplinary Scientists and the Telescope Scientist, who have helped develop JWST), and Guest Observers (GOs), drawn from the broad astronomical community. The GTOs will submit their proposed Cycle 1 observations in April 2017, in response to the Call for Proposals (CP). Those observations, which will likely account for ~25% of the time available in Cycle 1, will be finalized and published by June 2017.

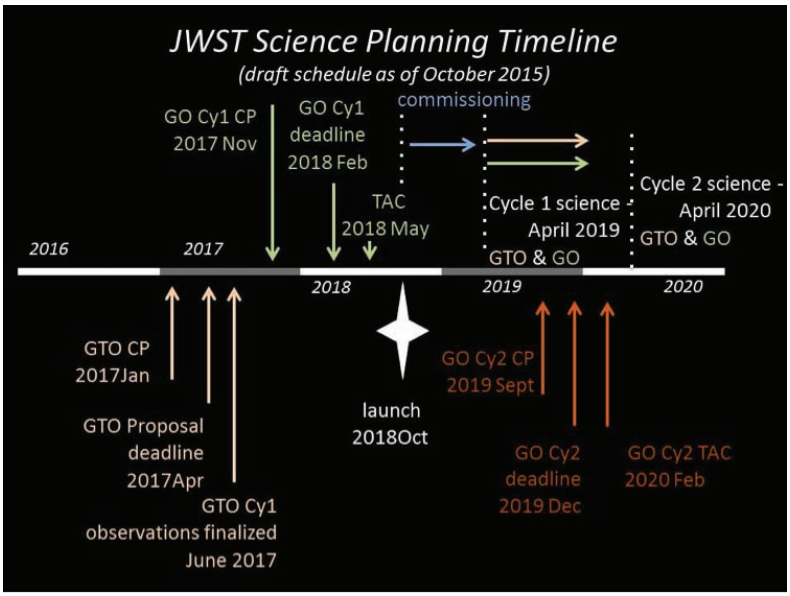


Figure 1: The GO proposal schedule for JWST Cycles 1 and 2

Between 5,000 and 6,000 hours will be available for GO proposals from the general astronomical community in JWST Cycle 1. The GO Call for Proposals will be issued in November 2017, with proposals due in February 2018. GO proposals may not duplicate GTO observations without a clear scientific justification (for example, repeat observations to measure photometric variability or proper motions). The proposals will be subject to peer review, with the Telescope Allocation Committee (TAC) meeting in May 2018 to recommend the final program.

The Cycle 2 proposal schedule is more condensed. The GO Call for Proposals will be issued in September 2019, with the proposal deadline set for December 2019 and the TAC meeting in February 2020. With the proposal deadline only 7 months into the cycle, members of the GO community could be faced with very limited access to JWST science data as they prepare their Cycle 2

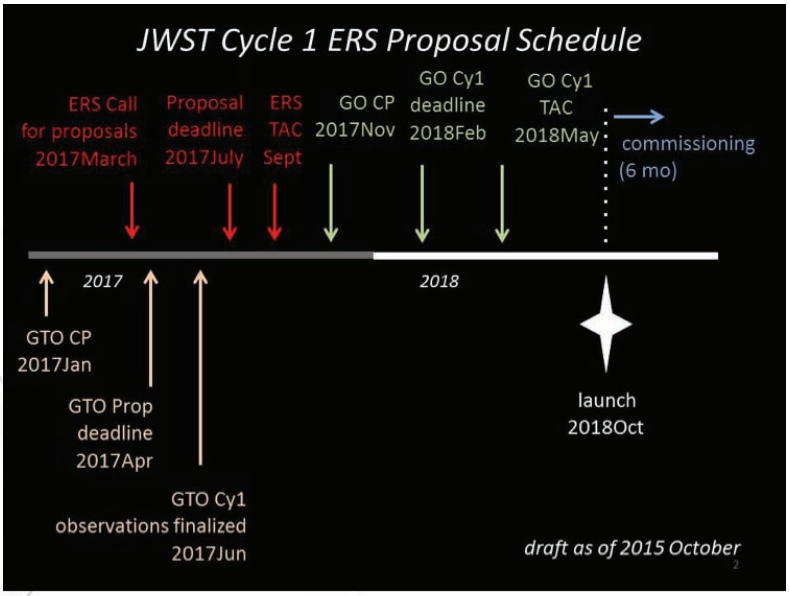


Figure 2: The draft schedule for Early Release Science observations

observing proposals. Following the recommendation of the JWST Advisory Committee (JSTAC), we will address this issue through an Early Release Science (ERS) program, undertaken relatively early in Cycle 1 using Director's Discretionary Time.

The ERS program will comprise a suite of science-driven observing programs, designed by the community and selected through proposal peer review. Programs will be selected to span key observing modes, technical challenges, and science areas. Approximately 500 hours of Director's Discretionary Time will be made available for the program.

The anticipated timeline for the ERS program is shown in Figure 2. The Call for Proposals will be issued in March 2017, and may be preceded by a call for mandatory Notices of Intent to allow appropriate planning. The proposal deadline will be after the GTO Cycle 1 observations have been finalized and published, and the program selected by peer review in September 2017. The results will be publicized with the GO Cycle 1 Call in November 2017. The ERS call will be the first opportunity for the GO community to apply for JWST time.

The ERS program will present the community with an exciting opportunity to rapidly gain expertise through hands-on analysis of scientifically compelling data sets in JWST's complex instrument modes. More information on the JWST ERS program will be posted here, http://www.stsci.edu/jwst/science/ers and was presented at the JWST Town Hall at the Jan 2016 American Astronomical Society meeting.

Exploring the Universe with JWST – 49th ESLAB symposium

by Pierre Ferruit

During the week of the 12th to 16th of October 2015, an international conference dedicated to the presentation and discussion of future scientific research that will be enabled by JWST was organized. Entitled "Exploring the Universe with JWST – 49th ESLAB symposium", it took place at the European Space Agency ESTEC center in the Netherlands.

A total of 200 researchers attended the conference, giving talks, presenting posters or simply listening to and participating in the discussion sessions. Reflecting the richness and variety of JWST scientific goals, the presentations covered scientific topics ranging from studies of planets and planetary systems (including our Solar System) to deep imaging and spectroscopic surveys targeting the reionization epoch and the birth of the first galaxies.

The presentations given during the conference are now available at the following address:

http://www.cosmos.esa.int/web/jwst/conferences/jwst2015

We are progressively adding the posters and discussion summaries to this web site.

JWST Guest Speakers

Would you like a colloquium at your university on JWST? How about a talk at a conference you are organizing? These JWST scientists are willing to give a talk. The JWST project has allocated some funding to pay the expenses for talks in the US; talks in other countries can also be arranged. In addition to the specific topics listed below, the speakers are also available to give JWST Mission Overview talks and talks at the general public level.

- Rene Doyon, Universite de Montreal, "JWST NIRISS Science"
- Jonathan Gardner, GSFC, "JWST and Galaxy Evolution"
- Matt Greenhouse, GSFC, "JWST Mission Overview and Status"
- Heidi Hammel, AURA, "Planetary Exploration with JWST"
- Jason Kalirai, STScI, “Resolved Stellar Populations in the Near IR with JWST”
- Jonathan Lunine, Cornell University, "JWST, Exoplanets, and the Solar System"
- John Mather, GSFC, "JWST Mission Overview and Status"
- Michael McElwain, GSFC, “JWST Exoplanetary Science”
- Stefanie Milam, GSFC, “Innovative Solar System Science with JWST”
- Bernie Rauscher, GSFC, “JWST and its HAWAII-2RG and SIDECAR ASIC Detector Systems”
- George Rieke, University of Arizona, "Debris Disks and the Evolution of Planetary Systems," or “The Place of JWST in the Growth of Infrared Astronomy”
- Marcia Rieke, University of Arizona, "NIRCam for JWST: Exoplanets to Deep Surveys"
- Jane Rigby, GSFC, “Gravitationally Lensed Galaxies and JWST,” or “AGN and JWST”
- Eric Smith, NASA HQ, “Why are we building the James Webb Space Telescope?” or “JWST: Lessons Learned (so far)”
- George Sonneborn, GSFC, "Imaging and Spectroscopy with JWST"
- Massimo Stiavelli, STScI, "Studying the first galaxies and reionization with JWST"
- Amber Straughn, GSFC, "JWST and Galaxy Assembly"
- Chris Willot, NRC, “JWST Spectroscopy of the Distant Universe”
- Rogier Windhorst, Arizona State University, "First Light, Reionization and Galaxy Assembly with JWST" or "JWST and Supermassive Black Hole Growth"

To arrange a talk, please email jwst-science@lists.nasa.gov or contact the speaker directly. For European universities and institutions interested in inviting speakers to give talks covering the full range of scientific topics addressed by JWST, please contact Pierre Ferruit (ESA JWST Project Scientist, ESTEC, pferruit@rssd.esa.int).

Upcoming Conferences with Invited JWST Presentations

American Association for Advancement in Science Annual Meeting
Washington DC
February 11-14 2016
http://www.aaas.org/

Lorentz Center: Globular Clusters and Galaxy Halos
Leiden, The Netherlands
February 22-26 2016
http://lorentzcenter.nl/lc/web/2016/756/info.php3?wsid=756&venue=Oort

STScI Spring Symposium: What Shapes Galaxies: Rewriting the Hubble Sequence
Baltimore, MD
April 25-28 2016
http://www.cvent.com/events/2016-spring-symposium-what-shapes-galaxies-/event-summary-5a5fdf05ce3b48a38d7025e994ab807e.aspx

SPIE Astronomical Telescopes + Instrumentation
Edinburgh, UK
26 June – 1 July 2016
http://spie.org/conferences-and-exhibitions/astronomical-telescopes-and-instrumentation

XII Scientific Meeting of the Spanish Astronomical Society
Bilbao, Basque Country, Spain
19-22 July 2016
http://www.sea-astronomia.es/SEA2016

First Stars V
Heidelberg, Germany
1-5 August 2016
http://www.lsw.uni-heidelberg.de/FirstStarsV/

Mastering the Science Instruments and Observing Modes of JWST - On your mark
European Space Astronomy Center (ESAC) – Madrid, Spain
26-28 September 2016
http://www.cosmos.esa.int/web/jwst/esac2016
email: jwst_2016@sciops.esa.int

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