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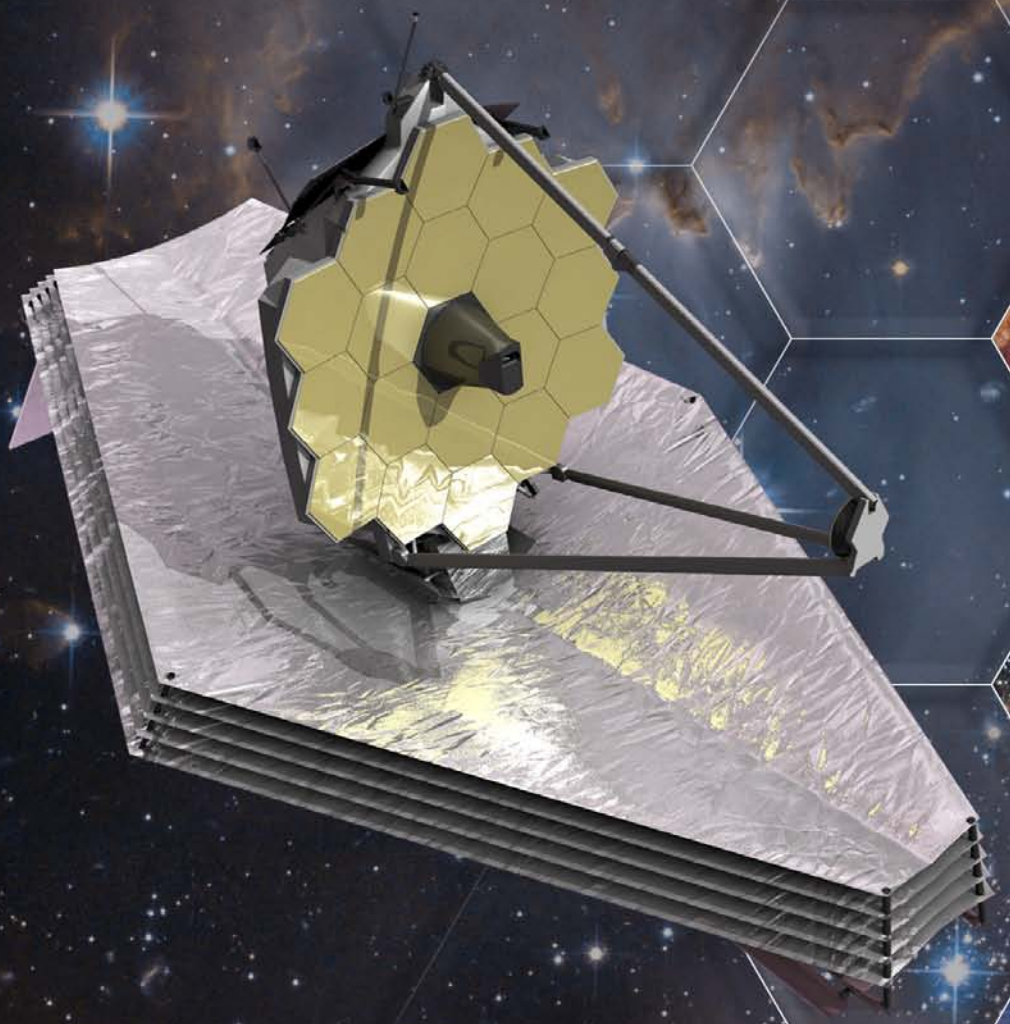

Webb

Update

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Issue #13, September 2012

James Webb Space Telescope

JWST Science Instruments begin their arrival at Goddard for Integration & Test

MIRI in the NASA Goddard cleanroom.

By Malcolm Niedner

On May 29 and July 31, the JWST Project witnessed two critical milestones with the arrival at Goddard of the first scientific instruments: first the Mid-Infrared Instrument (MIRI) and then the Fine Guidance Sensor/Near-Infrared Imager and Slitless Spectrograph (FGS/NIRISS). The instrument development teams—the MIRI European Consortium and JPL, and the Canadian Space Agency and ComDev, respectively—deserve high praise and congratulations for these outstanding achievements!

Within the next year, MIRI and FGS/NIRISS will be joined at Goddard by the Near-Infrared Camera and the Near-Infrared Spectrograph. Over the course of the next several years, all four instruments will be mounted and aligned on the already built and tested Integrated Science Instrument Module (ISIM) structure, and go through several cycles of rigorous cryogenic testing in Goddard's SES thermal vacuum chamber (refer to Randy Kimble's article in the May 2012 Webb Update for more details).

Looking further down the road, following the successful completion of these tests the ISIM will be mated at Goddard to the Optical Telescope Element to become "OTIS." Cryogenic testing of OTIS will take place in Chamber A at the Johnson Space Center (see Mary Cerimele's accompanying article in this Issue) and will represent the largest built-up assembly of JWST to be tested at space temperatures. The last pieces—the spacecraft and sunshield—will be mated to OTIS at Northrop Grumman Aerospace Systems in Redondo Beach, CA, and at that point the launch in 2018 will not be far off.

MIRI will observe over the wavelength range of 5-28.5 microns—the farthest foray into the infrared of any of JWST's instruments. Containing an abundance of observing modes in imaging, spectroscopy, and coronagraphy, MIRI will provide critical data on cold molecular clouds and star formation sites, stellar debris disks and protoplanetary systems and, far from least, fledgling galaxies at distances well beyond Hubble Space Telescope's reach or that of any other current/planned ground or space facility. Following receipt at Goddard, MIRI went through a "post-ship functional test," which it passed, as well as metrology testing—the instrument is in great shape. More details on MIRI can be found in an article by Gillian Wright,and George Rieke, in the Summer 2011 Webb Update.

FGS/NIRISS in the NASA Goddard cleanroom.

FGS/NIRISS in the NASA Goddard cleanroom.

As the name implies, FGS/NIRISS is a two-module instrument that performs double duty on JWST: 1.) service to the telescope and other instruments via the Fine Guidance Sensor; and 2.) science through the imaging and spectroscopic capabilities of NIRISS. These efforts were lead by John Hutchings and René Doyon. The FGS is the heart of JWST's Attitude Control System, locking onto a single guide star and precisely maintaining its line-of-sight position within the FGS field of view (the star trackers—all mounted at large angles with respect to the science line-of-sight—control spacecraft roll). FGS is therefore absolutely key to establishing the tight pointing performance needed by all the science instruments.

The NIRISS replaces the Tunable Filter Imager (TFI) which was dropped because of development difficulties. For a summary of NIRISS science and development, refer to the Winter 2012 Webb Update and the article by René Doyon. The change from TFI to NIRISS was accomplished on an extremely challenging and tight schedule. This was a remarkable achievement, and one that is recognized as such by a very grateful Project.

Modifications Complete for Johnson Space Center's Chamber A

By Mary Cerimele & Brandi Dean

An upgrade eight years in the making is complete, and Johnson Space Center is now home to the only vacuum chamber in the world that is large enough and cold enough to provide a space-like environment for the James Webb Space Telescope.

While the rest of Houston was sweltering through the August heat, JSC's massive Chamber A successfully made it down to 11 Kelvin (K) – about 440 degrees below zero on the Fahrenheit scale. That accomplishment is the result of work that started with a feasibility

Chamber A and part of the JSC JWST team

study in 2004. The design work was then done in 2007 and 2008, before demolition and reconstruction began in 2009. It was topped off by a successful, three-week functional test of the entire integrated chamber system with all its new components working together for the first time. Initial performance of all the new subsystems was even better than predicted during this initial test drive.

To make Chamber A – a National Historic Landmark which has been used to test space vehicles and components for all major programs since Apollo – cold enough, clean enough and quiescent enough to test a telescope like JWST, a number of modifications were made, both to the vacuum chamber itself and to its building infrastructure. Helium and liquid nitrogen shrouds were installed, along with their respective refrigeration and delivery systems; the vacuum system was switched to oil-free; and the chamber's data, power, control, and air flow systems were all upgraded – to name just a few of the modifications. Most significantly, the entire system for supplying liquid nitrogen to the chamber interior was redesigned and re-plumbed. It went from a powered, pump-fed system with well over a hundred valves – all potential reliability risks – to a passive, thermo-siphon system with less than two dozen valves. Not only will it keep working even during a power outage or a hurricane, but it uses less than half the liquid nitrogen as before. Now that the modifications are complete and have been shown to be successful, the next step is to install a class 10000 cleanroom zone to the front of the chamber. Construction will start in February, spearheaded by Goddard Space Flight Center and the JWST program, and the new walls will obscure Chamber A's famous 40-ton door. But you can still catch a glimpse of it closing majestically in the 1998 movie, *Armageddon.*

Pieces of the JWST ground support equipment are scheduled to start arriving at JSC for testing in early 2014, followed by an engineering development unit "Pathfinder" test article. By 2017, Chamber A will have performed a half dozen lead-in tests for the program and be ready to test the one-of-a-kind flight telescope in a full-up thermal vacuum environment. This series of tests leading up to the final test of the flight unit will go a long way toward reducing the technical risks that naturally accompany such a technologically ambitious science mission.

JWST Programmatic Update

By Eric Smith

The past several months have been highly productive ones for the JWST program with major hardware deliveries and milestones as described in this Issue. The project has also undergone a change in senior management.

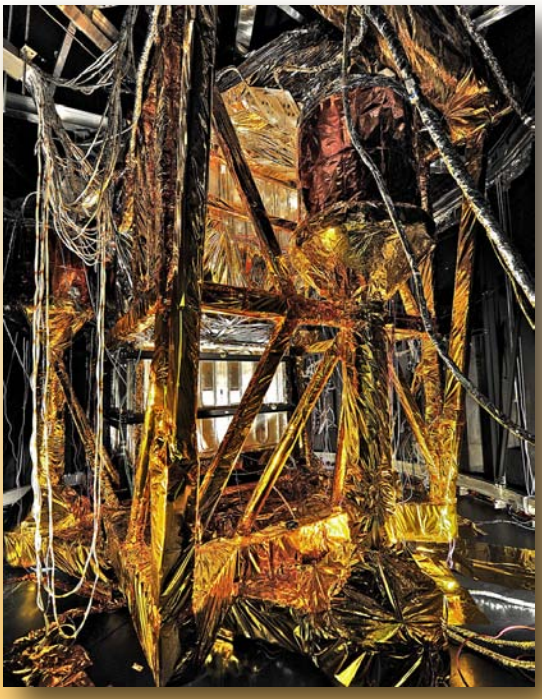
In addition to the two instrument deliveries to Goddard, instrument performance testing continues on JWST's NIRCam at Lockheed-Martin, Palo Alto. It is finishing its first cycle of cryogenic testing and will be coming to Goddard later in the Fall of this year. The European Space Agency's NIRSpec instrument is being re-assembled at Astrium in Germany after last year's finding that its initial flight optics bench had flaws. Flight optics are being installed on a flight spare bench and they expect to re-enter instrument level testing this Fall.

Richard Howard retired from NASA, leaving his position as JWST Program Director. Geoff Yoder, former Deputy Director of the Astrophysics Division, was appointed as the new Program Director. Mr. Howard was awarded the NASA Outstanding Leadership medal for his work in developing the replan that has put JWST on its current successful path, both in budget and schedule. Since the program began its replanned effort (early 2011) it has remained within

budget and has actually increased its funded schedule reserve from 13 to 14 months to the October 2018 launch readiness date. Mr. Yoder brings years of large program management experience to JWST as well as his familiarity with the US astronomical community goals from his time as Astrophysics Deputy Director.

The JWST team is looking forward to community engagement at several upcoming large meetings. First, JWST will be represented at the Division of Planetary Science Annual Meeting in Reno on October 14-19th, 2012. In addition to our booth presence, we are organizing a special workshop titled "Planning your Solar System Observations with JWST". This workshop will take place from 9 am to noon on Sunday October 14th, and will cover topics such as moving target capabilities, bright observing modes, imaging and spectroscopic sensitivities for Solar System objects, and much more.

The JWST team will also have a strong presence at the winter AAS Long Beach meeting (January 6-10th, 2013). Scientists will be on hand at the STScI/JWST booth, and will be available to answer questions about the observatory status and science potential. This year's meeting will also feature a special JWST science session on Monday January 7th at 2 pm, featuring a half dozen science talks by members of the AAS. Finally, we will organize a JWST Town Hall meeting on Wednesday January 9th at 12:45 pm to provide a quick update on the status of JWST. The science speaker at this year's Town Hall meeting will be Caltech astronomer, and recent Kavli Prize winner in Astrophysics, Mike Brown.



OSIM in the SES at NASA Goddard.

JWST Family Science Night at NASA Goddard.

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.

- Mark Clampin, GSFC, "Exoplanets with JWST"
- 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"
- 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”
- 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"
- 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).

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