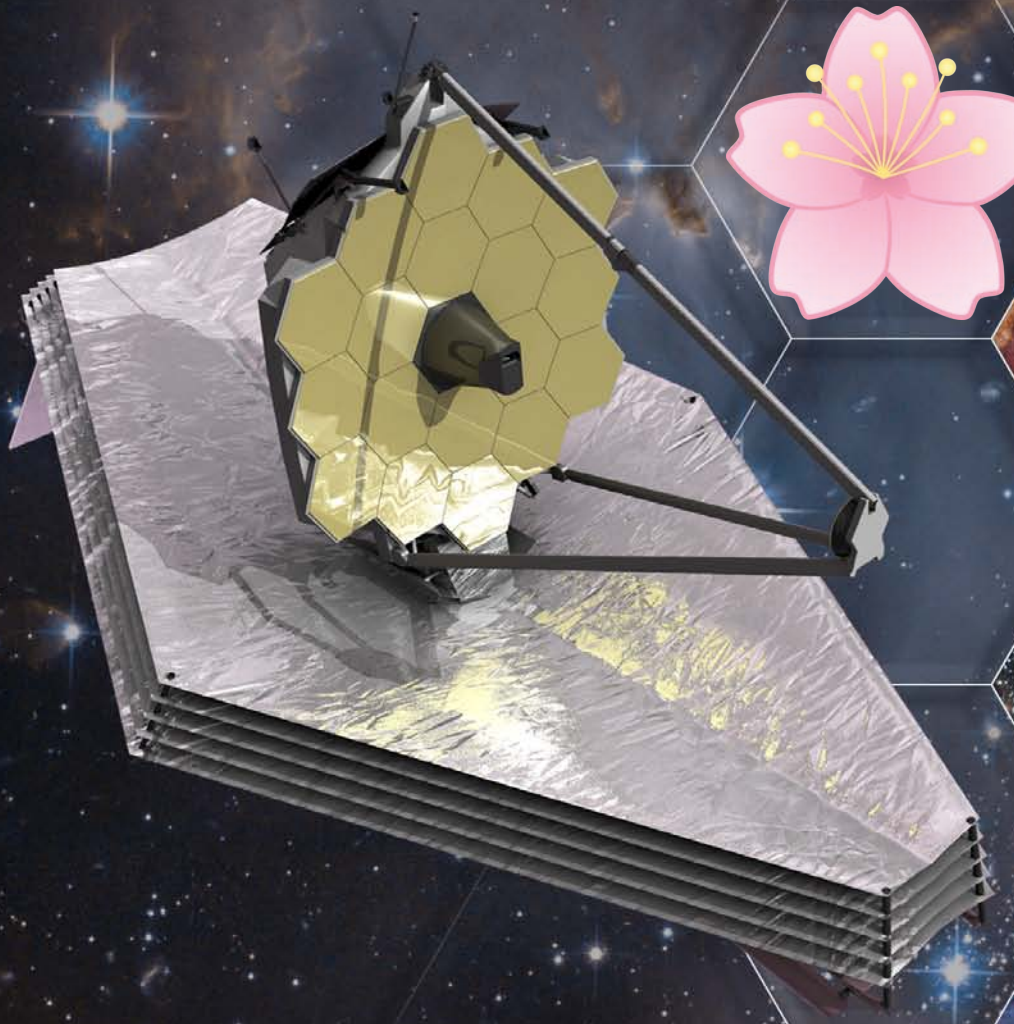
National Aeronautics and Space Administration



Webb

Update

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Webb Update

Issue #15, April 2013

James Webb Space Telescope

ISIM Nears Readiness for Space Simulation Testing

By Matt Greenhouse

The Integrated Science Instrument Module (ISIM) is the science instrument payload of the JWST. It is a 1.4 metric ton element of the space vehicle consisting of four science instruments, a fine guidance sensor, and nine other systems (Lundquist et al., Proc SPIE, vol. 8442, 2012). During July 2013, the ISIM will undergo the first of three planned element-level tests in a simulated space environment. This test will occur in Goddard's Space Environment Simulator (SES), and will be the largest and most complex deep cryogenic test that NASA has ever conducted. We call it CV-1RR.

During this test (Figure 1), the ISIM will be put through its paces using a high fidelity simulator of the JWST telescope (Sullivan et al., Proc SPIE, vol. 7731, 2010). This simulator (Figure 2) is currently undergoing its second and final cryogenic certification test, which will be completed in May. The ISIM will then be installed into the SES, and the CV-1RR test will run during July through October, 2013.

All of the individual systems of the ISIM have completed flight qualification testing prior to their delivery to ISIM integration. The CV-1RR test will be the first time that these systems have functioned together at the ISIM-element level of assembly. The ISIM flight qualification testing is very complex. This first test will be a risk reduction activity (hence, the RR designation) which includes some of the tests necessary for full flight qualification. The ISIM configuration for the CV-1RR will include two of four science instruments—FGS/NIRISS (Doyon Proc SPIE, vol. 8442, 2012) and MIRI (Wright et al., Proc SPIE, vol. 7731, 2010)—and will use pre-flight builds of its two software systems, but will otherwise be complete.

The CV-1RR test will be followed by two additional cryogenic performance tests (CV-2 and -3) of the ISIM with all four science instruments. Those tests will bracket room-temperature vibration and acoustic tests that simulate the launch environment . CV-2 and CV-3 will occur during spring of 2014 and 2015, and will complete the full performance verification and flight qualification of the ISIM ahead of its delivery for integration with the telescope at Goddard during October of 2015.

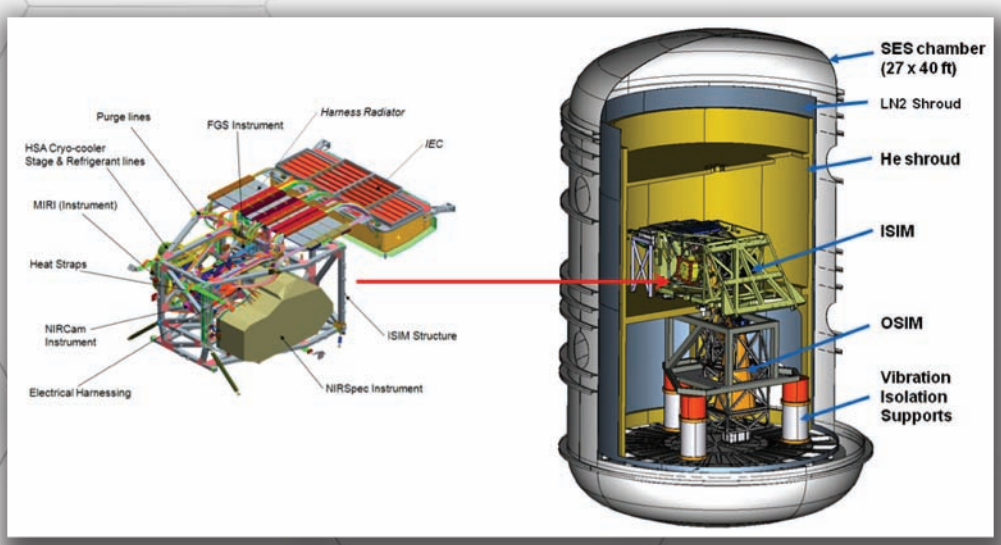


Figure 1: The cryogenic portion of the ISIM system (left) is shown in its test configuration (right) for the CV-1RR. A high fidelity simulation of the JWST telescope beam is fed from below into the ISIM by an Optical SIMulator (OSIM) that is mounted on vibration isolators. The SES vacuum vessel is equipped with nitrogen and helium shrouds to enable testing at the 40K nominal flight operating temperature.

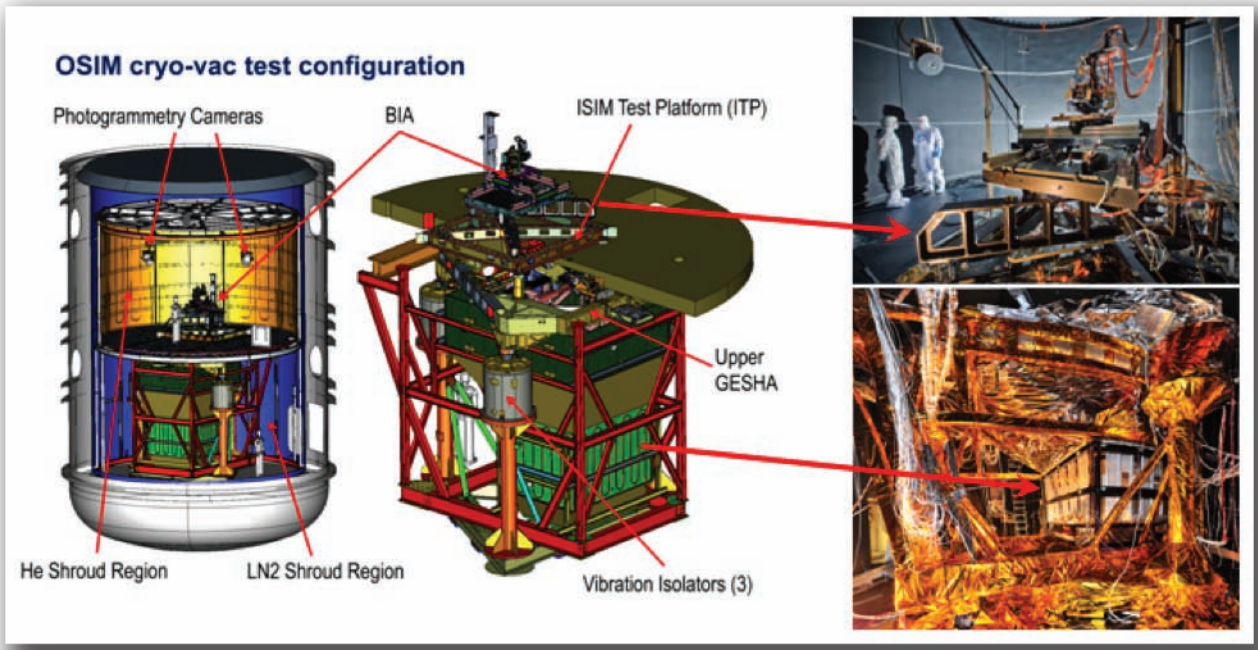


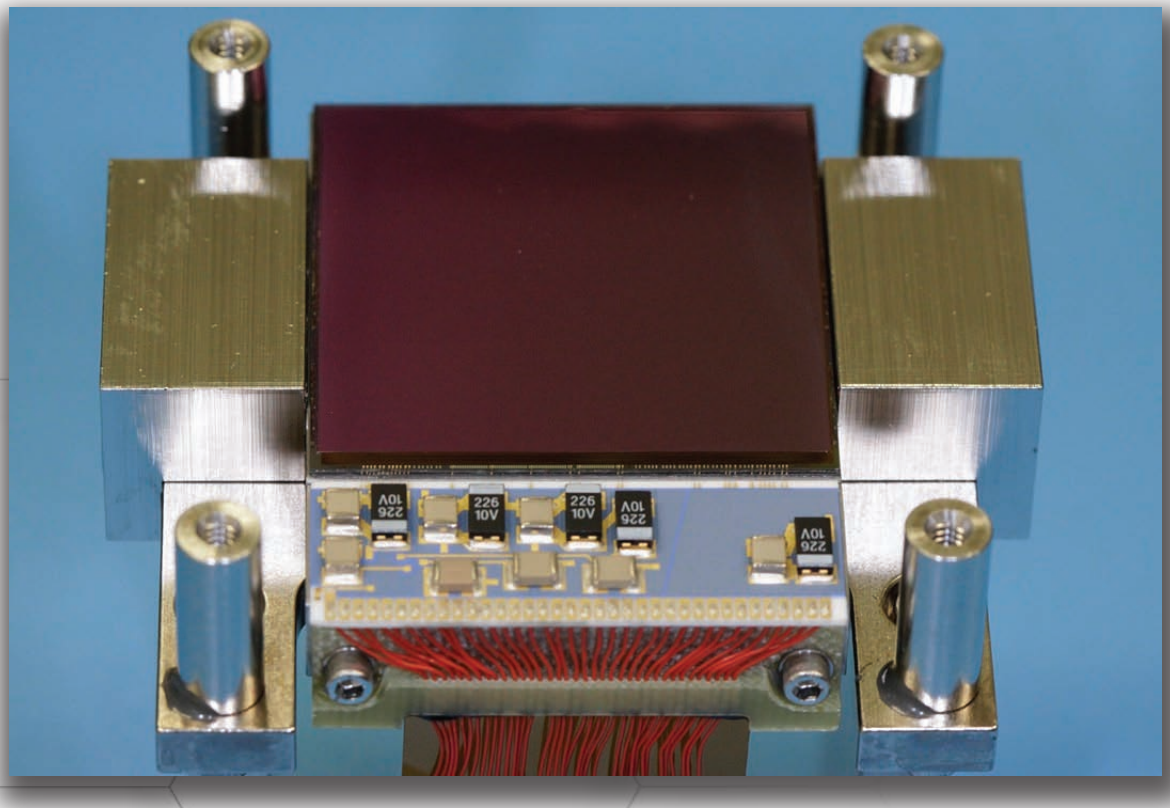
Figure 2:The OSIM test configuration is shown (left) with a Beam Image Analyzer (BIA) in place of the ISIM. The BIA is an instrument package that is designed to verify the fidelity of the simulated telescope beam. Photographs (right) show the OSIM and BIA in the SES chamber. Note personnel at upper right for scale.

Figure 3: The flight FGS/NIRISS instrument is shown being integrated with the ISIM structure in preparation for the CV-1RR test.

JWST Detector Update

By Bernie Rauscher

In order for the James Webb Space Telescope to achieve it's science goals, new cutting-edge near-infrared array detectors had to be developed. The new Teledyne detectors—named "H2RGs"—will be used in three of Webb's four science instruments: the Near Infrared Camera (NIRCam), Near Infrared Spectrograph (NIRSpec), and the Fine Guidance Sensor & Near-Infrared Imager and Slitless Spectrograph (FGS/NIRISS). These detectors include an "improved barrier layer" design that increases the ground storage lifetime (Rauscher et al. 2012, AIP Advances, 2(2), 021901.) In addition, the new H2RGs incorporate other minor improvements in the process. Testing at Teledyne and at the University of Arizona has shown that the new design reduces read noise by about 10% and possibly increases quantum efficiency. Production at Teledyne has gone very well, and is running ahead of schedule. Currently, NIRCam has 13 flight-candidate 2.5 μm cutoff H2RGs, of which 8 are needed for flight. The new 5 μm cutoff detectors are just starting to arrive now.



This new 2Kx2K pixel NIRCam sensor chip assembly incorporates improved barrier layers to increase the ground storage lifetime. It is somewhat higher performing than the previous parts, and production is currently running ahead of schedule.

"Give me data now!" HST and JWST Will Get On-demand Archives

By Jane Rigby and Gretchen Greene

When querying the Hubble Space Telescope science archive, users have had to wait a few hours between asking for a dataset and downloading the data. The HST archive uses an "on-the-fly" calibration scheme, in which the latest calibrations are applied only after a user requests a particular dataset. Under this scheme, that users always get the most recent calibrations, but at the cost of having to wait a few hours. The delay doesn't work well with the multi-wavelength Virtual Observatory or other on-demand data services.

The Hubble Legacy Archive demonstrates a different approach, in which calibrated science data products are prepared in advance, and made available for immediate download. This approach lets users data-mine, explore, and interact with datasets, and opens the door to interoperability with the worldwide virtual observatory.

The JWST archive will adopt a hybrid approach that combines the best of both of these approaches. The JWST Data Management Subsystem (DMS), currently under development, will ingest, calibrate, archive, and recalibrate JWST data, and will serve JWST data to scientific users. The JWST DMS will take advantage of gains in computational power to dynamically create and recreate calibrated science data products. As improved calibrations become available, the JWST archive will identify which science datasets are affected, then automatically reprocess and re-calibrate the data. We call this dynamic background reprocessing. As a result, when a user requests science data, the best-calibrated data will be available for immediate download, at least 95% of the time. In the other 5% of the time, the system will reprocess the data on-the-fly, and notify the user when done. This scheme of dynamic back ground reprocessing will demand more of the JWST archive, but will pay off in allowing users to immediately access JWST data. It will also enable the virtual observatory and other portals to access JWST data.

This scheme of reprocessing the archive in the background was developed for JWST, but has proven so successful, that the HST Project will adopt it for the HST archive, starting in Summer 2014. The result will give HST users a more powerful archive, one that serves them their data immediately, and works well with on-demand services like the virtual observatory. Thus, the ongoing development of the JWST archive will result in an improved archive for HST as well. The HST archive's adoption of background reprocessing will also provide clear advantages to JWST: development costs are shared between the two projects; and HST's operational use will translate to reduce costs and risk for JWST.

Infrared Hubble image of the Horsehead Nebula released for 23rd annivesary of the telescope.

JWST Budget News

By Eric Smith

The President's fiscal 2014 budget request for NASA includes the "replan" figure for JWST to keep the program on track for its 2018 launch. The good performance of the project since the replan in the three-space defined by technical, fiscal and schedule areas has clearly played an important role in decision makers budget planning. Since the replan, the Program has stayed within its budget guidelines, increased its schedule reserve by one month, and completed numerous challenging technical milestones. As we move deeper into the integration and test phases of the project, maintaining the strong fiscal and schedule discipline developed over the past two years will be important for retaining the high levels of support the Program now receives from Congress and the Administration.

This calendar year we've begun the physical integration of the science instruments into ISIM. Starting with the Canadian Space Agency's FGS/NIRISS and soon to be followed by the European/JPL instrument MIRI, the ISIM will gets its first risk reduction cryogenic test in the late summer. The primary imaging camera, the University of Arizona's NIRCam, will be arriving in June followed by the final instrument, NIRSpec, from the European Space Agency. These will be exciting and challenging activities as the instruments are integrated and tested at the next higher level of observatory assembly.

The fiscal 2014 request would change how the government funds STEM education activities. In the future those activities would be funded by the Department of Education for K-12, NSF for undergraduates and graduates, and the Smithsonian Institution for informal educational outreach activities. Money for STEM EPO in all other agencies would be given to these three agencies who would direct the spending to activities. Many of the details of how this would actually work are yet to be determined. For JWST, this means that funds in the project budget for EPO were removed from the fiscal 2014 and out-year budgets. However, since the work that went with this also was removed from the project's responsibility it does not represent a reduction that would affect the ability of NASA to maintain its development schedule.

JWST Full Scale Model at the South By Southwest Interactive Festival in Austin, TX, March 8-10, 2013. Representatives from NASA, NGAS, STScI, and institutional partners interacted with 15,000+ people in person and millions through online interactions.

JWST Talks

Would you like a colloquium at your university on JWST? How about a talk at a conference you are organizing? Or a public lecture about JWST? Please email jwst-science@lists.nasa.gov.

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