

# James Webb telescope completes mirror-coating milestone

September 13 2011

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The first six flight ready James Webb Space Telescope's primary mirror segments are prepped to begin final cryogenic testing at NASA's Marshall Space Flight Center in Huntsville, Ala. Credit: NASA/Chris Gunn

(PhysOrg.com) -- NASA's James Webb Space Telescope has reached a major milestone in its development. The mirrors that will fly aboard the telescope have completed the coating process at Quantum Coating Inc. in Moorestown, N.J.

The telescope's mirrors have been coated with a microscopically thin

layer of gold, selected for its ability to properly reflect infrared light from the mirrors into the observatory's science instruments. The coating allows the Webb telescope's "infrared eyes" to observe extremely faint objects in infrared light. Webb's mission is to observe the most distant objects in the universe.

"Finishing all [mirror](#) coatings on schedule is another major success story for the Webb [telescope](#) mirrors," said Lee Feinberg, NASA [Optical Telescope](#) Element manager for the Webb telescope at the agency's Goddard Space Flight Center in Greenbelt, Md. "These coatings easily meet their specifications, ensuring even more [scientific discovery](#) potential for the Webb telescope."

The Webb telescope has 21 mirrors, with 18 mirror segments working together as one large 21.3-foot (6.5-meter) primary mirror. The mirror segments are made of beryllium, which was selected for its stiffness, light weight and stability at [cryogenic temperatures](#). Bare beryllium is not very reflective of near-infrared light, so each mirror is coated with about 0.12 ounce of gold.

The last full size (4.9-foot /1.5-meter) hexagonal beryllium primary mirror segment that will fly aboard the observatory recently was coated, completing this stage of mirror production.

The Webb telescope is the world's next-generation [space observatory](#) and successor to the [Hubble Space Telescope](#). The most powerful space telescope ever built, the Webb telescope will provide images of the first galaxies ever formed, and explore planets around distant stars. It is a joint project of NASA, the [European Space Agency](#) and the [Canadian Space Agency](#).

Mirror manufacturing began eight years ago with blanks made out of beryllium, an extremely hard metal that holds its shape in the extreme

cold of space where the telescope will orbit. Mirror coating began in June 2010. Several of the smaller mirrors in the telescope, the tertiary mirror and the fine steering mirror, were coated in 2010. The secondary mirror was finished earlier this year.

Quantum Coating Inc. (QCI) is under contract to Ball Aerospace and Northrop Grumman. QCI constructed a new coating facility and clean room to coat the large mirror segments. QCI developed the gold coating for performance in certain areas, such as uniformity, cryogenic cycling, durability, stress and reflectance, in a two-year effort prior to coating the first flight mirror.

In the process, gold is heated to its liquid point, more than 2,500 Fahrenheit (1,371 degrees Celsius), and evaporates onto the mirror's optical surface. The coatings are 120 nanometers, a thickness of about a millionth of an inch or 200 times thinner than a human hair.

"We faced many technical challenges on the Webb mirror coating program," said Ian Stevenson, director of coating at Quantum Coating. "One of the most daunting was that all flight hardware runs had to be executed without a single failure."

The mirror segments recently were shipped to Ball Aerospace in Boulder, Colo., where actuators are attached that help move the mirror. From there, the segments travel to the X-ray and Calibration Facility at NASA's Marshall Space Flight Center in Huntsville, Ala., to undergo a final test when they will be chilled to -400 Fahrenheit (-240 degrees Celsius). The last batch of six flight mirrors should complete the test by the end of this year.

Provided by NASA's Goddard Space Flight Center

Citation: James Webb telescope completes mirror-coating milestone (2011, September 13)  
retrieved 10 April 2024 from

<https://phys.org/news/2011-09-james-webb-telescope-mirror-coating-milestone.html>

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