NASA's Webb Telescope Completes Mirror Coating Milestone

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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. Northrop Grumman Corporation (NYSE:NOC) is leading the telescope's design and development effort for the space agency's Goddard Space Flight Center, Greenbelt, Md.

"Completion of this coating process on all 18 flight mirror segments is another very important milestone for the program," said Scott Willoughby, vice president and Webb Telescope program manager for Northrop Grumman Aerospace Systems. "One of the most challenging and exacting tasks in building Webb, mirror manufacturing, has been successfully accomplished due to the hard work and dedication of the entire team."

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 Goddard Space Flight Center. "These coatings easily meet their specifications, ensuring even more scientific discovery potential for the Webb telescope."

The Webb telescope has 21 mirrors in total, of which 18 mirror segments work together as one large 6.5 meter (21.3 feet) 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 was recently coated, completing this stage of mirror production.

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 outer space where Webb 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. is under contract to Ball Aerospace and Northrop Grumman. QCI constructed a new coating facility and cleanroom 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 QCI. "One of the most daunting was that all flight hardware runs had to be executed without a single failure."

The mirror segments were recently 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, Huntsville, Ala., to undergo a final test, chilled to -400 Fahrenheit (-240 degrees Celsius). The last batch of six flight mirrors should complete the test by the end of this year.

Successor to the Hubble Space Telescope, the James Webb Space Telescope is the world's next-generation space observatory. It is the most powerful space telescope ever built and now has more than 75 percent of its hardware either completed, in production or undergoing testing. Webb will observe the most distant objects in the universe, provide images of the very first galaxies ever formed and study planets around distant stars. The Webb Telescope is a joint project of NASA, the European Space Agency and the Canadian Space Agency.

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