Scientists assemble new space telescope

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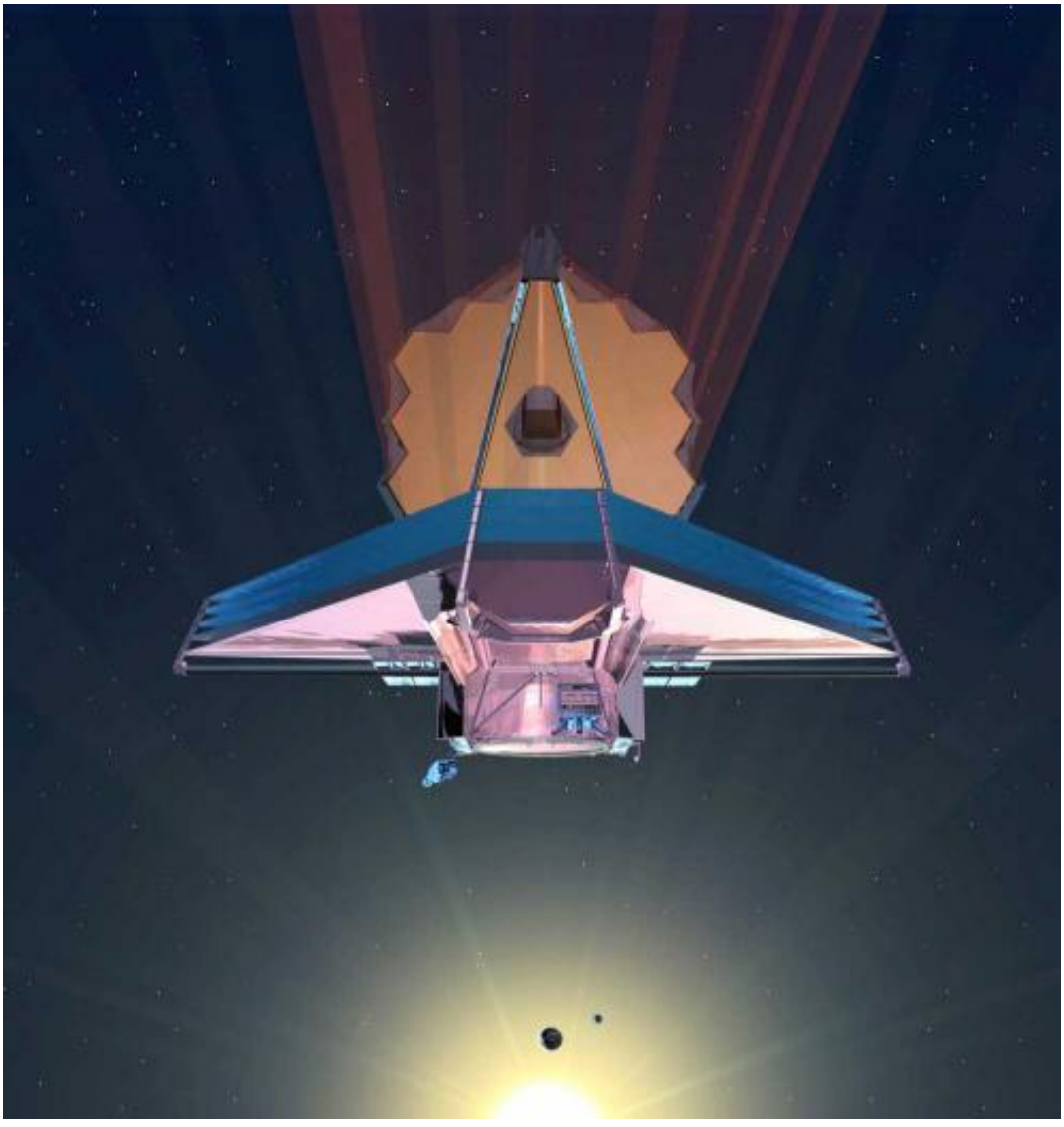

Artist's concept of the James Webb Space Telescope in orbit. Credit: NASA

Scientists and engineers at NASA's Goddard Space Flight Center have begun to assemble and test the James Webb Space Telescope in advance of its 2018 debut.

At the Goddard Space Flight Center, the instruments to the Webb telescope remain in the "clean room" - the central area where scientists are putting it together. Only after taking an air shower and wearing a full-body clean suit and gloves can a scientist enter the area.

"Going into the clean room is like going into an operating room," said Ray Lundquist, a Webb telescope systems engineer, adding that the mirrors' cleanliness is required so that images are guaranteed the highest quality.

The telescope will use four main instruments to detect light from distant galaxies and celestial bodies.

The Near InfraRed Camera, provided by the University of Arizona, is the Webb telescope's main camera and will detect light from the earliest galaxies and stars.

The Near InfraRed Spectrograph, from the European Space Agency, can analyze the spectrum of 100 objects simultaneously and will assist in studying the temperature, mass and chemical components of celestial bodies.

The Mid-InfraRed Instrument, built by European scientists, will be used to detect distant galaxies and newly formed stars.

And the Fine Guidance Sensor/Near InfraRed Imager and Slitless Spectrograph (FGS-NIRISS) will allow the telescope to point accurately and take high-definition images and discover planets outside of the Solar System.

At the heart of the Webb telescope is the primary mirror, 6.5 meters in diameter and made up of 18 beryllium segments that are gold-coated to help capture the most remote infrared light.

"All of the mirrors are built, the backplane is built, and the electronic boxes are built," said Paul Geithner, the Webb telescope deputy project manager. "The sunshield is being built and we're entering assembly and testing."

While the European Space Agency and Canadian Space Agency provided three of the four science instruments, scientists at NASA carry the responsibility of putting all the pieces together and testing to simulate a space environment. The telescope must withstand extreme temperatures, so scientists at Goddard must complete cryogenic cold tests on the Webb's mirrors.

With a budget of $8 billion, the Webb telescope will complement the current Hubble Space Telescope, which scientists expect to retire in 2020. It will be positioned at the L2 Lagrange Point, nearly four times the distance between the Earth and the moon, and circle the sun to gather information about the origins of the universe.

In order to observe even more distant objects, the telescope requires a large mirror. "We needed a primary mirror that is bigger in diameter than the biggest rocket," said Webb telescope project scientist Matthew Greenhouse, who joined the team in 1997.

The Webb telescope is expected to operate for only five to 10 years, but is "100 times more powerful than the Hubble," according to Geithner. "This mission picks up where Hubble left off," he said.

The Earth-orbiting Hubble Space Telescope is roughly the size of a school bus, but the Webb telescope will be the size of a Boeing 737 jet.

The Hubble's primary mirror is 2.4 meters in diameter, and thus has a much smaller field of view than the Webb.

With the help of these robust mirrors built for the Webb telescope, scientists will be able to search for the earliest galaxies that formed after the Big Bang, study the origins of those galaxies, observe how stars and planetary systems develop and even study the chemical properties of planets that could potentially host life.

The process to prepare for the launch of the telescope by 2018 is difficult, Greenhouse said. Scientists are faced with the challenge of preparing the observatory for extreme temperatures and its complicated launch. The primary mirror of the telescope weighs 6 metric tons and must fold up inside the rocket in order to get into space.

The Webb telescope will remain in a "commissioning period" for six months after being launched into space and will spend one week unfolding and aligning the mirrors.

Mike Menzel, the Webb Telescope NASA systems engineer who also worked on the Hubble, said that after the six-month calibrating period, the telescope will be handed over to astronomers from around the world who can submit proposals for science investigations. Much like the Hubble process, a review committee will select the best proposals for future missions.

The Webb telescope will launch from the European Space Complex in Kourou, French Guiana. During the final year of production, the Webb telescope will be moved to NASA's Johnson Space Center in Houston for final testing and diagnostics.

"This will rewrite the books on astronomy and engineering," Menzel said.