James Webb Telescope's last backbone component completed

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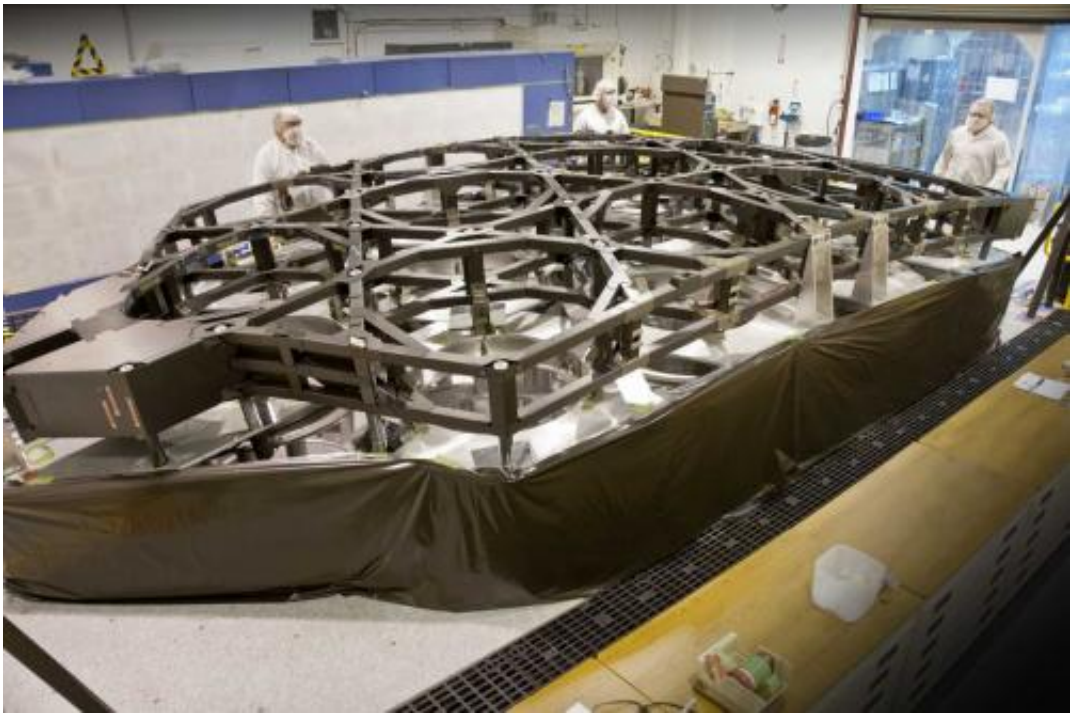


The center section of the James Webb Space Telescope flight backplane, or Primary Mirror Backplane Support Structure, at ATK's manufacturing facility in Magna, Utah. Credit: ATK

(Phys.org) —Assembly of the backbone of NASA's James Webb Space Telescope, the primary mirror backplane support structure, is a step closer to completion with the recent addition of the backplane support frame, a fixture that will be used to connect all the pieces of the telescope together.

The backplane support frame will bring together Webb's center section and wings, secondary mirror support structure, aft optics system and integrated science instrument module. ATK of Magna, Utah, finished fabrication under the direction of the observatory's builder, Northrop Grumman Corp.

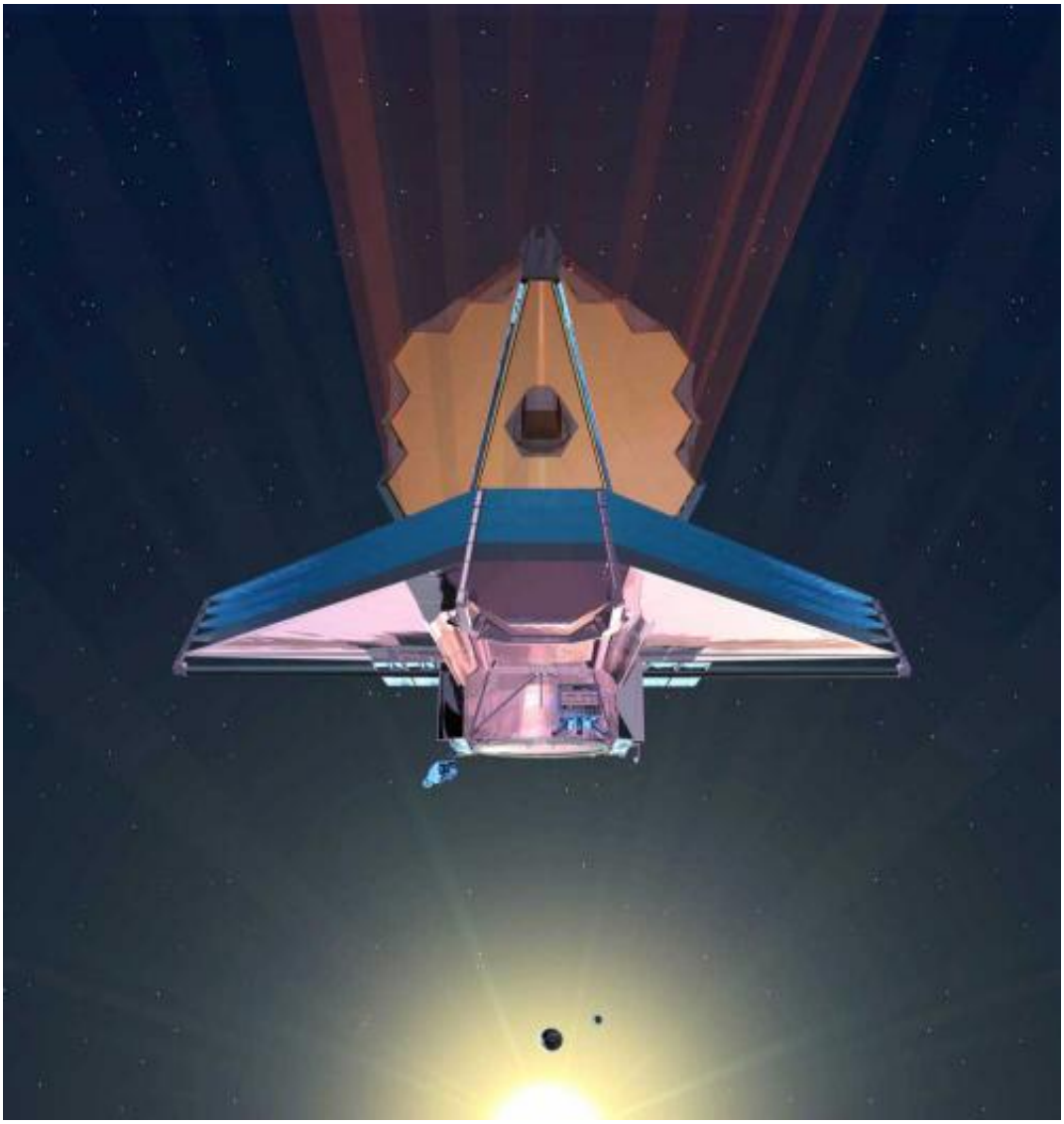
The backplane support frame also will keep the light path aligned inside the telescope during science observations. Measuring 11.5 feet by 9.1 feet by 23.6 feet and weighing 1,102 pounds, it is the final segment needed to complete the primary mirror backplane support structure. This structure will support the observatory's weight during its launch from Earth and hold its18-piece, 21-foot-diameter primary mirror nearly motionless while Webb peers into deep space.

ATK has begun final integration of the backplane support frame to the backplane center section, which it completed in April 2012 and two backplane wing assemblies, which it completed in March.

"Fabricating and assembling the backplane support frame of this size and stability is a significant technological step as it is one of the largest cryogenic composite structures ever built," said Lee Feinberg, James Webb Space Telescope optical telescope element manager at NASA's Goddard Space Flight Center in Greenbelt, Md.

The frame, which was built at room temperature but must operate at temperatures ranging from minus 406 degrees to minus 343 degrees Fahrenheit, will undergo extremely cold, or cryogenic, thermal testing at NASA's Marshall Space Flight Center in Huntsville, Ala. The backplane support frame and primary mirror backplane support structure will shrink as they cool down in space. The tests, exceeding the low temperatures the telescope's backbone will experience in space, are to verify the components will be the right size and operate correctly in space.

The primary mirror backplane support structure consists of more than 10,000 parts, all designed, engineered and built by ATK. The support structure will measure about 24 feet tall, 19.5 feet wide and more than 11 feet deep when fully deployed, but weigh only 2,138 pounds with the wing assemblies, center section and backplane support frame attached. When the mission payload and instruments are installed, the fully populated support structure will support more than 7,300 pounds, more than three times its own weight.



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

The primary mirror backplane support structure also will meet unprecedented thermal stability requirements to minimize heat distortion. While the telescope is operating at a range of extremely cold temperatures, from minus 406 degrees to minus 343 degrees Fahrenheit, the backplane must not vary more than 38 nanometers (approximately 1 one-thousandth the diameter of a human hair).

The primary backplane support structure is made of lightweight graphite materials using and advanced fabrication techniques. The composite parts are connected with precision metallic fittings made of invar and titanium.

"The ATK team is providing program hardware that is arguably the largest and most advanced cryogenic structure ever built," said Bob Hellekson, ATK's Webb telescope program manager.

The assembled primary backplane support structure and backplane support frame are scheduled for delivery to Marshall later this year for the extreme cryogenic thermal testing. They will undergo structural static testing at Northrop Grumman's facilities in Redondo Beach, Calif. in early 2014, and then be combined with the wing assemblies.

The James Webb Space Telescope, the successor to NASA's Hubble Space Telescope, will be the most powerful space telescope ever built. It will observe the most distant objects in the universe, provide images of the first galaxies formed and see unexplored planets around distant stars. The Webb telescope is a joint project of NASA, the European Space Agency and the Canadian Space Agency.

Provided by NASA