

James Webb Space Telescope opens its eyes on the Universe

July 11 2022, by Issam AHMED

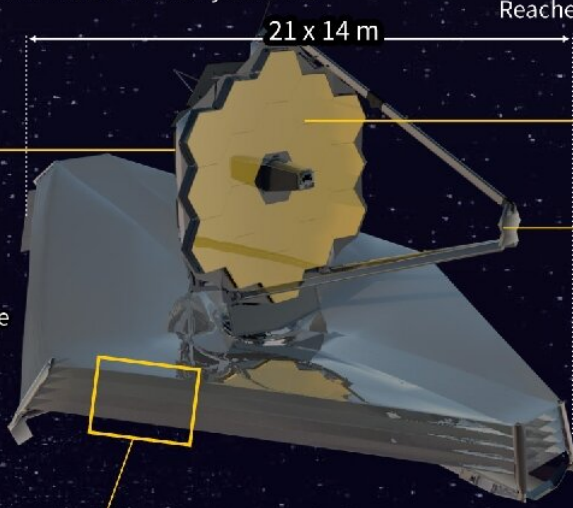
James Webb telescope

The most powerful space telescope* ever launched, successor to Hubble, to reveal its first images

MISSION GOALS (10 YEARS)

- Measure planetary systems and investigate for potential life
- Observe the formation of stars and evolution of galaxies
- Search for the first galaxies formed in the early universe

LAUNCHED on an Ariane 5 rocket on Dec 25, 2021
Fully deployed its sunshield on Jan 4, 2022
Reached destination Jan 24, 2022



21 x 14 m


Instruments: cameras and spectrographs must be kept very cold to detect extremely faint heat signals in the universe

Primary mirror diameter: 6.5 m
18 segments

Secondary mirror: 0.74 m

Weight: 6.2 tonnes

SUNSHIELD
5 layers:
0.05-0.025 mm thick




Inner layer temp -235 °C (-390 °F)

Outer layer 125 °C (260 °F)

Sunlight

ORBIT

In position 1.5 million kms from Earth




Earth Moon Webb's orbit

Sun

Not to scale

Source: NASA *Joint project by NASA, ESA and Canadian Space Agency

AFP 

Graphic of the James Webb space telescope, successor to Hubble.

Space enthusiasts are holding their breath.

The James Webb Space Telescope, the most powerful ever sent into orbit, is set Tuesday to unveil breathtaking new views of the Universe with a clarity that's never been seen before.

Distant galaxies, bright nebulae and a faraway giant gas planet are among the observatory's first targets, US space agency NASA said Friday.

But the images themselves have been jealously guarded to build suspense ahead of the big reveal.

"I'm looking very much forward to not having to keep these secrets anymore, that will be a great relief," Klaus Pontoppidan, an astronomer at the Space Telescope Science Institute (STSI) that oversees Webb, told AFP.

NASA chief Bill Nelson has promised the "deepest image of our Universe that has ever been taken."

Webb's infrared capabilities are what make it uniquely powerful—allowing it to both pierce through cosmic dust clouds and detect light from the earliest stars, which has been stretched into infrared wavelengths as the Universe expanded.

This lets it peer further back in time than any previous telescope, to the period shortly after the Big Bang, 13.8 billion years ago.

"When I first saw the images... I suddenly learned three things about the

Universe that I didn't know before," Dan Coe, an STSI astronomer and expert on the early Universe, told AFP. "It's totally blown my mind."

First targets

An international committee decided the first wave of images would include the Carina Nebula, an enormous cloud of dust and gas 7,600 [light years](#) away.

Carina Nebula is famous for its towering pillars that include "Mystic Mountain," a three-light-year-tall cosmic pinnacle captured in an iconic image by the Hubble Space Telescope, until now humanity's premier space observatory.

Webb has also carried out a spectroscopy—an analysis of light that reveals detailed information—on a faraway gas giant called WASP-96 b, which was discovered in 2014.



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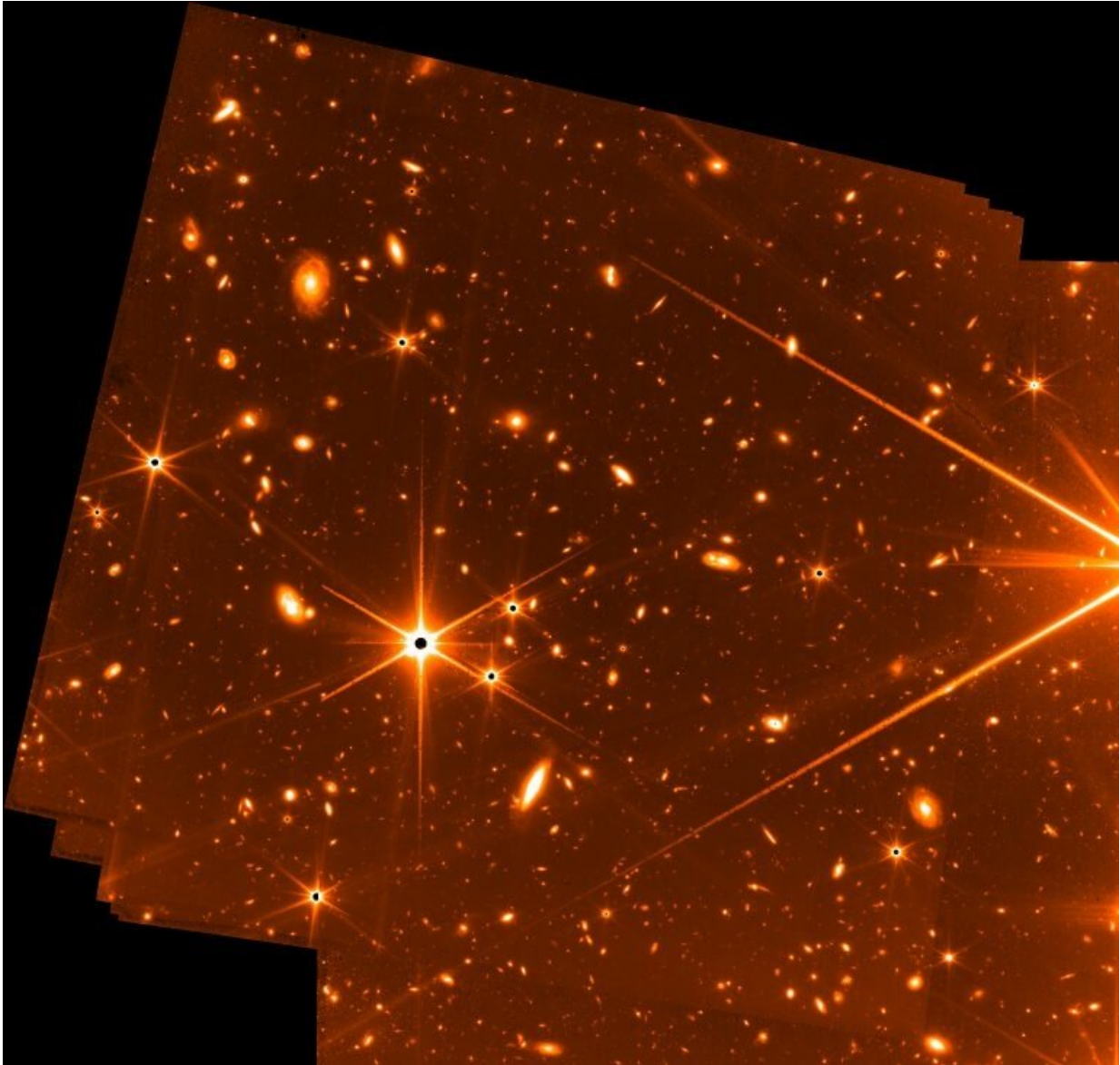
Nearly 1,150 light-years from Earth, WASP-96 b is about half the mass of Jupiter and zips around its star in just 3.4 days.

Nestor Espinoza, an STSI astronomer, told AFP that previous exoplanet

spectroscopies carried out using existing instruments were very limited compared to what Webb could do.

"It's like being in a room that is very dark and you only have a little pinhole you can look through," he said of the prior technology. Now, with Webb, "You've opened a huge window, you can see all the little details."

Perhaps most enticing of all, Webb has gathered an image using foreground galaxy clusters called SMACS 0723 as a kind of cosmic magnifying glass for the extremely distant and faint objects behind it.



This handout image released on July 6, 2022 by NASA, CSA and FGS shows a Fine Guidance Sensor test image which was acquired in parallel with NIRCam imaging of the star HD147980 over a period of eight days at the beginning of May.

Million miles from Earth

Launched in December 2021 from French Guiana on an Ariane 5 rocket, Webb is orbiting the Sun at a distance of a million miles (1.6 million kilometers) from Earth, in a region of space called the second Lagrange point.

Here, it remains in a fixed position relative to the Earth and Sun, with minimal fuel required for course corrections.

A wonder of engineering, the total project cost is estimated at \$10 billion, making it one of the most expensive scientific platforms ever built, comparable to the Large Hadron Collider at CERN.

Webb's primary mirror is over 21 feet (6.5 meters) wide and is made up of 18 gold-coated mirror segments. Like a camera held in one's hand, the structure must remain as stable as possible to achieve the best shots.

Charlie Atkinson, chief engineer on the James Webb Space Telescope program at lead contractor Northrop Grumman, told AFP that it wobbles no more than 17 millionths of a millimeter.

Atkinson, who has been working on the program since 1998, said: "We knew it was going to require some of the best talents across the world, but it was doable."

After the first images, astronomers around the globe will get shares of time on the telescope, with projects selected competitively through a process in which applicants and selectors don't know each others' identity, to minimize bias.

Thanks to an efficient launch, NASA estimates Webb has enough propellant for a 20-year life, as it works in concert with the Hubble and Spitzer [space](#) telescopes to answer fundamental questions about the cosmos.

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