



# NASA's James Webb Space Telescope: A Vision For Tomorrow

NASA's James Webb Space Telescope (JWST) is the successor to the highly successful Hubble Space Telescope. Through its breathtaking images, Hubble has both changed our view of the universe and our place within it, yet also opened up new mysteries and questions that are beyond its grasp.

Astronomers now need a more advanced and powerful space telescope to enable a new leap forward in our understanding of the universe. JWST will have unprecedented infrared sensitivity and image clarity,

and reshape our knowledge of planets, stars, galaxies, and the universe itself.

As the mysteries of nature become ever more profound, more-complex machines are needed to decipher them. Astronomers using Webb will seek answers to some of the most fundamental questions of our time: Are we alone in the cosmos? How did galaxies form and evolve? How do planetary systems form around other stars?

## Webb Space Telescope's Vital Stats:

### Launch:

Via an Ariane 5 rocket, provided by the European Space Agency, from Kourou, French Guiana

### Destination:

Orbiting the Sun 940,000 miles (1.5 million km) from Earth at the Second Lagrange Point (L2)

### Total Mass:

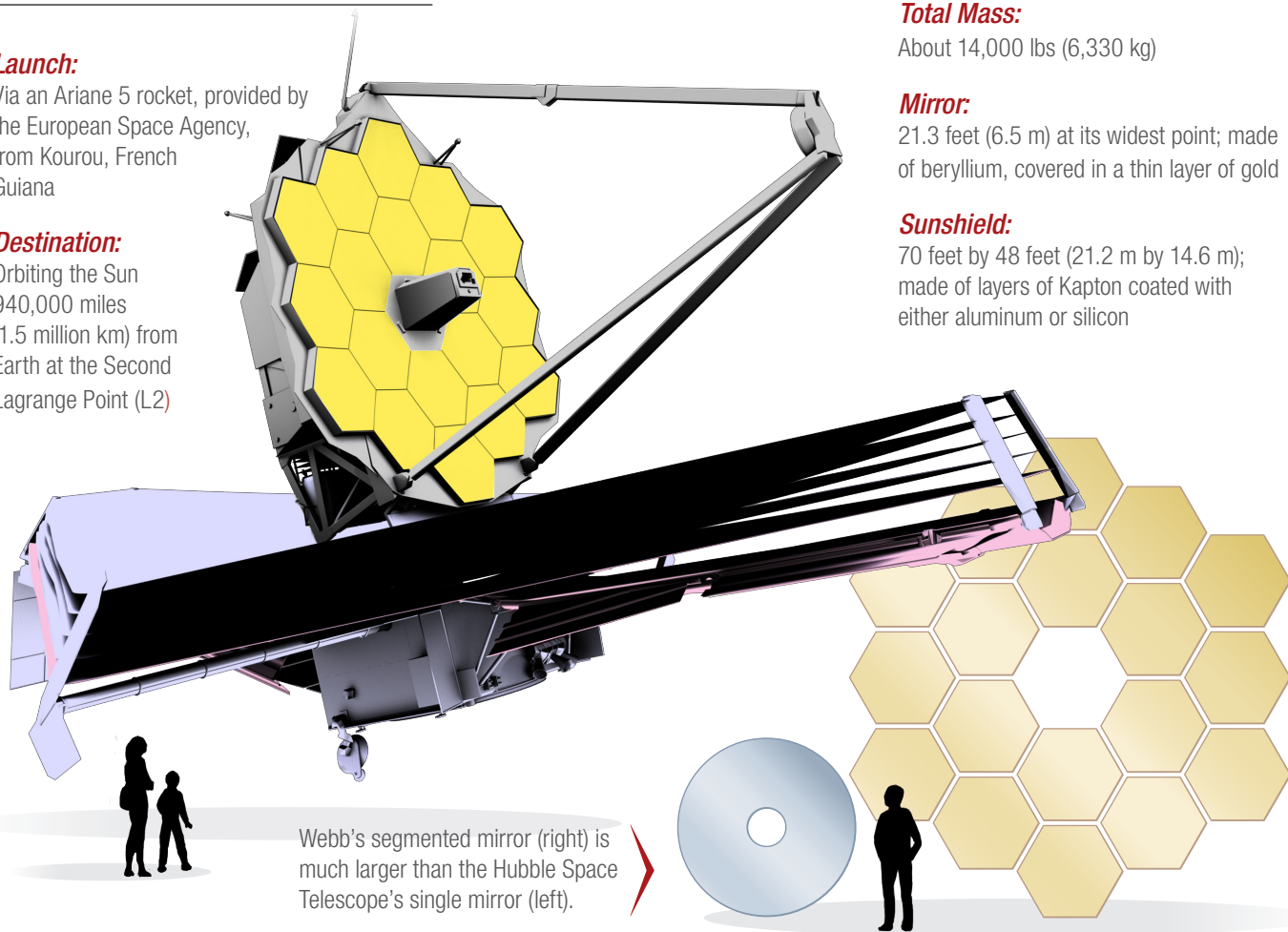
About 14,000 lbs (6,330 kg)

### Mirror:

21.3 feet (6.5 m) at its widest point; made of beryllium, covered in a thin layer of gold

### Sunshield:

70 feet by 48 feet (21.2 m by 14.6 m); made of layers of Kapton coated with either aluminum or silicon



Webb's segmented mirror (right) is much larger than the Hubble Space Telescope's single mirror (left).





JWST will be humankind's most powerful "time machine" for sweeping us back into the universe's early formative years, when the grand assembly of stars and galaxies began. JWST has the potential to be a life finder by studying nearby extrasolar planets in exquisite detail. It will measure the composition of the atmospheres of these planets and look for the chemistry required for life: oxygen, methane, carbon dioxide, and water.

Webb promises to carry us along on an even grander journey of exploration and discovery than that kicked off by Hubble's launch over 20 years ago. If Hubble's history is any example, profound surprises no doubt lie just ahead. Webb's most important discoveries will provide answers to questions we do not yet know how to ask and will concern phenomena we have not yet imagined.

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## We may at last know if life is common among the stars.

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To boldly look where no human has looked before, astronomers and engineers are constructing one of the most powerful and complex science instruments ever conceived. JWST's engineers have invented 10 new technologies to achieve high levels of precision and optical perfection under harsh, deep-space conditions never before realized in astronomy. Too large to be launched fully assembled, Webb must be folded to fit inside an Ariane 5 rocket. The telescope will be launched to a point in space one million miles from Earth. From its perch at that distant point between Earth and the Sun, Webb will enjoy a crystal-clear view of the heavens without the glare of light or heat from Earth.

The giant telescope will be fully assembled and optically tested on Earth before it is launched into the



Webb will study star formation, like that taking place in galaxy M74. (Hubble image credit: NASA/ESA/STScI)

cold vacuum of space. Top aerospace companies, space agencies, science institutions, and universities across the country and in Europe and Canada are building and testing Webb's many complex components and instruments. To date, seventy-five percent of the flight hardware is in fabrication or completed.

JWST's 21-foot primary mirror consists of 18 hexagonal beryllium mirrors, coated with a thin layer of gold for maximum reflectivity. The mirrors alone will collect nearly 10 times as much light as Hubble can, and weigh 10 times less than Hubble's mirror. JWST's suite of onboard imaging cameras, spectrographs, and coronagraphs will be the most sensitive and sharpest electronic eyes ever aimed at the universe. They will provide a sensitivity to faint objects unmatched by much larger ground-based telescopes of the next decade, or any other space mission envisioned. The complete telescope will be 100 times more powerful than Hubble.

The James Webb Space Telescope is one of our most ambitious expressions of pure human curiosity. It defines us as an inquisitive species—one that is always ready to try to discover the limits of the possible by reaching for the seemingly impossible.

Follow the James Webb Space Telescope at [webbtelescope.org](http://webbtelescope.org) and [jwst.nasa.gov](http://jwst.nasa.gov)

*JWST is a joint collaboration among NASA, the European Space Agency, and the Canadian Space Agency*

