THE JAMES WEBB SPACE TELESCOPE

A new Age of Telescopes dawns

Previously known as Next Generation Space Telescope (NGST), the JWST is a part of NASA's ongoing Flagship program and developed in cooperation with the European Space Agency and Canadian Space Agency. It is under construction and scheduled to launch in October 2018. The JWST will offer unprecedented resolution and sensitivity from long-wavelength (orange-red) visible light, through near-infrared to the mid-infrared (0.6 to 27 micrometers). While the Hubble Space Telescope has a 2.4-metre mirror, the JWST features a larger and segmented 6.5-metre-diameter primary mirror and will be located at the Earth–Sun Lagrange point L2. A large five level Sun shield will keep its mirror and four science instruments below 50º Kelvin .

JWST's capabilities will enable a broad range of investigations across the fields of astronomy and cosmology. One particular goal involves observing some of the most distant events and objects in the Universe, such as the formation of the first galaxies. These types of targets are beyond the reach of current ground and space-based instruments. Another goal is understanding the formation of stars and planets. This will include direct imaging of exoplanets.

James Edwin Webb (7/10/1906– 27/3/1992) During his administration, NASA developed from a loose collection of research centers into a coordinated organization. Webb had a key role in creating the Manned Spacecraft Center, later, the Johnson Space Center, in Houston, Texas.

In gestation since 1996, the project represents an international collaboration of the European Space Agency, Canadian Space Agency and team members of other countries led by NASA. It is named after **James E. Webb**, the second administrator of NASA, who played an integral role in the Apollo program.**NASA has described JWST as the scientific successor of the Hubble Space Telescope, but not a replacement, because the capabilities are not identical. JWST has the objective to see high-redshift objects, typically both older and farther away than previous instruments could assess.** The result was to try and extend the life of Hubble until the next generation telescope could go online. This allowed a radically altered design for JWST beyond the capabilities of the Infrared Space Observatory and the Spitzer Space Telescope.

In December 2016, NASA announced that the JWST had passed major milestones, including completion of its primary mirror and integration of science instruments with the payload module, and is undergoing acoustic and extreme vibration testing to simulate launch conditions.

DESIGN DETAILS

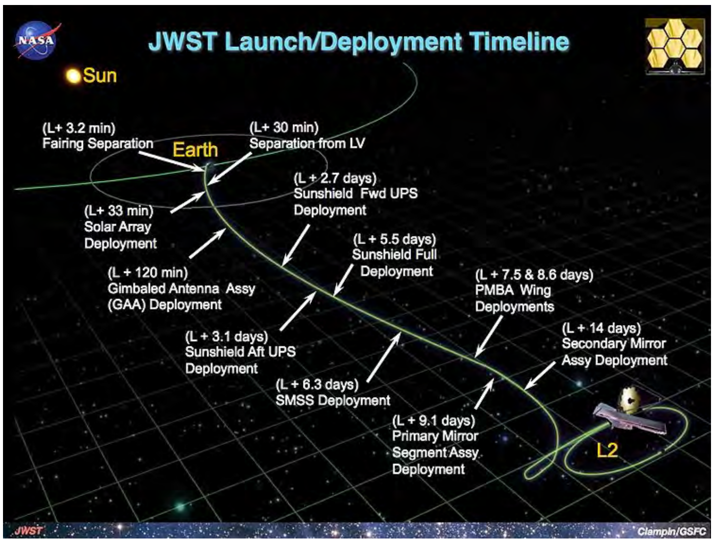
The telescope itself has an expected mass about half of Hubble Space Telescope's, but its primary mirror (a 6.5 metre diameter gold-coated beryllium reflector) will have a collecting area about five times as large ($25m^2$ vs. $4.5m^2$). The JWST is oriented toward near-infrared astronomy, but can also see orange and red visible light, as well as the mid-infrared region. **The design emphasizes the near to mid-infrared for three main reasons: High-redshift objects have their visible emissions shifted into the infrared, cold objects such as debris disks and planets emit most strongly in the infrared, and this band is difficult to study from the ground or by existing space telescopes such as Hubble**.

The JWST will operate at the Earth-Sun L2 point, approximately 1,500,000 km beyond the Earth. By way of comparison, Hubble orbits 550 km above Earth's surface, and the Moon is about 400,000 km from Earth. This distance makes post-launch repair or upgrade of the JWST hardware virtually impossible. Objects near this point can orbit the Sun in synchrony with the Earth, allowing the telescope to remain at a roughly constant distance and use a single Sun shield to block heat and light from the Sun and Earth. This will keep the temperature of the spacecraft below 50º K.

COMPONENTS OF THE JWST:
Primary mirror, 18 segments (gold-plated beryllium)
Secondary mirror. Tertiary mirror, Fine steering mirror
Sun Shield
Instruments NIRCam, NIRSpec, MIRI (Mid-Infrared Instrument), FGS/NIRISS
Spacecraft Bus: Electrical power subsystem (2KW Solar panel setup to power whole spacecraft), Attitude control subsystem, Communication subsystem (radio communication with mission control), Command and data handling subsystem (the control centre of the spacecraft), Propulsion subsystem (fuel tanks, rockets controlled by attitude subsystem) Thermal control subsystem to maintain temperature of the Bus.
Ariane 5 launch system rocket to propel it into space.

Main mirror assembled at Goddard Spaceflight Center

The JWST three major sections are, the Optical Telescope Element (OTE), the Spacecraft Element (SE), which includes the spacecraft Bus and Sun shield, the Integrated Science Instrument Module (ISIM), which holds the instruments and other systems.
THE SPACECRAFT BUS is the primary support component of the James Webb Space Telescope, that hosts a multitude of computing, communication, propulsion, and structural parts, bringing the different parts of the telescope together. Along with the Sun shield, it forms the Spacecraft Element of the space telescope. **The structure of the Spacecraft Bus must support the 6.5 ton space telescope, while it itself weighs just 350 kg. It is made primarily of graphite composite material. The bus can provide pointing of one-arcsecond and isolates vibration down to two milliarcseconds**.
Another important aspect of the Spacecraft Bus is the central computing, memory storage, and communications equipment. The processor and software direct data to and from the instruments, to the solid-state memory core, and to the radio system, which can send data back to Earth and receive commands. The computer also controls the pointing and moment of the spacecraft, taking in sensor data from the gyroscopes and star tracker, and sending the necessary commands to stabilizers.
LAUNCH AND MISSION
Launch is now scheduled for October 2018 on an Ariane 5 rocket. Its nominal mission time is five years, with a goal of ten years. The ultimate limit to its effective lifetime is the propellant JWST needs to maintain a stable orbit around the L2 point. The planned five year science mission starts after a 6-month commissioning phase.
The JWST's primary scientific mission has four key goals: (1) to search for light from the first stars and galaxies that formed in the Universe after the Big Bang, (2) to study the formation and evolution of galaxies, (3) to understand the formation of stars and planetary systems and (4) to study planetary systems and the origins of life. These goals can be accomplished more effectively by observation in near-infrared light rather than light in the visible part of the spectrum. For this reason the JWST's instruments will not measure visible or ultraviolet light like the Hubble Telescope, but will have a much greater capacity to perform infrared astronomy. The JWST will be sensitive to a range of wavelengths from 0.6 (orange light) to 28 micrometers (deep infrared radiation).
JWST may also help to gather information on the dimming light of star KIC 8462852 (Tabby's Star) discovered in 2015, which has some abnormal light-curve properties.
Lets hope the project will in 2018 finally become a reality. First proposed in 1996 at a cost of $500 million, but by 2011 the project had already burned through $6.2 billion. Current estimates of total costs of the project is $9 billion.
AK, with Notes from Wikipedia & Time Magazine



What happens after the James Webb Space Telescope is launched?