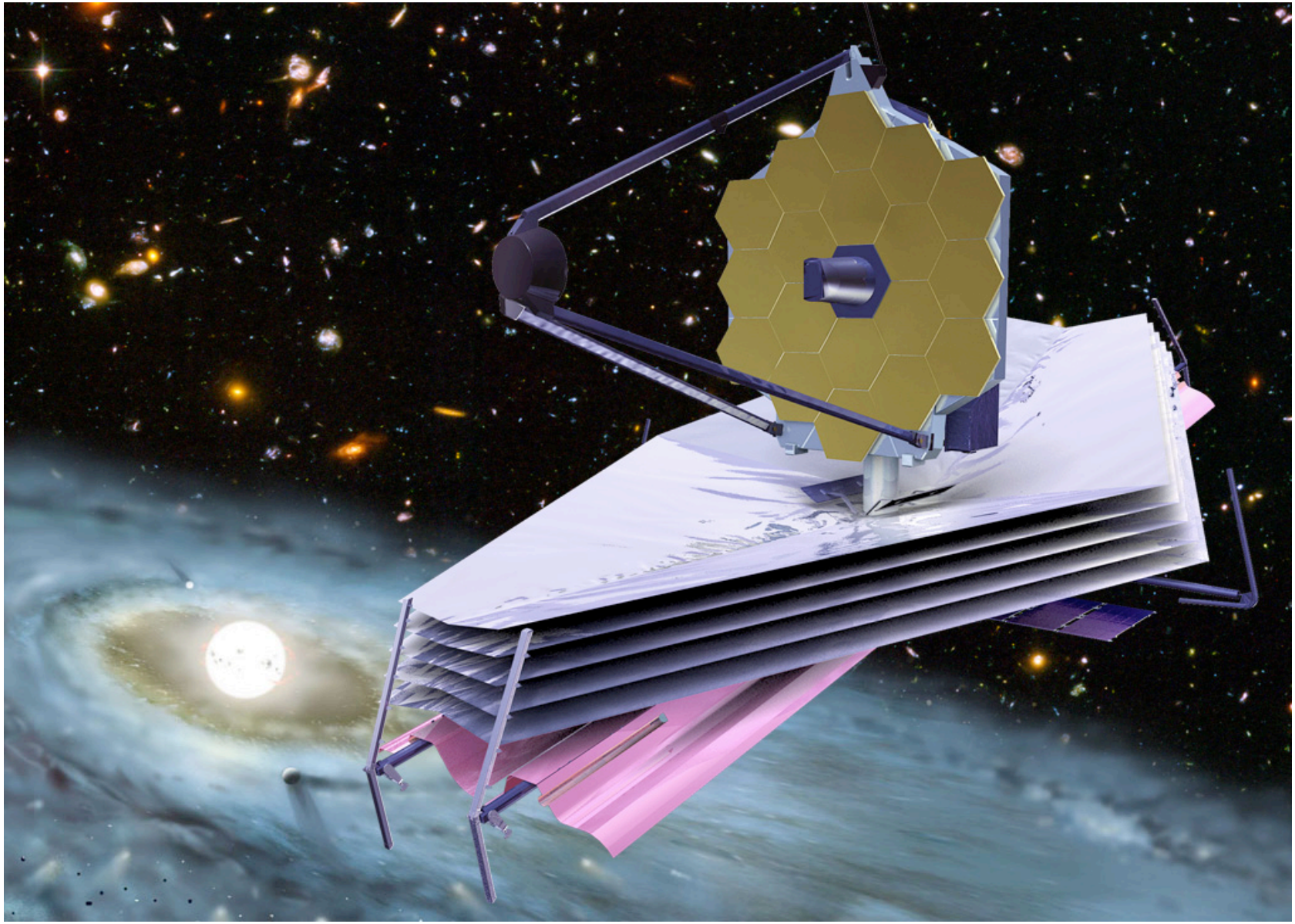
James Webb Space Telescope



James Webb Space Telescope

The JWST Science Mission

The launch of the James Webb Space Telescope (JWST) will be a giant step forward in the human quest to understand our place in the Universe. With its infrared-optimized telescope cooled to tens of degrees above absolute zero, hanging in the darkness of space far from Earth at L2, JWST will examine every phase of our history: from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own Solar System. JWST will be the premier space observatory for astronomers worldwide, extending the tantalizing discoveries of the Hubble Space Telescope, the Spitzer Space Telescope, and giant ground-based telescopes.

First Light: After the Big Bang, the first galaxies probably formed as groups of very massive stars. As these stars finished their lives in explosions called supernovae, elements such as carbon, oxygen and iron were formed and blown into space to seed future generations of stars. JWST will find and study the First Light Objects.

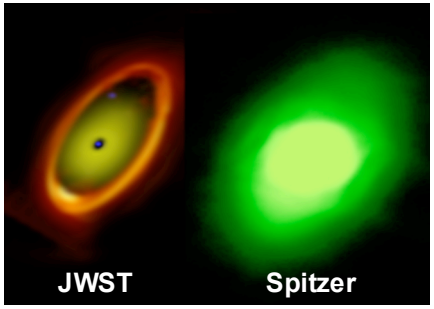
Image: WMAP Science Team, NASA/GSFC

Galaxy Assembly: Large galaxies are assembled through the merging together of smaller ones. JWST will observe millions of galaxies at all stages of development with broad wavelength coverage and Hubble-like image quality. The result will be a complete picture of galaxy assembly from the epoch of First Light through the present.

Image: Beckwith et al., STScI

The Birthplaces of Stars: Stars and planetary systems form within nearby dust clouds, which hide the details of this process from view. JWST – observing in infrared light that can penetrate these dusty shrouds – will reveal the environments within these stellar nurseries and the conditions for formation of planetary systems.

Image: M. McCaughrean, M. Andersen, AIP/ESO



Planets and Life: JWST will study the evolution of planetary systems and ways they could support life. It will explore the distribution of organic molecules and water in our own Solar System; identify planetary footprints around other stars; image young planets in nearby systems; and study the atmospheres of planets as they transit parent stars.

Images: JWST: G. Rieke, Univ. of Arizona; Spitzer: K. Stapelfeldt, JPL-Caltech

Mission Concept

To enable scientific discoveries, JWST will have a large 6.5-meter primary mirror, passively cooled to about 45K by a sunshield. It will be sensitive to light from 0.6 to 27 micrometers. There will be four instruments: a near-infrared (IR) camera, near-IR multi-object spectrograph, mid-IR instrument, and tunable filter imager.

Technology

Innovations for JWST include a folding, segmented primary mirror, adjusted to shape after launch; ultra-lightweight beryllium optics; detectors able to record extremely weak signals, microshutters that enable programmable object selection for the spectrograph; and a cryocooler for cooling the mid-IR detectors to 7K.

Mission Status

Long-lead items, such as the beryllium mirror segments and science instruments, are under construction. All mission enabling technologies will be demonstrated by January 2007. External review committees have confirmed the Project's estimates for the plans, schedules, and budget. Launch is planned for 2013.

Partners

JWST is an international collaboration among NASA, the European Space Agency, and the Canadian Space Agency. The Goddard Space Flight Center manages the development effort. The prime contractor is Northrop Grumman Space Technologies. The Space Telescope Science Institute will operate JWST.

Cover art: Illustration of JWST courtesy Northrop Grumman. Artist's representation of a solar system in formation around the star Fomalhaut; © David A. Hardy/www.astroart.org/PPARC.