NASAfacts

Europa Clipper

Exploring Jupiter's Ocean World

Europa, an icy moon that orbits Jupiter, is considered one of the most promising places in our solar system to find an environment suitable for life beyond Earth. There is strong evidence of an ocean beneath the moon's thick icy crust, potentially with twice as much liquid water as all of Earth's oceans combined. Everywhere on Earth that there's water, there's life, and scientists want to know if oceans elsewhere in the solar system can also be habitable.

NASA's Europa Clipper mission will be the first to conduct a detailed survey of this icy moon. While Europa Clipper is not a life-detection mission, it aims to answer questions about Europa's potential to support life. The mission will confirm whether there is an ocean, look for evidence of energy sources beneath Europa's surface, and determine the moon's makeup.

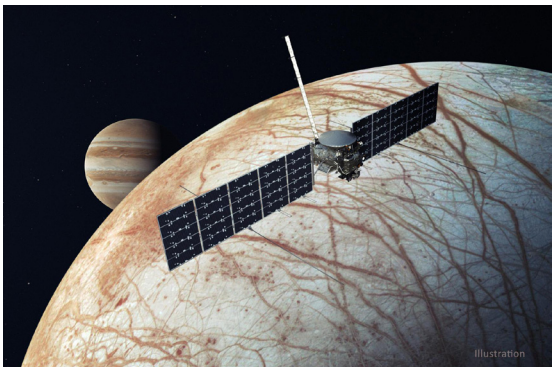
Expected Mission Timeline

- **October 2024:** Europa Clipper is scheduled to launch from NASA's Kennedy Space Center on a SpaceX Falcon Heavy rocket.
- **February 2025:** Spacecraft flies by Mars for a gravity assist to gain speed.
- **February 2026:** Spacecraft flies by Earth for another gravity assist on its way to the outer solar system.
- **April 2030:** Spacecraft enters orbit around Jupiter after a journey of about 1.8 billion miles (2.9 billion kilometers).
- **March 2031:** First of 49 flybys of Europa begins.
- **June 2034:** End of the prime mission.

Goals and Objectives

Determine whether there are places below the surface of Europa that could support life by studying:

- the geology of Europa's icy shell
- the interior of Europa, including the ice shell and the liquid water ocean beneath it
- the composition of the surface and interior



This artist's concept depicts NASA's Europa Clipper flying by the icy moon Europa as the spacecraft orbits Jupiter.

Credit: NASA/JPL-Caltech

Key Hardware

Europa Clipper has a suite of nine instruments dedicated to collecting science and a gravity experiment that uses the telecommunications system.

- **Imagers:** Europa Imaging System (EIS) has two visible-light cameras that will map Europa at a range of resolutions. Europa Thermal Emission Imaging System (E-THEMIS) uses an infrared camera to map temperature and roughness. Mapping Imaging Spectrometer for Europa (MISE) will map surface composition by using infrared light. Europa Ultraviolet Spectrograph (Europa-UVS) will collect ultraviolet light to search for plumes and analyze the composition of Europa's surface and thin atmosphere.

- **Ice-penetrating radar:** Radar for Europa Assessment and Sounding: Ocean to Near-surface (REASON) to study Europa's ice structure and thickness.
- **Gas and Dust measurements:** Mass Spectrometer for Planetary Exploration/Europa (MASPEX) will analyze gases in the atmosphere and in possible plumes spraying from the surface. Surface Dust Analyzer (SUDA) will identify the makeup of dust particles ejected from the surface.
- **Magnetometer and Plasma Instruments:** Europa Clipper Magnetometer (ECM) will work hand-in-hand with the Plasma Instrument for Magnetic Sounding (PIMS) to study magnetic fields to confirm the existence of an ocean, measure the ocean's depth and saltiness, and assess the thickness of the ice shell.
- **Gravity science experiment:** By analyzing the radio signals sent back and forth through space via the spacecraft's telecommunications system, scientists will study how changes in Europa's gravity can reveal the moon's internal structure.

Europa Clipper Spacecraft

Europa Clipper is the largest spacecraft NASA has ever developed for a planetary mission. The main spacecraft body is about 10 feet (3 meters) wide, 15.5 feet (4.7 meters) tall, and 13 feet (4 meters) deep — about the size of a small box truck. When fully deployed, Europa Clipper stretches over 100 feet (30.5 meters) wide, a little longer than a basketball court.

Because Jupiter is so far from the Sun, Europa Clipper needs enormous solar arrays to convert the faint sunlight into electricity, providing power for the spacecraft's computers, heaters, science instruments, and other subsystems. The solar arrays will provide at least 700 watts throughout the prime mission, equivalent to powering seven 100-watt light bulbs.

Europa Clipper is built to protect itself from Jupiter's harsh radiation environment. The surface of the spacecraft will be exposed to the equivalent of about a few million chest X-rays during each flyby of Europa. A special aluminum-zinc alloy vault protects its sensitive electronics, and the design of the spacecraft's Europa flybys minimizes the amount of time in high-radiation zones. The vault also features a unique tantalum metal plate engraved with messages in the form of artwork and poetry, along with a microchip stenciled with more than 2.6 million names contributed by the public to ride along to Europa.



Engineers and technicians inspect the main body of the Europa Clipper spacecraft just after delivery to NASA's Jet Propulsion Laboratory in early June 2022.

Credit: NASA/JPL-Caltech

Mission Partners

Managed by Caltech in Pasadena, California, NASA's Jet Propulsion Laboratory (JPL) leads the development of the Europa Clipper mission in partnership with the Johns Hopkins Applied Physics Laboratory (APL) for NASA's Science Mission Directorate in Washington. APL designed the main spacecraft body in collaboration with JPL and NASA's Goddard Space Flight Center in Greenbelt, Maryland; NASA's Marshall Space Flight Center in Huntsville, Alabama; and NASA's Langley Research Center in Hampton, Virginia. The instruments were designed and built by JPL, APL, Arizona State University, and the University of Colorado at Boulder. The Planetary Missions Program Office at NASA's Marshall Space Flight Center in Huntsville, Alabama, executes program management of the Europa Clipper mission.

NASA's Launch Services Program at Kennedy Space Center manages launch operations.

Mission Websites

For more information about the Europa Clipper mission, visit: https://europa.nasa.gov/