ESA Launches The Jupiter Icy Moons Explorer (JUICE) Spacecraft

JUICE Mission To Study Jupiter's Icy Moons In Search Of Life

With the launch of the European Jupiter Icy Moons Explorer (JUICE) spacecraft on a mission to study Jupiter's icy moons, a new chapter in humanity's search for extraterrestrial life begins. The JUICE spacecraft will be launched into orbit by the heavy lift launch vehicle Ariane 5 - the identical rocket that was used to successfully launch the James Webb Space Telescope into orbit at the end of 2021 - from the European Space Agency (ESA) spaceport in Kourou, French Guiana. Arianespace is a French launch service provider. The gas giant Jupiter and its three big ocean moons, Ganymede, Callisto, and Europa, will be closely observed by ESA's JUICE. JUICE will characterise the moons and learn more about the planets as prospective homes for past or current life using a robust suite of geophysical, remote sensing, and in situ equipment.

What is the JUICE Mission?

One of Europe's most ambitious space missions to date, JUICE or the Jupiter ICy moons Explorer, will conduct a series of flybys of Jupiter and its three enormous ocean-bearing moons, Callisto, Ganymede, and Europa. The six-tonne spacecraft will approach these worlds closer than ever before and use an updated suite of instruments to study the gas giant and determine if any of the satellites that orbit it are habitable. Over the course of eight and a half years, it will journey 4.1 billion miles (6.6 billion kilometres) to the Jovian system, where it will touch down on Jupiter in July 2031. Before settling into a stable orbit above Ganymede in late 2034, the Juice spacecraft will make 35 flybys of Jupiter's three moons.

Does Juice Have the Ability to Detect Life?

There is a chance that life exists on the three moons Ganymede, Callisto, and Europa since they are thought to contain enormous volumes of water, possibly up to six times as much as the water in Earth's oceans. ESA believes that there may be bacteria living on these moons. More advanced organisms, such as those we find in deep-sea trenches and in hydrothermal vents on Earth, such as different types of coral, worm, mussel, prawns, and fish, may also be present. Juice is unable to detect life, though. It can determine whether the requirements for supporting life, like water, biologically required components, energy, and stability, are present in locations within the icy moons around Jupiter.

Reasons for JUICE's Research on Ganymede

The mission will study all three moons, but Ganymede will receive the majority of attention. JUICE plans to study Ganymed far more thoroughly than Callisto and Europa. This is due to the fact that it is both the largest moon in the Solar System, larger than Mercury and Pluto, and an ocean moon with a magnetic field of its own. Ganymede's magnetosphere has the ability to shield life by rerouting the flow of cosmic rays and radioactive particles from Jupiter's radiation belts, much like Earth's magnetosphere does.

While at Ganymede, JUICE has a wide range of scientific goals. They consist of:

Ocean layer classification and search for potential subsurface water reservoirs

surface compositional, geological, and topographical mapping

study of the icy crusts' physical characteristics

Internal mass distribution, dynamics, and inner evolution are described.

Research into the Exosphere

investigation of the magnetic field on Ganymede and its interactions with the jovian magnetosphere

Understanding this cold, wet world better will also help us comprehend potential faraway worlds orbiting other suns. A major step forward in our attempt to unravel the mysteries of Jupiter and its fascinating moons is represented by this ambitious expedition.

JUICE’s Journey to the Jovian System

JUICE won't be travelling in a straight line to the Jovian system. Instead, the spaceship will pass four distinct planets and moons, which will change and accelerate its trajectory and allow it to save fuel. This move is sometimes referred to as a gravity assist manoeuvre. JUICE will encounter the highest radiation levels in the Solar System along the trip. Its electrical modules must be housed in lead-shielded chambers, and its components must be "hardened" in order to withstand the hostile environment. Extreme temperatures will also be a challenge for JUICE, ranging from +250°C when it passes Venus to -230°C in the Jovian system. The probe was given the moniker "silver beauty" because it includes a multilayer thermal insulation built of a grey silicon aluminium alloy to maintain a steady interior temperature.

Previous Spacecrafts on Jupiter

Only two previous spacecraft have ever studied Jupiter: Juno, which has been orbiting the planet since 2016, and the Galileo probe, which orbited the gas giant between 1995 and 2003. Notably, another spacecraft, NASA's Europa Clipper, which is expected to launch in October of this year and arrive at Jupiter in 2030 with the goal of studying its Europa moon, would already be orbiting the planet by the time Juice reaches Jupiter.

The Way Forward of JUICE Mission

We anticipate any life on these moons to be in the water, which is exceedingly difficult to reach. This is due to the fact that it is currently not feasible to travel very far beneath the ice crusts, where life may be present. When JUICE and Europa Clipper arrive, Juno will have completed its mission and used up all of its fuel. However, the possibility of having two probes in the system at once excites researchers since it may allow for simultaneous observations of Jupiter's magnetic field at two different locations. The planned conclusion of both missions is a safe crash landing on Ganymede's surface. The one that lasts the longest might get a close-up look at how the other impacts things. 12 years after Juno and 30 years after Galileo, these observations and the ensuing data analysis will allow JUICE scientists to more precisely target their findings. The JUICE mission is anticipated to yield a wealth of exciting scientific discoveries even without the discovery of life.