

India-EU Cooperation in Deep Space Exploration: A Brief Overview

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Space cooperation has historically been an integral component of science and technology cooperation between Europe and India. The cooperation draws from an extensive past experience of collaborations involving the Indian Space Research Organisation (ISRO), European Space Agency (ESA) and the national space agencies of EU member-states. ISRO has signed more than 60 Memoranda of Understanding with European Countries, with France being “the most active partner”. Cooperation with the ESA has intensified over the past couple of years, culminating in ISRO successfully launching Europe’s Proba-3 mission on 5 December 2024.

Both Europe and India are invested in ensuring that outer space is utilised for peaceful purposes, given their growing reliance on space assets for both economy and military. Viewing space as a strategic priority in the current geopolitical context, both the EU and India wish to counter various threats to space assets from, especially as the United States, China and Russia are engaged in a space arms race. In this background, the EU and India have started to view space cooperation as an area of mutual benefit, while prioritising areas including environmental monitoring, space governance and space commerce. However, deep space exploration in recent years has emerged as the mainstay of bilateral space cooperation. This article elaborates the priority areas and key ventures within India-EU cooperation in deep space exploration.

Deep Space Communications

Spacecraft rely on ground stations as they navigate themselves through outer space. This essentially allows operators to be in touch with the spacecraft while allowing them to keep track of risks along the way. Both space agencies and private players often rely on other organisations to deploy their spacecraft. Deep space communications in a way have evolved “to foster international spaceflight collaboration”. This is one area where India-EU cooperation is growing strong, especially as India is starting to undertake interplanetary missions.

Along with NASA, ISRO relied on ESA for supporting the Chandrayaan-3 lunar landing mission launched in 2023. While ESA’s 15-metre deep space antenna in Kourou helped track the spacecraft in the immediate days following its launch, the Goonhilly Earth Station located in the United Kingdom was purportedly involved in Chandrayaan-3’s propulsion and lander modules, along with facilitating lunar surface operations. ESA supported India with the deployment of its Aditya L1 Solar Probe through providing deep space communication services and validating critical flight dynamics software. In addition to ground facilities including 35-metre deep space antennas in Australia, Spain and Argentina, the mission was also supported by Kourou station in French Guiana with coordinated support from Goonhilly Earth Station in the UK.

On 4 December 2024, the ISRO signed a technical supporting agreement with the ESA for India’s upcoming Gaganyaan-1 human

spaceflight mission. As per the terms of the agreement, The Network Operations Centre at ESA’s ESOC mission control centre in Germany will coordinate a series of radio antennas in the global European Space Tracking network to enable ISRO to track, monitor and command the Gaganyaan crew module throughout each mission”. ESOC is expected to begin the compatibility testing for Gaganyaan’s radio equipment to ensure that it can transmit and receive communications from ESA’s space antenna in Kourou.

Cooperation in Solar Astronomy

Both India and the EU have sought to contribute to knowledge on solar astronomy through various collaborative projects. In a first instance of its kind, ISRO launched the Proba-3, which ESA terms, “the world’s first precision formation flying mission”. Proba-3 Consists of two satellites, Coronagraph Spacecraft (CSC) and the Occulter Spacecraft (OSC) which separated after launch. The Occulter shall maneuver to block the sun’s light to cast the shadow on the Coronagraph, allowing the latter to take detailed images of the sun’s corona. The demonstration mission additionally aims to “validate strategies, guidance, navigation and control and other algorithms, such as relative GPS navigation”. Meanwhile, ESA’s ground stations are also downlinking the bulk of the data gathered by ISRO’s Aditya-L1 In the second quarter of 2025, both Proba-3 and Aditya L1 would purportedly work together to make solar observations.