

ISRO's Chandrayaan-3 mission a success



Chandrayaan-3 is the third Indian lunar exploration mission under the Indian Space Research Organisation's (ISRO) Chandrayaan programme. It consists of a lander named Vikram and a rover named Pragyan, similar to those of the Chandrayaan-2 mission. The propulsion module carried the lander and rover configuration to lunar orbit in preparation for a powered descent by the lander.

Chandrayaan-3 was launched on 14 July 2023 with the mission objectives of getting the lander to land safely and softly on the surface of the Moon, observing and demonstrating the rover's driving capabilities on the Moon, and then conducting and observing experiments on the materials available on the lunar surface to better understand the composition of the Moon. The spacecraft entered lunar orbit on 5 August, and the lander touched down in the lunar South Pole region on 23 August 2023 at 12:32 UTC, making India the fourth country to successfully land on the lunar surface, and the first to do so near the lunar South Pole.

The lunar South Pole region holds particular interest for scientific exploration due to studies that show large amounts of ice there. Mountainous terrain and unpredictable lighting conditions not only protect the ice from melting but also make landing scientific probes there a challenging undertaking. This ice could contain solid state compounds that would normally melt under warmer conditions elsewhere on the Moon, compounds which could provide insight into lunar, Earth and Solar System history. Ice could also be used as a source of drinking water and hydrogen for fuel and oxygen for future crewed missions and outposts.

The European Space Tracking network (ESTRACK), operated by the European Space Agency (ESA), and Deep Space Network operated by Jet Propulsion Laboratory (JPL) of NASA are supporting the mission. For the Chandrayaan-3 mission, ESA is coordinating routine support from its Kourou station in French Guiana and from Goonhilly Earth Station Ltd in the UK. These stations compliment support from NASA's Deep Space Network and ISRO's own stations. ESA's 35-metre antenna in New Norcia, Australia, provided additional tracking support during the lunar landing, serving as a backup for ISRO's own ground station. New Norcia received the stream of vital signs from the Chandrayaan-3 lander, information about its health, location and trajectory, in parallel with the ISRO station. This type of back-up support is common during key moments of a space mission such as a landing.

It was this stream of telemetry that was ultimately used to confirm the success of the landing. Under a new cross-support arrangement, ESA

tracking support could be provided for upcoming ISRO missions such as those of India's first human spaceflight programme, Gaganyaan, and the Aditya-L1 solar research mission. In return, future ESA missions will receive similar support from ISRO's own tracking stations.

Chandrayaan-3 comprises three main components: a propulsion module, lander, and rover. The 2,148 kg propulsion module carries the lander and rover configuration to a 100 kilometres lunar orbit. It is a box-like structure with a large solar panel mounted on one side and a cylindrical mounting structure for the lander (the Intermodular Adapter Cone) on top. The propulsion module carries Spectro-polarimetry of Habitable Planet Earth (SHAPE) to study spectral and polarimetric measurements of Earth from the lunar orbit in the Near Infrared (NIR) wavelength range (1–1.7 μm [3.9 $\times 10^{-5}$ –6.7 $\times 10^{-5}$ in]).

The 1,752kg Vikram lander is programmed for the soft landing on the Moon. It is also box-shaped, with four

