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Space exploration

India's moon craft enter sleep mode for the freezing lunar night

Matthew Sparkes

THE groundbreaking lunar exploration mission Chandrayaan-3 has reached its official end point, with India's rover and lander entering "sleep mode" and preparing for sunset and freezing conditions that may destroy their electronic components. But engineers from the Indian Space

"Hoping for a successful awakening. Else, it will forever stay there as India's lunar ambassador"

Research Organisation (ISRO) are confident that the rover will boot up once more when the sun rises on the moon in two weeks' time.

The mission gently touched down its Vikram lander near the moon's south pole on 23 August, making India the first country to explore the region. A six-wheeled rover called Pragyan, which weighs just 26 kilograms, rolled onto the surface and the two solar-powered craft had a single period of daylight – around 14 Earth days – to carry out experiments.

Chandrayaan-3 quickly began providing scientific data from its numerous instruments, including devices on the lander called ChaSTE, which sampled the temperature of the moon dust below the surface, and ILSA, which recorded seismic activity.

The Vikram lander also made a second soft touchdown on the moon in a "hop" experiment, ISRO announced. Engineers on Earth instructed it to fire its engines, lift off to a height of 40 centimetres and move 30 to 40cm laterally before softly landing again. A video of the test shows the tracks left by the rover quickly being obscured by a cloud of moon dust as the engines fire, then appearing slightly further away once the lander had touched down, cut its engines and allowed the dust to settle.

ISRO said that the test "enthuses future sample return and human missions", both of which would require not only a soft landing,

ISRO

India's Vikram lander is now in sleep mode on the surface of the moon

but also a subsequent take-off for return to Earth. After the successful hop, the lander redeployed the ramp for the rover and restarted its scientific payloads ChaSTE and ILSA for more measurements.

On 2 September, ISRO announced that the Pragyan rover had covered a distance of 100 metres, having had to adjust course to avoid a crater on its way. Just 8 hours later, it said that the Chandrayaan-3 mission was complete and that the hardware had entered "sleep mode" ahead of sunset, which is expected to bring temperatures as low as -238°C. The scientific payloads were switched off, with all data having been transmitted back to Earth via the lander, and its solar panel was oriented into the best position to start producing power at the next sunrise, which is expected on 22 September.

ISRO didn't respond to a request for interview, but said in a tweet: "Hoping for a successful awakening for another set of assignments! Else, it will forever stay there as India's lunar ambassador."

On 4 September, the organisation announced that the lander – which was some 100 metres from the then-inactive rover – had also entered sleep mode, bringing all operations on the moon to a halt. Both the rover and lander are designed to harvest solar power when available, boot up and resume transmission with Earth, providing their hardware isn't damaged by the cold.

Although the mission was officially only meant to last a lunar day, there is optimism that the hardware will reawaken. Mission operations director M. Srikanth told the *Times of India* at the beginning of the project that engineers were "confident" the rover and lander will revive after the lunar night.

"So far, all margins are looking good and we are confident of the lander and rover coming back to life when night ends. If that happens, that will be a bonus and in case that cannot be achieved, the mission is still complete," said Srikanth. ▮

Probe launches to investigate the mysteries of the sun

Just days after India became the first country to make a successful soft landing near the moon's south pole (see main story), it launched a solar observation satellite to study the sun and the effect of its weather on Earth.

The Aditya-L1 mission will "take India to the forefront of solar space observation" and supply unprecedented data to scientists, says Helen Mason at the University of Cambridge.

The Indian Space Research Organisation launched the satellite on 2 September on a PSLV-XL rocket from Satish Dhawan Space Centre on the country's east coast.

Aditya-L1 is named after both the Hindu sun god and Lagrange point 1 (L1) between Earth and the sun, where the gravitational pull from both bodies is equal.

It will be placed in orbit around L1 so that it can continuously view the sun without obstruction and benefit from the gravitational equilibrium by holding its position without using much fuel. Because the sun is vastly more massive than Earth, L1 is only 1 per cent of the way from Earth to the sun, which are, on average, 150 million kilometres from each other.

The mission objectives include studying why the sun's corona is much hotter than its surface and investigating solar wind and flares. The satellite weighs 1500 kilograms and will carry seven scientific payloads, all developed in India. Four will view the sun and three will carry out measurements of particles and magnetic fields from L1.

Mason says scientists around the world are excited to get their hands on the data once the craft has reached its destination in January 2024.

"This will be unique because it has some instruments which are not carried on other satellites," says Mason. "All the instruments are exciting and they will all push the boundaries of what we have at the moment."