

## Chandrayaan-1

In a historic event, the Indian space programme achieved a unique feat on 14 November 2008 with the placing of Indian tricolour on the Moon's surface on Pandit Jawaharlal Nehru's birthday. The Indian flag was painted on the sides of Moon Impact Probe (MIP), one of the 11 payloads of Chandrayaan-1 spacecraft, that successfully hit the lunar surface at 20:31 h (8:31 pm) IST on November 14. This was the first Indian built object to reach the surface of the moon. The point of MIP's impact was near the Moon's South Polar Region. It may be recalled that the modern Indian space programme was initiated in 1962 when Pandit Jawaharlal Nehru was the Prime Minister of India.

Weighing 34 kg at the time of its launch onboard Chandrayaan-1, the box-shaped MIP carried three instruments – a video imaging system, a radar altimeter

and a mass spectrometer. The video imaging system was intended to take the pictures of the moon's surface as MIP approached it. The radar altimeter was included to measure the rate of descent of the probe to the lunar surface. Such instruments are necessary for future lunar soft landing missions. And, the mass spectrometer was for studying the extremely thin lunar atmosphere.

Chandrayaan-1 spacecraft successfully reached its intended operational orbit at a height of about 100 km from the lunar surface on 12 November 2008. This followed a series of four orbit reduction manoeuvres conducted by repeatedly firing the spacecraft's 440 Newton liquid engine after it entered into an elliptical orbit around the moon on 8 November 2008. As part of these manoeuvres, the engine was fired for a cumulative duration of about 17 min. As a result of these

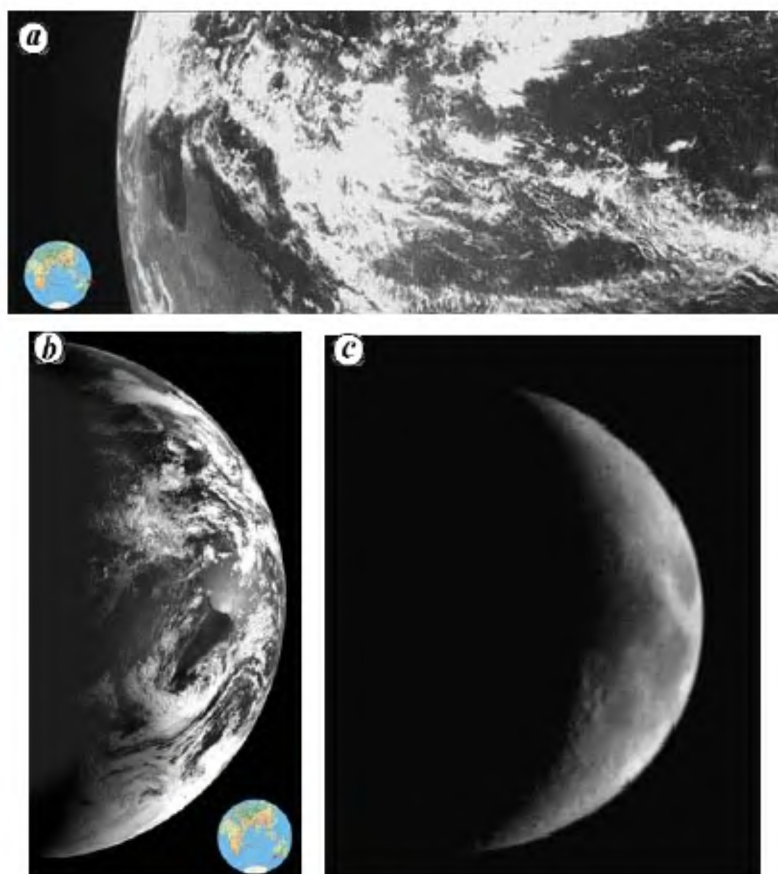
manoeuvres, the farthest point of Chandrayaan-1's orbit (aposele) from the moon's surface was first reduced from 7,500 km to 255 km and finally to 100 km while the nearest point (perisele) was reduced from 500 km to about 200 km and finally to 100 km.

It may be recalled that Chandrayaan-1 was successfully launched by PSLV-C11 on 22 October 2008 from India's spaceport at Satish Dhawan Space Centre SHAR, Sriharikota into its intended initial elliptical orbit around the earth. Following this, the spacecraft's orbit was raised in steps and it was made to pass near the moon by repeatedly firing its 440 Newton liquid engine.

The complex sequence of operations that were carried out to put Chandrayaan-1 from its initial earth orbit to its intended operational lunar orbit with the use of its liquid engine onboard the spacecraft were carefully planned. During these operations, Chandrayaan-1's liquid engine was fired a total of 10 times successfully. In its present operational orbit of 100 km height, Chandrayaan-1 spacecraft takes about two hours to go round the moon once.

From its operational circular orbit passing over the polar regions of the moon, it is intended to conduct chemical, mineralogical and photo-geological mapping of the moon with Chandrayaan-1's 11 scientific instruments (payloads). Two of those 11 payloads – Terrain Mapping Camera (TMC) and Radiation Dose Monitor (RADOM) – were successfully switched ON as the spacecraft was orbiting the earth. TMC successfully took the pictures of earth and moon. And, the third payload – the MIP – has successfully reached the lunar surface. It is now planned to switch ON and test the remaining eight payloads of the spacecraft in the coming few days.

Since its launch, the health and orbit of Chandrayaan-1 was continuously monitored from the Spacecraft Control Centre of ISRO's Telemetry, Tracking and Command Network (ISTRAC) at Bangalore with critical support from antennas of Indian Deep Space Network (IDSN) at Byalalu. IDSN antennas also received the images and scientific information gathered by TMC, RADOM, and more recently, by MIP.



Earth as viewed by Chandrayaan-1 Terrain Mapping Camera on 29 October 2008: **a**, satellite altitude – 9000 km; **b**, satellite altitude – 70,000 km. **c**, Moon as viewed by Chandrayaan-1 Terrain Mapping Camera on 4 November 2008 (Distance: 311,200 km from moon).