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SOARING TO THE MOON

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A decade after the first successful mission to the moon with Chandrayaan-1, the Indian Space Research Organisation successfully launched its sequel, Chandrayaan-2, to further explore the earth's natural satellite. Earlier this year, China landed a robotic spacecraft on the far side of the moon, in a first-ever attempt. Now India is attempting a similar feat — to land its rover Pragyan in the moon's South Polar region, attempted so far by none. The equatorial region has been the only one where rovers have landed and explored. The launch by itself is a huge achievement considering that it is the first operational flight of the indigenously developed Geosynchronous Satellite Launch Vehicle Mark-III (GSLV Mark-III) to send up satellites weighing up to four tonnes. The orbiter, the lander (Vikram) and the rover (Pragyan) together weigh 3.87 tonnes. Having reached the earth parking orbit, the orbit of the Chandrayaan-2 spacecraft will be raised in five steps or manoeuvres in the coming 23 days before it reaches the final orbit of 150 x 1,41,000 km. It is in this orbit that Chandrayaan-2 will attain the velocity to escape from the earth's gravitational pull and start the long journey towards the moon. A week later, on August 20, the spacecraft will come under the influence of the moon's gravitational pull, and in a series of steps the altitude of the orbit will be reduced in 13 days to reach the final circular orbit at a height of 100 km. The next crucial step will be the decoupling of the lander (Vikram) and the rover (Pragyan) from the orbiter, followed by the soft-landing of the lander-rover in the early hours of September 7. Despite the postponement of the launch from July 16 owing to a technical snag, the tweaked flight plan has ensured that the Pragyan robotic vehicle will have 14 earth days, or one moon day, to explore.

Unlike the crash-landing of the Moon Impact Probe on the Chandrayaan-1 mission in November 2008, this will be the first time that ISRO is attempting to soft-land a lander on the earth's natural satellite. A series of braking mechanisms will be needed to drastically reduce the velocity of the Vikram lander from nearly 6,000 km an hour, to ensure that the touchdown is soft. The presence of water on the moon was first indicated by the Moon Impact Probe and NASA's Moon Mineralogy Mapper on Chandrayaan-1 a decade ago. The imaging infrared spectrometer instrument on board the orbiter will enable ISRO to look for signatures indicating the presence of water. Though the Terrain Mapping Camera on board Chandrayaan-1 had mapped the moon three-dimensionally at 5-km resolution, Chandrayaan-2 too has such a camera to produce a 3-D map. But it will be for the first time that the vertical temperature gradient and thermal conductivity of the lunar surface, and lunar seismicity, will be studied. While ISRO gained much with the success of Chandrayaan-1 and Mangalyaan, the success of Chandrayaan-2 will go a long way in testing the technologies for deep-space missions.

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