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Chandrayaan 3 will aim for the Moon but look beyond it

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Who doesn't enjoy the sight of the Moon? Whether its phase is gibbous, crescent, or complete, the Moon mesmerises children, poets, and anyone who identifies with nature for its serene beauty, its sense of calm, and the sensations it kindles.

Scientists are interested in the Moon to understand its origin and characteristics, and, if possible, to explore the possibility of inhabiting it – and these studies require going to the Moon. Not many countries have undertaken such studies, but India is well-positioned with its industrial and technological support base and trained human resources to venture into studying the Moon at close quarters. This feat is yet another feather in the cap of the Indian Space Research Organisation (ISRO). No wonder it attracts talented youth from the best institutions in the country.

Chandrayaan 1

ISRO's first attempt was the Chandrayaan 1 (i.e. "Lunar Vehicle 1") mission, which began in October 2008 with a launch of the very successful Polar Satellite Launch Vehicle (PSLV). The rocket carried a lunar orbiter meant to go around the Moon, like a satellite, and an impact probe. The orbiter relieved the impact probe to hit the surface of the south polar region of the Moon, to generate data

relevant to designing a lunar rover that would be a part of the payload in a subsequent mission.

While descending to the Moon, the impactor probe collected information on the chemical composition of the lunar atmosphere. Notably, this mission established the availability of water molecules on the Moon, a discovery that may be crucial for future crewed missions. The probe also carved the national flag of India on the Moon, announcing our arrival.

The mission did not last two years as planned, possibly due to overheating issues in the orbiter, but it achieved most of its scientific objectives. In a testament to its success, it received many accolades from the international community.

Chandrayaan 2

The next such mission was Chandrayaan 2 in July 2019, which was launched by a Geosynchronous Satellite Launch Vehicle (GSLV). Its payload included a Moon lander that carried a rover to release on the Moon. The lander, unfortunately, crashed on the lunar surface due to a software glitch, and the rover did not detach from the lander, so further studies of the Moon's surface were impossible.

A Chennai-based amateur space enthusiast named Shanmuga Subramanian, skilled in image analysis, identified the location of the lander's debris, and NASA later confirmed it. Participation by citizens in big science projects is a welcome trend and researchers should strive to create such opportunities.

Currently, ISRO is planning Chandrayaan 3 to demonstrate end-to-end capability for safe landing and roving on the lunar surface. The launch is scheduled for July 14, 2023, at 2.35 pm. The mission will be launched on board the Launch Vehicle Mark III (LVM 3, a.k.a. GSLV Mk III). The vehicle will carry a lander attached to a

propulsion module. The latter will carry the former to a circular orbit around the Moon, after which the lander will descend to the surface. The lander module will carry a rover that it will deploy on the Moon, and a few other pieces of scientific equipment. The lander and the rover are expected to be operational for about two weeks.

As in previous missions, the scientific mission will study the chemical composition of the lunar surface, local seismic activity, and plasma concentration, among other features. The propulsion module will have a payload called ‘Spectro-polarimetry of Habitable Planet Earth’ (SHAPE), which will track radiation from the earth to help identify the signatures of life, which future missions can use in turn to look for signs of life on habitable exoplanets. So Chandrayaan 3 is also to look beyond the Moon.

Lessons learned from Chandrayaan 2 will help avoid design deficiencies that are likely to contribute to failures. Some such ‘upgrades’ already include strengthened legs on the lander and software updated to include failure scenarios.

Importance of the missions

Missions like Chandrayaan are important because many countries participate in them. These missions are collaborative global efforts that strengthen scientific exchange and camaraderie between countries.

There is scope for international collaboration in future missions to explore the south-polar region of the Moon. The craters here have locations that don’t receive sunlight. These shadowed sites are cold and hold hydrogen, water, and ice. They could also host primordial material that could help us understand the origins of the Solar System. The biggest lunar crater is also in the south polar region. The origin of this crater, which formed about 4 billion years ago, is

still unclear. So understanding our cosmic neighbour will go a long way towards gaining insights about the cosmos.

Why should India spend on these high-tech areas instead of investing in available technologies that can be used more readily for the public good? It is because they can be used for the public good, too. Developing countries need knowledge of such concepts to improve their citizens' quality of life. Space technologies have also become essential for weather prediction, assessment of marine resources, estimation of forest cover, communication, defence – to just name a few. Every country needs technologies of both futuristic and immediately relevant varieties, together with a well-thought-out apportionment of resources between these two areas.

Indeed, R. Chidambaram, a former Principal Scientific Advisor to the Government of India, once remarked that participating in an emerging technology makes a nation a leader in that field, giving it bargaining power when dealing with other countries. This in turn will enable a country to enhance its science and technology base to improve its citizens' lives and its prestige.

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