

MOON-BOUND AGAIN

Relevant for: Science & Technology | Topic: Space Technology & related matters

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India's second mission to the moon was planned for July 15, but got delayed owing to technical problems just one hour before the actual launch. However, ISRO scientists identified the anomaly quickly and now, within a week, the [Chandrayaan 2](#) mission has begun its journey towards the moon. The launch of the mission on July 22, is a successful first step towards realising a larger aim of the mission, which is to ensure that India's lander successfully makes a soft landing on the surface of the moon. Subsequently, from the belly of the lander, the rover would be released for making an assessment of the elemental composition of the moon's surface.

Chandrayaan 2 has been one of the most awaited missions of ISRO. After the success of Chandrayaan 1 in 2008, it was expected that the second mission would get moon-bound shortly. In fact, ISRO did plan the second mission for 2014. However, this was supposed to be a joint mission along with Russia. As per the plans, Russia was to provide the lander and rover system, but they failed to do so owing to the crisis within their space programme.

This resulted in a delay in the programme and now, after a gap of more than a decade, India's second moon mission has begun its journey towards the moon. There is both a negative and a positive angle to this delay. The negative angle is obvious — India's moon agenda has lagged behind significantly. Actually, by this time, India should have progressed towards undertaking its third mission to the moon. The good part is that Russia's non-participation made ISRO design and develop the entire lander-rover system indigenously. In the long run, this would make ISRO more self-sufficient.

After the successful launch of Chandrayaan 2, now the wait is for the soft landing on the moon on September 6. For the next one-and-a-half months, ISRO scientists would be required to ensure that the mission remains in good health. It would be a phase by phase journey, ISRO would be undertaking five to six orbit raising manoeuvres, known as earth orbit burns, to take the craft close to the moon. Subsequently, they would be performing lunar orbit burns and would effectively establish the craft (orbiter) 100 km above the moon surface. This would be followed by the soft landing of the lander. This landing is going to be the most critical part of this mission, which ISRO is calling "15 minutes of terror", since they would need to drastically reduce the velocity of the lander, finally reaching zero.

Chandrayaan 2 would be travelling a distance of approximately 4 lakh km. Finally, after reaching there, they would view and study the moon from a distance of 100 km for one year, at the minimum. But, the lander-rover system on the moon would function only for one moon day (equivalent to 14 Earth days) and during this period the rover could travel a maximum distance of 500 metres on the moon's surface. All this would cost around Rs 1,000 crore. The obvious question would be: Is the effort worth the investments?

Now, compare India's mission with two similar missions in China: Chang'e-3 (2013) and Chang'e-4 (soft landing on January 3 this year). The rover of Chang'e-4 called Yutu-2 is still

functional after six months. For its designed life of three months, Yutu-2 has managed to travel for 163 metres. The first Yutu rover of Chang'e-3 mission, managed to rove about 114 metres before the technical malfunction that left it unable to move. This rover continued to function while stationary until mid-2016. The lander for Chang'e-3 remained operational for more than 2,000 days and could even be operational today.

Officially, the costs towards the Chinese mission are not known, but based on available estimates, they are much more than the ISRO's. In respect of Chandrayaan 2, there is a possibility that the mission could even last for more than the designed life period. Please remember, India's Mars Orbiter Mission (MOM) has completed four years in its orbit on September 24, 2018, though the designed mission life was only six months.

Interestingly, during the 1970s, the Soviets had positioned the Lunokhod 1 rover to the lunar surface by the Luna 17 spacecraft. This was the first successful rover to operate beyond earth. It operated for 322 days and is known to have travelled around 10 km and sent thousands of images back. But this was the period when even humans went to the moon.

The 21st century challenges are different. Humanity is paying the price for neglecting the moon for the last five decades. The technology edge of the Apollo 11 era has disappeared. Americans are reinventing the wheel to get back to the moon. As the Chinese case indicates, today it is difficult to travel even a few meters on the moon successfully. During the last five decades, the world has witnessed an around 50 per cent success rate for such missions. Very recently, Israel's attempt for soft landing on the moon had resulted in failure.

In the backdrop of all this, ISRO has planned its mission. It has taken on the challenge upfront. Let us all wish India's lander (Vikram) and rover (Pragyan) happy-landings on September 6, and godspeed.

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