

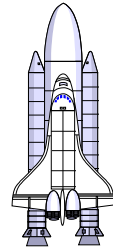
PHYSICS**KALPANA**

22



2018-2019

ISRO counts down to launch second spacecraft to 'Touch Moon'

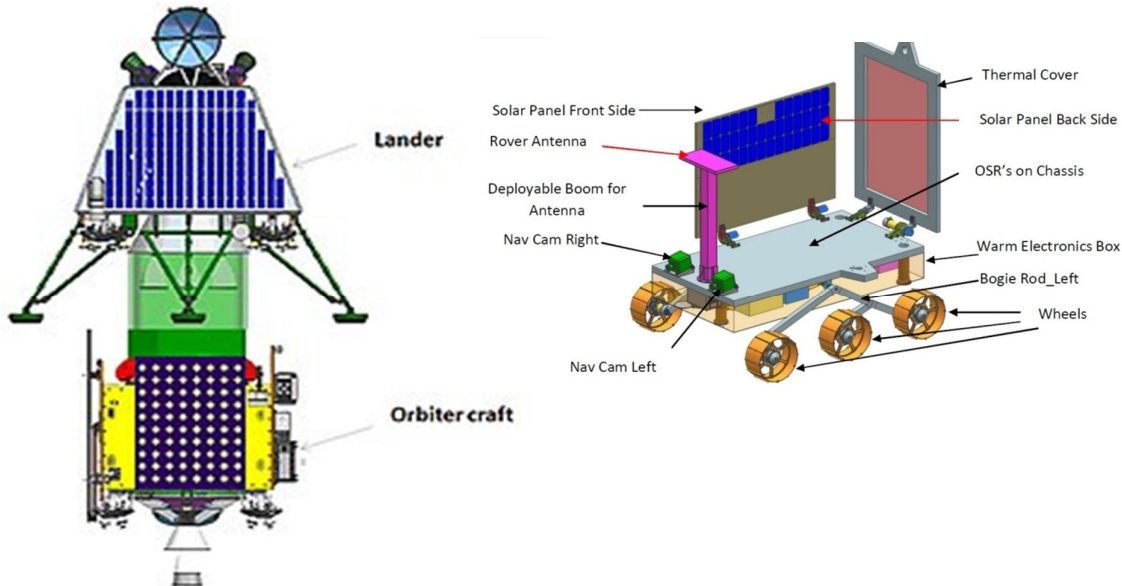


Chandrayaan-1 was India's first lunar probe. It was launched by the Indian Space Research Organisation in October 2008 and operated until August 2009. The mission included a lunar orbiter and an impactor. India launched the spacecraft using a PSLV-XL rocket, serial number C11, on 22 October 2008 at 00:52 UTC from Satish Dhawan Space Centre, at Sriharikota about 80 km (50 mi) north of Chennai. Prime Minister Atal Bihari Vajpayee announced the project on course in his Independence Day speech on 15 August 2003.

The mission was a major boost to India's space program, as India researched and developed its own technology in order to explore the Moon. The vehicle was inserted into lunar orbit on 8 November 2008. On 14 November 2008, the Moon Impact Probe separated from the Chandrayaan orbiter at 14:36 UTC and struck the south pole in a controlled manner, making India the fourth country to place its flag on the Moon. The probe hit near the crater Shackleton at 15:01 UTC, ejecting sub-surface soil that could be analysed for the presence of lunar water ice. The estimated cost for the project was 386 crore (US\$54 million). The remote sensing lunar satellite had a mass of 1,380 kg at launch and 675 kg in lunar orbit. It carried high resolution remote sensing equipment for visible, near infrared, and soft and hard X-ray frequencies. Over a two-year period, it was intended to survey the lunar surface to produce a complete map of its chemical characteristics and three-dimensional topography.

CHANDRAYAAN 2

Chandrayaan-2 is India's second lunar exploration mission after Chandrayaan-1 developed by the Indian Space Research Organisation (ISRO), the mission is planned to be launched to the Moon by a Geosynchronous Satellite Launch Vehicle Mark III (GSLV Mk III). It includes a lunar orbiter, lander and rover, all developed by India.



Chandrayaan-2 is scheduled to launch in April 2019 and will attempt to soft land a lander and rover in a high plain between two craters, Manzinus C and Simpelius N, at a latitude of about 70° south. If successful, Chandrayaan-2 will be the second mission to land a rover near the lunar south pole. According to ISRO, this mission will use and test various new technologies and conduct new experiments. The wheeled rover will move on the lunar surface and will perform on-site chemical analysis. The data will be relayed to Earth through the Chandrayaan-2 orbiter, which will piggyback on the same launch. The mission is planned to fly on a Geosynchronous Satellite Launch Vehicle Mark III (GSLV Mk III) with an approximate lift-off mass of 3877 kg from Satish Dhawan Space Centre on Sriharikota Island. As of February 2018, the mission has an allocated cost of 800 crore (approximately US\$125 million).

➤ **Orbiter**

- The orbiter will orbit the Moon at an altitude of 100 km.
- The mission will carry five instruments on the orbiter. Three of them are new, while two others are improved versions of those flown on Chandrayaan-1.
- The approximate launch mass will be 2379 kg. The Orbiter High Resolution Camera (OHRC) will conduct high-resolution observations of the landing site prior to separation of the lander from the orbiter.
- Interfaces between the orbiter and its GSLV Mk II launch vehicle have been finalised. The orbiter's structure was manufactured by Hindustan Aeronautics Limited and delivered to ISRO Satellite Centre on 22 June 2015.

➤ **Vikram Lander**

- The mission's lander is called *Vikram*, named after Vikram Sarabhai (1919-1971) who is widely regarded as the father of the Indian space programme.
- The *Vikram* lander will detach from the orbiter and descend to a lunar orbit of $30 \text{ km} \times 100 \text{ km}$ using its 800 N liquid main engines. It will then perform a comprehensive check of all its on-board systems before attempting to land on the lunar surface.
- Unlike Chandrayaan-1's Moon Impact Probe, the *Vikram* lander will make a soft landing, deploy the rover, and perform some scientific activities for approximately 15 days.
- The approximate combined mass of the lander and rover is 1,471 kg .
- The preliminary configuration study of the lander was completed in 2013 by the Space Applications Centre (SAC) in Ahmedabad.
- The lander's propulsion system consists of eight 50 N (thrusters for attitude control and five 800 N liquid main engines derived from ISRO's 440 N Liquid Apogee Motor. Initially, the lander design employed four main liquid engines, but a centrally mounted engine was added to handle new requirements of having to orbit the Moon before landing.
- The additional engine is expected to mitigate upward draft of lunar dust during the soft landing.

- Some associated technologies include a high resolution camera, navigation camera, hazard avoidance camera, an 800 N throttleable liquid main engine and attitude thrusters, altimeter, velocity meter, accelerometer, and the software needed to run these components.
- The lander's main engine has successfully undergone a high altitude test for duration of 513 seconds, and closed loop verification tests of the sensors, actuators and software were completed in 2016.
- Engineering models of the lander began undergoing ground and aerial tests in late October 2016, in Challakere in the Chitradurga district of Karnataka. ISRO created roughly 10 craters on the surface to help assess the ability of the lander's sensors to select a landing site.

- *Inspiration*

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