

This article is related to General Studies  
Paper-III (Sci & Tech)

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**"ISRO has announced a series of plans include a space station, human space flight, and the Moon landing mission next month. What will Chandrayaan-2 seek to achieve that Chandrayaan-1 could not?"**

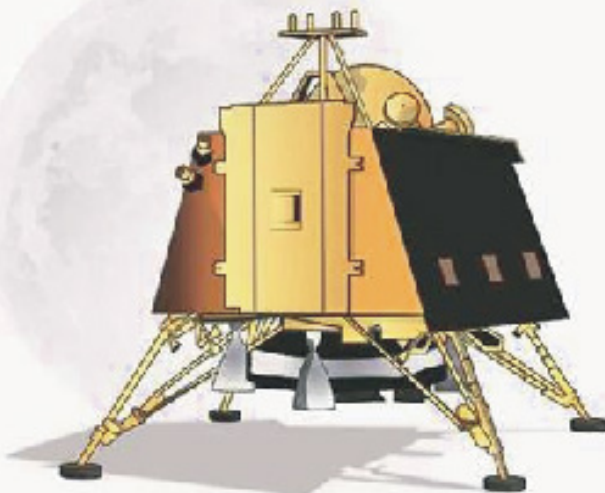
A day after it announced the launch date for the Chandrayaan-2 mission, the Indian Space Research Organisation (ISRO) said on Thursday it intended to build a permanent station in space in the next five to seven years. It seems to be a logical step forward, after the exploratory missions to the Moon (Chandrayaan -1) and Mars (Mangalyaan), the upcoming Lander and Rover mission to Moon (Chandrayaan-2), the declared human space flight before 2022 (Gaganyaan), and a possible, still undeclared, human mission to the Moon sometime later.

With these missions, ISRO has also been signalling a distinct change in its priorities — henceforth, it would be an agency engaged mainly in space and inter-planetary exploration, while other ventures like commercial satellite launches would only be secondary activities. Much would, however, depend on the success of Chandrayaan-2 and Gaganyaan.

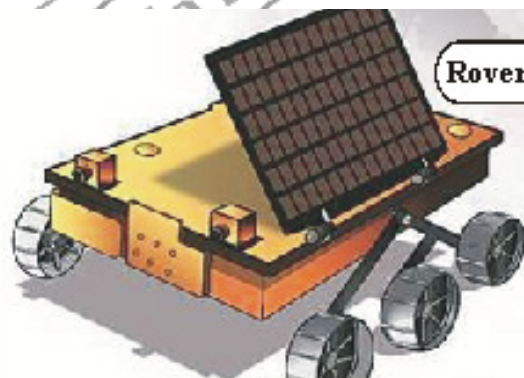
## Chandrayaan-2

ISRO has now said Chandrayaan-2 will be launched on July 15, and its lander and rover would touch down on the moon's surface on September 6.

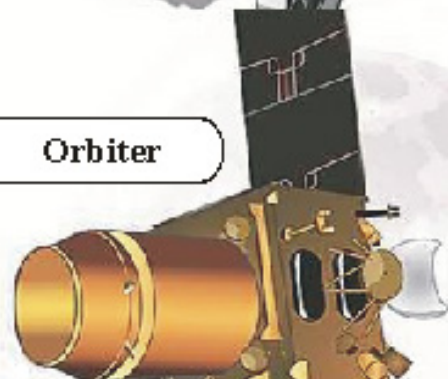
Lander (Vikram)



Rover (Pragyan)



Orbiter



A natural sequel to Chandrayaan-1, an Orbiter mission launched in October 2008, Chandrayaan-2 has taken a long way coming. It was originally scheduled to be launched in 2012, but at that time the lander module was supposed to come from Russian space agency Roskosmos. The Russians, however, withdrew after their similarly designed lander for another mission developed problems in 2011. That left it on ISRO to design, develop and build the lander on its own, which has taken a few years.

Now, it is expected to produce much more science than Chandrayaan-1 could. Chandrayaan-1, ISRO's first exploratory mission to moon, was designed to just orbit the Moon and make observations with instruments on board. The closest the spacecraft came was in an orbit 100 km from the Moon surface.

For largely symbolic reasons, though, the Chandrayaan-1 mission did send one of its instruments, called Moon Impact Probe, or MIP, a 35-kg cube-shaped module with the Indian tricolour on all its sides, to crash-land on the Moon's surface. ISRO later claimed data sent by MIP on its way to the Moon had shown evidence of presence of water, but it could not publish those findings because of anomalies in calibration.

The confirmation for water had come through studies on data produced by another instrument onboard the Chandrayaan-1 spacecraft, the M3 or Moon Mineralogy Mapper, that had been put by NASA.

Chandrayaan-2 consists of an Orbiter, Lander and Rover, all equipped with scientific instruments to study the moon. The Orbiter will once again orbit from 100 km away, while the Lander and Rover modules will separate and make a soft-landing on the surface. ISRO has named the Lander module Vikram, after Vikram Sarabhai, and the Rover module Pragyaan, meaning wisdom.

## **The Lander**

The Lander is the distinguishing feature. It is the first time that ISRO is attempting to soft-land a module in extra-terrestrial space. The main challenge is in controlling its speed as it approaches the surface. Once the Lander and the Rover, enter the Moon's gravity, they would be in a state of free fall. That could end in crash-landing and destruction of instrument; because of lack of air to provide drag, these instruments cannot make use of parachute-like technologies. Instead, the Lander fires thrusters in the opposite direction to slow down. To enable a smooth landing, the speed of the Lander just ahead of touchdown should be 1 m/s (3.6 km/h) or less.

Once on the Moon, the Rover, a six-wheeled solar-powered vehicle, will detach itself and slowly crawl on the surface, making observations and collecting data. It will be equipped with two instruments, and its primary objective will be to study the composition of the surface near the lunar landing site, and determine its abundance of various elements.

The 1471-kg Lander, which will remain stationary after touching down, will carry three instruments that will mainly study the moon's atmosphere. One of these will also look out for seismic activity.

While the Lander and Rover are designed to work for only 14 days (1 lunar day), the Orbiter, a 2,379-kg spacecraft with seven instruments on board, would remain in orbit for a year. It is equipped with different kinds of camera to take create high-resolution three-dimensional maps of the surface. It also has instruments to study the mineral composition on moon and the lunar atmosphere, and also to assess the abundance of water.

## **Uncharted territory**

With Chandrayaan-2, India will become only the fourth country to land a spacecraft on Moon. So far, all landings, human as well as non-human, have been in areas close to the Moon's equator. That was mainly because this area receives more sunlight, which is required by solar-powered instruments. In January this year, China landed a lander and rover on the Moon's far side (not facing the Earth). This was the first time any landing had taken place on that side. The Chinese mission, Chang'e 4, was designed to function for three lunar days but has already entered its fifth lunar night.

Chandrayaan-2 will make a landing at a site where no earlier mission has gone, near the south pole of the Moon.

The unexplored territory offers an opportunity for the mission to discover something new. Incidentally, the crash-landing of the MIP from Chandrayaan-1 had happened in the same region of the Moon.

The south pole of the Moon holds possibility of presence of water. In addition, this area is also supposed to have ancient rocks and craters that can offer indications of history of the Moon, and also contain clues to the fossil records of early solar system.

## Space Station

ISRO has not announced any date for establishing a space station. And that is because it would crucially depend on the success of Gaganyaan which will demonstrate the agency's capability to send astronauts and bring them back safely. Until a human space flight becomes successful, the space station would be meaningless.

As of now, only NASA's International Space Station is operational. Before that, the Mir station built by the erstwhile Soviet Union was the only such facility available. China is the only other country to have a space station programme, and it has tested out technologies through two Tiangong spacecraft. It is not yet ready to support habitation for astronauts.

## GS World Team...

### Chandrayaan-2

#### Why in the discussion?

- Recently ISRO has announced the date and time of launch of Chandrayaan-2.
- Chandrayaan-2 will be launched on July 15.
- According to ISRO, the GSLV Mark 3 rocket will set the orbiter in the polar orbit of the Earth in 15 minutes.
- It is known that in Chandrayaan-2 there is not even a single foreign payload. All its parts are completely indigenous, while Chandrayaan-1's orbiter has 3 Europe and 2 US Payloads.
- ISRO has hoped that Chandrayaan-2 will land near the of the moon on 6th September.
- Chandrayaan-II is the second moon mission and has three modules in Orbiter, Lander (Vikram) and Rover (Pragyan).
- India launched Chandrayaan-1 on October 22, 2008, after a decade later which of Chandrayaan-2 will be launched at a cost of 800 crores.

#### About mission

- Orbiter:** Chandrayaan-2's orbiter will be installed at a distance of 100 km from the moon. It will send the information from Lander and Rover to the ISRO Center while circling.
- There are 8 payloads in it. It will also bring the

command sent from ISRO to the lander and the rover. It was made by Hindustan Aeronautics Limited and handed to ISRO in 2015.

- Lander (Vikram):** Lander named is named after ISRO's founder and father of Indian space program Vikram Sarabhai. There are 4 payloads in it.
- It will conduct scientific research for 15 days. Its initial design was made by ISRO's space application center Ahmedabad. Later it was developed by the URSC of Bengaluru.
- Rover (Pragyan):** This is a robot and will be the responsibility of the whole mission will be on this conduct robot, weighing 27 kilograms. This robot has two payloads.
- It will cover a distance of 400 meters On the surface of the moon. During this, it will use various scientific experiments. Then send this information from the moon to Vikram Lander.
- Lander will send data to orbiter from there. Then the orbiter will send it to the ISRO center.
- This whole process will take about 15 minutes. That means the information sent from Pragyan Robot will take about 15 minutes to reach the ISRO center in India.

**Expected Questions (Prelims Exams)**

**Q.** Consider the following statements regarding Chandrayan-2 -

1. It will be launched with the help of GSLV-MK-III.
2. After its successful mission, India will become the fifth country of the world to land rover on the moon.
3. Under this mission, lander will be landed at South Pole of the moon.

Which of the above statements are correct?

- (a) 1 and 2
- (b) 2 and 3
- (c) 1 and 3
- (d) 1, 2 and 3

**Expected Questions (Mains Exams)**

**Q.1** How will the successful launch of Chandrayan-2 included in space missions of ISRO proved to be helpful in strengthening India's influence in space sector? Discuss.

(250Words)

**Note:** Answer of Prelims Expected Question given on 13 June is 1 (d)

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