GOVERNMENT OF INDIA

DEPARTMENT OF SPACE

LOK SABHA

UNSTARRED QUESTION NO. 2718

TO BE ANSWERED ON WEDNESDAY, DECEMBER 11, 2024

BENEFITS OF MOON MISSION

2718. SHRI BALABHADRA MAJHI:

Will the PRIME MINISTER be pleased to state:

(a) the details of the findings on the Moon by different countries which sent spacecraft to the Moon; and

(b) the details of expected benefits from the Moon Mission?

ANSWER

MINISTER OF STATE IN THE MINISTRY OF PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND IN THE PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH):

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(a) The Lunar missions sent by various countries have yielded significant scientific findings. A brief overview of the major missions is presented here.

India:

Chandrayaan-1 (2008): India's first lunar mission, it discovered water molecules on the lunar surface and exosphere, as well as mapped the Moon's mineral composition. Chandrayaan-1 also

carried the Moon Impact Probe (MIP), which found the signatures of the lunar exospheric water vapour and noble gases. The mission has generated a 3D lunar atlas from the indigenous Terrain Mapping Camera (TMC) onboard the orbiter. Discovery-class science results have been obtained about the interaction of the solar wind with the lunar regolith, discovery of ion population in the lunar wake region, as well as the mapping of the minimagnetospheres on the lunar surface.

Chandrayaan-2 (2019): India's second lunar mission, it aimed to soft-land a rover near the lunar south pole, but the lander was not successful in soft-landing. However, the orbiter continues to study the Moon's surface and composition, as well as the exosphere. This mission has generated high resolution (~25 cm spatial resolution in nadir direction) images of the lunar surface with the Orbiter High Resolution Camera (OHRC) onboard the orbiter. Moreover, the CHACE-2 mass spectrometer has mapped the lunar Ar-40 gas for the first time and studied its variation, which has implications to understand the radiogenic activities inside the Moon. The DF-SAR instrument has studied the sub-surface water-ice on the Moon, while the IIRS instrument has done unambiguous detection of the lunar surface water-ice with its extended wavelength range. The CLASS instrument has studied the surface minetarology and brought out several first-of-its kind of science results.

Chandrayaan-3 (2023): This mission successfully achieved a soft landing near the Moon's south pole on August 23, 2023.

This historic feat made India the fourth country to accomplish a soft landing on the Moon and the first to reach the lunar south polar region. The rover deployed by Chandrayaan-3 conducted scientific experiments to study the lunar surface composition, thermal properties, and mineral composition. The Chandrayaan-3 mission has validated the Lunar Magma Ocean (LMO) hypothesis and provided insights on the dynamics of the lunar materials during the early days of Moon. This mission has further enhanced India's position in space exploration and contributed valuable scientific data to our understanding of the Moon.

United States (NASA):

Ranger: A series of unmanned probes that impacted the Moon's surface, sending back high-resolution images before impact.

Lunar Orbiter: A series of unmanned spacecraft that orbited the Moon and took detailed photographs of the entire lunar surface, aiding in selecting landing sites for the Apollo missions.

Surveyor: A series of unmanned spacecraft that soft-landed on the Moon and conducted soil mechanics experiments, as well as taking photographs of the lunar surface.

Apollo Missions (1969-1972): The most iconic lunar missions, they brought back lunar rocks and soil samples, allowing scientists to study the Moon's composition and geological history. They also installed scientific instruments on the lunar

surface to measure seismic activity, magnetic fields, and solar wind.

Other Lunar Orbiter Missions: NASA has launched several lunar orbiters to study the Moon's surface, composition, and environment. These include the Clementine mission (1994), Lunar Prospector mission (1998), Lunar Reconnaissance Orbiter (2009), Gravity Recovery and Interior Laboratory (GRAIL) mission (2011) and the Lunar Atmosphere and Dust Environment Explorer (LADEE) mission (2013).

Soviet Union/Russia:

Luna Program (1959-1976): A series of unmanned missions that achieved several firsts, including the first spacecraft to reach the Moon, the first to photograph the far side of the Moon, and the first to perform a soft landing on the Moon.

Luna 24 (1976): The last Soviet lunar mission, it returned lunar soil samples from the Mare Crisium region.

Zond 5, 6, 7, and 8: These unmanned spacecraft flew around the Moon and returned to Earth, testing technologies for future crewed missions.

China:

Chang'e Program: The Chang’e program has successfully progressed through several phases. The initial phase involved orbiting the Moon, achieved by the Chang'e 1 and 2 missions.

Subsequently, the program focused on lunar landing and roving, accomplished by Chang'e 3 and 4. The most recent phase has involved sample return missions, with Chang'e 5 bringing lunar samples to Earth and Chang'e 6 returning samples from the far side of the Moon.

Japan:

Kaguya (2007): Japan's lunar orbiter studied the Moon's gravity field, topography, and mineral composition.

SLIM (Smart Lander for Investigating Moon) (2024): Successfully landed on the Moon in January 2024, demonstrating high-precision landing technology.

(b) Lunar missions offer a wealth of potential benefits, both scientific and economic. Studying the Moon can provide insights into the early solar system and the formation of Earth. Discovering resources like water-ice could support future lunar missions and potentially provide raw materials for space industries. Additionally, the Moon serves as a testing ground for technologies needed for other deep-space missions. Moon missions also enable the use of Moon as a vantage point for sensitive Astronomical observations. Economically, lunar missions could lead to space mining, lunar tourism, and the development of new technologies with applications on Earth. International cooperation is also a key benefit, as lunar missions often involve partnerships between nations, fostering collaboration and diplomacy.

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