**Chandrayaan-1**

Chandrayaan-1, India's first mission to Moon, was launched successfully on October 22, 2008 from SDSC SHAR, Sriharikota. The spacecraft was orbiting around the Moon at a height of 100 km from the lunar surface for chemical, mineralogical and photo-geologic mapping of the Moon. The spacecraft carried 11 scientific instruments built in India, USA, UK, Germany, Sweden and Bulgaria.  
  
After the successful completion of all the major mission objectives, the orbit has been raised to 200 km during May 2009. The satellite made more than 3400 orbits around the moon and the mission was concluded when the communication with the spacecraft was lost on August 29, 2009.

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| Mission | Remote Sensing, Planetary Science |
| Weight | 1380 kg (Mass at lift off) |
| Onboard power | 700 Watts |
| Stabilization | 3 - axis stabilised using reaction wheel and attitude control thrusters, sun sensors, star sensors, fibre optic gyros and accelerometers for attitude determination. |
| Payloads |  | |  | | --- | | Scientific Payloads from India  a) Terrain Mapping Camera (TMC) b) Hyper Spectral Imager (HySI) c) Lunar Laser Ranging Instrument (LLRI) d) High Energy X - ray Spectrometer (HEX) e) Moon Impact Probe(MIP) | | Scientific Payloads from abroad  f) Chandrayaan-I  X-ray Spectrometer (CIXS) g) Near Infrared Spectrometer (SIR - 2) h) Sub keV Atom Reflecting Analyzer (SARA) i) Miniature Synthetic Aperature Radar (Mini SAR) j) Moon Mineralogy Mapper (M3) k) Radiation Dose Monitor (RADOM) | |
| Launch Date | 22 October 2008 |
| Launch Site | SDSC, SHAR, Sriharikota |
| Launch Vehicle | PSLV - C11 |
| Orbit | 100 km x 100 km : Lunar Orbit |
| Mission life | 2 years |
| Prime Minister | Atal Bihari Vajpayee |
| ISRO Chairman | Madhavan Nair |

On 21 August 2009 Chandrayaan-1 along with the [Lunar Reconnaissance Orbiter](https://en.wikipedia.org/wiki/Lunar_Reconnaissance_Orbiter) attempted to perform a [bistatic radar](https://en.wikipedia.org/wiki/Bistatic_radar) experiment using their [Mini-SAR](https://en.wikipedia.org/wiki/Mini-RF) radars to detect the presence of [water ice on the lunar surface](https://en.wikipedia.org/wiki/Lunar_water). The attempt was a failure; it turned out the Chandrayaan-1 radar was not pointed at the Moon during the experiment

Although the results are consistent with recent findings of other NASA instruments onboard Chandrayaan-1 (the Moon Mineralogy Mapper (MP3) discovered water molecules in the Moon's polar regions, while water vapour was detected by NASA's [Lunar Crater Observation and Sensing Satellite](https://en.wikipedia.org/wiki/Lunar_Crater_Observation_and_Sensing_Satellite), or LCROSS[[89]](https://en.wikipedia.org/wiki/Chandrayaan-1#cite_note-additional_evidence-89)) this observation is not consistent with the presence of thick deposits of nearly pure water ice within a few meters of the lunar surface, but it does not rule out the presence of small (<~10 cm), discrete pieces of ice mixed in with the regolith.

The mission was launched on 22 October 2008 and expected to operate for two years. However, around 20:00 UTC on 28 August 2009 communication with the spacecraft was suddenly lost. The probe had operated for 312 days. The craft had been expected to remain in orbit for approximately another 1000 days and to crash into the lunar surface in late 2012,[[92]](https://en.wikipedia.org/wiki/Chandrayaan-1#cite_note-92) although in 2016 it was found to still be in orbit.

PSLV-C11

PSLV-C11, chosen to launch Chandrayaan-1 spacecraft, was an updated version of ISRO's Polar Satellite Launch Vehicle standard configuration. Weighing 320 tonne at lift-off, the vehicle used larger strap-on motors (PSOM-XL) to achieve higher payload capability.  
  
PSLV is the trusted workhorse launch Vehicle of ISRO. During September 1993- April 2008 period, PSLV had twelve consecutively successful launches carrying satellites to Sun Synchronous, Low Earth and Geosynchronous Transfer Orbits. On October 22, 2008, its fourteenth flight launched Chandrayaan-1 spacecraft.    
   
By mid 2008, PSLV had repeatedly proved its reliability and versatility by launching 29 satellites into a variety of orbits. Of these, ten remote sensing satellites of India, an Indian satellite for amateur radio communications, a recoverable Space Capsule (SRE-1) and fourteen satellites from abroad were put into polar Sun Synchronous Orbits (SSO) of 550-820 km heights. Besides, PSLV has launched two satellites from abroad into Low Earth Orbits of low or medium inclinations. This apart, PSLV has launched KALPANA-1, a weather satellite of India, into Geosynchronous Transfer Orbit (GTO).  
   
PSLV was initially designed by ISRO to place 1,000 kg class Indian Remote Sensing (IRS) satellites into 900 km polar SunSynchronous Orbits. Since the first successful flight in October 1994, the capability of PSLV was successively enhanced from 850 kg to 1,600 kg. In its ninth flight on May 5, 2005 from the Second Launch Pad (SLP), PSLV launched ISRO's remote sensing satellite,1,560 kg CARTOSAT-1 and the 42 kg Amateur Radio satellite, HAMSAT, into a 620 km polar Sun Synchronous Orbit. The improvement in the capability over successive flights has been achieved through several means. They include increased propellant loading in the stage motors, employing composite material for the satellite mounting structure and changing the sequence of firing of the strap-on motors.  
  
PSLV-C11 is 44.4 metre tall and has four stages using solid and liquid propulsion systems alternately. The first stage, carrying 138 tonne of propellant, is one of the largest solid propellant boosters in the world. Six solid propellant strap-on motors (PSOM-XL), each carrying twelve tonne of solid propellant, are strapped on to the first stage. The second stage carries 41.5 tonne of liquid propellant. The third stage uses 7.6 tonne of solid propellant and the fourth has a twin engine configuration with 2.5 tonne of liquid propellant.  
   
Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, designed and developed PSLV-C11. ISRO Inertial Systems Unit (IISU) at Thiruvananthapuram developed the inertial systems for the vehicle. Liquid Propulsion Systems Centre (LPSC), also at Thiruvananthapuram, developed the liquid propulsion stages for the second and fourth stages of PSLV-C11 as well as reaction control systems. SDSC SHAR processed the solid motors and carries out launch operations. ISRO Telemetry, Tracking and Command Network (ISTRAC) provide telemetry, tracking and command support during PSLV-C11's flight.

Chandrayan 2

Chandrayaan-2 mission is a highly complex mission, which represents a significant technological leap compared to the previous missions of ISRO. It comprised an Orbiter, Lander and Rover to explore the unexplored South Pole of the Moon. The mission is designed to expand the lunar scientific knowledge through detailed study of topography, seismography, mineral identification and distribution, surface chemical composition, thermo-physical characteristics of top soil and composition of the tenuous lunar atmosphere, leading to a new understanding of the origin and evolution of the Moon.

After the injection of Chandrayaan-2, a series of maneuvers were carried out to raise its orbit and on August 14, 2019, following Trans Lunar Insertion (TLI) maneuver, the spacecraft escaped from orbiting the earth and followed a path that took it to the vicinity of the Moon. On August 20, 2019, Chandrayaan-2 was successfully inserted into lunar orbit. While orbiting the moon in a 100 km lunar polar orbit, on September 02, 2019, Vikram Lander was separated from the Orbiter in preparation for landing. Subsequently, two de-orbit maneuvers were performed on Vikram Lander so as to change its orbit and begin circling the moon in a 100 km x 35 km orbit. Vikram Lander descent was as planned and normal performance was observed upto an altitude of 2.1 km. Subsequently communication from lander to the ground stations was lost.

The Orbiter placed in its intended orbit around the Moon will enrich our understanding of the moon’s evolution and mapping of the minerals and water molecules in Polar regions, using its eight state-of-the-art scientific instruments. The Orbiter camera is the highest resolution camera (0.3 m) in any lunar mission so far and will provide high resolution images which will be immensely useful to the global scientific community. The precise launch and mission management has ensured a long life of almost seven years instead of the planned one year.

Chandrayaan-2 is an Indian lunar mission to explore the unchartered south pole of the celestial body by landing a rover.

On September 7, India attempted to make a soft landing on to the lunar surface.

However, lander Vikram missed the primary landing site and went for the second. The visuals went missing henceforth.

According to Isro chief K Sivan, communication from Vikram lander was lost and data is still being analysed.

If India does succeed, it will be the fourth country to land on the moon, after the erstwhile USSR, US and China, to cement its place among the world's space-faring nations.

India's Geosynchronous Satellite Launch Vehicle, GSLV MkIII-M1 had successfully launched the 3,840-kg Chandrayaan-2 spacecraft into the earth's orbit on July 22.

Chandrayaan-2 satellite had begun its journey towards the moon leaving the earth's orbit in the dark hours on August 14, after a crucial maneuver called Trans Lunar Insertion (TLI) that was carried out by Isro to place the spacecraft on "Lunar Transfer Trajectory".

In a major milestone for India's second Moon mission, the Chandrayaan-2 spacecraft had successfully entered the lunar orbit on August 20 by performing Lunar Orbit Insertion (LOI) maneuver. On August 22, Isro released the first image of the moon captured by Chandrayaan-2. On September 2, 'Vikram' successfully separated from the orbiter, following which two de-orbiting manoeuvres were performed to bring the lander closer to the Moon.

**'Vikram' and 'Pragyan'**

As India attempted a soft landing on the lunar surface on September 7, all eyes were on the lander 'Vikram' and rover 'Pragyan'.

The 1,471-kg 'Vikram', named after [Vikram Sarabhai](https://www.business-standard.com/about/who-is-vikram-sarabhai), father of the Indian space programme, was designed to execute a soft landing on the lunar surface, and to function for one lunar day, which is equivalent to about 14 earth days.

Chandrayaan-2's 27-kg robotic vehicle 'Pragyan', which translates to 'wisdom' in Sanskrit, can travel up to 500 metres from the landing spot on the moon and leverages solar energy for its functioning.

If successful, Pragyaan will roll out from inside the lander to carry out an intense probe of the moon soil with its two payloads.

Chandrayaan, which means “moon vehicle” in Sanskrit, exemplifies the resurgence of international interest in space. The US, China and private corporations are among those racing to explore everything from resource mining to extraterrestrial colonies on the moon and even Mars.

**Science experiments**

Chandrayaan-2 has several science payloads to expand the lunar scientific knowledge through detailed study of topography, seismography, mineral identification and distribution, surface chemical composition, thermo-physical characteristics of top soil and composition of the tenuous lunar atmosphere, leading to a new understanding of the origin and evolution of the Moon.

The Orbiter payloads will conduct remote-sensing observations from a 100 km orbit while the Lander and Rover payloads will perform in-situ measurements near the landing site.

**Geosynchronous Satellite Launch Vehicle Mark-III (GSLV Mk-III)**

The GSLV Mk-III will carry Chandrayaan 2 to its designated orbit. This three-stage vehicle is India's most powerful launcher to date, and is capable of launching 4-ton class of satellites to the Geosynchronous Transfer Orbit (GTO).

Planned to land on the South Pole of the moon, [Chandrayaan-2](https://www.business-standard.com/about/what-is-chandrayaan-2) was launched on July 22. However, lander Vikram hard-landed on September 7, crashing India's dream to become the first nation to successfully land on the lunar surface in its maiden attempt.

The orbiter of the mission is working fine and has been sending data to Chandrayaan-1, the first lunar mission, and showed evidence that there was water on the moon, the paper said.