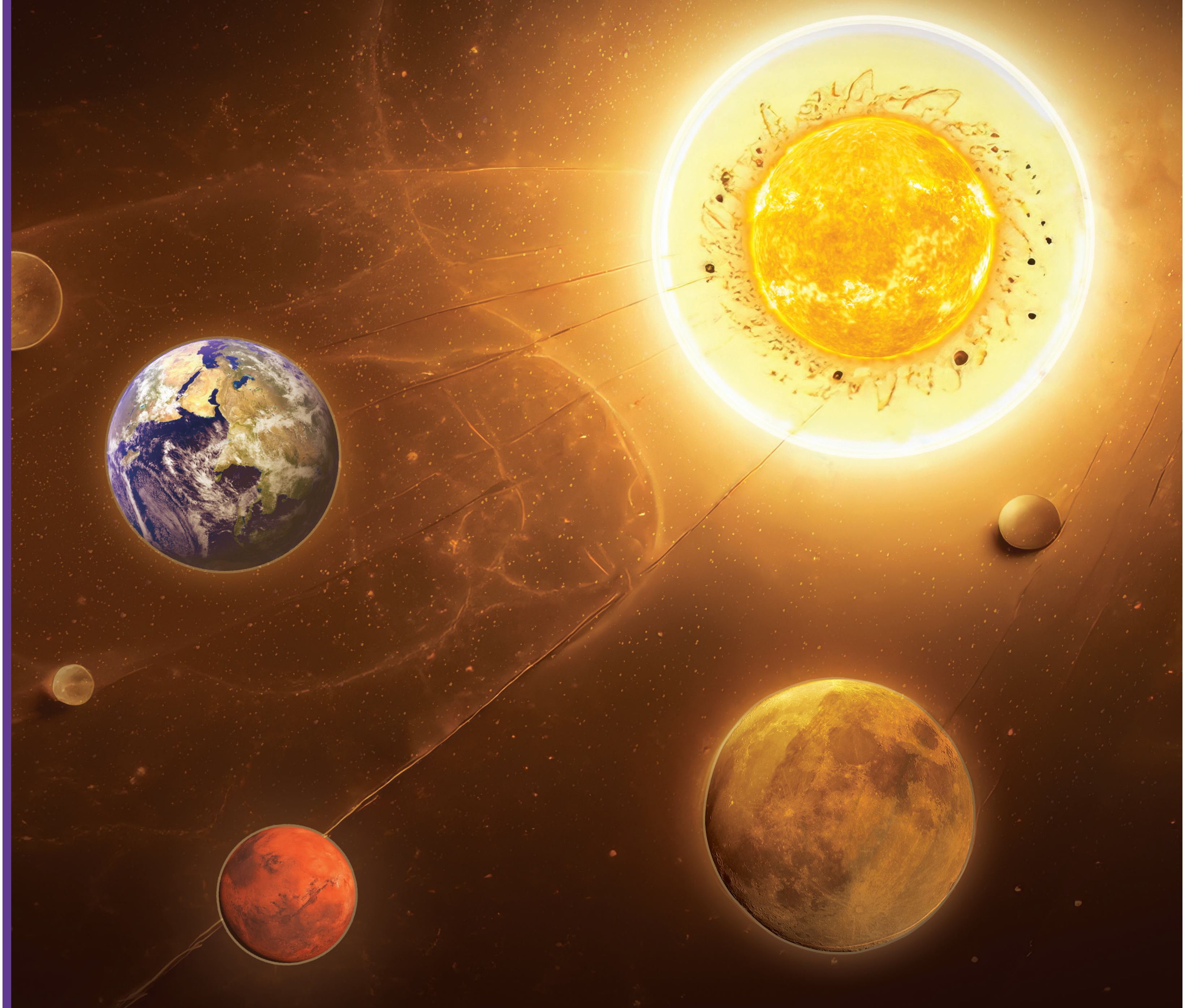
23 August
NATIONAL SPACE DAY

इसरो isro



THE ERA OF EXPLORATION

ISRO's Scientific Missions for Space Research

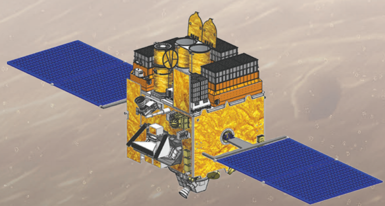
The Indian Space Programme explores Astronomy, Astrophysics, Planetary science, Earth science, Atmospheric science, and Theoretical physics.

By conducting research in these areas, scientists gain valuable insights into space, its celestial bodies, their characteristics such as geologies and atmospheres, the history of our solar system, and the position of our planet within the broader universe. This comprehensive approach helps deepen our understanding of space and its various phenomena.

AstroSat Mission

Launch Day : September 28, 2015
Launch Vehicle : PSLV-C30
Launch Port : SDSC, SHAR Sriharikota

AstroSat is India's first dedicated astronomy mission, designed to study celestial sources across X-ray, optical, and UV spectral bands simultaneously. Its payloads cover energy bands from Ultraviolet (Near and Far) and limited optical to X-ray (0.3 keV to 100 keV). A unique feature of the AstroSat mission is its capability for simultaneous multi-wavelength observations of various astronomical objects using a single satellite.



SCIENTIFIC OBJECTIVES

- To understand high energy processes in binary star systems containing neutron stars and black holes.
- Estimate magnetic fields of neutron stars.
- Study star birth regions and high energy processes in star systems lying beyond our galaxy.
- Detect new briefly bright X-ray sources in the sky.
- Perform a limited deep field survey of the Universe in the Ultraviolet region.

Currently, all the payloads are operational and actively observing cosmic sources. Both the spacecraft and its payloads are in good health. The initial six months were dedicated to performance verification and calibration of the payloads. Following this period, scientific observations commenced.

PAYLOADS

Ultra Violet Imaging Telescope (UVIT):
To image the sky simultaneously in three wavelengths, one covering the far UV band (130 – 180 nm) and the second sensitive in near UV (200 – 300nm) and Visible (320 – 550 nm) bands. The detector in each channel is a photon counting device. Multiple choices of filters are available in each channel.

Soft X-ray Telescope (SXT):
A focusing X-ray telescope with an X-ray CCD imaging camera operates mainly in photon counting mode, capturing the position, time, and energy of each detected photon within the energy range of 0.3-8 keV.

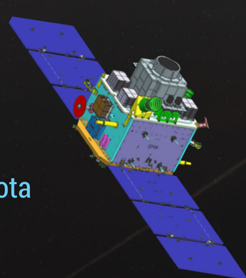
Large Area X-ray Proportional Counters (LAXPC):
A non-imaging payload consisting of three identical proportional counters, each with an effective area greater than 8000 cm² in the 5-30 keV range. Its primary function is to record variations in the total intensity of sources within its 1-degree field of view, providing high time resolution and moderate spectral resolution over a broad spectral band from 3 to 80 keV.

Cadmium-Zinc-Telluride Imager (CZTI):
A hard X-ray coded mask camera operating in the 10-100 keV band, featuring better spectral resolution than the LAXPC and offering coarse imaging capabilities through the coded mask.

Scanning Sky Monitor (SSM):
An instrument designed for detecting new X-ray transients and monitoring known X-ray sources in the 2.5 – 10 keV energy range. Additionally, it includes a Charged Particle Monitor (CPM) that detects high-energy particles during the satellite's orbital path and provides alerts to the instrumentation.

XPoSat Mission

Launch Day : January 01, 2024
Launch Vehicle : PSLV-C58
Launch Port : SDSC, SHAR Sriharikota



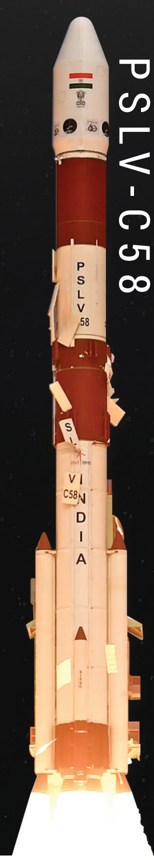
MISSION

XPoSaT is ISRO's first scientific satellite dedicated to studying cosmic X-ray sources. It analyses the polarisation of X-ray emissions from celestial objects such as neutron stars and black holes. The satellite's POLIX payload oboard, observes medium-energy X-rays, while the XSPECT payload studies the spectral and temporal characteristics of soft X-ray sources. Over its five-year mission, XPoSaT aims to enhance our understanding of the universe by observing about forty bright celestial objects. This mission marks a significant advancement in X-ray astronomy and polarimetry for ISRO.

PAYLOADS

XSPECT
X-ray Spectroscopy and Timing

POLIX
Polarimeter Instrument in X rays



PSLV-C58

Mars Orbiter Mission

Launch Day : November 05, 2013
Launch Vehicle : PSLV-C25
Launch Port : SDSC SHAR, Sriharikota

MISSION

The groundbreaking endeavour of the Mars Orbiter Mission, tested critical technologies for interplanetary exploration while analysing the Martian surface and atmosphere using five advanced scientific instruments from orbit. MOM, also known as Mangalyaan, successfully entered Mars orbit and gathered scientific data for over eight years, far surpassing its projected mission duration of six to 10 months. In the rich history of Mars exploration, India stands out as the only country to achieve total success in its first attempt.

Behind the scenes, a complex ground facility communicated with Mangalyaan using a giant 32m dish-shaped antenna and an 18m antenna. These antennas receive vital spacecraft data and transmit commands, supported by the Indian Deep Space Network. The Indian Space Science Data Centre manages scientific data, while the Spacecraft Control Centre ensures continuous guidance and monitors spacecraft health and safety, making sure of a seamless mission experience.

PAYLOADS

The mission had critical requirements on propulsion and other bus systems of the spacecraft. One scientific objective was the search for methane in the Martian atmosphere, which could provide clues about the presence of life on Mars.

- Mars Colour Camera (MCC)
  Tricolour camera to capture pictures of the Martian surface

MCC

- Thermal Infra-red Imaging Spectrometer (TIS) To study the minerals of the Martian surface and temperatures

TIS

- Methane Sensor for Mars (MSM)
  To sense minute quantities of methane gas possibly present in the Martian atmosphere

MSM

- Mars Exospheric Neutral Composition Analyser (MENCA) - To study the neutral composition and density distribution of the Martian exosphere

MENCA

- Lyman Alpha Photometer (LAP) - To understand the way water was lost from the Martian atmosphere in the past

LAP

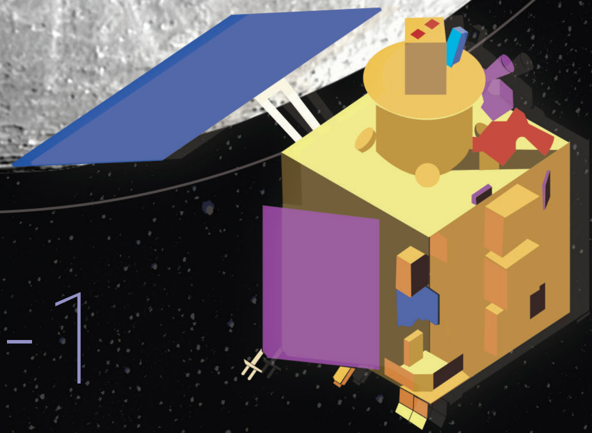
Test and Trials that Created Robust Minds

Completing the project in just 18 months was a significant achievement for the scientists. Launching a spacecraft to Mars was possible only once in every 26 months and meeting the timeline for the Mangalyaan mission was very challenging. Yet, the mission was a great success!

A travel time of 323 days, distance spanning 666 million km to reach Mars.

PSLV-C25

One of the last photographs taken by the Moon Impact Probe (MIP) as it descended to strike the Moon near the South Pole during Chandrayaan-1 Mission



Chandrayaan-1

Launch Day : October 22, 2008
Launch Vehicle : PSLV-C11
Launch Port : SDSC SHAR, Sriharikota

MISSION

India's first lunar mission soared into space onboard the PSLV-C11 lifting off from the Satish Dhawan Space Centre in Sriharikota. Upon reaching the designated orbit, the spacecraft surveyed the Moon from a distance of 100 km above its surface.

Its primary objectives included comprehensive mapping of the lunar terrain, investigating its chemical and mineral composition, and studying the physical attributes to better understand the geological history and processes that have shaped the lunar landscape over time.

The spacecraft carried eleven scientific instruments made in India and other countries like the USA, UK, Germany, Sweden, and Bulgaria. After achieving its main goals, the spacecraft's orbit was raised to 200 km in May 2009. It completed over 3400 orbits before communication was lost on August 29, 2009, marking the end of the mission.

SCIENTIFIC PAYLOADS FROM INDIA

- Terrain Mapping Camera (TMC)
- Hyper Spectral Imager (HySI)
- Lunar Laser Ranging Instrument (LLRI)
- High Energy X - ray Spectrometer (HEX)
- Moon Impact Probe (MIP)

INTERNATIONAL PAYLOADS

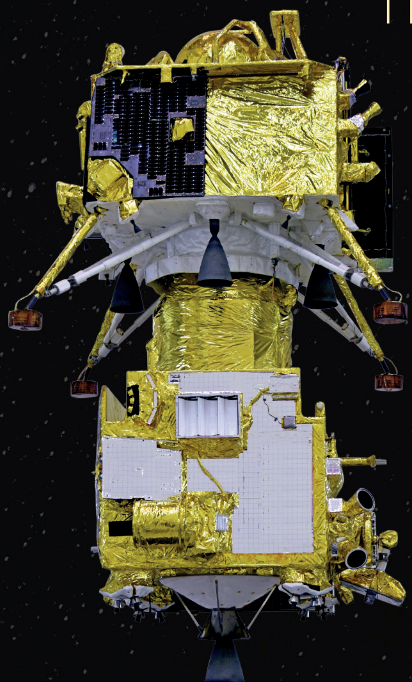
- Chandrayaan-I X-ray Spectrometer (CIXS)
- Near Infrared Spectrometer (SIR - 2)
- Sub keV Atom Reflecting Analyser (SARA)
- Miniature Synthetic Aperture Radar (Mini SAR)
- Moon Mineralogy Mapper (M3)
- Radiation Dose Monitor (RADOM)

Chandrayaan-2

Launch Day : July 22, 2019
Launch Vehicle : LVM3-M1
Launch Port : SDSC, SHAR, Sriharikota

MISSION

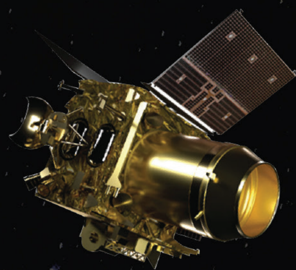
Chandrayaan-2 marked the onset of complex missions aimed at achieving a soft landing, and deploying a rover for in-situ measurements. Despite the unsuccessful soft landing, the orbiter and its eight scientific instruments continue to operate flawlessly to this day.



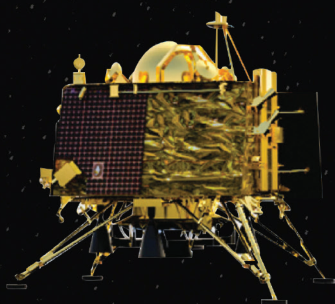
Integrated Spacecraft

THE ORBITER'S 8 SCIENTIFIC PAYLOADS

- Terrain Mapping Camera -2 (TMC-2)
- Optical High Resolution Camera (OHRC)
- Imaging Infrared Spectrometer (IIRS)
- Dual Frequency Synthetic Aperture Radar (DF-SAR)
- Chandra's Atmospheric Compositional Explorer-2 (CHACE-2)
- Chandrayaan-2 Large Area Soft X-ray Spectrometer (CLASS)
- Solar X-ray Monitor (XSM)
- Dual Frequency Radio Science (DFRS)



Orbiter



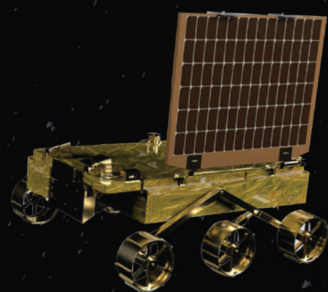
Vikram Lander

VIKRAM'S PAYLOADS

- Radio Anatomy of Moon Bound Hypersensitive ionosphere Atmosphere (RAMBHA)
- Chandra's Surface Thermophysical Experiment (CHaSTE)
- Instrument for Lunar Seismic Activity (ILSA)

PRAGYAN'S PAYLOADS

- Alpha Particle X-ray Spectrometer (APXS)
- Laser Induced Breakdown Spectroscope (LIBS)



Pragyan Rover

On 30th July 2020, Terrain Mapping Camera-2 (TMC-2)

Lunar North Pole region imaged by TMC-2, 23rd August 2019

Chandrayaan-3

Launch Day : July 14, 2023
Launch Vehicle : LVM3-M4
Launch Port : SDSC-SHAR, Sriharikota

VIKRAM'S HISTORIC DESCENT

India's Chandrayaan-3 mission successfully achieved a soft landing in the Moon's southern region and conducted in-depth studies on thermo-physical properties, seismic activity, plasma environment, and elemental composition. With the mission's key objectives fulfilled, the technological goals of demonstrating a safe landing, rover operations, and efficient resource utilisation in the challenging lunar South Polar environment were also successfully met.

The path retraced by the Chandrayaan-3 Rover on August 27, 2023, as viewed by Navigation Camera onboard Rover.

LVM3-M4

BLAZE TO SPACE

The Launch Vehicle Mark-III M4 placed the spacecraft into its designated orbit of 170 x 36500 km. Subsequently, the Propulsion Module transported the Lander and Rover to a lunar orbit of 100 km x 100 km.

Crater encountered by Rover on August 27, 2023 as seen by the Navigation camera.

A LEGENDARY MOON LANDING

Following the deployment of the Vikram Lander, the Propulsion Module continues to operate in orbit, managing an experimental payload. The Vikram Lander's capabilities mark a new chapter in India's lunar exploration, showcasing a safe and precise landing on the lunar surface. Its mission spanned one lunar day, equivalent to approximately 14 Earth days. Additionally, the Chandrayaan-3 Rover began its lunar journey as it descended from the lander, symbolising India's first steps on the Moon.

Vikram as seen by Pragyan, August 30, 2023, 07:35 Hrs. IST

Lunar far side area as imaged from the Lander Hazard Detection and Avoidance Camera (LHDC) onboard Chandrayaan-3 on August 19, 2023.

Reached the Destination!

Chandrayaan-3 successfully soft-landed on the Moon on August 23, 2023.

SCIENCE PAYLOADS

LANDER

Instrument for Lunar Seismic Activity (ILSA)

Captures ground accelerations resulting from lander operations and rover movement on the lunar surface, then analyse potential seismic activity.

Chandra's Surface Thermo-physical Experiment (ChaSTE)

Measures the temperature of the surface to the depth of 10cm and estimates thermal conductivity of lunar regolith based on measurements.

Laser Retroreflector Array (LRA)

A passive experiment from NASA for lunar laser ranging from orbiter.

RAMBHA– Langmuir Probe (LP)

Measure the ambient electron density / temperature near the surface and observes the temporal evolution of the plasma environment under varying solar conditions.

ROVER

Alpha Particle X-ray Spectrometer (APXS)

Investigates the abundance of major elements (Mg, Al, Si, K, Ca, Ti, and Fe) in lunar soil near the landing site.

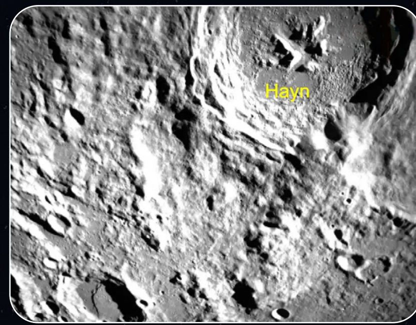
Laser Induced Breakdown Spectroscope (LIBS)

Investigates potential rock-forming elements (O, Na, Mg, Al, Si, K, Ca, Fe, Cr, Mn, and Ti) and trace elements (H, C, N, S, and P) near the landing site.

Propulsion Module

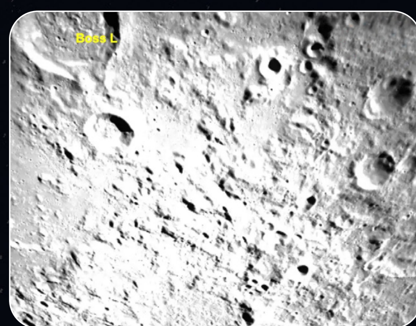
Spectro-polarimetry of HAbitable Planet Earth (SHAPE)

An experimental payload which observes the polarimetric and spectral signatures of Earth-like exoplanets from lunar orbit.

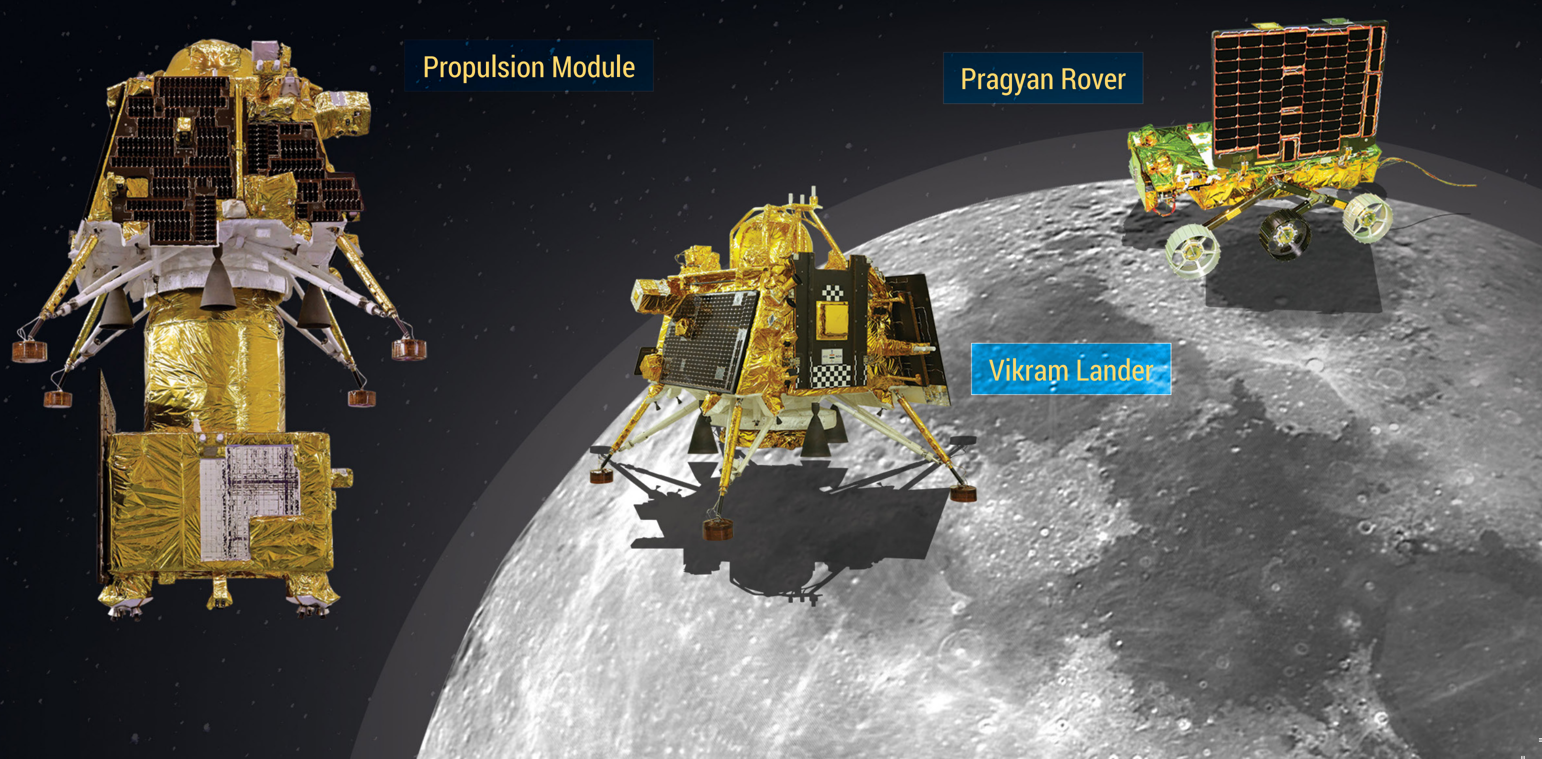


Lunar far side area as imaged from the Lander Hazard Detection and Avoidance Camera (LHDC) onboard Chandrayaan-3 on August 19, 2023.

Portion of the Chandrayaan-3's landing site taken after landing

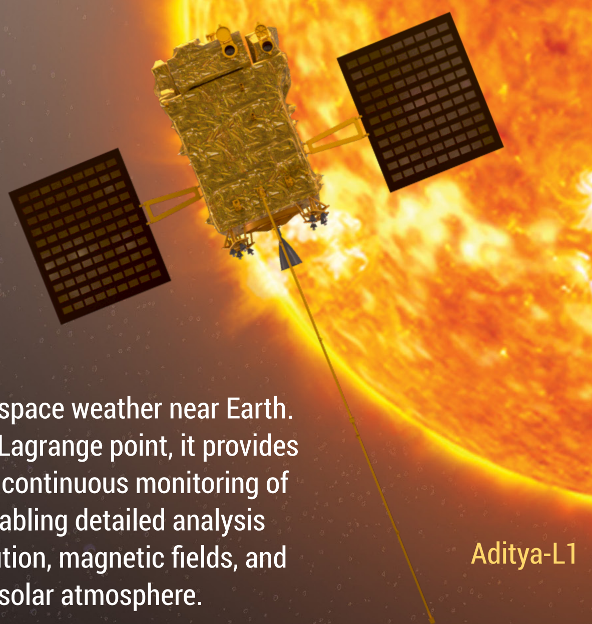


Lunar far side area as imaged from the Lander Hazard Detection and Avoidance Camera (LHDC) onboard Chandrayaan-3 on August 19, 2023.



Aditya-L1 Mission

Launch Day : September 2, 2023
Launch Vehicle : PSLV-C57
Launch Port : SDSC, SHAR Sriharikota



MISSION

Aditya-L1 is India's first observatory-class solar mission, dedicated to studying the dynamics of the Sun's upper atmosphere, particularly the chromosphere and corona. Its objectives include investigating chromospheric and coronal heating processes to understand temperature variations in these layers. Additionally, Aditya-L1 aims to explain the mechanisms triggering Coronal Mass Ejections (CMEs) and solar flares, which impact space weather near Earth. Positioned at the L1 Lagrange point, it provides a stable platform for continuous monitoring of solar phenomena, enabling detailed analysis of solar wind distribution, magnetic fields, and various dynamics of solar atmosphere.

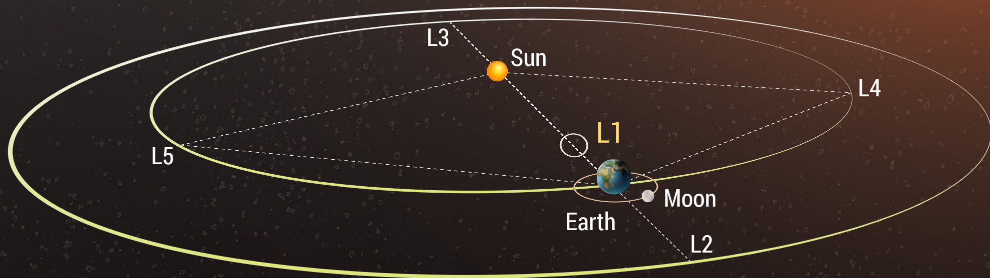
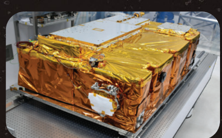
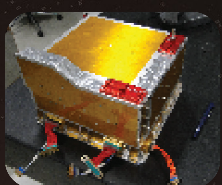


Illustration of all five Lagrange points of Sun-Earth system

PAYLOAD

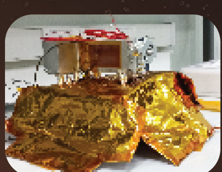


Visible Emission Line Coronagraph (VELC) is the prime payload, designed as a reflective coronagraph with a multi-slit spectrograph.



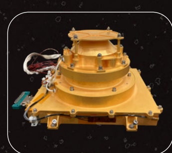
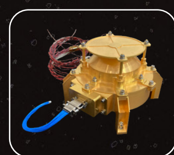
Plasma Analyser Package for Aditya (PAPA) is designed to understand solar winds, its composition and do mass analysis of solar wind ions.

High Energy L1 Orbiting X-ray Spectrometer (HEL1OS) is a hard X-ray spectrometer to study solar flares in the high energy X-rays.



Solar Low Energy X-ray Spectrometer (SoLEXS) is a soft X-ray spectrometer that continuously measures the solar soft X-ray flux to study solar flares.

Aditya Solar wind Particle Experiment (ASPEX) payload comprises two subsystems: SWIS and STEPS.

SWIS (Solar Wind Ion Spectrometer) is a low-energy spectrometer that measures the proton and alpha particles of the solar wind.


STEPS (Suprathermal and Energetic Particle Spectrometer) is a high-energy spectrometer that measures high-energy ions of the solar wind.

Solar Ultra-violet Imaging Telescope (SUIT) is an ultra-violet telescope.

Magnetometer (MAG) measures the interplanetary magnetic field. It features two sets of sensors: one at the tip of a 6-meter deployable boom and another positioned 3 metres away along the boom.

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