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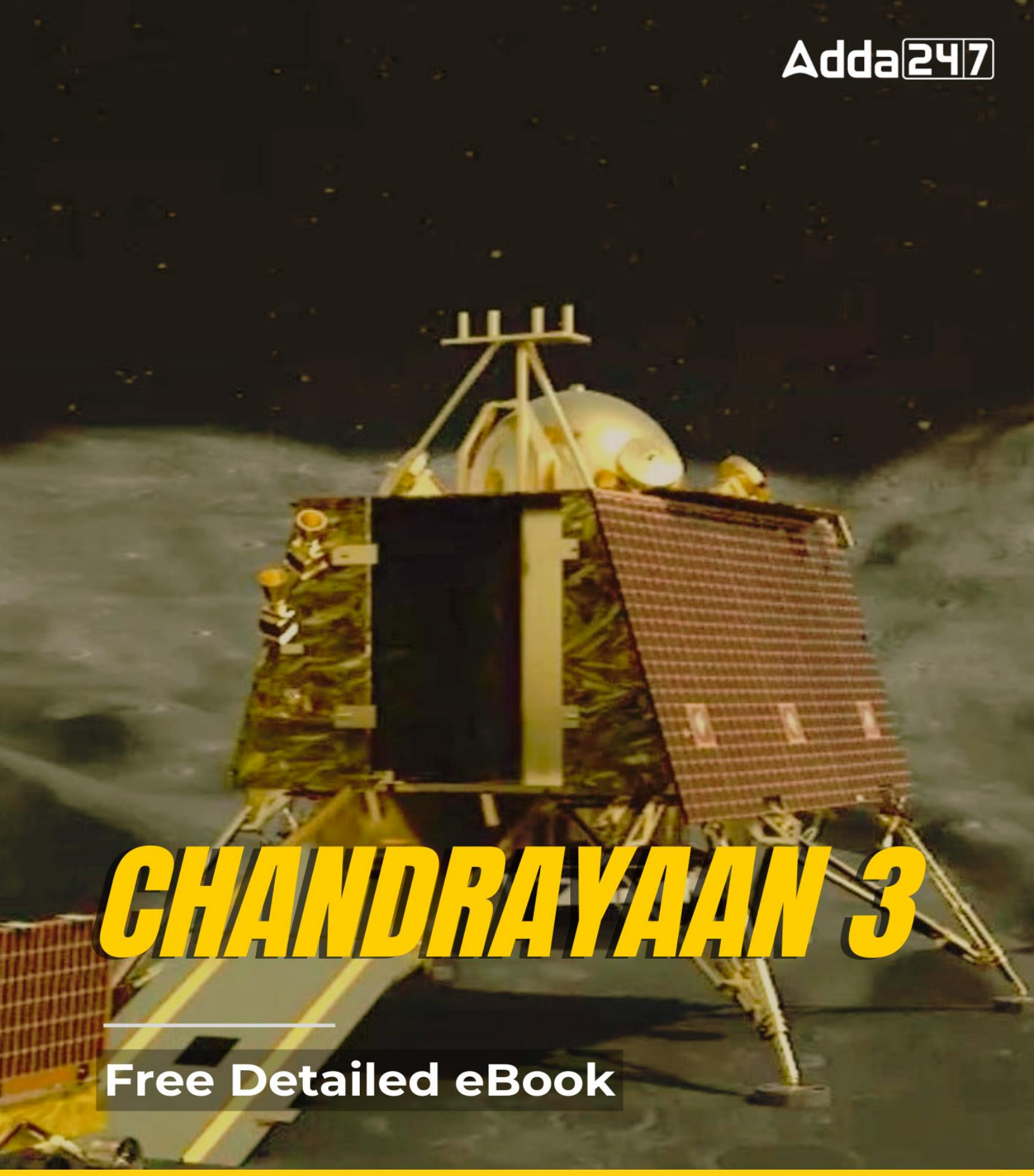

CHANDRAYAAN 3

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Chandrayaan-3

Chandrayaan 3: All you need to know about India's lunar mission

The **Indian Space Research Organisation** (ISRO) has made significant progress in its ambitious **Chandrayaan-3** mission, which aims to demonstrate the capability of a soft landing on the Moon. Following the setback of the Chandrayaan-2 mission, ISRO has diligently worked towards rectifying the issues and is now preparing for the launch of Chandrayaan-3 on **July 14**.

Objectives: Demonstrating Soft Landing and Scientific Exploration

The primary objective of the Chandrayaan-3 mission is to successfully achieve a soft landing on the Moon's surface. By accomplishing this feat, India aims to join the exclusive group of nations that have successfully landed on the Moon. The mission also intends to conduct chemical analyses, gather valuable scientific data, and contribute to advancements in lunar research.

Background: Learning from Chandrayaan-2's Setback

The Chandrayaan-2 mission, launched in 2019, faced challenges during its soft landing attempt, resulting in a setback for ISRO. However, the organization used this setback as an opportunity for learning and improvement. Chandrayaan-3 aims to address the shortcomings of its predecessor and accomplish a successful soft landing on the lunar surface.

Chandrayaan-3 Spacecraft: Building on Previous Successes

The Chandrayaan-3 spacecraft comprises three essential components: the **lander module**, the propulsion **module**, and a **rover**. The lander module is designed to achieve a soft landing on the Moon, deploying the rover for scientific exploration. The rover will conduct chemical analyses and carry scientific payloads to enhance our understanding of the lunar surface. Additionally, the propulsion module plays a crucial role in transporting the lander and rover to the lunar orbit.

Launch Vehicle Mark-III (LVM-3): Powering the Mission

The LVM-3, India's most powerful rocket developed by ISRO, serves as the launch vehicle for the Chandrayaan-3 mission. Standing tall at 43.5 meters with a diameter of 4 meters, it possesses a lift-off mass of 640 tonnes. The LVM-3 utilizes a cryogenic upper stage powered by CE-20, India's largest cryogenic engine, enabling it to carry heavier payloads. It also incorporates two S200 solid rocket boosters and two L110 liquid-stage Vikas rockets for additional thrust during takeoff.

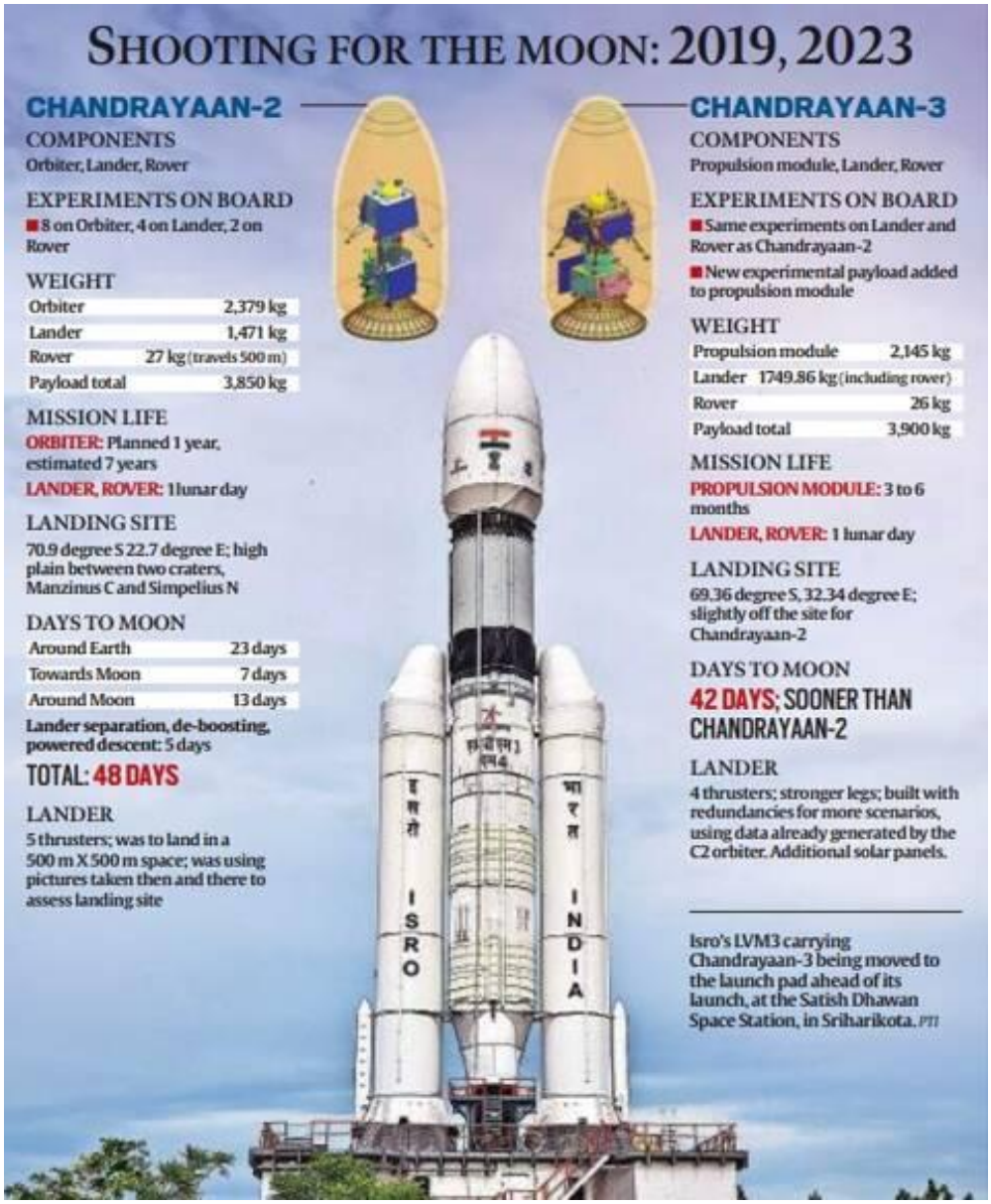
Significance: Advancing India's Technological Prowess and Scientific Understanding

The Chandrayaan-3 mission holds immense significance for India's space exploration endeavors. By showcasing its technological capabilities in lunar exploration, ISRO aims to establish itself as a prominent player in the global space community. The successful execution of a soft landing would mark a significant milestone in India's space achievements and pave the way for future lunar missions.

Chandrayaan-2 vs Chandrayaan-3: A Comparative Analysis

India's space agency, **ISRO (Indian Space Research Organization)**, is gearing up for its third lunar exploration mission – **Chandrayaan-3**, launched on July 14, 2023. This mission aims to rectify the setbacks encountered during its predecessor, Chandrayaan-2, and accomplish a successful soft landing on the lunar surface along with rover exploration. In this article, we will delve into the key differences between these two missions.

Mission Design and Approach:



Chandrayaan-2:

- Chandrayaan-2 comprised an orbiter, a lander named **Vikram, and a rover named Pragyan**.
- The mission design followed a success-based approach, aiming for a precise landing within a targeted 500mx500m area.
- The Vikram lander carried a central thruster and had five legs.

Chandrayaan-3:

- Chandrayaan-3 is designed with a focus on failure-based strategies to enhance mission success.
- The mission includes a lander named Vikram and a rover named Pragyan, omitting the orbiter from the configuration.
- The landing area has been expanded, allowing the lander to safely touch down anywhere within a 4kmx2.4km area.
- Vikram lander has been equipped with more fuel for longer travel distances to reach the landing site or an alternate site if needed.
- The lander's landing site determination has been improved by integrating high-resolution images from Chandrayaan-2's orbiter.
- Changes in the lander's physical structure include removing the central thruster, strengthening the legs for higher velocity landings, and adding more solar panels for increased power generation.

Payloads and Scientific Instruments:

Chandrayaan-2:

- Chandrayaan-2's payloads included scientific instruments on the orbiter, lander, and rover.
- The orbiter carried instruments to study the Moon's surface and exosphere, among others.
- Lander payloads included **RAMBHA, ChaSTE, ILSA, and LP,** aimed at measuring various aspects of the lunar environment.
- The Pragyan rover had Alpha Particle X-ray Spectrometer (APXS) and Laser Induced Breakdown Spectroscope (LIBS) for elemental analysis.

Chandrayaan-3:

- The propulsion module of Chandrayaan-3 carries the SHAPE payload, designed to search for habitable planets through spectro-polarimetry.
- Lander payloads include **RAMBHA (from NASA), ChaSTE, ILSA, and LP**, similar to Chandrayaan-2, measuring seismicity, thermal properties, and more.
- Rover payloads remain consistent with APXS and LIBS for in-situ elemental composition analysis.

Implementation and Soft Landing:

Chandrayaan-2:

- The Vikram lander attempted a soft landing on the lunar surface but faced a failure during descent due to a last-minute glitch.
- Chandrayaan-2's Pragyan rover couldn't be deployed due to the unsuccessful landing.

Chandrayaan-3:

- Chandrayaan-3 aims to achieve a successful soft landing with Vikram and deploy Pragyan rover to explore the lunar surface.
- The changes in design and improvements in landing site determination increase the chances of a successful landing.

Significance and International Context:

- Chandrayaan-2's setback highlighted the complexity and challenges of lunar exploration, inspiring a failure-based approach in Chandrayaan-3.
- If Chandrayaan-3 succeeds in its mission objectives, India will become the fourth country to achieve a successful soft landing on the Moon, following the US, Russia, and China.

Chandrayaan-3 Landing Date Scheduled on August 23, 2023

The **Indian Space Research Organisation (ISRO)** has announced that the landing of **Chandrayaan-3** on the Moon is scheduled for **August 23, 2023.** The spacecraft was launched on July 14, 2023, and has been in lunar orbit since August 5, 2023. The Chandrayaan-3 mission is India's third lunar mission, and its goal is to soft-land a lander and rover on the Moon's south pole. The lander, named Vikram, will be carrying the rover, named Pragyan.

The south pole of the Moon is a region that has not been extensively explored by previous missions. It is believed to be rich in water ice, which could be a valuable resource for future human exploration of the Moon. The Chandrayaan-3 landing will be a challenging feat, as the south pole of the Moon is a highland region with a lot of craters. However, ISRO is confident that the mission will be successful.

Chandrayaan-3 to Join Growing List of Lunar Missions

The Chandrayaan-3 landing will be the latest in a series of lunar missions in recent years. In 2019, China landed the Chang'e 4 probe on the far side of the Moon. In 2021, the United States landed the Perseverance rover on Mars, which is currently exploring the Jezero crater. The Chandrayaan-3 landing will also coincide with the arrival of Russia's Luna-25 mission, which is scheduled to land on the Moon's south pole in August 2023.

The growing number of lunar missions is a sign of the growing interest in lunar exploration. The Moon is a potentially valuable resource for future human exploration, and it is also a key stepping stone to Mars.

Chandrayaan-3 to Help India Become a Spacefaring Nation

The Chandrayaan-3 landing is a major milestone for India's space program. It will be India's third lunar mission, and its first soft landing on the Moon. The success of the Chandrayaan-3 mission will help India to become a spacefaring nation. It will also help to boost India's scientific and technological prowess. The Chandrayaan-3 mission is a testament to the hard work and dedication of the ISRO team. It is a proud moment for India, and it is a sign of great things to come.

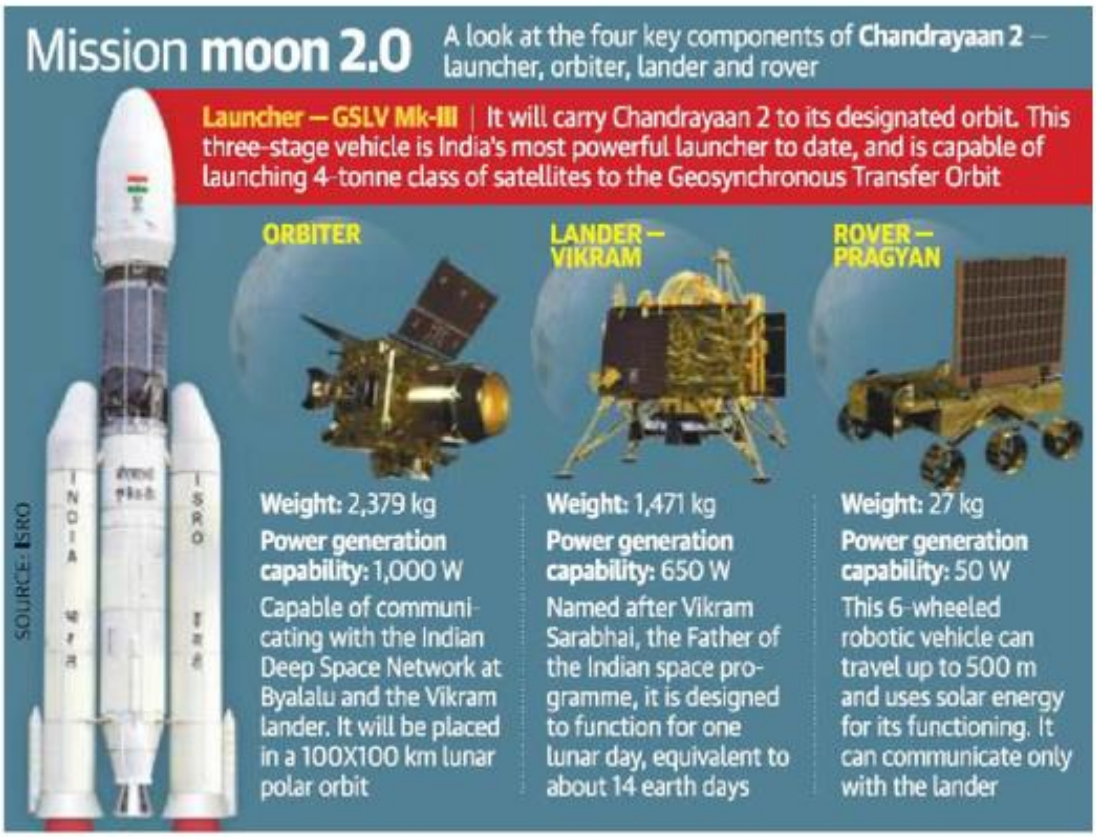
History of Chandrayaan: India's Lunar Exploration Journey

Chandrayaan, meaning "**mooncraft**" in Sanskrit, represents India's lunar exploration program launched by the **Indian Space Research Organisation (ISRO)**. The **Chandrayaan** program aims to study the moon's surface, minerals, water ice presence, and enhance India's space capabilities.

Chandrayaan-1 (2008): India's Maiden Lunar Mission

- Launched on October 22, 2008, Chandrayaan-1 was India's first lunar probe.
- Equipped with 11 scientific instruments, it conducted high-resolution remote sensing of the moon's surface and detected water molecules on the lunar surface.
- Made significant contributions to lunar science by mapping various elements and minerals.

Chandrayaan-2 (2019): A Complex Lunar Mission



Launched on July 22, 2019, Chandrayaan-2 aimed for a soft landing on the moon's south pole.

- Consisted of an orbiter, a lander named Vikram, and a rover named Pragyan.
- The orbiter continues to study the moon from orbit, while the lander's soft landing attempt failed due to a last-minute glitch.

Chandrayaan-3 (2023): Learning from Setbacks

- Chandrayaan-3 is India's third lunar mission, designed to address the limitations of Chandrayaan-2.
- Aims for a successful soft landing on the lunar surface and rover-based exploration.
- Adopts a failure-based design approach, with changes to landing area, lander autonomy, fuel capacity, and structure.

Chandrayaan-3 Payloads:

- **Propulsion Module:** Carries the lander-rover configuration to lunar orbit.
- **Lander Payloads:** Includes RAMBHA, ChaSTE, ILSA, LP for seismic, thermal, atmospheric, and compositional analysis.
- **Rover Payloads:** APXS and LIBS for elemental composition analysis near the landing site.

International Collaborations:

- Chandrayaan missions have fostered international collaboration, such as payloads from NASA.
- These collaborations enhance the scientific potential of the missions and contribute to global lunar research.

India's Space Ambitions:

- Chandrayaan missions showcase India's growing space capabilities and technological advancements.
- Successes and setbacks alike contribute to the nation's experience and expertise in space exploration.

Future Lunar Endeavors:

- Chandrayaan program is expected to pave the way for more ambitious lunar missions in the future.
- India aims to continue expanding its lunar exploration capabilities and contribute to global lunar research efforts.

International Recognition:

- Chandrayaan missions have earned India international recognition in the field of space exploration.
- They highlight India's commitment to advancing scientific knowledge and space technology.

10 Facts you must know about Chandrayan-3

10 Facts you must know about Chandrayan-3

Chandrayaan-3 has been launched at **2:35 P.M**. from the **Satish Dhawan Space Centre, Sriharikota,** Andhra Pradesh carries by ISRO's largest and most powerful rocket, the **Launch Vehicle Mark III.**

India aims at soft landing of Chandrayaan-3 on the **Moon's South Pole**. If this mission is accomplished India will become the fourth nation to successfully complete the soft landing of spacecraft on the Earth's Natural Satellite. And also India will become the first country in the world to land a spacecraft on the Moon's South Pole. Chandrayaan-3, is all set to make a soft and successful landing on the south polar region of the Moon around 6.04pm on August 23.

Here is the 10 Interesting Facts about the Chandrayaan-3:

1. **Chandrayaan-3** is a follow-on mission to **Chandrayaan-2** which aims at soft landing at Moon's south pole. It consists of a lander and a Rover which has been launched into the space by a rocket called LVM3 from SDSC SHAR, Sriharikota. While the Chandrayaan-2 which was launched in **2019** consisted of an orbiter, a Lander and a Rover, because of a software glitch the craft lost all communications just minutes before it was supposed to land and later it was crashed. Though it was not a complete failure, the orbiter is still functional and provides valuable data to the organization.
2. The launcher used to support the moon lander Vikram is **GSLV** (Geosynchronous Satellite Launch Vehicle) also known as **Launch Vehicle Mark III**. The height of this launcher is about **5 metres.**
3. The spacecraft is expected to touch down on the moon on **23 August** after a voyage that will last more than **40 days**. The craft is set to land on the Moon's South Pole, where Chandrayaan-1 discovered the molecules of water and shocked the world by its major success.
4. ISRO has done some modifications to make it reliable than its predecessor. Chandrayaan-3 consists of a **Lander Vikram**, which is named after **Vikram Sarabhai**, the **Rover Pragyan** and a propulsion module. The weight of the Vikram Lander has been increased by **280kg** from its previous version and it also carries more fuel to stay on it's intended path to the Moon's surface.
5. The craft collectively weighs **3,900 kg** in which the weight of the **propulsion is 2148 kg** and the weight of lander and Rover together is **1752 kg**. This total weight is close to the maximum capacity of the GSLV MK III which is India's strongest rocket.
6. Chandrayaan-3 has three phases: the Earth-Centric Phase, the lunar-transfer phase and the Moon-Centric Phase.

The Earth Centric Phase involves the pre-launch phase and the Earth bound manoeuvre phase which will help the spacecraft to change its directions.
The Lunar-Transfer Phase involves the transfer trajectory phase which will help it to choose the path that will lead it towards the lunar orbit.
The Moon-Centric Phase involves all steps from lunar orbit insertion to landing.

7. As Chandrayaan-3 safely lands on the moon, the Pragyan Rover will be deployed to explore. The Rover will be released from Lander using a ramp. This **six-wheeled rover** used in spacecraft is powered by solar energy and carries **two spectrometers** to study the composition of the moon's surface. It will move around the landing area for about **14 Earth Days** which is equivalent to **one lunar day**.
8. Vikram Lander used in Chandrayaan-3 is equipped with **four scientific instruments.** The first one is **seismometer** designed to detect moonquakes, the second one studies how heat moves through the lunar surface, the third aims at understanding the plasma environment around the moon and the fourth one is **retro-reflector** which helps to understand the gravitational interaction between the moon and the planets.
9. The lander will touch down on the moon's surface with a horizontal velocity of less than **5 metre per second**, a vertical velocity of less than **two metre per second** and a slope less than **120 degrees.**

10. To date only three countries have successfully achieved lunar landings: the United States, the former Soviet Union and China. India aiming to be the **fourth country** to safe landing on the Moon's surface and **first nation** in the world to land on the Moon's South Pole.

Who is the Chandryaan-3 lander and rover named after?

The lander module of **Chandrayaan 3,** Isro's third Moon mission, is set to attempt landing on the lunar mission. A successful soft landing will make India the first country to reach the uncharted south pole of the **Moon, Earth's only natural satellite.** Chandrayaan 3 is a follow-on mission to Chandrayaan-2 aimed at demonstrating safe and soft-landing on the lunar surface, roving on the Moon, and conducting in-situ scientific experiments. The Moon's south pole region is of interest because there could be a possibility of water in permanently shadowed areas around it.

Who is Chandryaan-3 lander named after?

The lander and rover of Chandrayaan 3 will have a mission life of one lunar day **(about 14 earth days)** to study the surroundings on the Moon's south pole. ISRO officials, however, haven't ruled out the possibility of the lander module coming to life for another lunar day. The lander, 'Vikram', has been named after Indian space program pioneer **Vikram Sarabhai.** With a mass of 1749.86 kg, including 26 kg for the rover, the box-shaped lander has four landing legs and four landing thrusters and can generate 738 W using side-mounted solar panels. The Vikram lander will begin its final descent with the rover to the south polar region of the Moon at 5:45pm IST and is expected to land about 19 minutes later.

Who is Chandryaan-3 Rover named after?

India's lunar rover, named **Pragyan means wisdom in Sanskrit,** is designated to embark on a pioneering mission of lunar discovery after the successful landing of Chandrayaan-3's lander Vikram.

Chandrayaan-3 Gets Closer To Moon After Fourth Orbit Reduction Manoeuvre

The **Indian Space Research Organisation** (ISRO) continues its impressive progress in the Chandrayaan-3 mission, as it successfully executed another vital **orbit reduction maneuver** on August 14. This maneuver brings the spacecraft a step closer to achieving a **precise landing** on the lunar surface.

Orbit Circularisation Phase Commences

The recent maneuver was conducted at the **ISRO Telemetry, Tracking and Command Network** (ISTRAC) located in **Bengaluru**. As a result, Chandrayaan-3 has achieved an orbit of remarkable proximity to the moon, now positioned just 177 km away.

A Step Towards Lunar Exploration

ISRO reported that the precise maneuver performed during this phase has established a near-circular orbit with dimensions of **150 km x 177 km**. The upcoming operation is scheduled for August 16, 2023, around 0830 Hrs IST, and will mark the **fifth and final** orbit reduction maneuver in the mission.

Components of Chandrayaan-3

Launched on July 14, Chandrayaan-3 is comprised of **three** essential components: a **lander module** (LM), a **propulsion module** (PM), and a **rover**. These components work synergistically to ensure the successful execution of the lunar mission.

Path to the Lunar Poles

ISRO has strategically planned a series of maneuvers to gradually reduce Chandrayaan-3's orbit, ultimately positioning it over the lunar poles. As the mission advances, the **propulsion module will separate from the lander** while in orbit. Following this, a sequence of intricate braking maneuvers will be meticulously carried out to facilitate a soft landing in the South Polar region of the Moon on August 23, 2023.

Key Milestones Ahead

The PM (Propulsion Module) and LM (Lander Module) separation is anticipated to occur on August 17, a significant event that paves the way for subsequent phases. The mission timeline includes a **series of deboost maneuvers**, a crucial prelude to the power descent phase crucial for the mission's soft landing on the lunar surface.

Countdown to Lunar Touchdown

The grand finale of the Chandrayaan-3 mission is slated for **August 23** at 5.47 p.m. This momentous occasion marks the expected touchdown of the lander module on the moon's surface, a culmination of meticulous planning and precise execution.

ISRO's Chandrayaan-3: Nearing a Historic Lunar Landing

ISRO's persistent dedication and precisely executed maneuvers have **propelled** Chandrayaan-3 towards its paramount goal: a triumphant and accurate touchdown on the moon's surface. Through meticulously planned phases, ISRO's proficiency and unwavering commitment redefine India's stature in the **realm of space exploration**. As the mission advances, excitement heightens, and the global community eagerly anticipates the momentous lunar landing scheduled for August 23, 2023.

Chandrayaan-3 Successfully inserted into Lunar Orbit

Chandrayaan-3, the country's lunar mission, has successfully entered the lunar orbit **after a journey of twenty-three days**. This milestone marks a significant step in India's endeavor to become the first nation to achieve a soft landing on the moon. In this article you will get to know about the recent developments of Chandrayaan-3 and it's exciting journey.

The Journey towards the Chandrayaan-3

Twenty-three days ago, Chandrayaan-3 started its exciting journey from Earth towards the Moon. **For the last five days**, the **spacecraft has been steadily moving closer to the moon**, carefully adjusting its path to enter the moon's orbit.

The Entry into Lunar Orbit

On Saturday's evening, **Chandrayaan-3 successfully entered into the lunar orbit**, making a significant milestone in the mission's journey. As the spacecraft started circling the moon, **it began transmitting signals to the Mission Operators Complex (MOX) at the ISRO Telemetry, Tracking and Command Netwrok (ISTRAC).** The successful entry of spacecraft shows its readiness for further maneuvers and operations in the lunar orbit.

Current Status of Chandrayaan-3

As of now, Chandrayaan-3 is in an elliptical orbit around the moon, **situated approximately 18,074 km from the lunar surface** at its farthest point and **164 km at its nearest**. However, this elliptical orbit is not the final configuration. Over the next few days, the spacecraft's altitude will be progressively lowered. The mission aims to achieve a circular orbit, **with an altitude of 100 km x 100km above the moon's surface.**

The Path Ahead of Chandrayaan-3

ISRO engineers and scientists are gearing up for a crucial series of altitude reduction maneuvers, this will bring Chandrayaan-3 closer to the moon's surface, preparing it for the final destination.

ISRO injects Chandrayaan-3 into translunar orbit

The **Chandrayaan-3** spacecraft, which marks India's **third** lunar exploration mission, has accomplished a noteworthy achievement by entering the moon's sphere of influence. This successful entry was made possible through a TransLunar Injection (TLI) executed by the **Indian Space Research Organisation** (ISRO). The upcoming crucial step is the Lunar Orbit Insertion (LOI) scheduled for August 5, during which the spacecraft's liquid engine will be activated once more to position it into a lunar orbit.

Successful TransLunar Injection from Bengaluru

ISRO's **Telemetry, Tracking, and Command Network** (ISTRAC) in **Bengaluru** has executed the TransLunar Injection (TLI), enabling Chandrayaan-3 to successfully complete its orbits around Earth and begin its journey towards the Moon. The spacecraft's health status has been confirmed as normal, ensuring a promising start to its lunar mission.

TransLunar Injection (TLI)

The **Trans Lunar Injection** (TLI) is a vital maneuver executed in space missions to propel spacecraft from Earth's orbit onto a trajectory leading them to the Moon. This pivotal step in lunar missions allows spacecraft to **break free** from Earth's gravitational force and commence their journey towards the Moon. TLI is precisely carried out when the spacecraft reaches a specific position in its orbit, referred to as 'perigee,' denoting the closest proximity to Earth

Final Lunar Orbit Separation

After the Lunar Orbit Insertion (LOI), the mission entails **four** more planned orbital maneuvers to position the spacecraft at an approximate distance of 100 km from the moon's surface. Chandrayaan-3 consists of a lander module (LM), a propulsion module (PM), and a rover. The anticipated event of PM and LM separation is scheduled for **August 17**, followed by a sequence of deboost maneuvers to prepare for the powered descent phase aimed at achieving a gentle landing on the lunar surface.

Moon Landing Date

The spacecraft is scheduled to make a touchdown on the moon's surface at 5.47 p.m. on **August 23**. This significant milestone will signify India's ongoing advancement in lunar exploration and scientific discoveries.

Chandrayaan-3: India's Mission to Soft-Land on the Moon's South Pole

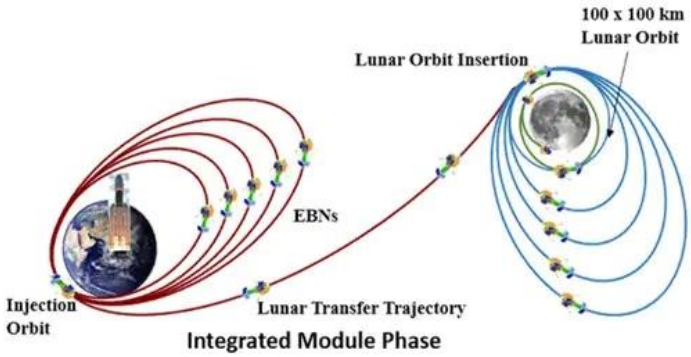
Chandrayaan-3: India's Mission to Soft-Land on the Moon's South Pole

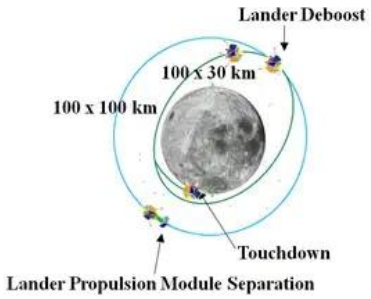
Chandrayaan-3 is India's third lunar mission, following the Chandrayaan-2 mission, with the goal of achieving a soft landing on the lunar surface and deploying a rover. **Chandrayaan-3** aims to showcase India's capabilities in landing and exploring the **Moon's South Pole**, a region known for the presence of water molecules.

Launch and Landing:

Chandrayaan-3 was successfully launched on July 14, 2023, from the Satish Dhawan Space Center in Sriharikota, Andhra Pradesh, using the **Launch Vehicle Mark-III (LVM3)**.

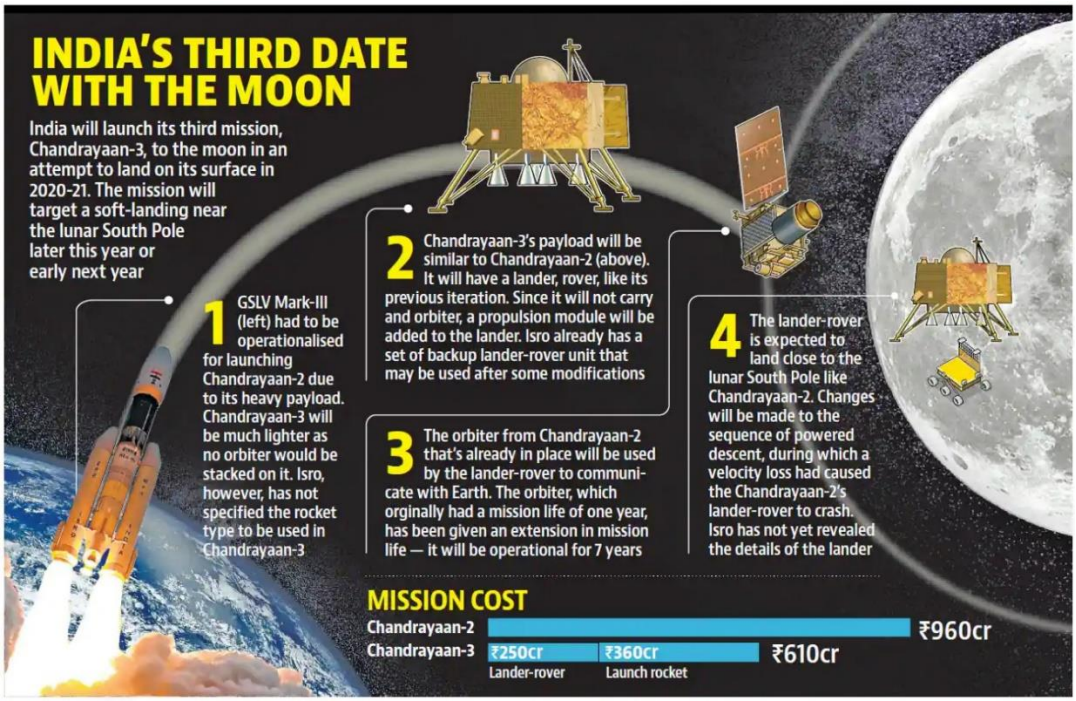
- The spacecraft consists of a lander, a rover, and a propulsion module, collectively weighing 3,900 kg.
- The **GSLV Mark 3** heavy-lift launch vehicle, also known as the Bahubali rocket, supports the moon lander Vikram.
- The craft is scheduled to touch down on the Moon's South Pole on August 23, following a journey lasting over 40 days.





Objective:

The Chandrayaan-3 mission has three main objectives:

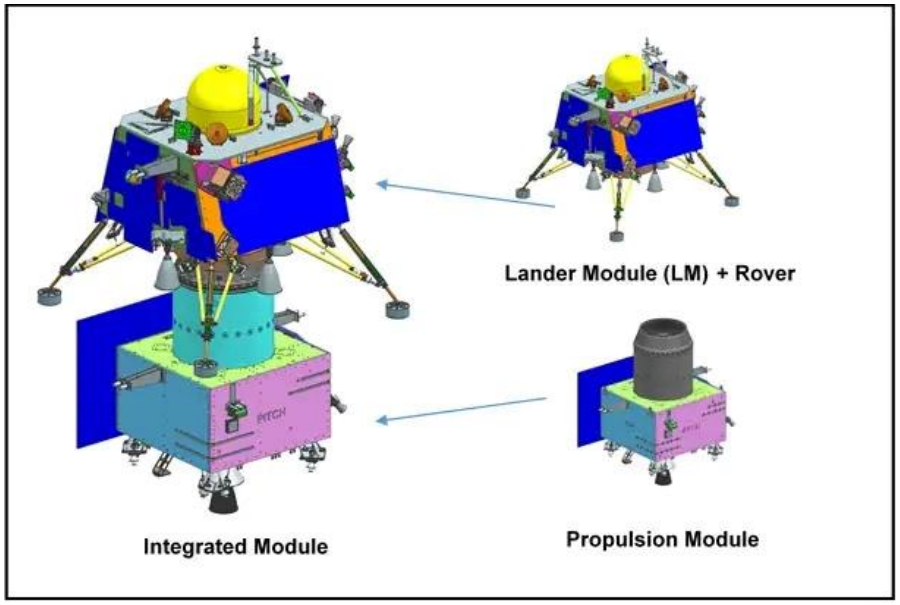


Safe and Soft Landing: The primary objective of Chandrayaan-3 is to achieve a safe and soft landing of the lander on the surface of the Moon. Learning from the previous mission's setback, this mission aims to successfully land the lander module on the lunar surface without any issues.

1. **Demonstration of Rover's Capabilities:** Chandrayaan-3 aims to demonstrate the capabilities of the rover by showcasing its roaming and exploration abilities on the lunar surface. The rover will be deployed after the successful landing of the lander and will perform various scientific experiments and observations.
2. **In-Site Scientific Observations:** The mission seeks to conduct in-site scientific observations and experiments to better understand the composition of the Moon. This includes analyzing the chemical and natural elements, soil, water, and other resources available on the lunar surface. These observations will contribute to expanding our knowledge of the Moon's composition and provide insights into the Moon's history and evolution.

Design:

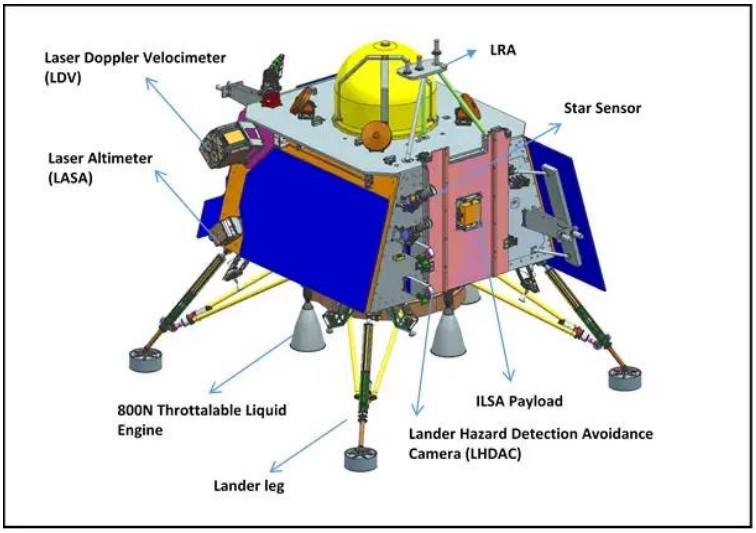
Chandrayaan-3 consists of three main components:



Propulsion Module: The propulsion module is responsible for carrying the lander and rover configuration to the lunar orbit of 100 kilometers. It is a box-like structure with a large solar panel and an intermodular adapter cone that acts as a mounting structure for the lander. Additionally, it carries the SHAPE payload, which studies spectral and polarimetric measurements of Earth from the lunar orbit.

1. **Lander:** The lander module is designed for a soft landing on the lunar surface. It has a box-shaped structure with four landing legs and four landing thrusters. The lander carries the rover and various scientific instruments for in-site analysis. It has undergone improvements in terms of structural rigidity, impact legs strength, and instrumentation redundancy compared to its predecessor.

The lander carries three payloads:



Chandra's Surface Thermophysical Experiment (ChaSTE): Measures thermal conductivity and temperature of the lunar surface.

- **Instrument for Lunar Seismic Activity (ILSA):** Measures seismic activity around the landing site.
- **Langmuir Probe (LP):** Estimates plasma density and its variations.

3. **Rover:** The Chandrayaan-3 rover is a six-wheeled vehicle weighing 26 kilograms. It is equipped with scientific instruments, including cameras, spectrometers, and a drill. The rover has a range of 500 meters and is designed to communicate with the lander and the ground control team in India. Its expected lifespan is one lunar day, equivalent to 14 Earth days.

The rover aims to make significant scientific discoveries, including studying the lunar surface composition, detecting the presence of water ice in the lunar soil, investigating lunar impacts' history, and studying the Moon's atmosphere evolution.

Modifications and Precautions:

- Chandrayaan-3 has undergone modifications by ISRO to enhance reliability compared to its predecessor, Chandrayaan-2.
- The lander Vikram has been upgraded and carries additional fuel to ensure a successful landing and stay on the intended path to the lunar surface.
- The craft has undergone rigorous testing and incorporates numerous safety measures to increase the mission's chances of success.

Mission Components:

- The 3,900-kilogram Chandrayaan-3 spacecraft consists of three major modules: the Propulsion module, Lander module, and Rover.
- The lander, named Vikram, and the rover, named Pragyaan, are similar to their counterparts in Chandrayaan-2 but have undergone upgrades for improved reliability.
- The mission's budget is Rs. 615 crore.

Chandrayaan 3 Lifts Off For Its Journey To The Moon

India launched its ambitious **Chandrayaan-3 mission** to the Moon. The spacecraft launched aboard India's heaviest rocket, Launch vehicle **Mark-III a.k.a LVM3** on a journey to the Moon. The spacecraft will complete the **3,84,000** kilometers-long journey in nearly **45 days** to attempt a soft-landing on the Moon by end of August. The Chandrayaan-3 mission began its journey to the Moon onboard India's heaviest rocket, the Launch Vehicle Mark-III. The spacecraft is neatly packed in the launch fairing of the rocket as it begins its journey to the lunar world.

Despite scorching heat and a forecast of dry weather, passenger vehicles carrying ardent space enthusiasts are making a beeline to this spaceport. Over 10,000 people from Tamil Nadu, Andhra Pradesh, and Karnataka have arrived at Sriharikota since early morning and they are witnessing the launch from the dedicated space gallery set up by Isro adjacent to the main entrance of the **Satish Dhawan Space Centre (SDSC).**

Chandrayaan 3: Overview of the launched

- LVM3 is in an automatic launch sequence and the onboard computer has taken over command. The launch to happen at 2:35 pm as Chandrayaan3 begins journey to the Moon.
- Isro conducts the textbook launch of the Chandrayaan-3 mission to the Moon. All systems function nominally.
- All system are functioning normally and payload fairing has been opened to expose Chandrayaan-3 to space.
- The third stage is powering the Chandrayaan-3 mission to begin its orbit-raising activity. The spacecraft is being pushed into the desired orbit above Earth and the cryogenic stage is performing nominally.
- The third stage has ignited and all eyes are on the seperation of Chandrayaan-3 spacecraft from the payload fairing. The third stage is pushing the spacecraft into the required altitude.

A new book released 'Prism: The Ancestral Abode of Rainbow' before Chandrayaan 3 launch

National award-winning filmmaker-writer **Vinod Mankara's new book** was released from the rocket launchpad at Satish Dhawan Space Centre (SDSC) in Sriharikota, Andhra Pradesh. The unique launch of **'Prism: The Ancestral Abode of Rainbow',** a collection of science articles, was held at the SDSC-SHAR, as preparations were going on full swing there for the country's much-awaited Moon mission Chandrayaan-3.

ISRO Chairman S Somanath released the book by handing it over to Vikram Sarabhai Space Centre (VSSC) Director S Unnikrishnan Nair while the countdown for the historic launch was progressing at the space centre. SDSC-SHAR Director A Rajarajan, Liquid Propulsion Systems Centre (LPSC) director V Narayanan, former ISRO Director K Radhakrishnan, and many other space scientists were present besides Lipi Publications managing director Lipi Akbar, the publisher of the book, during the function.

The essence of the book:

- Published by Kozhikode-based Lipi Books, 'Prism' is a compilation of 50 interesting articles from various streams of science including space science, astronomy, biology, anthropology and mathematics. It covers various topics such as the James Webb space telescope, dark sky tourism, black hole confirmation, the dog Laika's first space journey and so on.
- Somanath himself has penned the foreword for the 167-page book in which he said it was full of the "marvels of science".
- 'Prism' is an exploration into the aesthetic and poetic aspects of science and it would help common people develop a close bond with science and feel its beauty. Mankara is the maker of 'Yanam', a science-Sanskrit documentary on India's historic Mars Orbiter Mission 'Mangalyaan'. He has won national and state awards multiple times, has six films and 685 documentaries to his credit.

What is "15 Minutes of Terror" in Chandrayaan-03 Mission?

The critical technical manoeuvre that the **Chandrayaan-3 lander** will have to perform on **August 23** when it enters the final **15 minutes** of its attempt to make a soft landing on the Moon will be to transfer its high-speed horizontal position to a vertical one in order to facilitate a gentle descent on to the surface. The "15 Minutes of Terror" will be the most critical phase of the mission, but ISRO is confident that the Vikram lander will be able to complete these manoeuvres and land safely on the Moon's south pole.

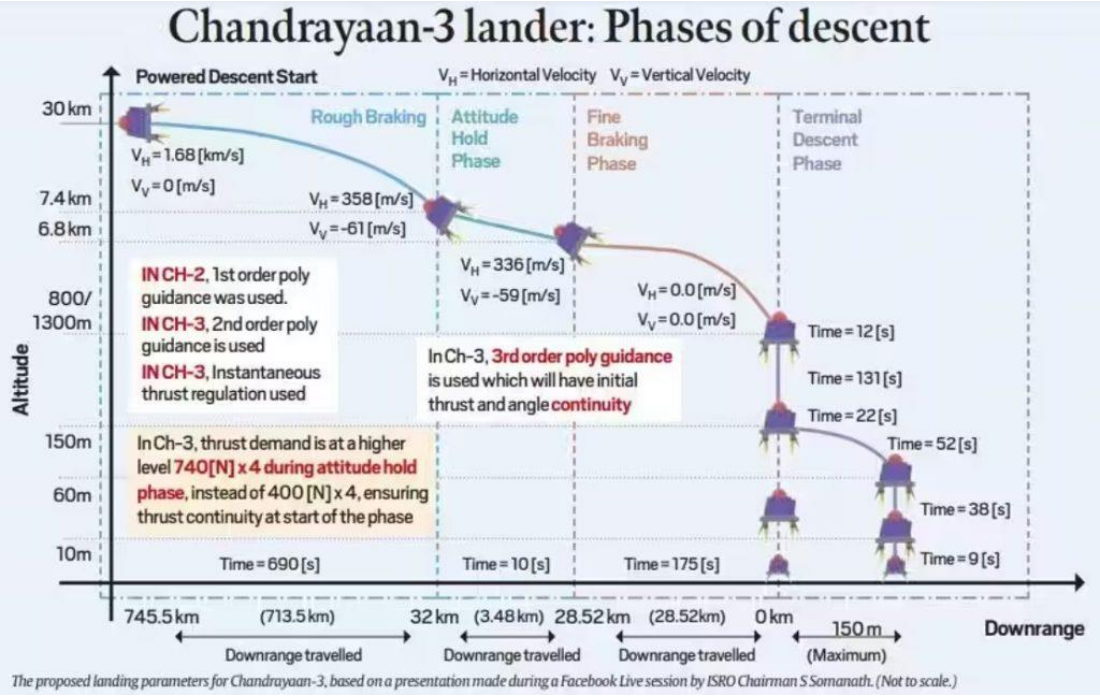
The initial preparation phase

The initial preparation phase comprises the final **1,139 seconds of the Chandrayaan-3 mission,** and it is during this stage that the most critical operations will be performed.

The velocity reduction phase

The next phase, which is velocity reduction, will last **690 seconds,** and thrusters will be fired to reduce Vikram's velocity to one-fourth of its initial speed.

The fine braking phase



The proposed landing parameters for Chandrayaan-3, based on a presentation made during a Facebook Live session by ISRO Chairman S Somanath. (Not to scale.)

The final critical manoeuvre is the fine braking phase. During this phase, the lander will be aligned vertically and will hover at a height of **800 to 1,300 meters** above the landing site. The lander will then use its thrusters to make small adjustments to its position in order to land safely.

The landing

Once the **Vikram lander** successfully lands on the lunar south pole, the sensors will signal the computer onboard the spacecraft. After this, the lander will be powered up completely, and Vikram will unfurl the rover ramp so that the **Pragyan rover** can embark on its lunar journey.

Learning from the failures

Before the Chandrayaan-2 probe could approach its final "terminal descent phase," it lost control and collided with the Moon's surface during the **"attitude hold phase"** and the **"fine braking phase".** The failure studies have been utilised to increase Chandrayaan-3's touchdown probability. The initial rough braking phase of Chandrayaan-2 used a first-order automated guidance system; whereas Chandrayaan-3 is using a second-order guidance system. In Chandrayaan-3, the rough braking phase also uses an immediate thrust regulation.

Chandrayaan-3 Mission Overview and Soft Landing on the Moon

Chandrayaan-3, India's lunar exploration mission, is set to achieve a critical milestone – a soft landing on the moon's surface. This achievement would make **India the only country** to successfully accomplish this feat. Let's delve into the significance of a soft landing, the challenges of landing on the **moon's south pole**, and the intricacies of **Chandrayaan-3's landing**.

What is a Soft Landing and Why South Pole?

- A soft landing involves **controlled descent** at a gentle speed to prevent spacecraft damage upon landing.
- Chandrayaan-3 aims to demonstrate safe and gentle landing, rover mobility, and scientific experiments.
- Landing at the moon's south pole is a remarkable challenge, as it showcases a spacecraft's technical prowess.
- Previous landings occurred near the equator for better terrain, temperature, sunlight, and energy supply.

Chandrayaan-2's Setback and Changes in Chandrayaan-3:

- Chandrayaan-2 faced software and hardware issues during its landing attempt in 2019.
- Chandrayaan-3 adopts a failure-based design approach to address the shortcomings.
- Changes include stronger landing legs, increased landing area, enhanced fuel capacity, and improved solar panels.

Technical Details of Chandrayaan-3's Landing:

Rough Braking Phase:

- Reduce horizontal velocity from 1.68 km/sec at 30 km altitude to nearly zero for soft landing.

Attitude Hold Phase:

- At 7.42 km altitude, the lander tilts from horizontal to vertical while covering 3.48 km.

Fine Braking Phase:

- Lasts around 175 seconds, moving lander fully into a vertical position.
- Descends to 800-1,000 m altitude, nominal speed of 0 m/sec.
- This phase is crucial due to Chandrayaan-2's past loss of control during this stage.

Terminal Descent:

- Final stage, where the lander descends vertically onto the moon's surface.

After Successful Landing:

- Payloads aboard Vikram lander and rover Pragyan remain consistent.
- Lander's payloads study lunar quakes, thermal properties, plasma changes, and distance measurement.
- Rover's payloads analyze lunar surface's chemical and mineral composition, including elements like magnesium, aluminum, and iron.

Timeline And Launch Details Of Chandrayaan-3

The Chandrayaan-3 endeavor is anticipated to undertake a gentle touchdown at 6.04 PM IST on **August 23rd**. The entire mission has been conceived and executed by the Indian Space Research Organisation (ISRO) as a subsequent step to Chandrayaan-2, which fell short of achieving its goals.

ISRO is aiming to softly land Chandrayaan-3 at th**e southern pole of the Moon**, a zone of great significance due to its potential accumulation of water ice.

Below are the events presented in chronological sequence:

1. Announcement and Preparations:

- July 6, 2023: ISRO reveals Chandrayaan-3's launch date as July 14, from Sriharikota's secondary pad.
- July 7, 2023: Successful completion of vehicle electrical assessments.
- July 11, 2023: 24-hour launch rehearsal simulating the launch procedure.

2. Launch and Initial Orbits:

- July 14, 2023: Chandrayaan-3 spacecraft launched with LVM3 M4 vehicle, achieving designated orbit.
- July 15, 2023: First orbit-raising maneuver to 41,762 km x 173 km.
- July 17, 2023: Second maneuver to 41,603 km x 226 km.
- July 22, 2023: Third maneuver to 71,351 km x 233 km.
- July 25, 2023: Additional orbit-raising maneuver.

3. Lunar Orbit Insertion:

- August 1, 2023: Chandrayaan-3 inserted into translunar orbit (288 km x 369,328 km).
- August 5, 2023: Lunar orbit achieved at 164 km x 18,074 km.

4. Orbit Adjustments:

- August 6, 2023: Lunar orbit adjusted to 170 km x 4,313 km.
- August 9, 2023: Chandrayaan-3's trajectory adjusted to maintain lunar orbit of 174 km x 1,437 km.
- August 14, 2023: Orbit further adjusted to 150 km x 177 km.
- August 20, 2023: Orbit set at 134 km x 25 km, representing farthest and nearest lunar points.

5. Final Lunar Orbit and Landing Preparation:

- August 17, 2023: Separation of landing module (Vikram lander and Pragyan rover) from propulsion system.
- August 18, 2023: "Deboosting" operation lowers landing module's orbit to 113 km x 157 km.
- August 20, 2023: Chandrayaan-3's orbit adjusted to 134 km x 25 km.

6. Lunar Touchdown Phase:

- August 23, 2023: Anticipated lunar touchdown initiation at 5:47 pm IST, with soft landing planned for 6:04 pm IST.

Benefits of Chandrayaan-3's South Pole Landing: Unlocking Lunar Secrets

Chandrayaan-3, India's lunar exploration mission, is poised to achieve a groundbreaking soft landing near the **Moon's south pole**. This strategic choice holds immense scientific and exploratory benefits, ranging from uncovering water ice reserves to unraveling the mysteries of the Solar System's evolution.

Water Ice Reserves:

- The **Moon's South Pole** boasts larger continuous shadow areas and colder climate, potentially harboring higher concentrations of water ice.
- Accumulated over billions of years due to extreme cold and limited sunlight, these ice deposits are valuable resources for future human missions.
- Water ice offers applications like drinking water, fuel production, and life support systems, making this region vital for potential lunar habitats.

Exploring Lunar History:

Limited sunlight in the south pole maintains the surface's pristine state, preserving the Moon's historical record.

- Geological features, rock structures, and impact craters here provide insights into the Moon's origin, development, and geological transformations.
- Scientists can extract valuable information about the Moon's evolution spanning billions of years.

Solar System Evolution:

- Polar craters have captured substances from the Solar System's initial phases, including comets and asteroids.
- The Moon's south pole becomes a treasure trove for studying these cosmic entities, enhancing understanding of their genesis and structure.
- Insights into overarching mechanisms influencing Solar System formation and development can be gleaned.

Future Lunar Bases Potential:

- Proximity of water ice near the south pole makes it an attractive site for establishing lunar bases.
- Water extraction and refinement offer crucial supplies for extended missions and sustaining human presence.
- Permanent shadow areas mitigate temperature fluctuations, making them potential sites for habitat construction.

Astronomical Observations:

- Moon's south pole provides a pristine, elevated position for unobstructed astronomical observations.
- Earth's atmospheric interference and light pollution are minimized, enabling in-depth space exploration.
- Astronomers can study remote galaxies, cosmic background radiation, and transient celestial events effectively.

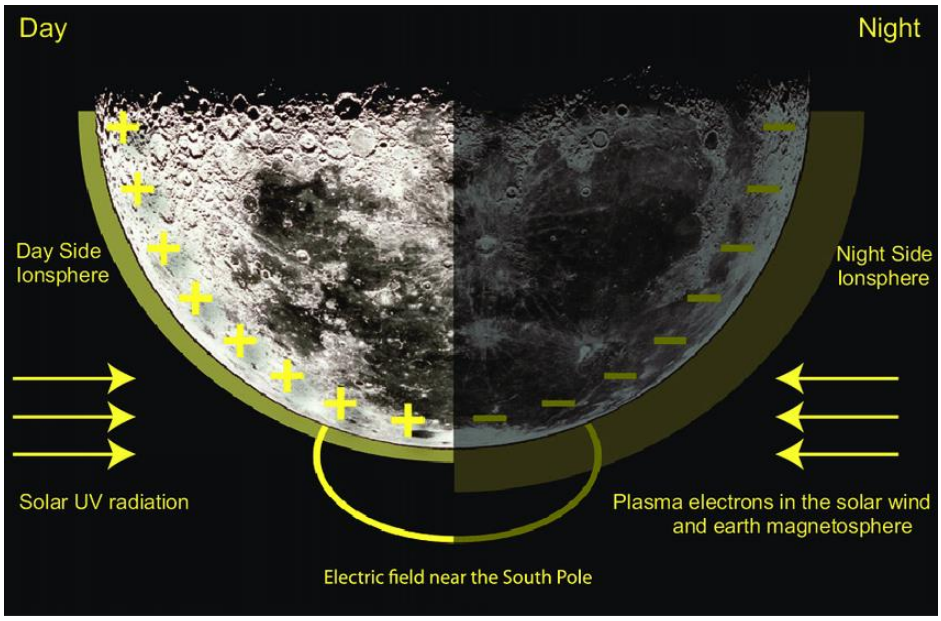
Exploring the Moon's South Pole: Temperature, Range, and Area

The **Moon's south pole** has become a focal point of exploration due to its unique characteristics. Understanding its temperature, range, and area holds immense importance for various scientific endeavors and future lunar missions.

Temperature at the South Pole:

- The moon's south pole experiences extreme temperatures due to its location.
- Temperatures can drop to as low as -230 degrees Celsius (-382 degrees Fahrenheit) in shadowed regions.
- Such frigid conditions are attributed to the prolonged absence of sunlight in certain areas.

Range of the South Pole:



- The **south pole** of the Moon covers a substantial range of latitude.
- Located at approximately 70 degrees south latitude, it spans a significant portion of the lunar surface.
- This polar region's expanse offers diverse terrain, including areas of permanent shadow and illumination.

Characteristics of the South Pole Area:

- The area around the Moon's south pole is characterized by both illuminated and shadowed regions.
- The continuous shadow areas are of particular interest due to their potential for water ice accumulation.
- The presence of craters and rugged terrain poses challenges for landing and exploration.

Scientific Significance:

- Investigating the temperature variations and ice presence contributes to understanding lunar geology and surface processes.

- The unique lighting conditions in the polar regions enable studying ancient impact craters and preserving historical records.
- These studies aid in unraveling the Moon's geological history, Solar System evolution, and potential resource utilization.

Chandrayaan-3 Mission Components: Unlocking Lunar Mysteries

Chandrayaan-3, building upon Chandrayaan-2, aims to demonstrate advanced lunar exploration capabilities. Consisting of a **Lander and Rover** configuration, this mission endeavors to uncover the Moon's secrets through scientific payloads and cutting-edge technology.

Lander Module:

- The indigenous Lander module is the centerpiece of Chandrayaan-3.
- Designed for soft landing, it carries scientific payloads to study lunar phenomena.
- Propulsion Module (PM) carries the Lander and Rover configuration to a 100 km lunar orbit.
- PM features the **Spectro-polarimetry of Habitable Planet Earth (SHAPE) payload**, analyzing Earth's spectral and polarimetric measurements from lunar orbit.

Lander Payloads:

- **Chandra's Surface Thermophysical Experiment (ChaSTE):** Measures thermal conductivity and temperature.
- **Instrument for Lunar Seismic Activity (ILSA):** Gauges seismicity around the landing site, probing lunar crust and mantle.
- **Langmuir Probe (LP):** Estimates plasma density and variations.
- **Laser Retroreflector Array (LRA):** NASA's passive experiment for lunar laser ranging studies.

Rover Payloads:

- **Alpha Particle X-ray Spectrometer (APXS):** Derives elemental composition of lunar soil and rocks.
- **Laser Induced Breakdown Spectroscope (LIBS):** Provides insights into chemical and mineral composition near the landing site.

Advanced Technologies and Objectives:

- Chandrayaan-3 aims to demonstrate advanced technologies for interplanetary missions.
- Lander employs altimeters, velocimeters, inertial measurement, propulsion systems, navigation, and hazard detection for safe landing.
- Mission objectives encompass safe landing, rover mobility, and in-situ scientific experiments.

Mission Specifications:

- Chandrayaan-3's mass is 3900 kg, with Propulsion Module at 2148 kg and Lander Module at 1752 kg.
- Power generation ranges from 50W (Rover) to 758W (Propulsion Module).
- Communication involves IDSN links for Propulsion Module and Lander, with contingency link to Chandrayaan-2 Orbiter.

Scientific Payloads Significance:

- Lander payloads study lunar plasma, thermal properties, seismic activity, and cosmic dynamics.
- Rover payloads unravel elemental and mineral composition, enriching lunar geological knowledge.
- Chandrayaan-3 contributes to exploring lunar history, Solar System evolution, and potential for future lunar bases.

Chandrayaan-3: Team behind India's Moon mission

Indian spacecraft **Chandrayaan-3** has completed the last endeavor and made a soft landing on the surface of the Moon. The touch down took place at 6:04 pm on August 23, 2023, as scheduled. With Chandrayaan-3's successful lunar touchdown, India has joined the ranks of the United States, China, and the former Soviet Union as the fourth nation to master the technology of soft lunar landings.

Nearly 54 female engineers/scientists participated in Chandrayaan-3 mission. According to an ISRO official, they are "associate and deputy project directors and project managers of various systems."

Here are some of the key people behind Chandrayaan-3:

S Somanath, ISRO Chairman

The brain behind India's ambitious Moon mission is **ISRO chief S Somanath.** Somanath has also been given the credits for accelerating ISRO's other missions including **Gaganyaan and Sun-mision Aditya-L1.** Somanath has also served as the director of the Vikram Sarabhai Space Centre (VSSC) and the Liquid Propulsion Systems Centre — the primary centres for development of rocket technologies for ISRO, before heading India's space organisation.

P Veeramuthuvel, Chandrayaan-3 project director

The project director for India's latest lunar touch-down mission is **P Veeramuthuvel.** In 2019, he took charge for the mission. Veeramuthuvel was serving as a deputy director in the Space Infrastructure Programme Office at the ISRO headquarters before the Moon mission started. He is known for his technical skills. Veeramuthuvel played a key role in Chandrayaan-2 mission as well, being the point person for its negotiations with National Aeronautics and Space Administration (NASA). A native of Villupuram in Tamil Nadu, Veeramuthuvel is an alumni of Indian Institute of Technology in Madras (IIT-M).

Mohana Kumar, Mission director

S Mohana Kumar, a senior scientists from the **Vikram Sarabhai Space Centre,** is the mission director for Chandrayaan-3. Kumar has worked as the director for the successful commercial launch of the One Web India 2 satellites on board the LVM3-M3 mission.

S Unnikrishnan Nair, Vikram Sarabhai Space Centre (VSSC) director

S Unnikrishnan Nair is the head of **Vikram Sarabhai Space Centre (VSSC)** at Thumba in Kerala's Thiruvananthapuram district. He and his team are responsible for the key functions of the crucial mission. The Geosynchronous Satellite Launch Vehicle (GSLV) Mark –III, which was renamed as Launch Vehicle Mark-III, rocket, was also developed by the Vikram Sarabhai Space Centre (VSSC)

M Sankaran, U R Rao Satellite Centre (URSC) director

The director of U R Rao Satellite Centre, **M Sankaran,** is responsible for leading the satellite fraternity to meet the national requirements in the areas like communication, navigation, remote sensing, meteorology and inter-planetary exploration. In June, 2021, he took over as director of the lead centre in India for design, development and realisation of all satellites of ISRO.

A Rajarajan, Launch Authorisation Board (LAB) chief

A scientist and director of the Satish Dhawan Space Centre SHAR (SDSC SHAR), Sriharikota, **A Rajarajan,** is an expert in the area of composites. He was looking after the fruition of solid motor production and launch complex infrastructure to meet ISRO's increased demand of launches including launches for Human Space Programme (Gaganyaan) and SSLV. The Launch Authorisation Board (LAB) gives the go-ahead for the launch.

Important Questions Related To Chandrayaan-3

1. Chandrayaan-3 has been launched form which of the following centres?
(a) Vikram Sarabhai Space Centre
(b) Satish Dhawan Space Centre
(c) ISRO
(d) Dr. Abdul Kalam Island

2. Which launching vehicle is used in the launch of Chandrayaan-3?
(a) GSLV (b) ASLV
(c) PSLC (d) SLV

3. What is the mass of propulsion module used in Chnadrayaan-3?
(a) 2145 kg ((b) 2245 kg
(c) 2148 kg ((d) 2543 kg

4. The mission life of the Lander and Rover of Chandrayaan-3 equals to:
(a) 24 Earth days (b) 16 Earth days
(c) 14 Earth days (d) 20 Earth days

5. The Chandrayaan-3 mission's Lander is known as:
(a) Vikram (b) Bheem
(c) Pragyaan (d) Dhruv

6. Which part of the Moon is Chandrayaan-3 aiming to land near?
(a) North Pole (b) Equator
(c) South Pole (d) Far Side

7. When was Chandrayaan-3 launched?
(a) 14th August (b) 14th July
(c) 30th June (d) 10th September

8. What is the unique feature of Chandrayaan-3's landing in comparison to other nation's lunar missions?
(a) landing on the dark side of the moon
(b) landing on the Moon's far side
(c) landing on Moon's North pole
(d) landing on Moon's South pole

9. On which date was the lander successfully separated from the Propulsion Module?
(a) 20th August (b) 19th August
(c) 16th August (d) 17th August

10. When did the Chandrayaan-3 spacecraft perform the second de-boosting maneuver?
(a) 20th August (b) 19th August
(c) 17th August (d) 16th August

11. Where is the ISRO Telemetry, Tracking and Command Network (ISTRA (c) located?
(a) New Delhi (b) Mumbai
(c) Chennai (d) Bengaluru

12. What was the purpose of the maneuver performed on 25th July 2023?
(a) Lunar-Orbit insertion (b) Orbit circulization
(c) Translunar Injection (d) Orbit-raising

13. Who is the director of the Chandrayaan-3 mission?
(a) Veeramuthuvel (b) M Vanitha
(c) K. Sivan (d) Ritu Karidhal

14. What is the total weight of Chandrayaan-3?
(a) 4,100 kg (b) 3,900 kg
(c) 2,190 kg (d) 5,200 kg

15. What is the total cost of mission Chandrayaan-3?
(a) 600 crore (b) 540 crore
(c) 800 crore (d) 1200 crore

Solutions

1. (b): Chandrayaan-3 is going to be launched from Satish Dhawan Space Centre, Sriharikota.

2. (a): The launcher used for Chandrayaan-3 is GSLV-Geosynchronous Satellite Launch Vehicle.

3. (c): The mass of the propulsion module used in Chandrayaan-3 is 2148 kg.

4. (c): The mission life of the Lander and Rover of Chandrayaan-3 is one lunar day which is equivalent to 14 Earth days.

5. (a): According to the ISRO Chairman, the name Vikram for the Lander and Pragyaan for the Rover will be carried over Chandrayaan-2 mission.

6. (c): Chandrayaan-3 mission aimed at soft landing on the south pole of the Moon.

7. (b): The launching date of Chandrayaan-3 mission was 14th July, 2023.

8. (d): Chandrayaan-3 mission aimed at soft landing on moon's south pole which is the unique feature of Chandrayaan-3's landing in comparison to other nation's lunar missions.

9. (d): The lander was successfully separated from the Propulsion Module on 17th August 2023.

10. (b): Chandrayaan-3 spacecraft performed the second de-boosting maneuver on 19th August, 2023.

11. (d): The ISRO Telemetry, Tracking and Command Network (ISTRAC) is located in Bengaluru.

12. (d): The purpose of the maneuver performed on 25th July 2023 was orbit-raising.

13. (d): Ritu Kharidhal is a prominent scientist at ISRO. She had lead the launch of Chandrayaan-3.

14. (b): The propulsion module, alone weighs 2,148 kg and the lander and the rover both weighs 1,752 kg which makes the total weight of Chandrayaan-3 3,900 kg.

15. (a): Chandrayaan-3 mission costs 600 crore less than the Chandrayaan-2