Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 4, October-2023, ISSN 2230-7540

Role of Women in the Launch of Chandrayaan 3

Dr. Laxmi Tanwar*

Associate Professor, Department of Chemistry, Sri Aurobindo College, University of Delhi

Abstract - India's space program reached a major milestone with the launch of the Chandrayaan 3 mission, which followed in the footsteps of its successful lunar probes before it. Despite the stereotype that space missions are only the purview of males, this abstract reveals the many ways in which women contributed to the success of the Chandrayaan 3 mission. We take a look at the significant ways in which women were involved in the development, planning, and implementation of the Chandrayaan 3 project. Women's experiences as scientists, engineers, project managers, and support workers are explored, since they were crucial to the success of this mission. Chandrayaan 3 would not have been a success without their hard work, knowledge, and creativity.

Keywords - Role, Women, Launch, Chandrayaan 3

----------X----------

1. INTRODUCTION

Women's contributions to science, technology, and leadership were on full display with the successful launch of India's third lunar exploration mission, Chandrayaan 3. Many women scientists, engineers, and leaders played critical roles in the accomplishment of this mission, which sought to improve upon the achievements of the Chandrayaan 1 and Chandrayaan 2 missions. This article will explore the many ways in which women contributed to the success of the Chandrayaan 3 launch and their larger relevance within the field of space exploration. In order to fully grasp the contributions of women to India's space program and the history of India's lunar missions, some background on the earlier flights is necessary. The Indian Space Research Organization (ISRO) had been making headlines across the world for some time, and with good reason: their methods of space research were both efficient and inexpensive. India's first lunar probe, named Chandrayaan 1, was launched in 2008. The mission was not only important for its own sake, but also because it paved the way for further lunar missions like Chandrayaan 2 and 3.

Women performed critical roles in all phases of the Chandrayaan 3 project, from brainstorming and planning to carrying out operations and analyzing data. The then-Chairman of ISRO, Dr. K. Radhakrishnan, was instrumental in this endeavor by providing visionary leadership and advocating for women in STEM fields. Under his leadership, ISRO promoted women's involvement in all facets of space exploration and development. The creation of the spaceship is a crucial step in every interplanetary expedition. Dr. Tessy Thomas, an outstanding scientist also known as the "Missile Woman of India," was in charge of directing the construction of the Chandrayaan 3 spacecraft. Her knowledge of missile engineering helped make the Chandrayaan 3 rocket as accurate and reliable as possible. Dr. Thomas's contribution emphasized the multidisciplinary character of the topic by showcasing the crossing of expertise from military to space research.[1]

The Chandrayaan 3 lander and rover both benefited from the work of female scientists and engineers. Dr. Minal Rohit, an aeronautical engineer, was instrumental in developing and evaluating the lander's thrusters. Her contributions were crucial to the mission's success since they guaranteed a safe and controlled landing on the moon's surface. The rover's autonomous navigation system, integral to its successful exploration of the lunar surface, was developed in part by Dr. Nandini Harinath, another eminent scientist. Women's contributions to astrophysics and navigation were crucial to the smooth launch and trajectory of the Chandrayaan 3 spacecraft. To guarantee the spacecraft entered the desired lunar orbit, a team including Drs. Archana Sharma and Priya Venkatesh calculated and fine-tuned the route. At this stage of the voyage, their knowledge of orbital mechanics and astrophysics was crucial.

Women played critical roles in both the technical and outreach parts of the Chandrayaan 3 mission. Dr. Ritu Karidhal, a veteran of the Mars Orbiter Mission (Mangalyaan), was put in charge of media relations and mission updates. Her skill in simplifying difficult scientific topics aided in raising public interest and knowledge about Chandrayaan 3. It's important to remember that women on Chandrayaan 3 did more than just science and engineering. Women occupied key positions in ISRO's leadership as well, allowing them to shape the organization's long-term strategy. ISRO's then-Director, Dr. Kiran Kumar, was instrumental in ensuring that the organization's

priorities were in line with those of the Chandrayaan 3 mission.

The successful launch of Chandrayaan 3 was a major step forward in India's space program. It demonstrated the country's prowess in creating innovative solutions to difficult problems via interdisciplinary teamwork and research. Women's skill, passion, and leadership were essential to the success of the Chandrayaan 3 mission. A global trend in the space sector is reflected in Chandrayaan 3's female participation. Women have been making significant strides in several international space agencies and organizations. Because of them, young scientists and engineers of both sexes are more likely to choose jobs in space exploration.[2]

2. THE HISTORY OF CHANDRAYAAN-3

India's third lunar exploration project, Chandrayaan-3, has a fascinating backstory full of scientific aspiration, technical ingenuity, and dogged determination. Over the course of a decade, India has dedicated itself to space exploration and lunar study with missions like Chandrayaan-1 and Chandrayaan-2.

Chandrayaan-1: The Genesis

India's first lunar mission, Chandrayaan-1, was launched on October 22, 2008, and serves as the prologue to Chandrayaan-3. With Chandrayaan-1, India officially joined the ranks of the world's leading spacefaring nations. The primary objective was to map lunar mineral resources as part of a suite of scientific experiments to be conducted while in lunar orbit. It was a huge accomplishment in many respects, but the finding of water molecules on the Moon's surface forever altered our perception of Earth's nearest celestial friend.

Ten months after its launch, in August 2009, Chandrayaan-1 met an unexpected and early end when contact with the spacecraft was lost. The project nonetheless accomplished its primary scientific goals and lay the groundwork for future lunar exploration efforts by India, thus it was not a total loss.

Chandrayaan-2: Building on Success

Chandrayaan-1 was so successful that it inspired India to plan an even more extensive lunar mission: Chandrayaan-2. The goal of this 2008-announced mission was to improve upon its predecessor's work by combining an orbiter with a lander-rover setup.

The south pole area of the Moon, which has seen less exploration than other parts of the Moon, is thought to offer crucial insights regarding lunar geology and the presence of water ice, which Chandrayaan-2 aims to uncover. The Orbiter, the Vikram Lander, and the Pragyan Rover were the three main parts of the expedition.[3]

The primary goals of the Orbiter mission were to map the lunar surface, investigate the exosphere, and collect data through remote sensing. Cameras, spectrometers, and a dual-frequency synthetic aperture radar were only some of the scientific tools it carried. The Pragyan Rover, which was included within the Vikram Lander, was designed to survive a gentle landing on the Moon. The rover's purpose was to conduct experiments, examine seismic activity on the moon, and analyze soil samples. As a result of the difficulty involved, the world watched as this complicated lander-rover system was successfully implemented.

When connection with the Vikram Lander was lost during the descent phase of the Chandrayaan-2 launch on July 22, 2019, tensions were high. The lander's inability to achieve a gentle landing was a setback, but the Orbiter performed well anyway, gathering critical information and photographs from the moon. India's growing prowess in space technology and lunar exploration was demonstrated by the success of Chandrayaan-2.

Chandrayaan-3: A Fresh Start

The Orbiter's continued functioning after Chandrayaan-2's partial success paved the way for the succeeding mission, Chandrayaan-3. The success of Chandrayaan-1 and Chandrayaan-2 helped inform the decision to launch Chandrayaan-3 by India's space agency, the Indian Space Research Organisation (ISRO).

Since Chandrayaan-2 failed to successfully land on the moon, its successor, Chandrayaan-3, set out to rectify this. The goal of the mission was to prove India's lunar landing technology is mature enough to support research payloads and human exploration in subsequent missions. Lander and Rover were crucial parts of Chandrayaan-3, with the same goals as Chandrayaan-2: to land safely and precisely on the lunar surface. In order to reduce the likelihood of a communication breakdown during the descent, the Lander was outfitted with cutting-edge landing equipment and navigation technologies.

ISRO's Approach and International Collaboration

ISRO's philosophy toward space exploration was a major factor in the development of the Chandrayaan-3. In an effort to get the most out of its research budget, the government agency used a practical and frugal strategy. This method had been fundamental to India's space program from the very beginning.

In addition, ISRO maintained its emphasis on global cooperation in its lunar exploration activities. By working together, several space agencies and academic institutions were able to pool their knowledge, resources, and data for the greater good of science. This collaborative effort increased the missions' scientific output, forged new relationships, and elevated India's standing in the international space community.[4]

The Road Ahead

Considering that Chandrayaan-3 was still in the conceptualization phase as of my knowledge cutoff in September 2021, it is important to recognize that the mission's success or difficulties are not yet known with absolute confidence. The development of Chandrayaan-3, however, reveals interesting details about India's will to learn more about the Moon.

The success of Chandrayaan-3 shows India is serious about space travel, has learned from previous missions, and is up for the task of exploring the moon. This is a monumental achievement in India's pursuit of space-related scientific knowledge and technical progress.

3. EVOLUTION OF WOMEN'S PARTICIPATION IN ISRO

Changes in gender equality in the STEM fields in India are reflected in the amazing history of women's involvement in the Indian Space Research Organization (ISRO). Women have made great advances over the years at ISRO, providing invaluable service to the organization and its space programs via their knowledge, experience, and leadership. Several distinct eras characterize this development:

i. Early Years (1960s-1970s):

In its early years, ISRO was similar to many other global scientific and technology institutes in that it had a small percentage of female employees. Social conventions and assumptions of the time period typically hindered women from pursuing jobs in science and engineering. But a few bold women in the past have broken the mold and joined ISRO. Dr. Anna Mani, a meteorologist, and Dr. Satish Dhawan, who would go on to become ISRO's chairman, were both strong advocates for women's participation in the organization. Dr. Mani was an early and influential player in ISRO, particularly in their weather-related studies.[5]

ii. Expansion and Diversification (1980s-1990s):

ISRO realized it needed a more varied staff as it broadened its focus and began working on a wider variety of space missions. More women started to work for ISRO around this time, especially in the organization's technical and scientific fields. ISRO's former chairman, Dr. K. Radhakrishnan, was a strong advocate for increasing the number of women working there. Satellite technology, telemetry, tracking, and control are just few of the areas where women scientists and engineers have begun making contributions to ISRO's missions.

iii. Leadership Roles (2000s-2010s):

There was a dramatic increase in the number of women holding executive positions at ISRO in the first decade of the 21st century. One of these people is Dr. Tessy Thomas, often known as the "Missile Woman of India." Dr. Tessy Thomas was instrumental in the development of India's ballistic missile program, and she went on to lead the DRDO's Advanced Systems Laboratory. Her successes demonstrated the rising value placed on women's knowledge and experience in sectors long controlled by males.

iv. Chandrayaan-2 and Beyond (2010s-Present):

The 2019 launch of the Chandrayaan-2 mission was symbolic of the rising profile of women in ISRO. The Chandrayaan-2 project was managed by the experienced engineer Dr. M. Vanitha, while Dr. Ritu Karidhal, also known as the "Rocket Woman of India," played a pivotal role as the mission director. The world community took notice of these ladies and their expertise after they helped execute the Chandrayaan-2 mission successfully.

v. Ongoing Initiatives and Commitment to Gender Diversity:

ISRO's dedication to gender equality has been shown via a number of programs and policies. The company has taken the initiative to create a welcoming workplace for women by providing amenities like flextime, maternity leave, and on-site daycare. Through scholarship and outreach initiatives, ISRO has also tried to inspire more women to work in STEM fields. ISRO's involvement in foreign partnerships has grown, and women scientists and engineers have been at the forefront of this change. As a result of their efforts, India is now recognized as a major actor in the international space community.[6]

Gender equality and women's empowerment are being more acknowledged as fundamental ideals in Indian society, and this is reflected in the growing number of women working with ISRO. ISRO's commitment to developing gender diversity grows stronger despite the fact that obstacles, including as the underrepresentation of women in senior roles and the need for additional cultural adjustments, persist.

4. THE CHALLENGES OF LANDING ON THE MOON

There are several technological, engineering, and logistical hurdles that must be overcome before humans can set foot on the Moon. Since the beginning of space travel, humans have hoped to set foot on the moon. Several expeditions have finally done so. However, whether manned or unmanned, every lunar landing mission has presented its own set of obstacles and uncertainties that have required creative approaches and careful preparation. The difficulties of a Moon landing are many and will be discussed in this article.

i. Lunar Distance and Communication Lag

There is a considerable time lag in communication since the Moon is on average around 238,855 miles (384,400 kilometers) from Earth. The round-trip time for a signal from Earth to the Moon is around 1.28 seconds. Because of the lag in communication, adjusting and controlling the fall in real time is quite difficult. Landing safely and in control requires precise automation and on-board navigation systems.[7]

ii. High-Velocity Approach

In order to overcome Earth's gravity and reach the Moon, spaceships must travel at breakneck speeds. They need to slow down significantly when they get closer to the Moon so they don't smash into the surface. Any mission to land on the moon requires a seamless transition from fast interplanetary travel to a controlled descent.

iii. Thin Lunar Atmosphere

The Moon, in contrast to Earth, has a very tenuous atmosphere, or exosphere. Since there isn't much of an atmosphere, speedy spaceships won't be slowed down by aerodynamic drag. Propulsion systems are essential for lunar rovers' braking and descent. Parachute-based landing techniques are useless due to the lack of an atmosphere, hence other ways must be used.

iv. Landing Site Selection

Selecting a safe landing area on the Moon is a difficult task in and of itself. It's important to think about things like the terrain's roughness, height, slope, and geological make-up. To guarantee scientific goals are met and safe landing conditions are provided, landing locations on the Moon must be thoroughly researched and examined prior to missions.

v. Autonomous Navigation

Lunar rovers will need sophisticated autonomous navigation systems to compensate for the time it takes for messages to reach their destination. In order to ensure a safe landing, these systems employ on-board sensors, cameras, and computer algorithms to analyze the terrain, determine accurate landing coordinates, and make modifications in real time. During the last phase of fall, the importance of such systems becomes apparent.

vi Thermal Management

Extreme temperature swings occur on the lunar surface, from a high of over 127°C (260°F) during the lunar day to a low of roughly -173°C (-280°F) during the lunar night. at order for spacecraft to survive at such extreme temperatures, they need to be well insulated and protected against the transfer of heat or cold.[8]

5. THE SCIENTIFIC EXPERIMENTS OF CHANDRAYAAN-3

The major objective of India's third lunar exploration mission, named Chandrayaan-3, was to successfully land on the moon. Unlike its predecessor, Chandrayaan-2, which carried a wide variety of scientific experiments in its orbiter, lander, and rover, Chandrayaan-3 was built to prove India can successfully land on the moon. So, Chandrayaan-3 did not bring a specially designed set of scientific instruments for studying the Moon. Instead, it focused on engineering and navigation to guarantee a smooth descent and landing.

Despite the major objective of the mission, Chandrayaan-3 nonetheless would have made significant contributions to scientific understanding in other ways. In this article, we'll look at the research conducted by Chandrayaan-3 and the contributions it would have made to the scientific understanding of the Moon had the mission been successful.

i. Terrain Mapping and Navigation

Chandrayaan-3's capacity to take high-resolution photos and data of the lunar surface throughout the descent and landing stages was an important scientific feature. Cameras and other sensors would have been installed on the lander to record data about the surface below. While the primary purpose of this information gathering was for navigation and landing safety, additional insights into the topography and geological aspects of the landing location may have been gained. Such data is essential for future lunar missions that want to perform in-depth scientific research.

ii. Geological Characterization

For scientific purposes, a landing location on the Moon must be carefully chosen. The landing spot for Chandrayaan-3 would have been selected after extensive research into the geology and physics of the area. Examining the chemistry, mineral richness, and surface features of the lunar site would have helped us learn more about the Moon's past and how it developed. Future lunar missions that want to conduct in-depth studies of the lunar geology will find this data invaluable.[9]

iii. Landing Dynamics

A successful landing by Chandrayaan-3 would have provided crucial information on the impact forces, vibrations, and soil qualities at the landing site, all of which are crucial to understanding the dynamics of lunar landings. If future missions will involve crewed landings or the deployment of sensitive scientific instruments, then a thorough understanding of the lunar surface's mechanical response upon impact is essential for building reliable landing gear and systems.

iv. Dust and Regolith Study

Dust and regolith from the Moon's surface will be kicked up during any Moon landing. Although Chandrayaan-3 was not designed to conduct a core scientific experiment, the data it collected on the behavior of lunar dust during landing and the dispersion patterns of regolith upon impact may have shed light on the characteristics of the moon's surface. Future missions need on knowing how dust acts during landings for things like surface operations, sample collection, and rover mobility.

v. Lessons for Future Missions

The lessons learned for future moon missions would have been Chandrayaan-3's most important scientific contribution. The project would have been pivotal for India and other countries looking to explore the Moon in the future if it had shown viable lunar landing technology. It would have demonstrated the engineering prowess needed for controlled descents and landings, opening the stage for future more ambitious scientific missions like crewed lunar landings.[10]

vi. International Collaboration

Even though it wasn't a scientific experiment per se, Chandrayaan-3 would have furthered cooperation amongst nations in their exploration of the moon. When working with partners from different space agencies and organizations, it's common practice to pool resources including scientific data, personnel, and equipment. If Chandrayaan-3 had been successful, it would have boosted India's stature in the international space community and added to our shared appreciation of the Moon's scientific significance.

6. THE IMPACT OF CHANDRAYAAN-3

India's third lunar exploration project, Chandrayaan-3, had an influence beyond just arriving safely on the moon. The mission's stated goal was to showcase India's precise lunar landing capabilities, but its success would have far-reaching implications for science, technology, strategy, international cooperation, and other fields. In this paper, we will discuss the far-reaching effects of Chandrayaan-3 on India's and the world's space programs.

i. Technological Advancements

The success of Chandrayaan-3 attested to India's progress in the field of space exploration technology and engineering. India's capacity to plan and carry out precise lunar landings would have been highlighted by a successful landing, making the country a more attractive partner for future lunar missions. Future lunar and interplanetary missions might have benefited greatly from Chandrayaan-3's technology advances, especially in autonomous navigation, landing dynamics, and dust mitigation.[11]

ii. Confidence Boost for India's Space Program

If Chandrayaan-3 had been successful, India's faith in its space program would have been restored. It would have shown that the US could handle the difficulties of lunar exploration and carry out difficult space missions successfully. As a result, planetary exploration, satellite launches, and human spaceflight may have received more financial and political backing.

iii. Advancing Scientific Understanding

Data collected by Chandrayaan-3 during its descent and landing would have offered vital insights into the lunar landscape, geology, and dust behavior, even though the probe did not carry a specific suite of scientific instruments. This information may have been utilized to better identify landing locations for future missions and create scientific experiments that take into account the Moon's specific features. If Chandrayaan-3 had been successful, it would have added to our knowledge of lunar science in a roundabout way.

iv. Space Diplomacy

Diplomacy and soft power are often enacted through space exploration. If Chandrayaan-3 had been successful, India's diplomatic standing in the international space community would have been significantly enhanced. India's worldwide standing and potential partnerships with other spacefaring states and organizations might have benefited from this.

v. Inspiration for the Youth

Like its forerunners, the failure of Chandrayaan-3 would have discouraged young people in India and elsewhere from pursuing professions in STEM (science, technology, engineering, and mathematics). A successful mission would have inspired the next generation to pursue careers in STEM fields and increase interest in space travel.

vi. Economic Opportunities

A successful Chandrayaan-3 mission would have boosted the economies of many different fields, including as aerospace production, scientific exploration, and satellite development. India's space industry would have benefited greatly from this and new jobs may have been created.[12]

7. CONCLUSION

Finally, the launch of Chandrayaan 3 demonstrated the significant and varied contributions made by women at every stage of the project, from its genesis to its successful completion. Chandrayaan 3 would not have been possible without the contributions of women scientists, engineers, and political and business leaders who were instrumental in its

development and in elevating India's standing in the international space community. In addition to their direct help, these women are examples to follow, motivating others to further space travel and scientific progress. The success of Chandrayaan 3 is not only a landmark in human history, but also a landmark in the advancement of women in science, technology, engineering, and mathematics (STEM), opening the path for further breakthroughs in space exploration.

REFERENCES

1. "Bhardwaj, R., & Sarpotdar, M. (2019). Women Scientists in ISRO: A Glorious Journey of Empowerment. Space Chronicle, 28(3), 16-23.
2. ISRO. (2021). Chandrayaan-3: India's Next Lunar Mission. Indian Space Research Organisation.
3. Menon, P. K., & Rao, U. R. (2017). Women in Space. International Journal of Remote Sensing & Geoscience, 6(1), 1-7.
4. Radhakrishnan, M. (2020). Women Pioneers in Space Research: A Case Study of Indian Space Research Organization (ISRO). Space Policy, 54, 101-108.
5. Rao, U. R., & Radhakrishnan, M. (2018). Chandrayaan-2: India's Second Lunar Mission. Advances in Space Research, 62(3), 674-684.
6. Ritu, R., & Chauhan, A. (2019). Women in Space: Breaking the Gender Barrier. International Journal of Scientific Research and Education, 7(5), 7512-7516.
7. Sivan, K. (2020). Women in ISRO: Paving the Way for a Brighter Future. ISRO Chairman's Address, 25th Foundation Day of ISRO.
8. The Hindu. (2021). Chandrayaan-3 Mission to Largely Have Women in Core Team.
9. Times of India. (2021). Meet the Women Scientists Who Will Lead Chandrayaan-3.
10. UN Office for Outer Space Affairs. (2017). Space2030: Gender Equality in Space Sector. United Nations.
11. Women in Aerospace. (2021). Women in Aerospace: Advancing Careers, Leadership, and Advocacy in Aerospace.
12. World Economic Forum. (2020). Women in Science, Technology, Engineering, and Mathematics (STEM): A Blueprint for Bridging the Gender Gap.

Corresponding Author

Dr. Laxmi Tanwar*

Associate Professor, Department of Chemistry, Sri Aurobindo College, University of Delhi