



**DEPARTMENT
OF
PHYSICS**

S P A C E M I S S I O N

“The sky is not the limit; it’s just the beginning”.

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Physics

A Brief History of Space Exploration

Humans have always looked up into the night sky and dreamed about space.

In the latter half of the 20th century, rockets were developed that were powerful enough to overcome the force of gravity to reach orbital velocities, paving the way for space exploration to become a reality.

In the 1930s and 1940s, Nazi Germany saw the possibilities of using long-distance rockets as weapons. Late in World War II, London was attacked by 200-mile-range V-2 missiles, which arched 60 miles high over the English Channel at more than 3,500 miles per hour. After World War II, the United States and the Soviet Union created their own missile programs.

On Oct. 4, 1957, the Soviets launched the first artificial satellite, Sputnik 1, into space. Four years later on April 12, 1961, Russian Lt. Yuri Gagarin became the first human to orbit Earth in Vostok 1. His flight lasted 108 minutes, and Gagarin reached an altitude of 327 kilometers (about 202 miles).

The first U.S. satellite, Explorer 1, went into orbit on Jan. 31, 1958. In 1961, Alan Shepard became the first American to fly into space. On Feb. 20, 1962, John Glenn's historic flight made him the first American to orbit Earth.



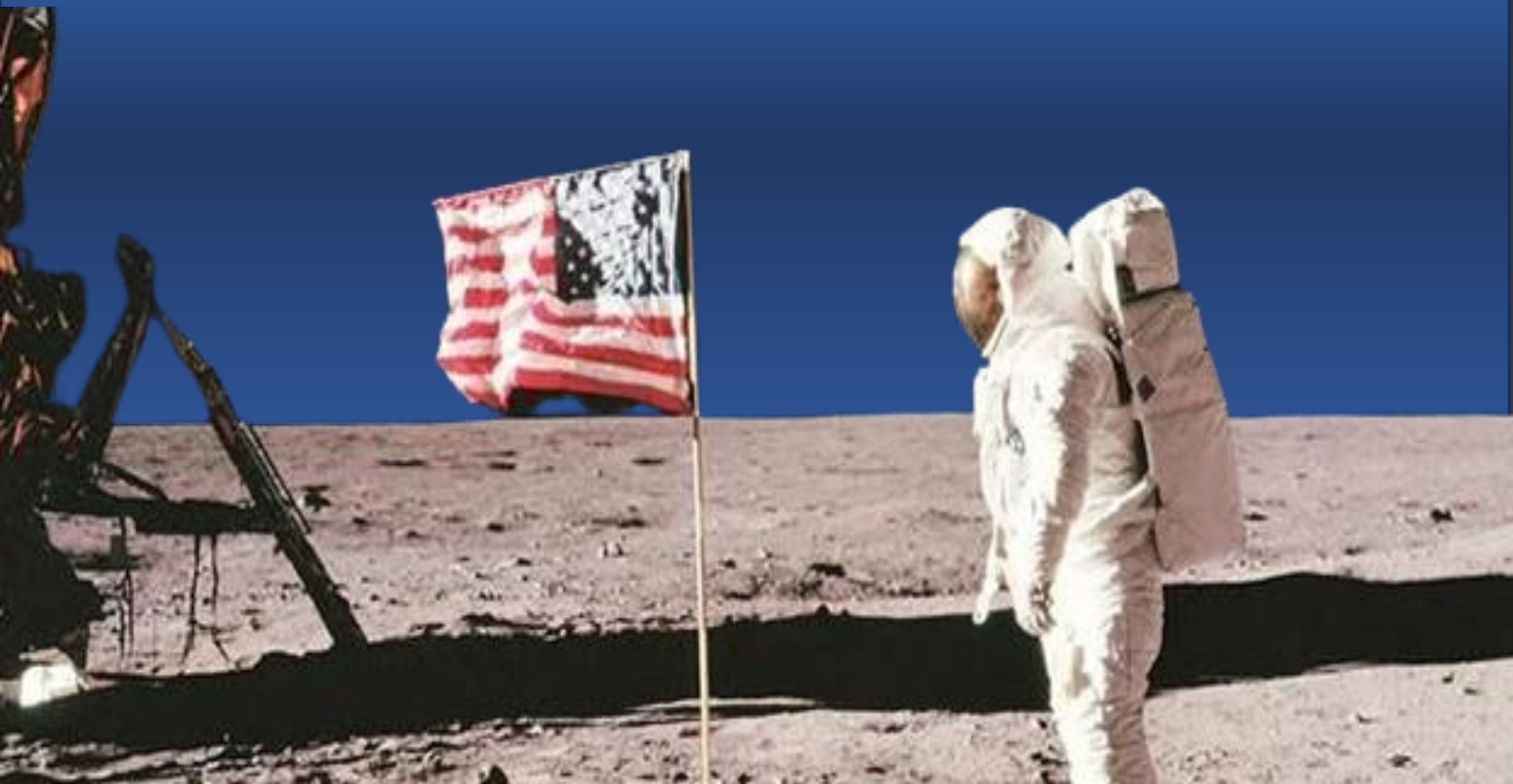
Landing on the moon: Apollo 12 launches for second moon landing Nov. 14, 1969.

“Landing a man on the Moon and returning him safely to Earth within a decade” was a national goal set by President John F. Kennedy in 1961. On July 20, 1969, astronaut Neil Armstrong took “one giant leap for mankind” as he stepped onto the Moon. Six Apollo missions were made to explore the Moon between 1969 and 1972.

Timeline of Solar System Exploration

This is a timeline of Solar System exploration ordering events in the exploration of the Solar System by date of spacecraft launch:

- 4 Oct 1957** • First Artificial Satellite, Sputnik 1, launched by the Soviet Union.
- 12 Apr 1961** • Yuri Gagarin becomes the first human travel to Space.
- 20 Jul 1969** • Apollo 11 Lands on the Moon, Neil Armstrong becomes the first human to walk on the Moon.
- 03 Nov 1971** • Mariner 9 becomes the first spacecraft to orbit another planet, Mars.
- 11 Dec 1971** • Apollo 17 lands on the Moon, the last human mission to the Moon.
- 20 Aug 1977** • Voyager 2 launched, first spacecraft to study the outer Solar System.
- 19 Feb 1986** • Mir Space Station launched by the Soviet Union.
- 24 Apr 1990** • Hubble Space Telescope launched by NASA.
- 07 Nov 1997** • First successful landing on another planet, Mars, by Mars Pathfinder.




India's Stellar Journey: A Glimpse into Space Research

India's space program, spearheaded by the Indian Space Research Organization (ISRO), has witnessed remarkable growth and achievements in recent decades. From humble beginnings to becoming a global leader in space exploration, India's journey has been marked by innovation, determination, and a commitment to scientific advancement.

Timeline of Indian Space Exploration

India's space program, led by the Indian Space Research Organisation (ISRO), has made significant strides over the decades. Here's a brief timeline of some of its key achievements:

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- Apr 1962** ● Indian National Committee for Space Research (INCOSPAR) established.
 - 15 Aug 1969** ● ISRO formed.
 - 19 Apr 1970** ● First satellite, Aryabhata, launched.
 - 18 Apr 1975** ● First experimental satellite launch vehicle (SLV-3) launched.
 - 19 Jun 1980** ● First operational satellite, Bhaskara, launched.
 - 03 Apr 1984** ● First Indian in space, Rakesh Sharma, aboard a Soviet spacecraft.
 - 17 Aug 1987** ● First geosynchronous satellite, INSAT-1A, launched.
 - 20 May 1994** ● Polar Satellite Launch Vehicle (PSLV) successfully launches a satellite into polar orbit.
 - 22 Oct 2008** ● Chandrayaan-1 lunar orbiter launched, discovers water ice on the Moon.
 - 5 Nov 2013** ● Mars Orbiter Mission (MOM) successfully reaches Mars, becoming the first Asian spacecraft to do so.
 - 5 Jan 2014** ● First successful launch of the Geosynchronous Satellite Launch Vehicle (GSLV) with a cryogenic upper stage.
 - 28 Sep 2015** ● Astrosat, India's first dedicated multi-wavelength space observatory, launched.
 - 15 Feb 2017** ● ISRO launches 104 satellites in a single mission, a world record at the time.
 - 7 Sep 2020** ● Aditya-L1, India's first solar mission, launched.
 - 23 Aug 2023** ● Chandrayaan-3 successfully lands on the Moon's south pole, making India the fourth country to do so.

• Early Years and Milestones

ISRO was established in 1969 with the primary goal of developing indigenous satellite technology. Over the years, the organization has achieved numerous milestones, including:

- **Satellite Launches:** India has successfully launched numerous satellites for communication, remote sensing, meteorology, and scientific research.
- **Chandrayaan Missions:** India's lunar exploration program, Chandrayaan, has made significant strides. Chandrayaan-1, launched in 2008, discovered water ice on the Moon's surface. Chandrayaan-2 attempted a soft landing on the Moon's south pole in 2019, although the lander faced challenges.
- **Mars Orbiter Mission (MOM):** India's maiden interplanetary mission, MOM, successfully reached Mars in 2014, making it the first Asian nation to do so.
- **Solar Missions:** India has also ventured into solar exploration with missions like Aditya-L1, which aims to study the Sun from a vantage point in space.

Contributions to Global Space Exploration

India's space program has not only benefited the country but has also contributed significantly to global space exploration. Some notable contributions include:

- **International Collaborations:** ISRO has collaborated with various international space agencies, such as NASA, ESA, and JAXA, on joint projects and missions.
- **Technology Transfer:** India has shared its expertise and technology with other developing nations, helping them establish their own space programs.
- **Scientific Research:** Indian satellites and missions have provided valuable data for scientific research in areas such as climate change, natural disasters, and astronomy.

Future Endeavors

India's space ambitions continue to soar, with ambitious plans for the future. Some of the upcoming projects include:

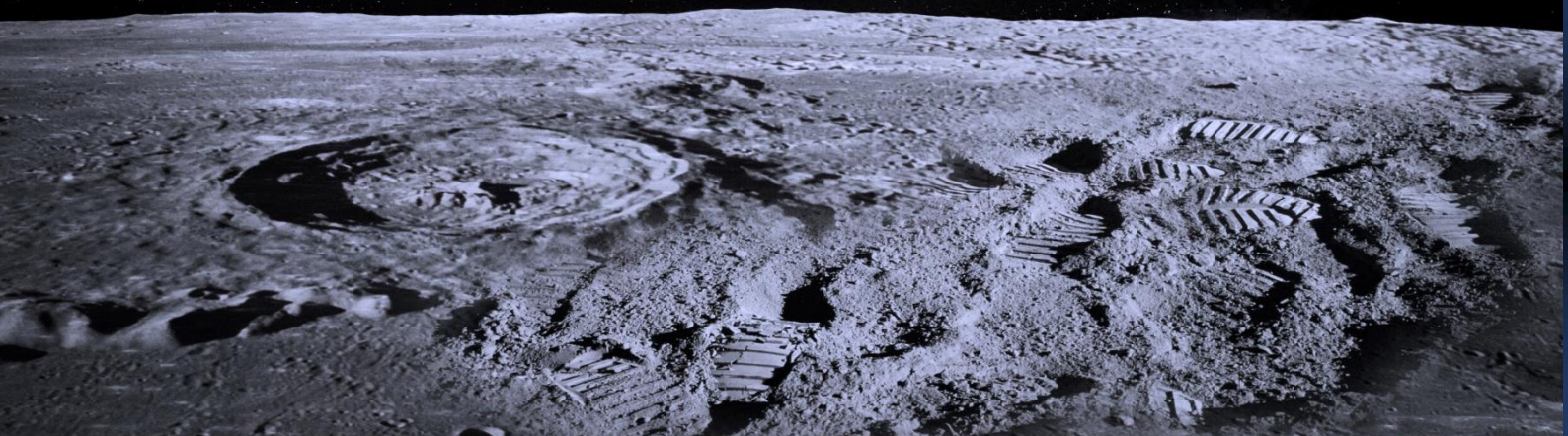
- **Gaganyaan:** India's manned space mission aims to send astronauts into orbit by 2025.
- **Chandrayaan-3:** A follow-up to Chandrayaan-2, this mission aims to achieve a soft landing on the Moon and deploy a rover.
- **Space Station:** India is exploring the possibility of developing its own space station in collaboration with other countries.



CHANDRAYAAN-3

Chandrayaan-3 is the third mission in the Chandrayaan programme, a series of lunar-exploration missions developed by the Indian Space Research Organisation (ISRO). The mission consists of a Vikram lunar lander and a Pragyan lunar rover was launched from Satish Dhawan Space Centre on 14 July 2023. The spacecraft entered lunar orbit on 5 August, and India became the first country to touch down near the lunar south pole, at 69°S, the southernmost lunar landing on 23 August 2023 at 18:03 IST (12:33 UTC), made ISRO the fourth space agency to successfully land on the Moon, after USSR, NASA and CNSA.

Chandrayaan-3 was launched from Satish Dhawan Space Centre on 14 July 2023. The spacecraft entered lunar orbit on 5 August, and became the first lander to touch down near the lunar south pole on 23 August at 18:03 IST (12:33 UTC), making India the fourth country to successfully land on the Moon, and at 69°S, the southernmost lunar landing, until IM-1 landed further southwards in Malapert A crater on 22 February 2024. The lander was not built to withstand the cold temperatures of the lunar night, and sunset over the landing site ended the surface mission twelve days after landing. The propulsion module, still operational, transited back to a high Earth orbit from lunar orbit on 22 November 2023 for continued scientific observations of Earth. It operated until 22 August 2024.



CHANDRAYAAN-3

Mission type	Lander- Rover
Mission Duration	1year,1month and 8days(pm)
	<ul style="list-style-type: none"> Propulsion module : 6month(planned) 1yr 17day(since insertion)
	<ul style="list-style-type: none"> Lander: <14days(planned) 1yr.28days since landing)
	<ul style="list-style-type: none"> Router: <14days (planned) 12days (final)
Launch mass:	3900kg
Payload mass:	Propulsion molule:2148kg
	Lander module:1726kg
	Router:26kg
Power:	Propulsion module758w
	Lander:738w
	Power:50w
Launch Date:	14th July 2023 14:35:17 IST
Rocket:	LVM3 M4
Lanch Site:	SDSC
LANDER	
Landing Date:	23rd Aug 2023 :18:03 IST
Return Launch:	3 Sept 2023
Landing Site:	Statio Shiv Shakti(Shiv Shakti Point). 69.378°S,32.319°E(between Manzinus C and Simpelius N craters)
ROVER	
Landing date:	2027(tentative)
Landing site:	Near Shiv Shakti Point

