



To the Moon and Beyond!

Article

PART 1

NEW DELHI, India. Both India and China are surging ahead in space exploration. Both countries launched space missions in late 2013. India's Mars Orbiter Mission (MOM) was sent to Mars in November, and China's Chang'e 3 spaceship blasted off on its way to the moon in December.

India

India launched its first spacecraft bound for Mars on November 5, 2013. The orbiter spent slightly less than a month in Earth's orbit, and then, on November 30, 2013, the orbiter left Earth's sphere of influence on its way to orbit the Red Planet.

"The Earth orbiting phase of the spacecraft ended. The spacecraft is now on a course to encounter Mars after a journey of about 10 months around the sun," the Indian Space Research Organisation (ISRO) said in a statement in early December.

The 3,000-pound (1,350-kilogram) orbiter Mangalyaan, which means "Mars craft" in Hindi, must travel 485 million miles (780 million kilometers) for about 300 days to reach an orbit around Mars in September 2014.

The orbiter will gather images and data that will help in determining how Martian weather systems work. India is also looking to MOM to answer the question of what happened to the large quantities of water that are believed to have once existed on Mars.

The MOM orbiter will also search Mars for methane, a key chemical in life processes that could also come from geological processes. Experts say the data will improve their understanding about how planets form, what conditions might make life possible, and where else in the universe life forms might exist.

The orbiter is expected to have at least six months to investigate the planet's landscape and atmosphere. At its closest point, it will be 227 miles (365 kilometers) from the planet's surface, and its farthest point will be 49,700 miles (80,000 kilometers) away from Mars.

Some have questioned India's \$72 million mission to Mars while the country is still dealing with widespread hunger and poverty. But the government defended the Mars mission and its \$1 billion space program, saying the program provides jobs for scientists and engineers.

The space program also offers practical applications in solving problems on Earth, India's government asserted. Decades of space research have allowed India to develop satellite, communication, and remote sensing technologies that are helping to solve everyday problems at home. These problems range from forecasting where fish can be caught by fishermen to predicting storms and floods, which a country could then deal with proactively.



Photo credit and all related images:
Arun Sankar K/AP

Soldiers stand guard at the Satish Dhawan Space Center in southern India. India sent its first spaceship to Mars in November 2013.

If MOM is successful, India will become the fourth space program to visit the Red Planet. The Soviet Union, the United States, and Europe have already accomplished this.

China

Meanwhile, China is busy with its own space mission. The country successfully launched a rocket carrying the rover "Yutu," or "Jade Rabbit." Yutu was sent off aboard an unmanned Chang'e 3 spaceship on December 2, 2013, from a launch center in southwestern China. Yutu arrived on the moon just 12 days later, on December 14. The mission is named after "Chang'e," a mythical Chinese goddess of the moon. "Yutu" is Chang'e's pet.

With the first soft landing on the moon in 37 years, China became the third country to successfully achieve this, after the United States and the former Soviet Union. A soft landing does not damage the craft or the equipment it carries.

The solar-powered rover was sent to survey the moon's geological structure and to set up a telescope to survey the moon's surface and observe Earth's plasmasphere, a region of dense, cold plasma that surrounds the planet.

However, about a month into the mission, China announced that Yutu was experiencing mechanical problems. The problems appeared to be related to the solar-powered lander's process for shutting down for the lunar night, which lasts more than two Earth weeks. The temperature during that time drops to -292 degrees Fahrenheit (-180 degrees Celsius).

Yutu had survived its first lunar night. Then, things went awry. Officials believe that lunar dust blocked one of the solar panels from folding inward, which left the equipment exposed to the extremely low temperatures. Would the lander be able to function again? In late January 2014, no one was sure. Still, China had not thrown in the towel.

"The engineers...haven't given up yet," officials wrote in a blog post about the issue.

China sent its first astronaut into space in 2003. Its space program is a source of enormous national pride—the program has already made major breakthroughs in a relatively short time, although it lags behind the United States and Russia in space technology and experience. China's eventual goals are to have a space station and put an astronaut on the moon.

"We...strive for our space dream as part of the Chinese dream of national rejuvenation," said Xichang Satellite Launch Center director Zhang Zhenzhong.

The Associated Press contributed to this story.



Photo credit: AP/Xinhua, Li Gang

On December 2, 2013, China launched its first spaceship to the moon. The spaceship landed 12 days later. It has a rover that will study the planet and also use a telescope to observe Earth.

PART 2

Dig Deeper

Most research in space is accomplished through the use of spacecraft without crews aboard. The spacecraft carry instruments that test the compositions and characteristics of planets. Data and images are sent back to Earth as radio signals. Onboard computers and radio signals from Earth guide the spacecraft. Scientists and engineers have designed different types of spacecraft to carry out these missions.

Spacecraft called orbiters are designed to study a planet over a long period of time. As an orbiter approaches its target planet, rocket engines are fired to slow the spacecraft down. The spacecraft then goes into orbit around the planet.

In an orbiter mission, a spacecraft orbits a planet for several months to several years. Since an orbiter remains near a planet for a much longer period of time than a flyby spacecraft, it can view most or all of the planet's surface. An orbiter can also keep track of changes that occur over time, such as changes in weather and volcanic activity.

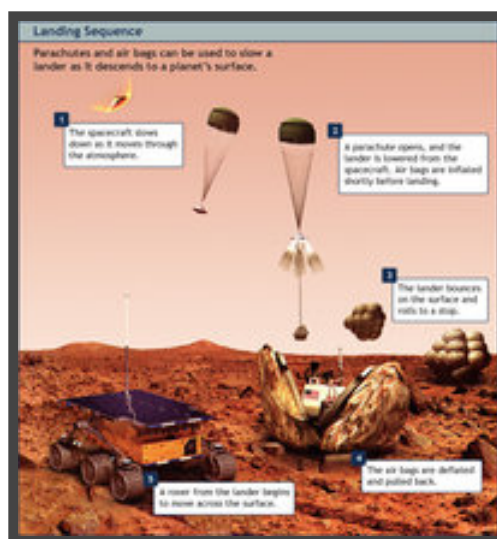
- Orbiters allow astronomers to create detailed maps of planets.
- Most orbiters have cameras to photograph planet surfaces.
- Orbiters may also carry other instruments, such as a device for determining the altitudes of surface features or one for measuring temperatures in different regions.
- Some orbiters are designed to explore moons or other bodies in space instead of planets.
- It is also possible to send a spacecraft to orbit a planet and later move it into orbit around one of the planet's moons.

Landers and probes enable exploration by landing instruments on the surface or sending instruments through a planet's atmosphere. Such a mission can tell us more about the features and properties of a planet. It can also provide clues to what a moon or planet was like in the past.

A lander is a craft designed to land on a planet's surface. After a lander touches down, controllers on Earth can send it commands to collect data. Landers have been placed successfully on the Moon, Venus, and Mars. Some have operated for months or years at a time.

- The images taken by a lander are more detailed than those taken by an orbiter.
- In addition to providing close-up views of a planet's surface, a lander can measure properties of the planet's atmosphere and surface.
- A lander may have a mechanical arm for gathering soil and rock samples.
- A lander may contain a small vehicle called a rover that can explore beyond the landing site.

One of the most successful space missions was that of *Mars Pathfinder*, which landed on Mars in 1997. *Mars Pathfinder* and its rover sent back thousands of photographs. These images provided evidence that water once flowed over the surface of Mars. Unfortunately, another lander, sent two years later, failed to work after it reached Mars.



Some spacecraft are designed to work only for a short time before they are destroyed by conditions on a planet. The term probe is often used to describe a spacecraft that drops into a planet's atmosphere.

- As the probe travels through the atmosphere, its instruments identify gases and measure properties, such as pressure and temperature.
- Probes are especially important for exploring the deep atmospheres of giant planets, such as Jupiter.

A lander or a probe can work in combination with an orbiter. For example, in 1995 the orbiter *Galileo* released a probe into Jupiter's atmosphere as it began orbiting the planet. The probe sent data back to the orbiter for nearly an hour before it was destroyed. The orbiter passed the data on to Earth. *Galileo* continued to orbit Jupiter for 8 years. Future space missions may involve even more complex combinations of spacecraft.

Dictionary

awry (*adverb*) not in keeping with plans or expectations

lander (*noun*) a spacecraft designed to land on a planet's surface

lunar (*adjective*) having to do with the moon

proactively (*adverb*) acting in advance to stop something from becoming a problem

probe (*noun*) a spacecraft that is sent into a planet's atmosphere or onto a solid surface

rejuvenation (*noun*) renewal

Activity

PART 1

Question 1

Based on information in the article, which best describes a difference between the space launches by China and India in 2013?

- (A) India's spacecraft is still in flight on its way to gather images and data about Mars, while China's rocket achieved a soft landing on the moon.
- (B) India's space launch was the latest space mission for that country, while China's rocket launch was the first attempted by that nation.
- (C) India's space launch was praised by citizens of that country, while China's rocket launch was questioned by many in that nation.
- (D) India's spacecraft malfunctioned while performing a maneuver to leave Earth's orbit, while China's rocket is successfully transmitting data to Earth.

Question 2

What is this article mainly about?

- (A) Both India and China are being forced to defend their space missions in countries where poverty is widespread.
- (B) Both India and China sent a spacecraft to survey the moon's surface and geological structure in 2014.
- (C) Both India and China turn to their space missions for answers to everyday problems on Earth, like predicting storms and floods.
- (D) Both India and China are surging ahead in space exploration, with each country launching a space mission in 2013.

Question 3

Which is the closest **antonym** for the word *rejuvenation*?

- (A) Duplication
- (B) Devastation
- (C) Revitalization
- (D) Restoration

Question 4

Carlo wants to know more about how India and China's missions into space are progressing. He would find **most** of his information by _____.

- (A) Viewing a documentary about the successful launch of the missions
- (B) Interviewing an astronaut who has completed a mission into space
- (C) Reading an account of one engineer's thoughts about the missions
- (D) Following news outlets that report on the missions in the two countries

Question 5

The reader can infer from the article that _____.

- (A) India and China plan to work together to build and maintain a new space station.
- (B) The U.S. and Russia are planning to help China put an astronaut on the moon.
- (C) Space exploration is important to several countries around the world.
- (D) Several countries with space programs are planning a joint mission to Mars.

Question 6

The article states:

The space program also offers practical applications in solving problems on Earth, India's government asserted.

Which is closest **synonym** for the word *assert*?

- (A) Implore
- (B) Atone
- (C) Reject
- (D) Maintain

Question 7

This article could be placed in a category of news called "Space." In which other category would this article fit best?

- (A) Environmental Issues
- (B) Weather Trends
- (C) World Geography
- (D) Modern Exploration

Question 8

Which statement from the article best supports the idea that China might be unable to achieve all the goals set for its lunar mission?

- (A) Yutu was sent off aboard an unmanned Chang'e 3 spaceship on December 2, 2013, from a launch center in southwestern China.
- (B) ...About a month into the mission, China announced that Yutu was experiencing mechanical problems.
- (C) With the first soft landing on the moon in 37 years, China became the third country to successfully achieve this, after the United States and the former Soviet Union.
- (D) The solar-powered rover was sent to survey the moon's geological structure and to set up a telescope to survey the moon's surface and observe Earth's plasmasphere, a region of dense, cold plasma that surrounds the planet.