



To the Moon and Beyond!

Article

PART 1

NEW DELHI, India. Both India and China are moving ahead in space exploration. Both countries launched space missions in 2013. India's Mars Orbiter Mission (MOM) was sent to Mars in November. 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 craft spent almost a month in Earth's orbit. Then, on November 30, 2013, the orbiter went on its way to the Red Planet.

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

The 3,000-pound (1,350-kilogram) orbiter is called Mangalyaan. That means "Mars craft" in Hindi. It must travel 485 million miles (780 million kilometers) to reach an orbit around Mars. It will take about 300 days. It is expected to do this by September 2014.

The orbiter will gather images and data. They will help in determining how Martian weather systems work. India is also looking to MOM to figure out 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. Methane can also come from geological processes. Experts say the data will improve their understanding about how planets form. They will also learn more about what conditions might make life possible and where else in the universe it 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. At its farthest point, it will be 49,700 miles (80,000 kilometers) away from Mars.

Some have questioned India's \$72 million mission to Mars. The country has widespread hunger and poverty. But the government defended the Mars mission and its \$1 billion space program. The program provides jobs for scientists and engineers, the government said.

The space program also offers practical applications in solving problems on Earth. Decades of space research have allowed India to develop satellite, communication, and remote sensing technologies. These 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 in advance.



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

This is 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 Chang'e 3 spaceship on December 2, 2013. It left Earth from a launch center in 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.

It was the first soft landing on the moon in 37 years. It made China 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 structures. It was also sent to set up a telescope to survey the surface. That telescope would also observe Earth's plasmasphere, a region of dense, cold material that surrounds the planet.

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

Yutu made it through its first night. Then, things went really wrong. Officials believe that moon dust got onto one of the solar panels. It may have blocked it from folding inward. This would have left Yutu exposed to the extreme cold. Would the lander still work? In late January 2014, no one was sure. But China's engineers had not given up.

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

"We [work] for our space dream as part of the Chinese dream of national [growth]," said Zhang Zhenzhong. He is head of the Xichang Satellite Launch Center.

The Associated Press contributed to this story.



Photo credit: AP/Xinhua, Li Gang
China launched its first spaceship to the moon in December 2013. The spaceship 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 done by using spacecraft without crews. The unmanned spacecraft carry instruments. These instruments test the compositions of planets. They also test the planets' characteristics. Data and images are sent back to Earth. They are sent as radio signals. Onboard computers guide the spacecraft; so do radio signals from Earth. Scientists and engineers have designed different kinds of spacecraft to carry out these missions.

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

In an orbiter mission, a spacecraft orbits a planet. It orbits for several months to several years. An orbiter stays near a planet for a much longer time than a flyby spacecraft. So, it can view most or all of the planet's surface. An orbiter can also keep track of changes that take place over time. These could be changes in weather. Or they could be changes in volcanic activity.

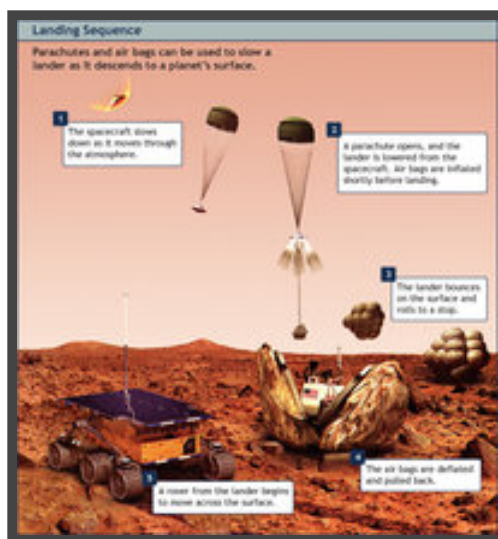
- Orbiters allow astronomers to create detailed maps of planets.
- Most orbiters have cameras. They photograph planet surfaces.
- Orbiters may also carry other instruments. One might determine the altitudes of surface features. Another could measure temperatures in different regions.
- Some orbiters do not explore planets. Instead, they are designed to explore moons or other bodies in space.
- It is possible to change the body a spacecraft orbits. The spacecraft can be sent to orbit a planet. Then, it can be moved to orbit one of the planet's moons.

Landers and probes allow for exploration. They do this by landing instruments on a planet or sending instruments through its atmosphere. What is the purpose of such a mission? It can tell us more about the features of a planet. It can also tell us more about the properties of a planet. It can even 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. What happens once it lands? Controllers on Earth send it commands. They command the lander to collect data. Landers have been placed successfully on the Moon. They have also been placed successfully on Venus and Mars. Some have worked for months or years at a time.

- Landers take images. These images are more detailed than those taken by an orbiter.
- Landers offer close-up views of a planet's surface. They also measure properties of the planet's atmosphere and surface.
- A lander may have a mechanical arm. It uses this arm for gathering soil and rock samples.
- A lander may contain a small vehicle. This vehicle is called a rover. A rover can explore past the landing site.

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



Some spacecraft are designed to work only for a short time. This is before they are destroyed by conditions on a planet. A probe is a spacecraft that drops into a planet's atmosphere.

- The probe travels through the atmosphere. As it travels, its instruments identify gases. They measure properties such as pressure and temperature.
- Some planets, like Jupiter, are giant. They have deep atmospheres. Probes are especially important for exploring these atmospheres.

A lander or a probe can work together with an orbiter. What is an example? In 1995, the orbiter *Galileo* was sent into space. It began orbiting the planet Jupiter. It sent a probe into Jupiter's atmosphere. The probe sent data back to the orbiter. It sent data for nearly an hour before it was destroyed. The orbiter passed the data on to Earth. *Galileo* continued to orbit Jupiter for eight years. Future space missions may use even more complex combinations of spacecraft.

Dictionary

geological (*adjective*) having to do with a planet's landforms and surfaces

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

landscape (*noun*) scenery; land within view

phase (*noun*) a stage

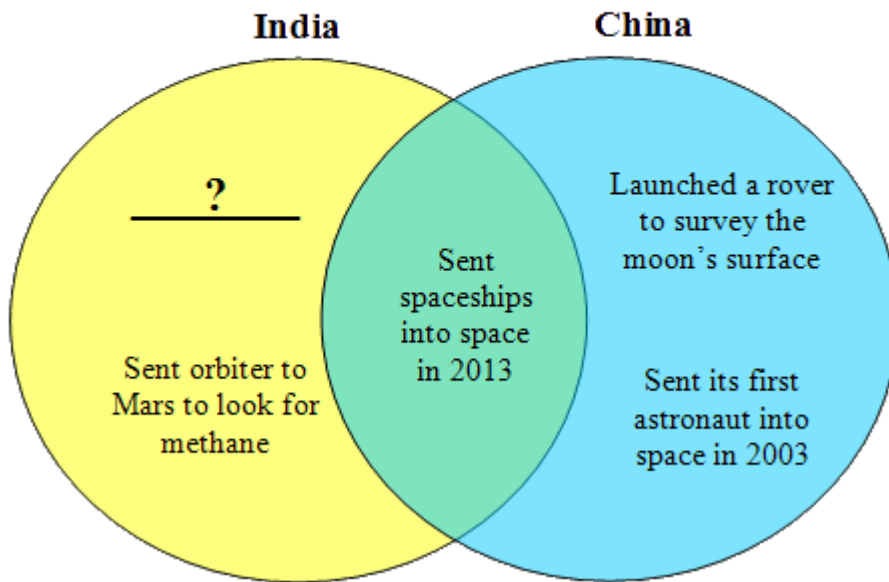
probe (*noun*) a spacecraft that is sent into a planet's atmosphere or onto a solid surface

Activity

PART 1

Question 1

How Are These Alike and Different?



Based on the article, which best replaces the question mark in the diagram above?

- (A) Launched a solar-powered spacecraft that will have a soft landing on the moon
- (B) Launched its first spacecraft with an orbiter that will circle the moon
- (C) Launched a spacecraft that will land the first astronaut on Mars
- (D) Launched its first spacecraft heading for Mars to study its weather

Question 2

What is this article mainly about?

- (A) Two countries that each launched a spacecraft on a mission that was the first of its kind to the planet Mars
- (B) Two countries that each launched a spacecraft on a mission to orbit the sun and then land on and explore the moon
- (C) Two countries that each launched a spacecraft on a mission to test new technologies that will be used to solve problems on Earth
- (D) Two countries that each launched a spacecraft on a mission that was the first of its kind for that country

Question 3

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

- (A) Period
- (B) Ceremony
- (C) Experiment
- (D) Attempt

Question 4

Yehuda wants to learn more about Earth's plasmasphere. He would find the **most** information _____.

- (A) In a news article about recent studies done by the Indian Space Research Organisation
- (B) In a news article explaining what China's solar-powered rover was built to study
- (C) In a news article about recent studies done by the Mangalyaan orbiter
- (D) In a news article explaining what China learned from the Chang'e 3 spaceship launch

Question 5

According to the article, the reader can tell that _____.

- (A) India hopes that exploring space will lead to technology that will help people who are poor.
- (B) Exploring space is too expensive for any country to continue to have a modern space program.
- (C) Exploring space is important to many countries around the world.
- (D) China will probably be the first country to find methane on Mars.

Question 6

The article states:

Officials believe that moon dust got onto one of [Yutu's] solar panels. It may have blocked it from folding inward. This would have left Yutu exposed to the *extreme* cold. Would the lander still work?

Look at the passage above and think about the article. Which is the closest **synonym** for the word *extreme*?

- (A) Expected
- (B) Intense
- (C) Obvious
- (D) Unpredictable

Question 7

Which information is **not** in the article?

- Ⓐ The year that China sent its first astronaut into space
- Ⓑ How many pounds or kilograms India's Mars orbiter weighs
- Ⓒ The reason why China decided to observe Earth's plasmasphere
- Ⓓ How much India is spending on its mission to Mars

Question 8

Which statement from the article best supports the opinion that China intends to have future space missions?

- Ⓐ [China] still lags behind the United States and Russia in space technology and experience.
- Ⓑ "We [work] for our space dream as part of the Chinese dream of national [growth]," said Zhang Zhenzhong.
- Ⓒ The mission is named after "Chang'e," a mythical Chinese goddess of the moon.
- Ⓓ ...About a month into the mission, China announced that Yutu was having mechanical problems.