



To the Moon and Beyond!

Article

PART 1

NEW DELHI, India. Both India and China are exploring space. 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 to Mars on November 5, 2013. The craft spent almost a month in Earth's orbit. Then, on November 30, 2013, the orbiter headed toward Mars.

"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 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 orbit Mars. It will take about 300 days to get there. That is expected to be in September 2014.

The orbiter will get pictures and data. Scientists want to learn about Martian weather. India also hopes to figure out what happened to the water that may once have existed on Mars.

The MOM orbiter will also search Mars for methane. It's a chemical needed for living things. Methane can also come from geological processes. Experts say the information will help them understand 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 should have six months to study the planet's surface and atmosphere. At its closest point, it will be 227 miles (365 kilometers) from Mars. At its farthest point, it will be 49,700 miles (80,000 kilometers) away.

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

The space program also offers practical technologies for solving problems on Earth. These problems range from finding where fish can be caught by fishermen to predicting storms and floods, which a country could then deal with in advance.

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 done this.



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.

China

Meanwhile, China is busy with its own space mission. It launched a rocket carrying the rover "Yutu," or "Jade Rabbit." Yutu was sent off aboard Chang'e 3 spaceship on December 2, 2013. Yutu arrived on the moon just 12 days later, on December 14. The mission is named after "Chang'e." That's 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 achieve this, after the United States and the Soviet Union. A soft landing does not damage the craft or its equipment.

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. That is a region of dense, cold material around our planet.

However, about a month into the mission, China said that Yutu was having problems. They seemed 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, something happened. Officials believe that moon dust got onto one of the solar panels. This may have blocked it from folding up. This would have left Yutu unprotected from the 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. It has made great advances since then. China wants to have a space station. It also plans to 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.

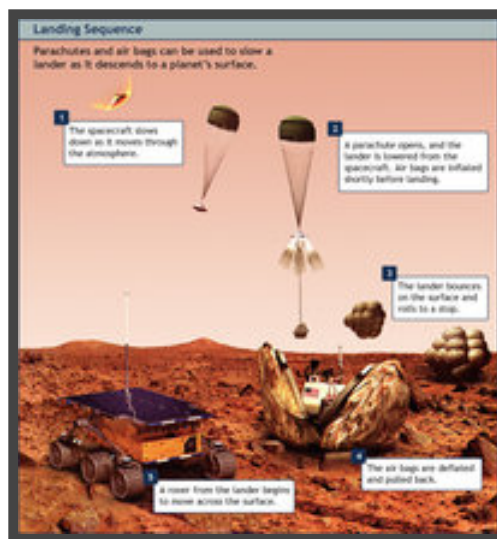
- Orbiters may also carry other instruments. One might determine the altitudes of surface features. Another could measure temperatures in different regions.
- Some orbiters do not explore planets. Instead, they are designed to explore moons or other bodies in space.
- It is possible to change the body 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

data (*noun*) information; facts

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

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

phase (*noun*) a stage

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

rover (*noun*) a car-like machine that moves around on a planet or moon in order to study it

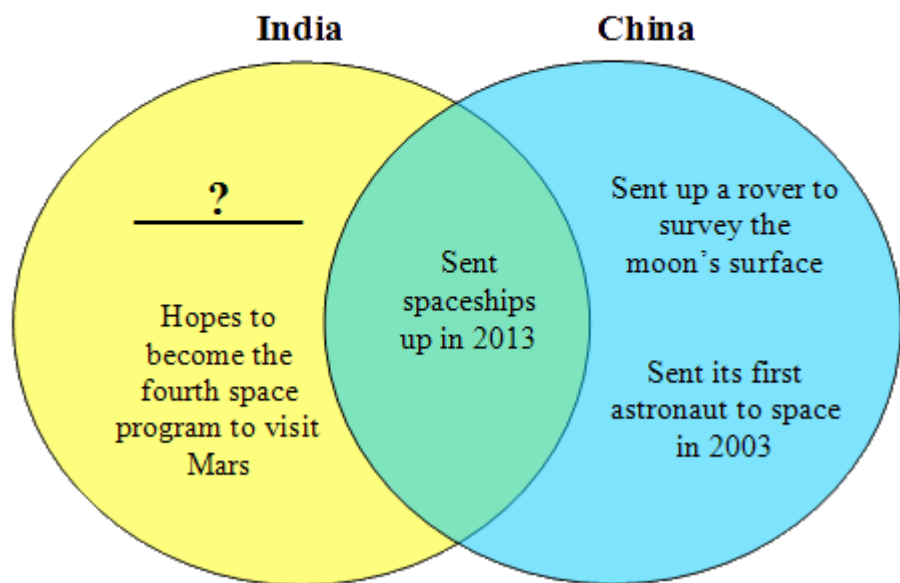
technology (*noun*) the use of science to make new things

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 spacecraft to Mars
- (B) Used solar power on its spacecraft
- (C) Named its rover after a goddess' pet
- (D) Plans to put a person on the moon

Question 2

What is this article mainly about?

- (A) Two countries that each launched a spacecraft carrying a solar-powered rover
- (B) Two countries that each launched a spacecraft on a mission to the planet Mars
- (C) Two countries that each launched a spacecraft that was the first of its kind for the country
- (D) Two countries that each launched a spacecraft to orbit the sun and then land on the moon

Question 3

Which two words from the article are the closest **synonyms**?

- (A) Rover and mission
- (B) Data and information
- (C) Phase and orbit
- (D) Technology and telescope

Question 4

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

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

Question 5

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

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

Question 6

The article states:

Both India and China are exploring space. Both countries *launched* space missions in 2013.

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

- (A) Increased
- (B) Denied
- (C) Expected
- (D) Started

Question 7

Which question is **not** answered by the article?

- A When did China send its first astronaut into space?
- B Why did China decide to observe Earth's plasmasphere?
- C How much is India spending on the trip to Mars?
- D How much does India's Mars orbiter weigh?

Question 8

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

- A "We [work] for our space dream as part of the Chinese dream of national [growth]," said Zhang Zhenzhong.
- B The solar-powered rover was sent to survey the moon's geological structures.
- C [China] launched a rocket carrying the rover "Yutu," or "Jade Rabbit."
- D ...About a month into the mission, China said that Yutu was having problems.