



## To the Moon and Beyond!

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### Article

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#### 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. 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 encounter 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) for about 300 days to reach an orbit around Mars. 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 is still dealing with 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 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 in advance.



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. It left Earth 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 structures. It was also sent to set up a telescope to survey the surface as well as 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 experiencing 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 survived its first night. Then, things went really wrong. Officials believe that moon dust blocked one of the solar panels from folding inward. This would have left the equipment exposed to the extremely low temperatures. Would the lander still work? 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 made major breakthroughs in a relatively short time. It still 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 [growth]," said Xichang Satellite Launch Center director Zhang Zhenzhong.

*The Associated Press contributed to this story.*

## PART 2

### Dig Deeper

Most research in space is done 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. They are sent 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.

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

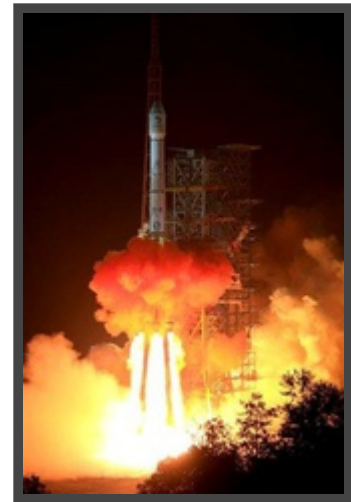


Photo credit: AP/Xinhua, Li Gang

*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.*

In an orbiter mission, a spacecraft orbits a planet for several months to several years. An orbiter remains near a planet for a much longer period of 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 occur over time. These could be changes in weather and volcanic activity.

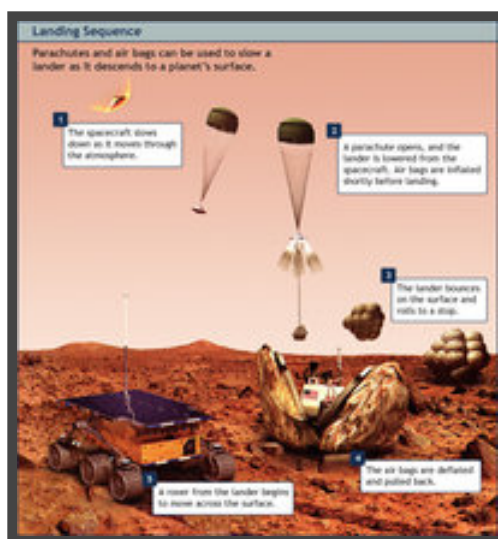
- Orbiters allow astronomers to create detailed maps of planets.
- Most orbiters have cameras. They photograph planet surfaces.
- Orbiters may also carry other instruments. One might determine the altitudes of surface features. Another could measure temperatures in different regions.
- Some orbiters 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 and then moved to orbit one of the planet's moons.

Landers and probes aid in exploration by landing instruments on the surface of a planet 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. What happens 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.

- Landers take images. These images are more detailed than those taken by an orbiter.
- Landers provide 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 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 provided evidence that water once flowed over the surface of Mars. Another lander was sent two years later. Unfortunately, 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. The term probe is often used to describe 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.
- Probes are especially important for exploring the deep atmospheres of giant planets, such as Jupiter.

A lander or a probe can work together with an orbiter. For example, in 1995 the orbiter *Galileo* began orbiting the planet Jupiter. It released 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 8 years. Future space missions may involve even more complex combinations of spacecraft.

**Dictionary**

**encounter** (*verb*) to meet up with

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

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

**strive** (*verb*) to try hard

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## Activity

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### 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 space launch was praised by citizens of that country, while China's rocket launch was questioned by many in that nation.
- (B) India's space launch was the latest space mission for that country, while China's rocket launch was the first one attempted by that nation.
- (C) India's spacecraft will be the last one developed by that country, while China's rocket is the first of many more to be designed by its experts.
- (D) India's spacecraft will gather images and data about Mars, while China's rover is designed to survey the moon's geological structures.

#### Question 2

What is this article mainly about?

- (A) China and India are both using various space launches as part of a national plan to increase pride among their citizens.
- (B) India and China sent a rocket carrying a rover toward Mars in a path that will require it to fly for about 10 months around the sun.
- (C) Both India and China are moving ahead with space programs, with each country setting off to explore different parts of space in 2013.
- (D) Both India and China are advancing space programs that will provide valuable information about Earth's plasmasphere.

#### Question 3

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

- (A) Launched and sent
- (B) Phase and system
- (C) Breakthrough and problem
- (D) Accomplish and predict

#### Question 4

This article would be **most** useful as a source for a student research project on \_\_\_\_\_.

- (A) Problems overcome by solar-powered spacecraft
- (B) Leadership in Asia's largest countries
- (C) Conditions that make life possible in space
- (D) Space exploration by nations around the world

## Question 5

The reader can infer from the article that \_\_\_\_\_.

- (A) India and China will work together to build a space station.
- (B) Space exploration programs will continue to grow around the world.
- (C) The U.S. will help China achieve the goal of putting an astronaut on the moon.
- (D) Several countries are planning to build a space station on Mars.

## Question 6

Which would be the closest **synonym** for the word *data*?

- (A) Communication
- (B) Preparation
- (C) Declaration
- (D) Information

## Question 7

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

- (A) Politics
- (B) Geography
- (C) Science
- (D) Zoology

## Question 8

Which statement from the article best supports the idea that China might have to abandon Yutu?

- (A) [China] still lags behind the United States and Russia in space technology and experience.
- (B) China's eventual goals are to have a space station and put an astronaut on the moon.
- (C) Yutu was sent off aboard an unmanned Chang'e 3 spaceship on December 2, 2013.
- (D) Officials believe that moon dust blocked one of the solar panels from folding inward.