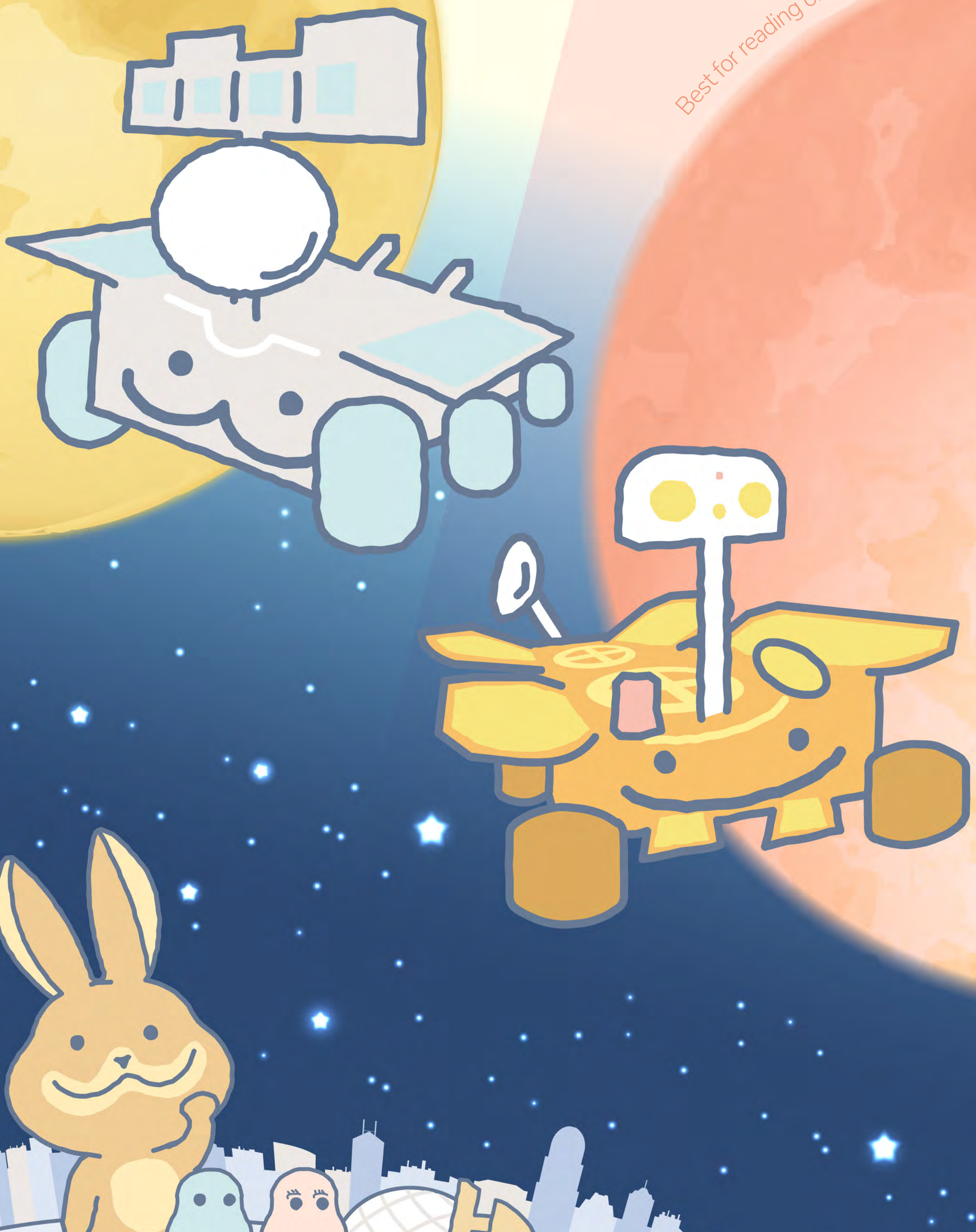
Parent-Child Booklet

LUNAR AND MARS EXPLORATION

Best for reading on mobile devices



Moon

Near side of the Moon
(the side facing Earth)

Credit: NASA

Let's find out the mysteries of Moon! Moon is a natural satellite of Earth which orbits Earth. Though Moon does not shine by itself, it reflects light from Sun. This allows us to see a bright moon at night.

Use Your Imagination

The darker places on the Moon surface are known as "maria". If you combine the lunar maria shown above, which animal do you think it looks like?

Does it look like a rabbit? It's the legendary Jade Rabbit (Yutu), which lives on the Moon!

Moon

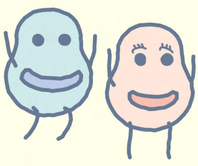
Far side of the Moon
(the side facing away from Earth)

Credit: NASA

Science Corner

Have you ever seen the far side of the Moon? Actually we can only see one side of the Moon on Earth!

The Moon's rotation period is the same as its orbital period around Earth, hence the same side of the Moon is always facing Earth. It is similar to the scenario where you are facing your partner while holding each other's hands and walking in circle. Both of you can only see the front of your partner.



Lunar Exploration Mission

What can we do? Yutu is facing some challenges on the Moon!!

The lunar atmosphere is extremely thin. There is insufficient oxygen for organisms and harmful cosmic radiation is everywhere!

The daily temperature range is really huge. It may rise to 120°C during the day and fall to minus 170°C at night!

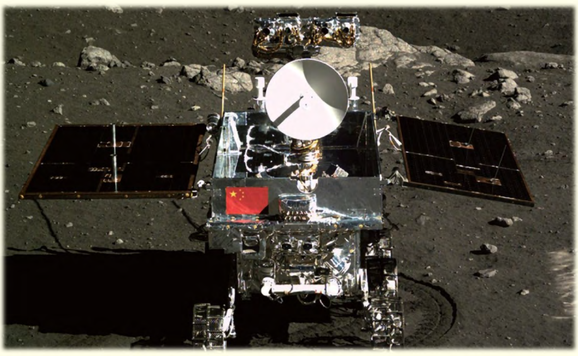
The fine dust on the lunar surface is harmful to our health and cause damages to our scientific instruments!

The lunar surface is full of impact craters and it is hard to find a flat spot for landing!

Credit: NASA

Think About It

When we join Yutu on lunar missions, how should we get equipped to tackle the challenges mentioned above?



In order to reduce risks, scientists used unmanned rovers to explore the Moon. China's lunar rover "Yutu" is one of them.

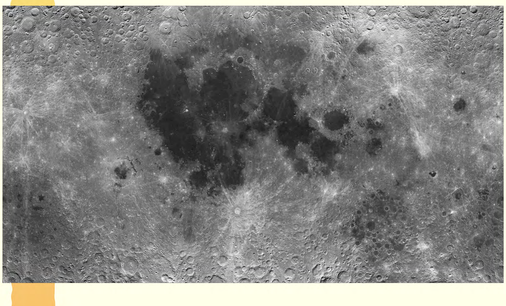
China's Lunar Exploration Program

China's Lunar Exploration Program was officially launched in 2004. The lunar exploration missions carried out by Chang'e-1 to Chang'e-6 probes brought us a number of major discoveries!

2008

China released the country's first full map of the lunar surface. The image was generated from the data collected by Chang'e-1 probe.

China's First Full Map of the Lunar Surface

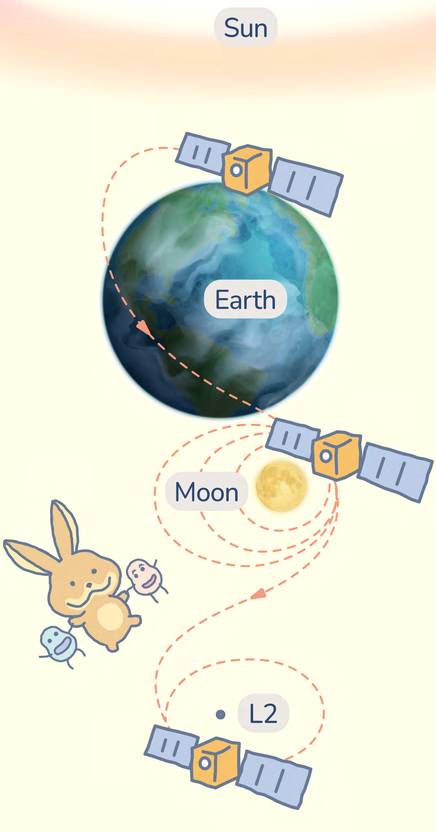


2010

Chang'e-2 probe entered the lunar orbit, and after completing its mission, it left for the second Lagrangian point (L2). In 2011, the probe performed the world's first controlled accurate-entry into the orbit around L2 from the lunar orbit.

Science Corner

The second Lagrangian point (L2) is a special location where the gravitational forces of the celestial bodies cancel each other out. Taking the Sun-Earth system as an example, there are five Lagrangian points between Sun and Earth. Probes can orbit around these Lagrangian points and remain in their oribits for long-term missions with minimal fuel consumption.



China's Lunar Exploration Program

2013 Chang'e-3 probe carried China's first lunar rover "Yutu" and soft-landed on the Moon. Yutu lunar rover moved across the lunar surface to conduct scientific exploration.

2019 Chang'e-4 probe soft-landed on the far side of the Moon and sent back the world's first close-up image of the Moon's far side.

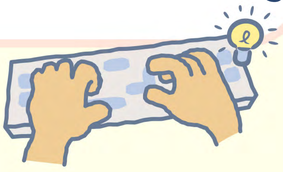
2020 Chang'e-5 probe returned to Earth with soil samples collected from the Moon.

2024 Chang'e-6 probe brought back soil samples collected from the far side of the Moon to Earth.

Interesting Facts

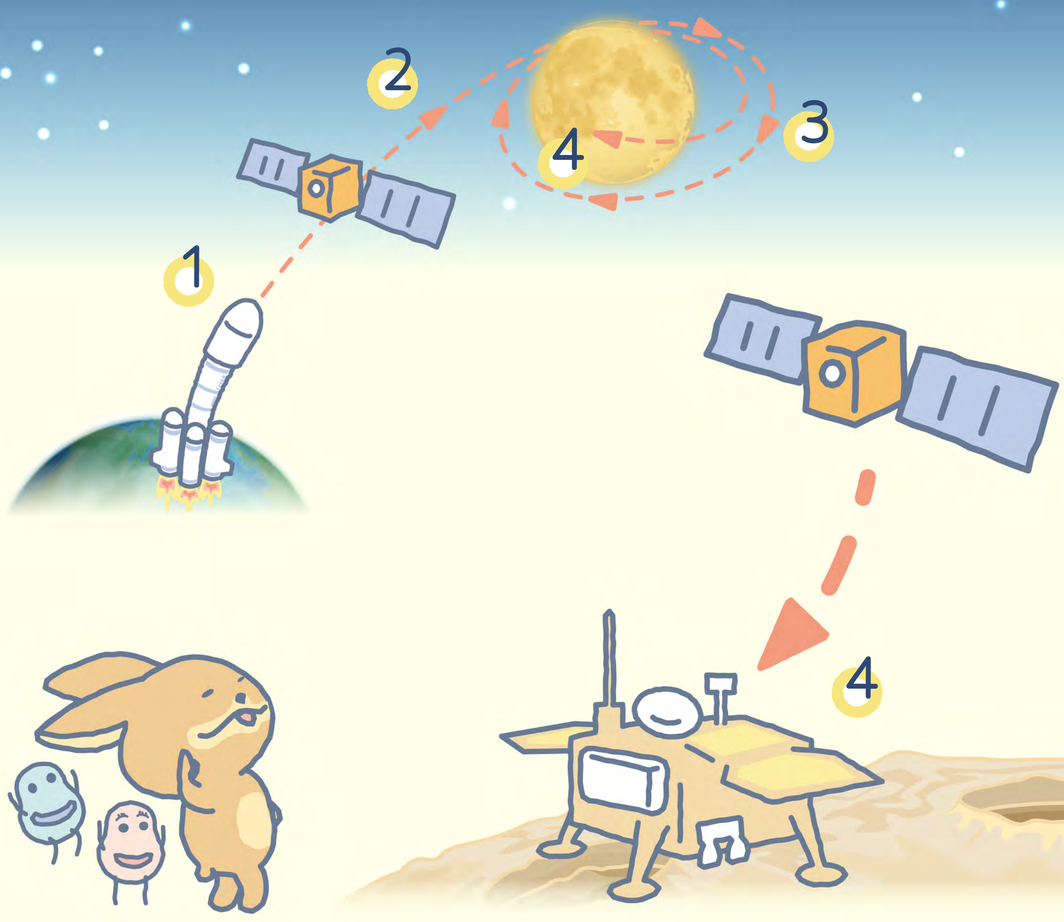
China's space exploration missions and rovers are named after ancient poems or legends, for example, Chang'e, Yutu, Tianwen, Zhurong, and so on. Try searching these names on the internet for their origin.

Chang'e / Yutu / Tianwen / Zhurong



China's Lunar Exploration Program

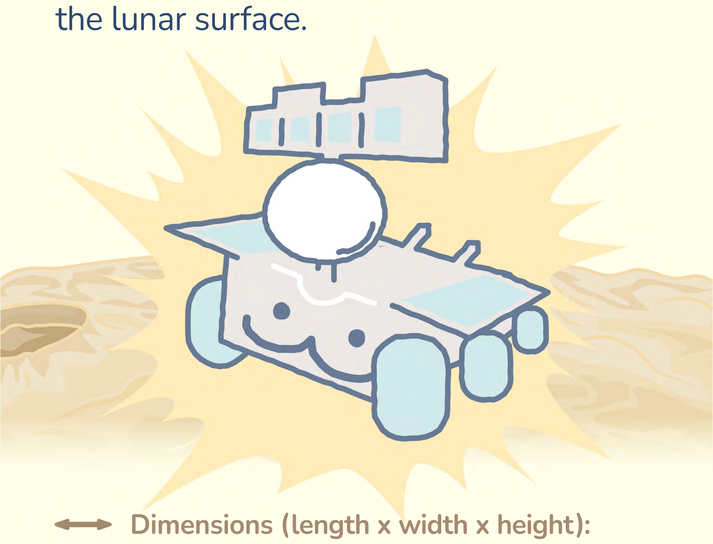
How did the Chang'e-3 probe carry the lunar rover "Yutu" from Earth to the Moon?



1. Carrier rocket sent Chang'e-3 into the Earth-Moon transfer orbit.
2. Entered the lunar orbits.
3. Entered the orbit for operation after the orbit adjustment.
4. Chang'e-3 landed on the Moon's surface and released the lunar rover Yutu.

Yutu Rover

Yutu is the first China's lunar rover, which can withstand the extreme conditions of the lunar surface.

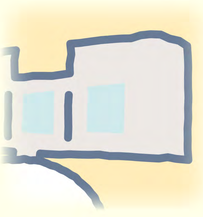


Dimensions (length x width x height):
1.5m x 1m x 1.1m
(with all solar panels folded up)

Maximum speed:
about 200 m/h

Find It Out

Can you find out the tools that help Yutu explore the Moon?



Panoramic camera
for taking images to investigate the landscape of the lunar surface

Solar panels
for generating electricity for the rover

Radar antennae
for exploring the structure of the lunar surface

Directional antenna
for transmitting data

Be a Designer

What additional tool(s) would you like to provide for Yutu?

Can you find Mars among the stars?

Mars

Being one of the eight planets in the Solar System, Mars is a neighbour of Earth. However, the diameter of Mars is only half of that of Earth.

Western hemisphere of Mars

Science Corner

Why does the Martian surface appear orange red?

That's because the surface of Mars is full of iron oxide!

Mars

Eastern hemisphere of Mars

Find It Out

Can you identify the following geographical features from the Martian images?

The highest mountain in the Solar System

Olympus Mons

The largest canyon in the Solar System

Valles Marineris

Exploring Mars

Similarly, we face lots of challenges when we are on Mars!

The Martian atmosphere is extremely thin. We don't have enough oxygen to breathe!

Mars has a large daily temperature range variation. It is so cold at night!

Severe dust storms take place on Mars from time to time. It is so dangerous!

The Martian surface is so uneven that we have no idea where to land safely!

Credit: NASA

Think About It

How would you solve these challenges of living on Mars?

China's Mars Mission

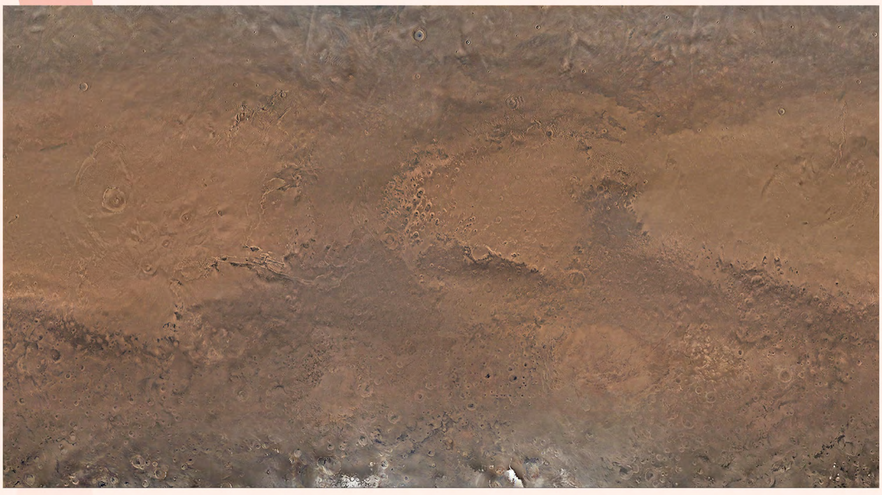
China's Mars Mission was officially commenced in 2016. Tianwen-1 probe and the Zhurong rover on board successfully landed on Mars in 2021. The data collected from the Mars exploration mission helps us gain a better understanding of Mars.

2020 Tianwen-1 probe was launched by a carrier rocket.

2021 The Mars rover "Zhurong", carried by Tianwen-1 probe, soft landed on Mars.

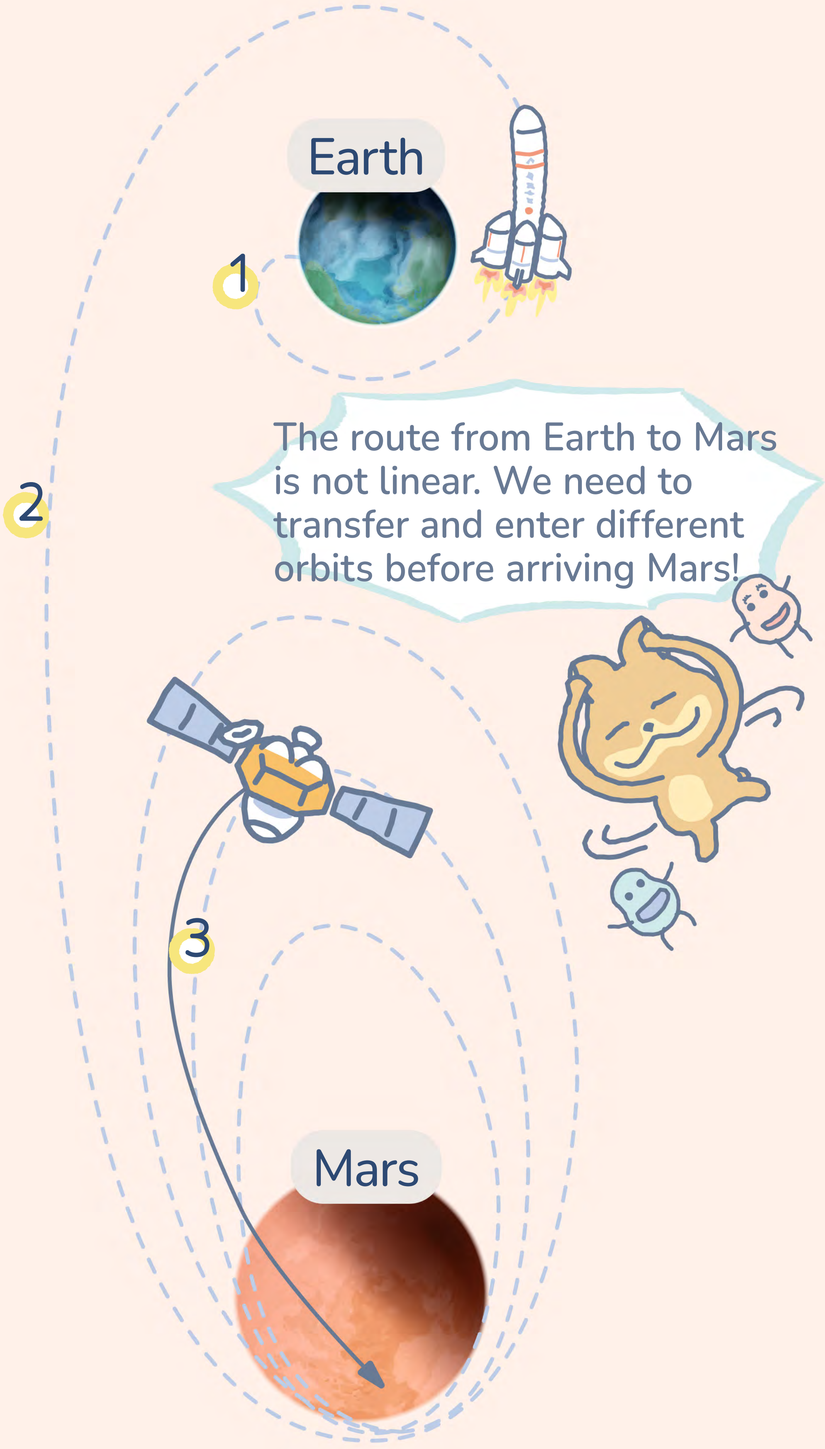
2023 China released a global map of Mars captured by the Zhurong Mars rover.

Global Map of Mars
from China's First Mars Mission



The journey of human exploration on Mars has just begun. Many more missions are coming up!

China's Mars Mission



1 Via a carrier rocket, Tianwen-1 probe was launched from Earth.

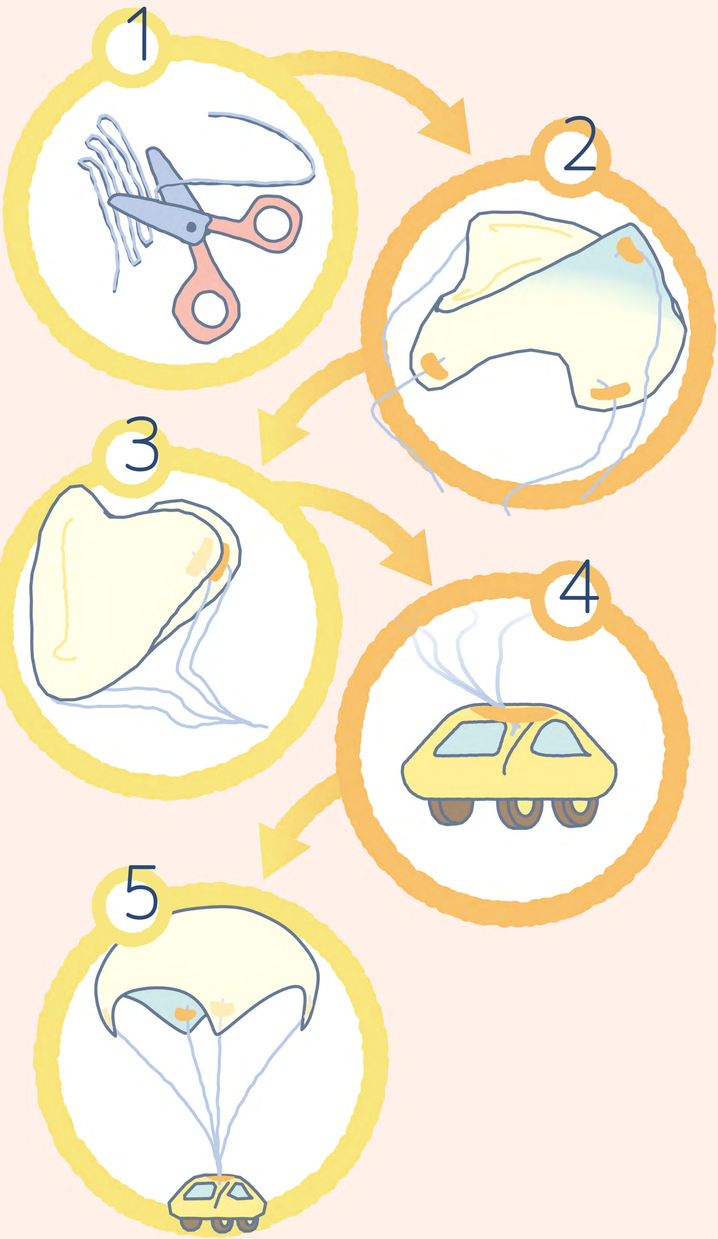
2 The carrier rocket sent Tianwen-1 probe into the Earth-Mars transfer orbit. After flying for about 7 months, the probe entered the orbits around Mars.

3 Tianwen-1 probe prepared to land on Mars.

Simple DIY Experiment

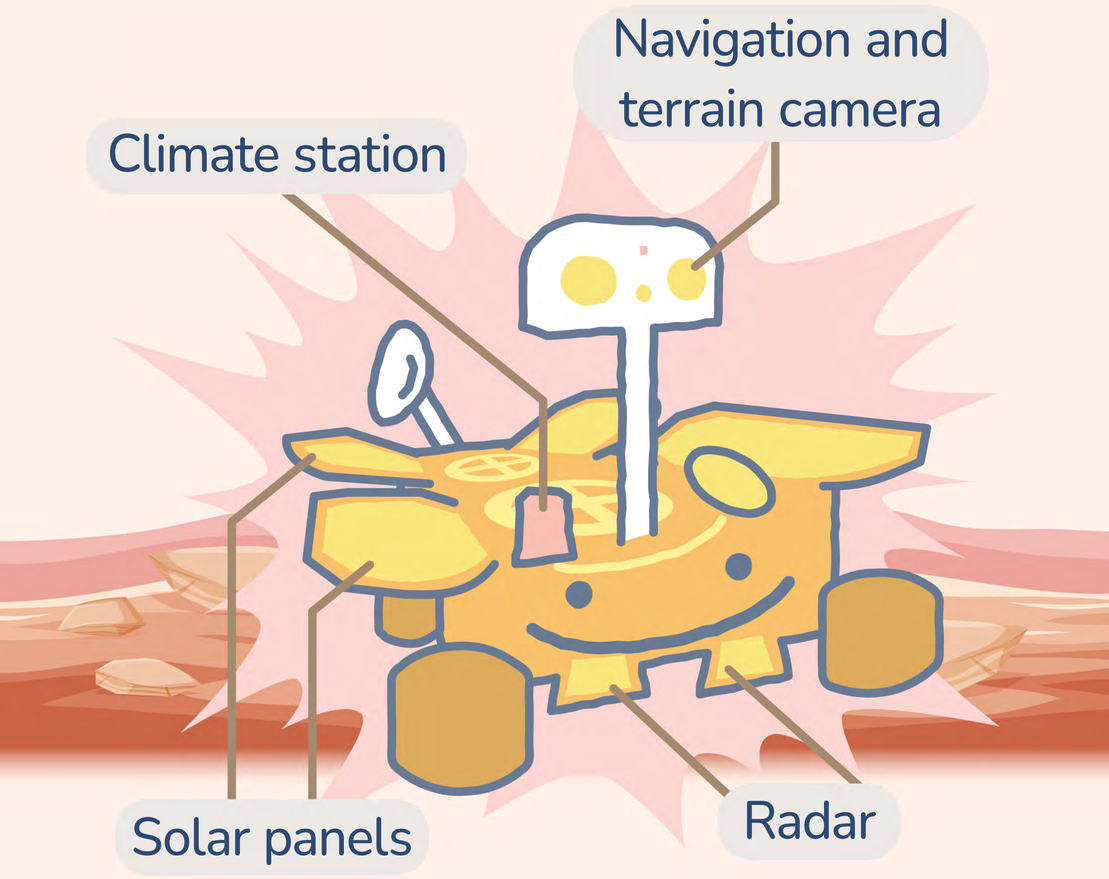
To land on Mars, the probe needs a parachute to decelerate for a soft landing. Make a parachute with the following materials to help the probe land on Mars!

- Plastic bag
- Tape
- Cotton thread
- Scissors
- Toy (Mars rover)



Zhurong Rover

Zhurong is China's first rover operating on planet other than Earth. It can resist the dust storms and low-temperature conditions of Mars.



Dimensions (length x width x height):
2.6m x 3m x 1.85m
(with all solar panels fully unfolded)

Maximum speed:
about 200 m/h

See how Zhurong moves on the uneven surface of Mars!

Let's learn more about Zhurong's equipment:

Solar panels
for generating electricity for the rover

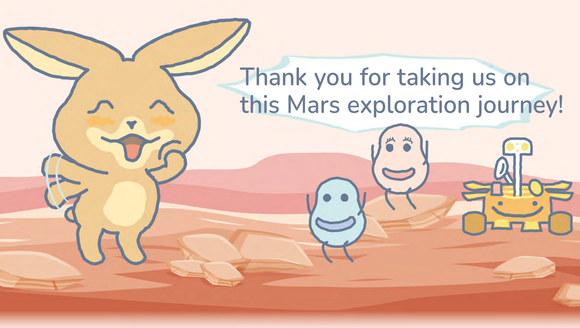
Navigation and terrain camera
for capturing images and conducting terrain survey

Climate station
for collecting weather data

Radar
for detecting subsurface structure

Draw on Your Creativity

Which animal do you think Zhurong looks like? Try to draw it out. If you were a rover designer, how would you design Zhurong's outlook?
Hint: The appearance of Zhurong's resembles a type of butterfly known as the Blue Morpho Butterfly. The solar panels can be folded and when all of them get unfolded, they look like the wings of a butterfly. The antennae of the rover also look similar to those of a butterfly.



康樂及文化事務署
Leisure and Cultural
Services Department

香 港 太 空 館
HONG KONG SPACE MUSEUM

2721 0226 hkspm@lcsd.gov.hk

https://hk.space.museum

hkspacem

香港太空館編製
Published by the Hong Kong Space Museum