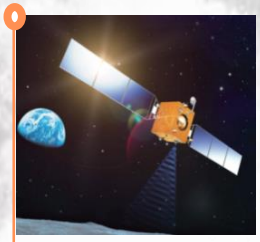
Introduction to chang'e-4 mission

China National Space Administration

2019.2.12

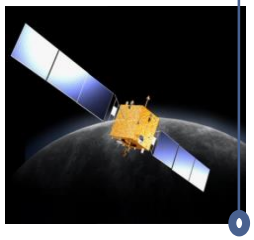
China Lunar Exploration Program before 2020

Orbiting

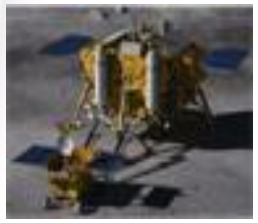


Chang'E-1
2007.10

Chang'E-2
2010.10



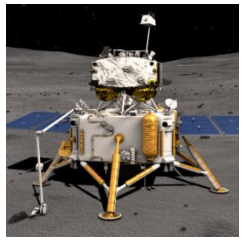
Landing



Chang'E-3
2013.12

Chang'E-4
2018

Sample return

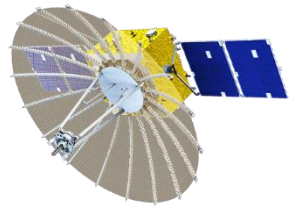


Chang'E-5
before 2020

The first mission of CLEP Phase IV

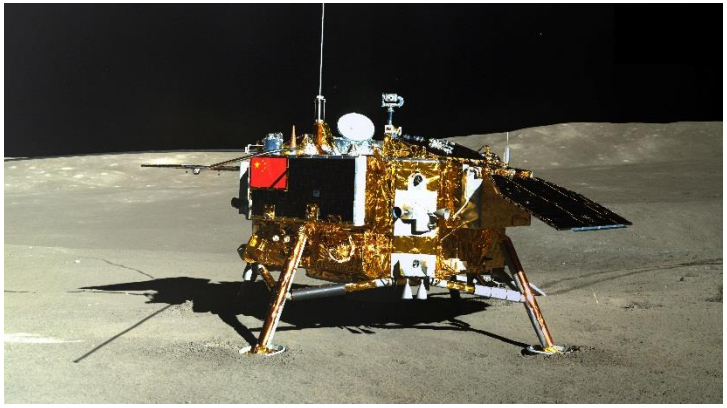
Chang’e-4 mission

Chang’E-4 mission: Queqiao Relay satellite and lander、Yutu 2 rover.



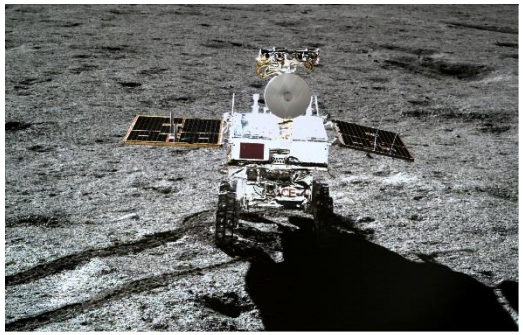
Engineering Objectives：

- Realize the first TT&C and relay communication at the Earth-Moon L2 Point.
- Realize the first soft landing on the lunar far side and perform exploration.



Scientific Objectives：

- Carry out low frequency astronomical observation and research on lunar far side.
- Carry out exploration and study on the topography and mineral composition of the lunar surface.
- Carry out exploration and study on the shallow subsurface structure of the lunar surface.
- Carry out experiments to detect the lunar environment, such as neutron radiation dose and neutral atom.



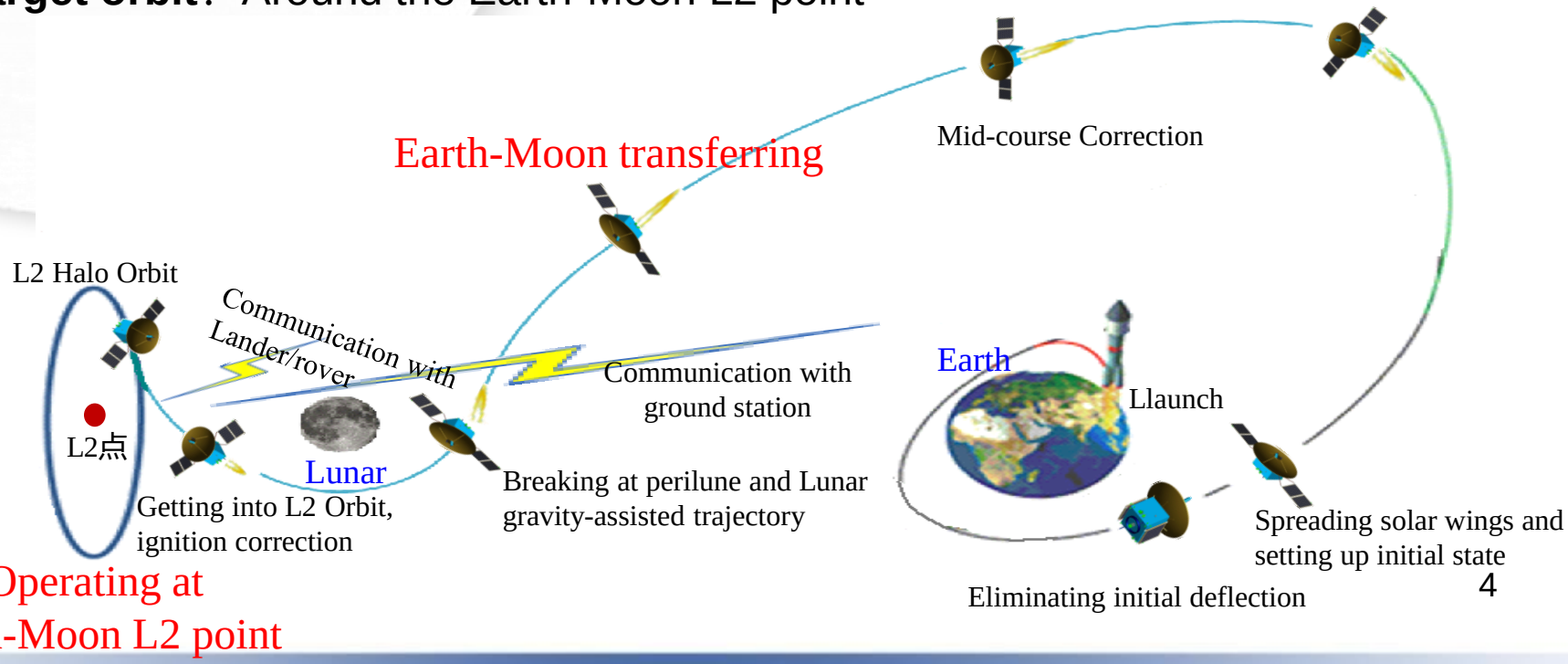
Relay Satellite

Launched：21 May, 2018

Rocket：LM-4C Y27

Flight profile：launch, Earth-Lunar transfer, Lunar orbit insertion burn at perilune, Enter into L2 Orbit.

Target orbit：Around the Earth-Moon L2 point



Relay Satellite

Objectives:

1.Realize TT&C and data relay transmission of Earth-Moon L2 point.

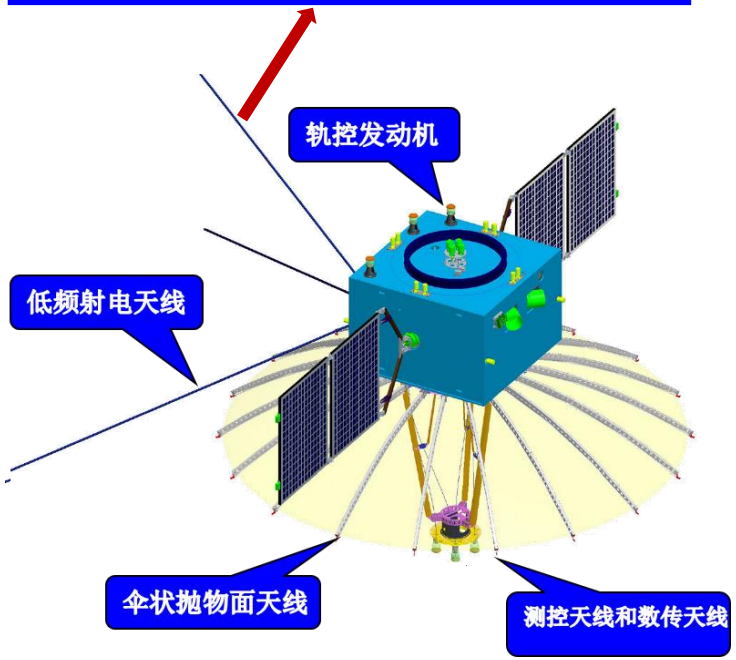
2.Carry out low frequency astronomical. observation.

Frequency: 0.1MHz ~ 80MHz

Mass: 10kg

Power: 20W

Antenna: 3,everyone is 5m

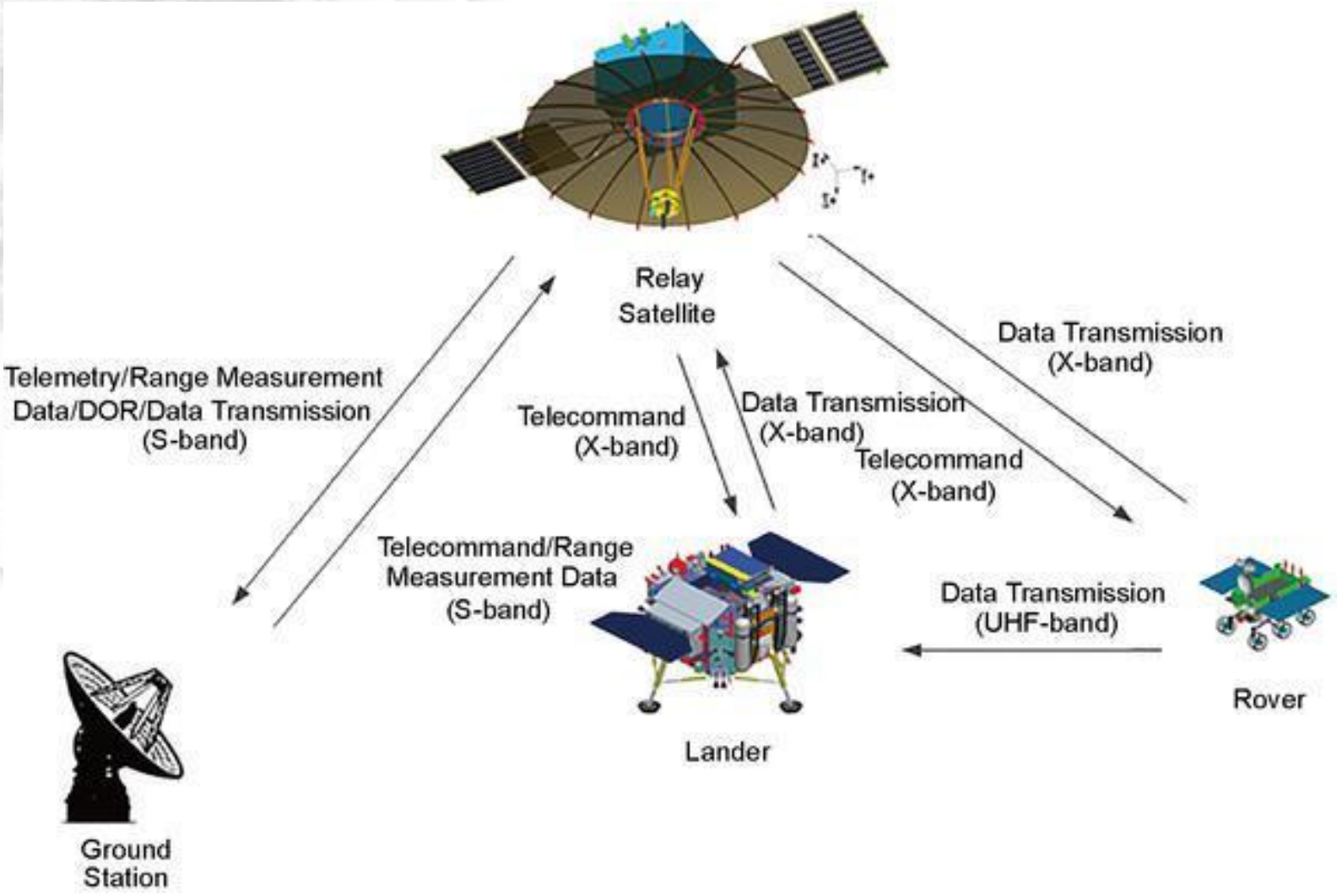


Low frequency spectrometer (Netherlands):

- Detect solar low frequency radio features and lunar surface low frequency radio environment.
- Demonstrate technologies such as VLBI and low frequency space-based radio telescope.

Relay Satellite

Communication Link



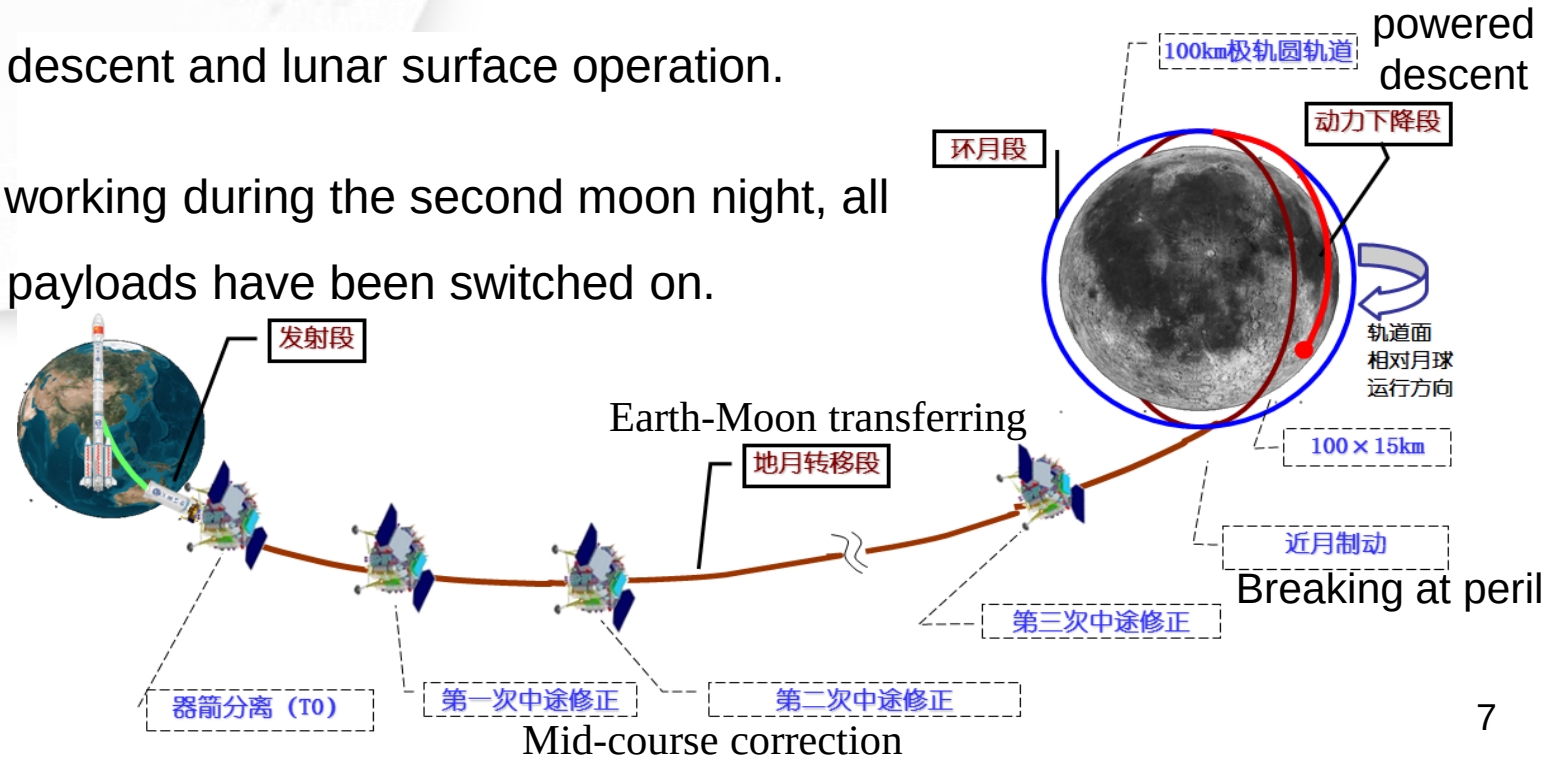
Lander and rover

Launched： 8 DEC, 2018, six months after the launch of the *Queqiao* relay satellite.

Rocket： LM-3B.

Flight profile： launch、Earth-Lunar transfer、lunar orbit, after 26 days, powered descent and lunar surface operation.

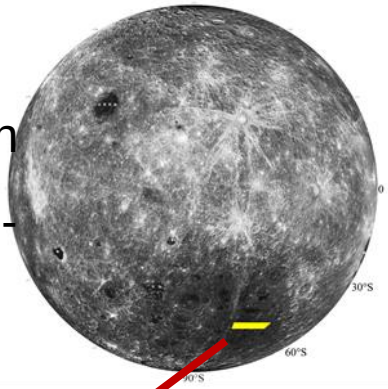
Status： working during the second moon night, all scientific payloads have been switched on.



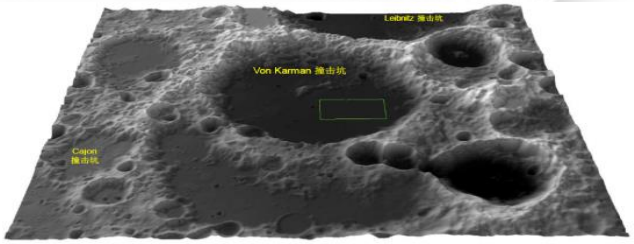
Lander and rover

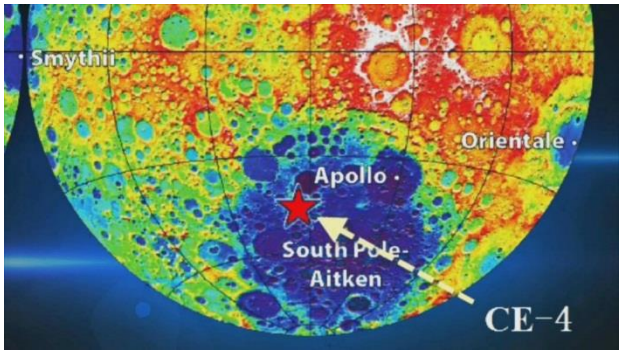
Chang'e-4 achieved the first soft landing on the far side of the moon, on 3 January 2019.

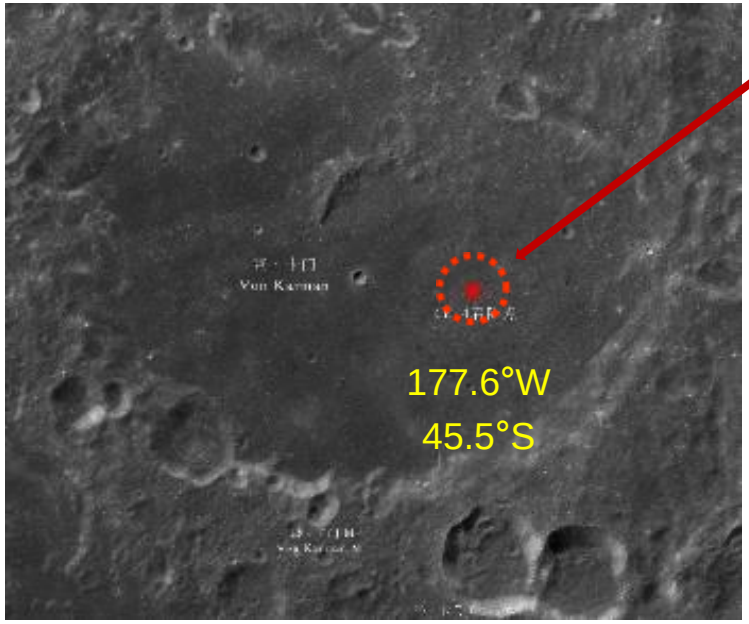
Landing site: 177.6°W, 45.5°S, the southern floor of the Von Karman crater, a crater 180 km across lying within the South Pole-Aitken impact basin.



Landing site







Lander and rover

1. The decent phase begins with 8 kilometers above the surface.
2. The detector rotated from horizontal flight to vertical flight and vertically downward.
3. Initially select the landing site.
4. Hovering at a height of about 100 meters to accurately select the landing point.
5. Enter the final stage of decent.
6. The engine blows off the moon dust.
7. Successfully landed softly on far side of the moon.

Decent process

Lander and rover

- On Jan. 3rd, the rover separated from lander, driving onto the lunar surface.
- On Jan. 4th, the rover and relay sat. established independent digital transmission links.
- On Jan. 4th, the rover switched to dormant mode at noon.

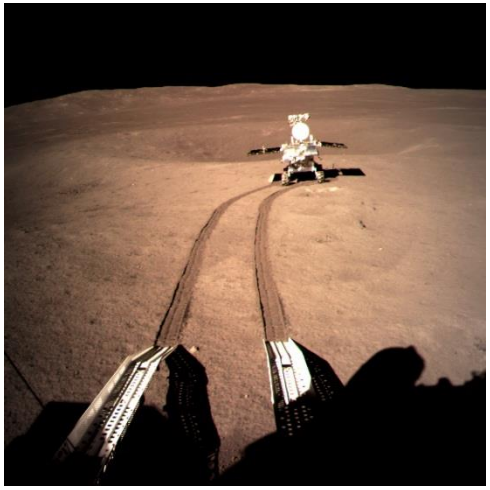
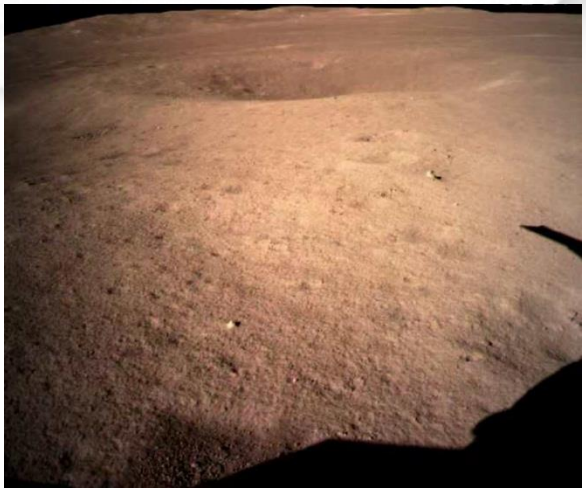


Image of rover



The first image returned by the lander on far side of the Moon

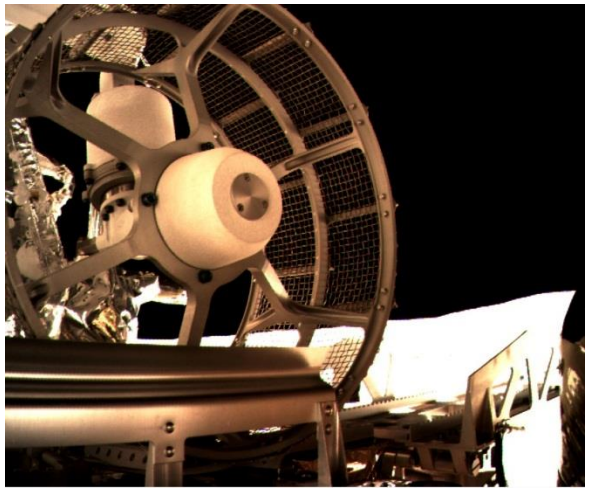
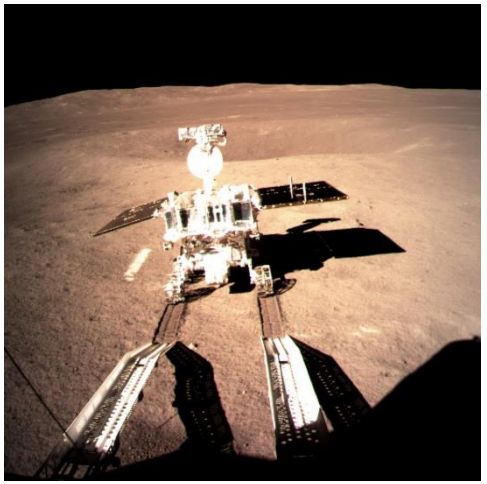


Image of rover wheel

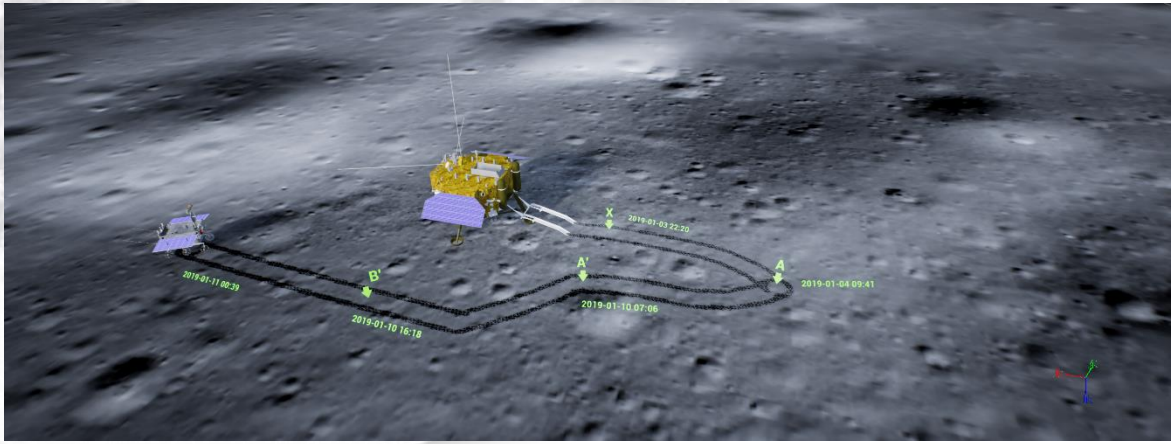


The first track on far side of the moon

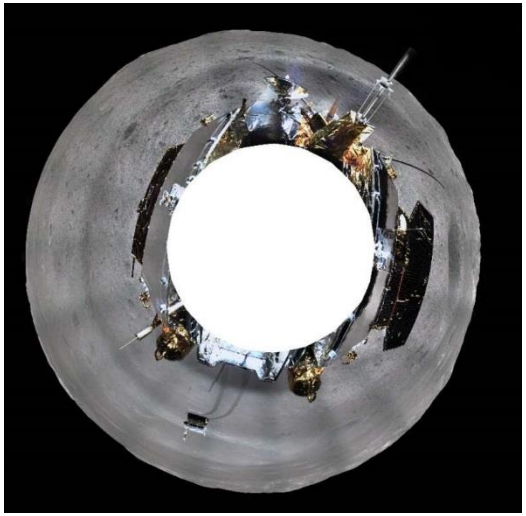
Lander and rover

On Jan. 11th, the rover woke up and continue working.

On Jan. 11th, the lander and rover took pictures for each other. Then entered a "sleep mode" as the first lunar night.



Virtual image of rover track



The azimuth (top) and cylindrical views

First complete panorama images

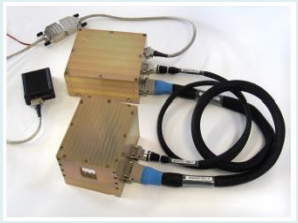
Scientific payloads

Six domestic scientific payloads, four international payloads and three sci-tech experimental programs developed by Chinese universities are developed.

Payloads of China	International cooperation payloads	Sci-Tech experimental programs
topography camera	lander Neutrons and Dosimetry, Germany	biological science experiments
landing camera	neutral atom detector, Sweden	Laser ranging test program
low frequency spectrometer	low frequency explorer, Netherlands	lunar orbit ultra-long wave astronomical observation micro satellite program
lunar penetrating radar	Micro optical camera, Saudi Arabia	
panoramic camera		
Infrared imaging spectrometer		

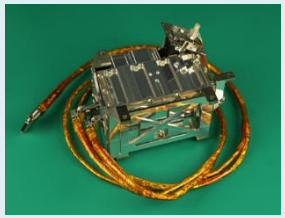
Scientific payloads

International cooperation payloads



lander Neutrons and Dosimetry
Germany

Gather radiation dosimetry for future human exploration of the Moon, and will contribute to solar wind studies



neutral atom detector
Sweden

Reveal how solar wind interacts with the lunar surface

low frequency explorer
Netherlands

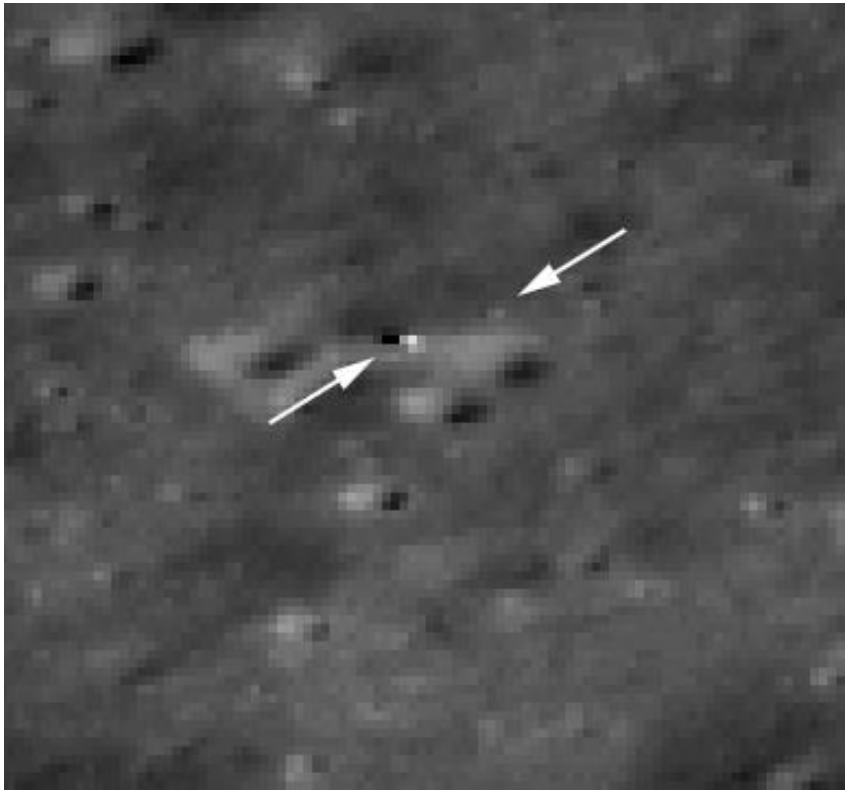
Performing astr ophysical studies in the unexplored radio regime of 80 kilohertz to 80 megahertz

Micro optical camera
Saudi Arabia

Shooting a lunar image of the visible spectrum

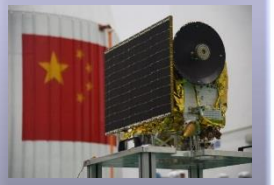
Scientific payloads

- On 30 January LRO acquired a spectacular limb shot centered on the Chang‘e 4 landing site, looking across the floor of Von Kármán crater. Chang'e 4 was only a few pixels across and the rover was not discernable.
- The following day LRO was closer to the site and again slewed (59° this time) to capture another view. This time the small Yutu-2 rover shows up (two pixels) just north of the lander.

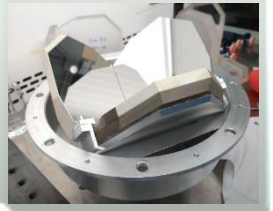


Chang'e 4 lander (near tip of left arrow) and rover (near tip of right arrow)

Sci-Tech experimental programs



The payload onboard the relay satellite is ultra-long wave detector, obtaining all-day images and measuring radio spectrum.



Achieving the first meter-level precision laser ranging test at a distance beyond the Earth-Moon distance in the world.

Under low gravity and strong radiation conditions to verify seed respiration and plant photosynthesis in the lunar environment.

Image of the Moon and Earth captured by the Saudi camer

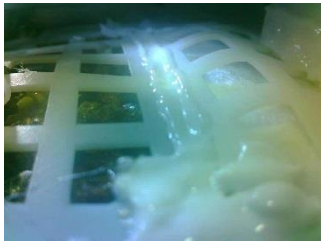


Image of biological science experiments

Scientific Data Policy

Basic Principle : Openness and Sharing

Management Organization

- On behalf of CNSA, Lunar Exploration and Space Engineering Center (LESEC) is responsible for the management of scientific data from lunar and deep space missions.
- The National Astronomical Observatory is responsible for receiving, processing and storing scientific data.

Data Level

- 0 Level
- 1 Level
- 2 Level

Scientific Data Policy

Processing Period

- *1-year data processing period*
- **CNSA identifies the types of scientific data that are publicly available**

Data Users

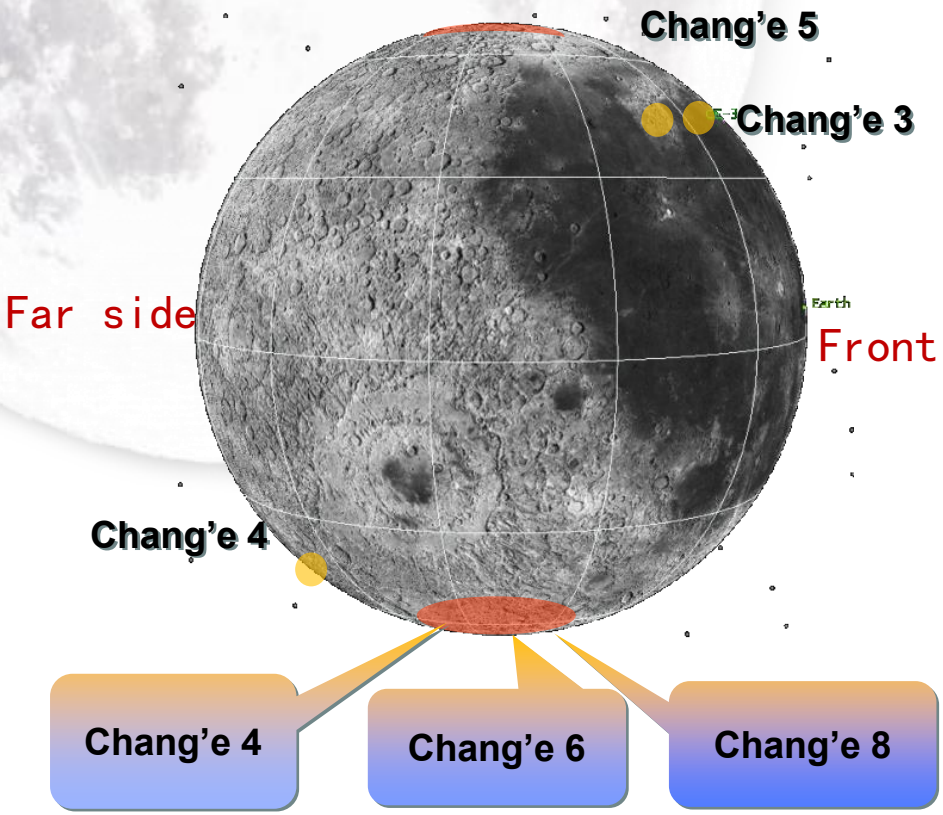
- **Payloads development units can use all levels of scientific data for its payload.**
- **Other users may apply for use of Level 1 and 2 scientific data and indicate whether subsequent data for that type are required.**

Data Application

- **The new scientific data policy released in 2016 (http://www.cnsa.gov.cn/n6758823/n6758839/c6805196/content.html)**
- **Data on Chang'E 1, 2 and 3, as well as future Chang'E-4, 5, Mars mission, and lunar samples can be applied.**

Future lunar mission

Lunar south pole region missions



Chang'E-7: Conduct a comprehensive survey on the moon's south pole to detect the topography, material composition and space environment of the moon.

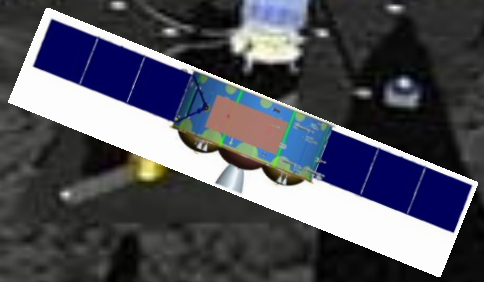
Chang'E-8: In addition to continuing scientific testing, some key technical verifications will be carried out.

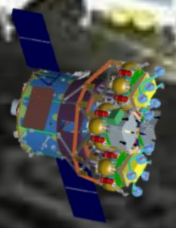
2 to 3 missions are under planned finished before 2030.

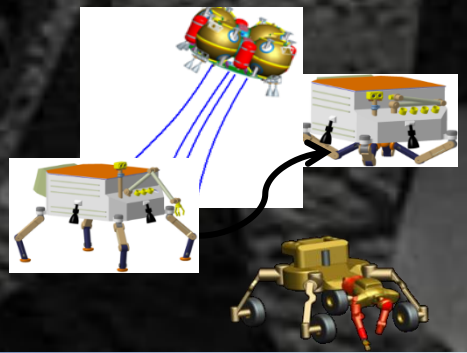
Future lunar mission

International Research Station

The International Lunar Research Station will adopt a functional modular design concept. The use of standardized interfaces facilitates the expansion and international cooperation. Partners can jointly build lunar and lunar orbital infrastructure to achieve cooperation.








Thank you !