

# **A Preliminary Suggestion for International Cooperation of Chang'E-4 Probe**

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**Chinese National Space Administration**

**June, 2015**

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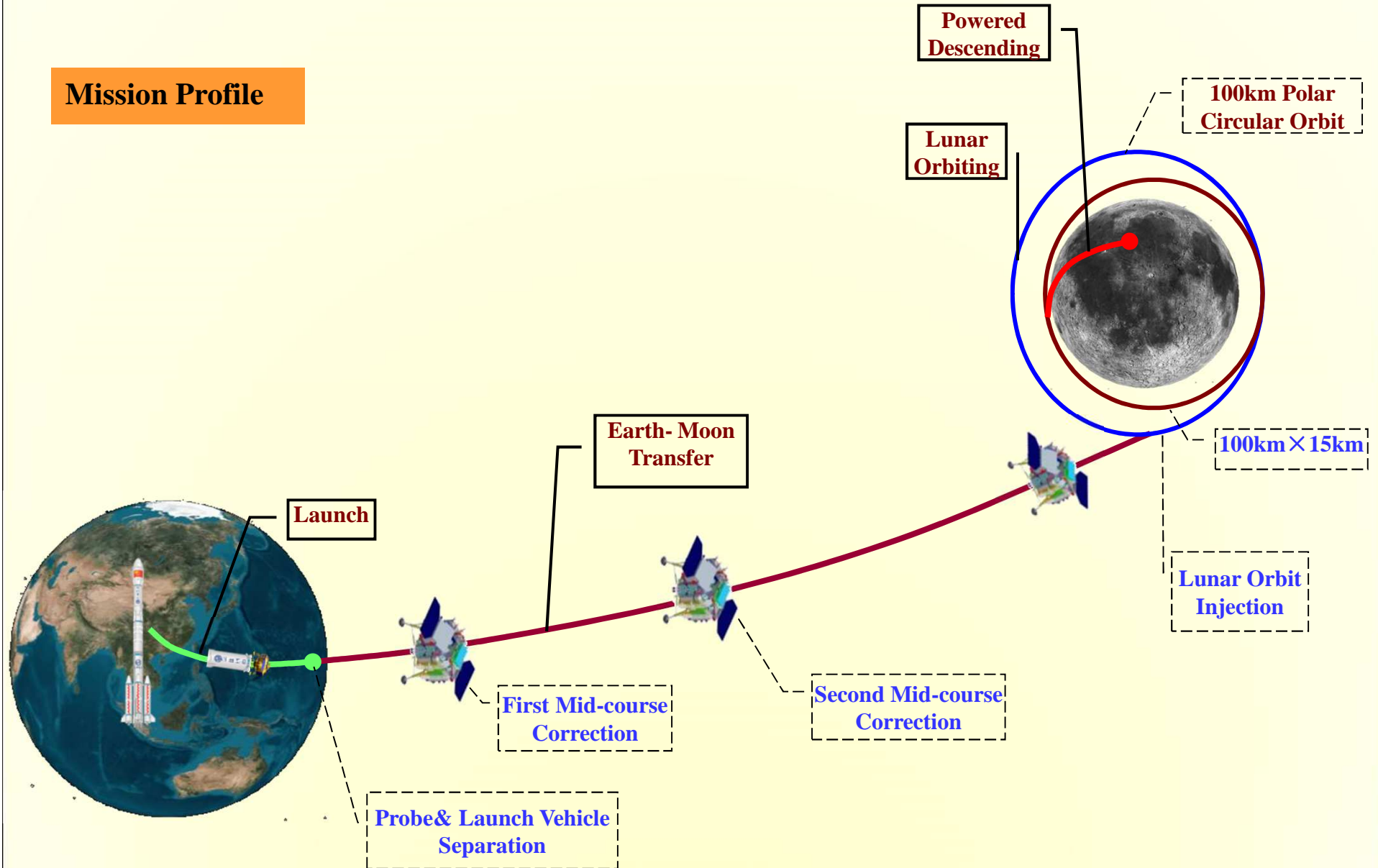
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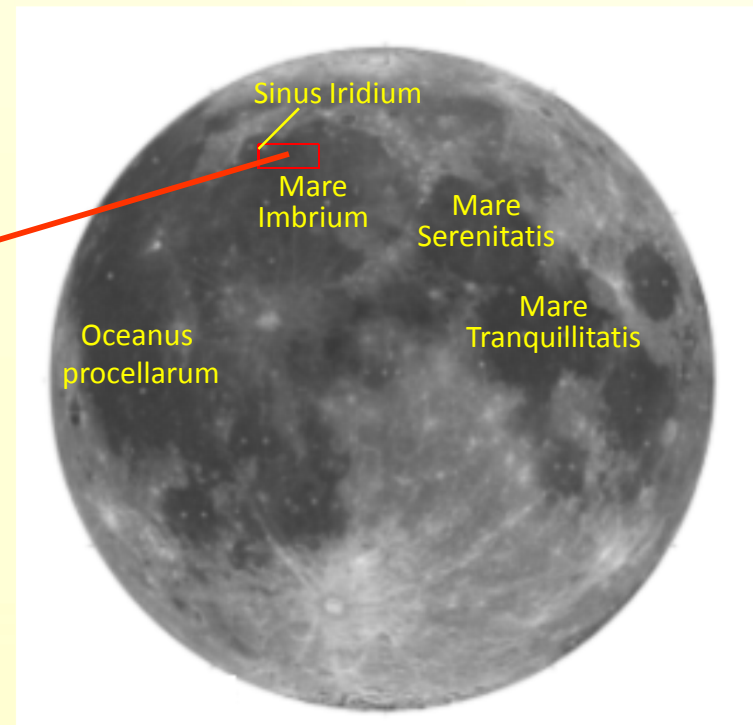
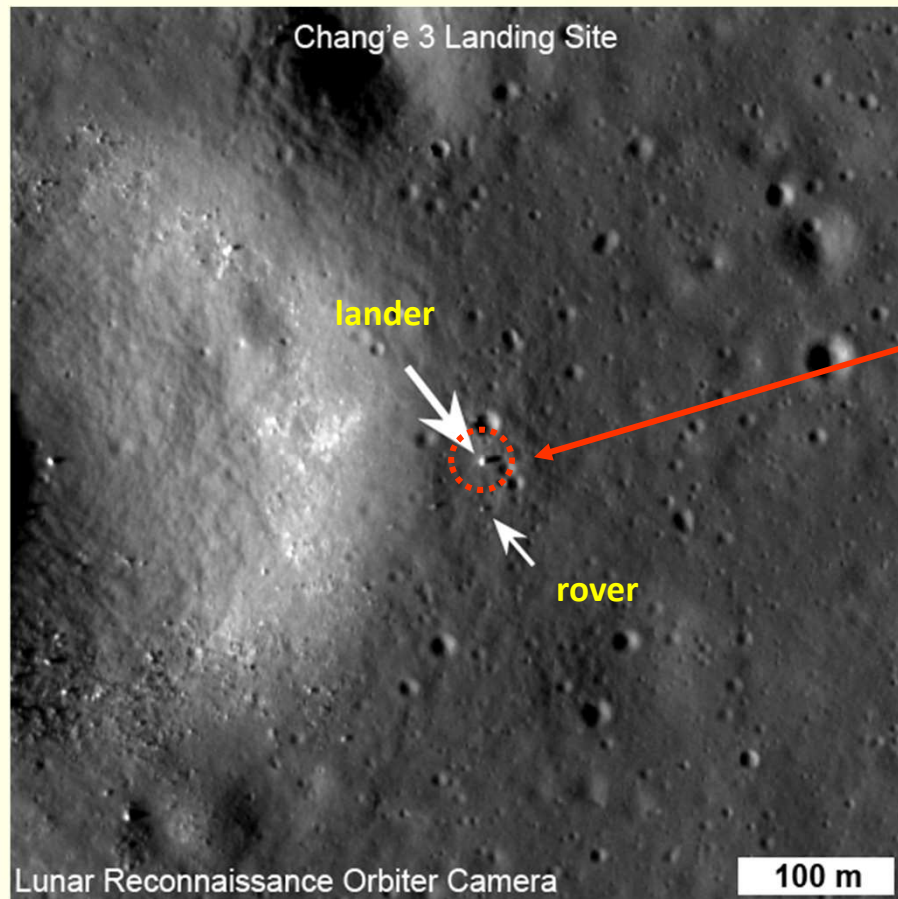
# I An Overview of Chang'E-3 Probe

## Mission Profile



# I An Overview of Chang'E-3 Probe

At 21:11 on 14th Dec. 2014, Chang'E-3 landed on the  $44.12^{\circ}$  N,  $19.51^{\circ}$  W northwest region of



# I An Overview of Chang'E-3 Probe

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Chang'E-3 Probe has accomplished lunar landing, which is the second phase of China Lunar Exploration Program(CLEP) with three phase of " Orbiting, Landing and Return".

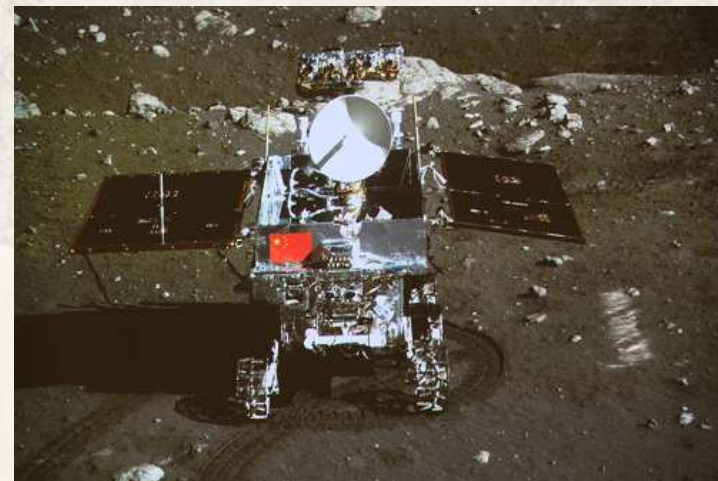
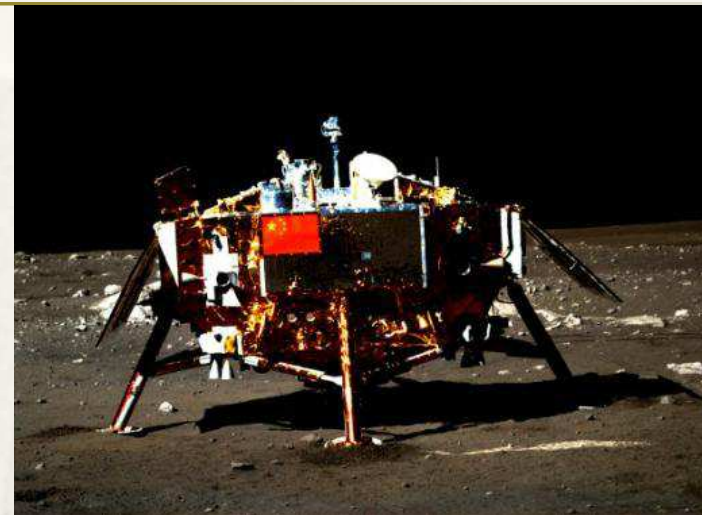
- Lunar Orbiting 2004~2009 (the first phase)
- **Soft landing and roving** 2008~2014 (the second phase)
- Sample return 2011~2020 (the third phase)



# I An Overview of Chang'E-3 Probe

## Scientific Objectives :

- lunar surface topography and geology survey
- lunar surface material composition and resource survey
- Earth plasmasphere survey and lunar astronomical observation



# I An Overview of Chang'E-3 Probe

Probe	Payload	Mission
Lander	Topography Camera	To obtain landing site optical images to study lunar geological and geomorphic feature
	Landing Camera	During landing process, to obtain the optical images of the landing site to analyze geological and geomorphic feature of the landing area, as well as its geological condition
	Extreme Ultraviolet Camera	During lunar day, to take extreme-UV images of plasmasphere of the earth
	Lunar-based Optical Telescope	During lunar day, to carry out lunar based optical astronomy observation
Rover	Panoramic Camera	To obtain lunar surface images of roving region
	Lunar Radar	To measure the thickness of lunar soil and shallow-layer structure of lunar crust along roving route
	IR Imaging Spectrometer	To study the material composition at roving region
	Particle X-Ray Spectrometer	To analyze and explore the main elements of lunar surface materials of the roving region

# I An Overview of Chang'E-3 Probe

## Scientific Achievements

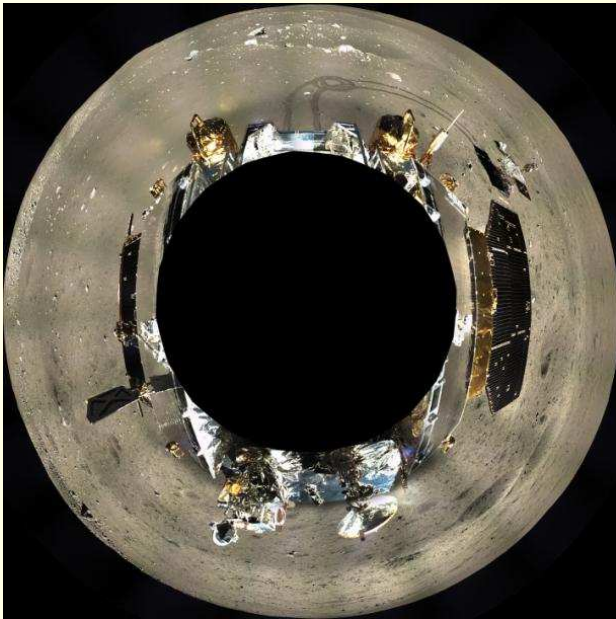


Fig.1 Landing Region Picture Taken By Topography Camera

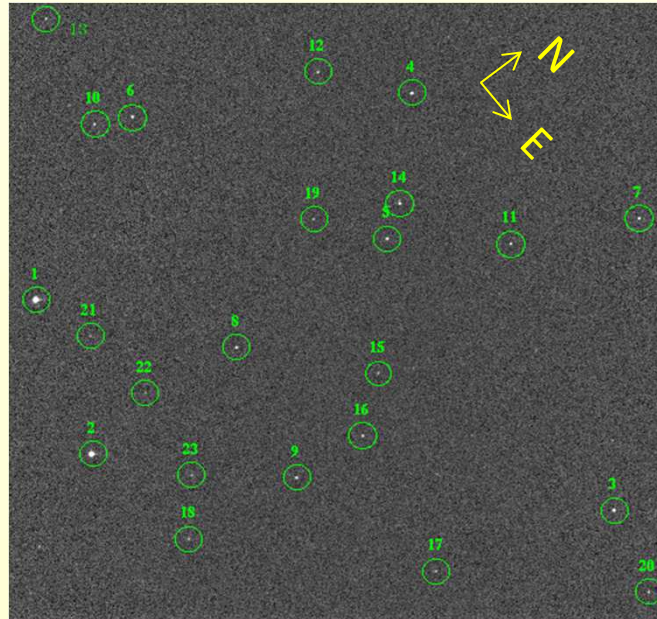


Fig.2 Star Map Observed by Lunar-based Optical Telescope

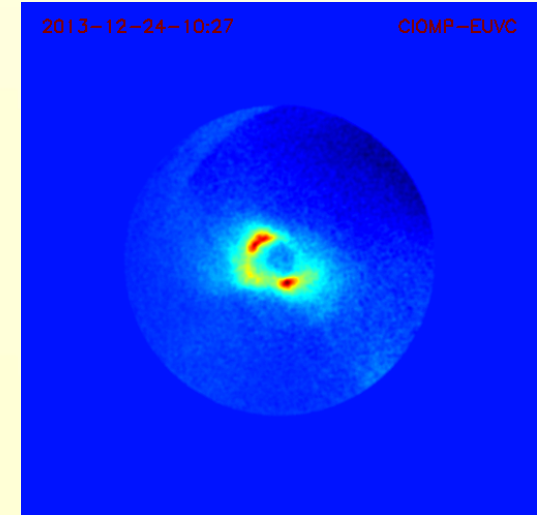
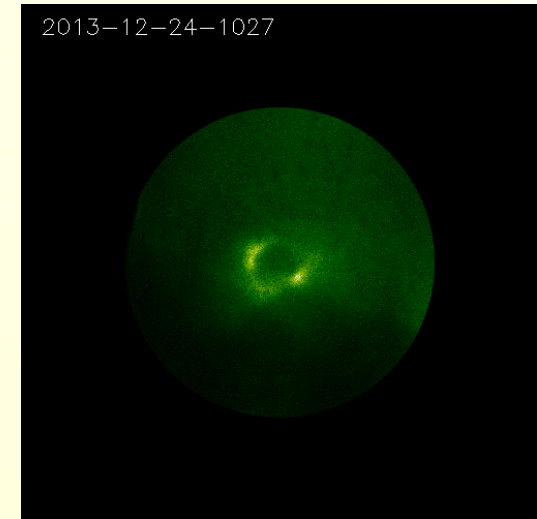


Fig.3 Pictures Taken by Extreme-UV Camera



# I An Overview of Chang'E-3 Probe

## Scientific Achievements

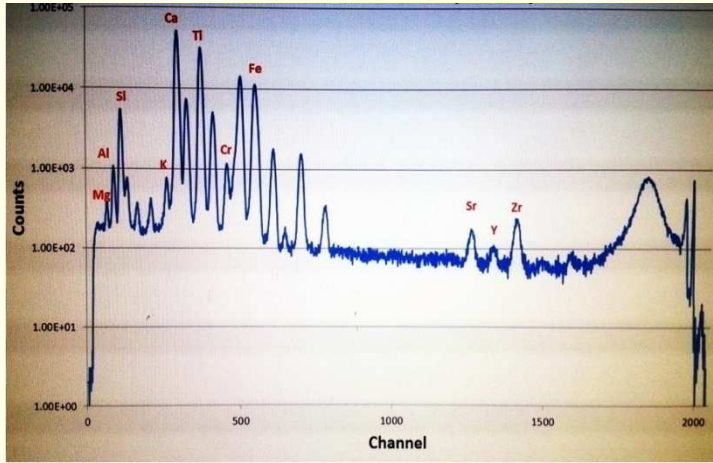


Fig.4 Lunar Energy Spectrum Curve Measured by Particle X-Ray Spectrometer

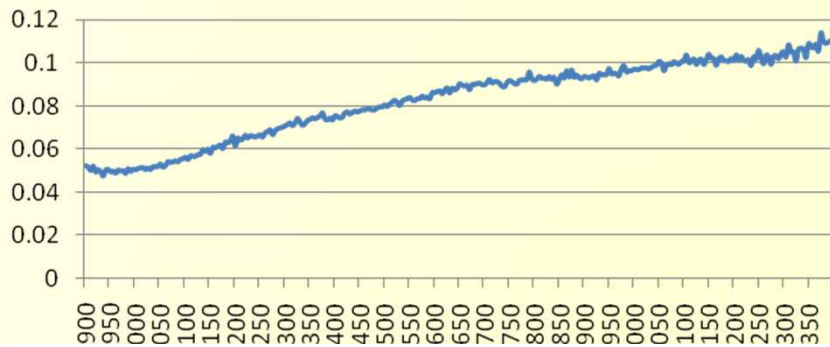


Fig.5-1 Spectrum Curve Firstly Shot by IR Imaging Spectrometer at landing region ( Short Wave Infrared )



Fig.5-2 single band gray level image firstly shot by IR Imaging Spectrometer at the Landing region

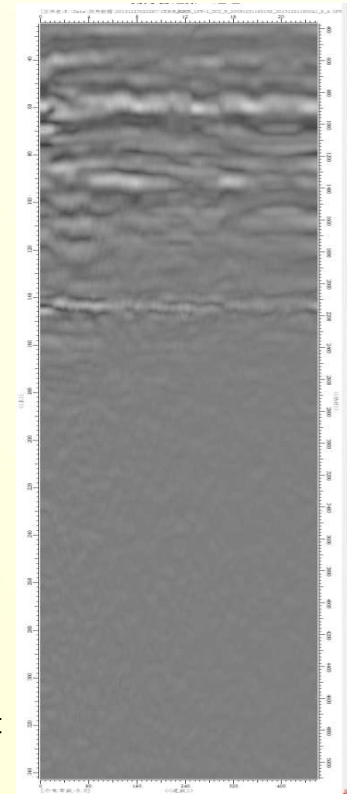


Fig.6-1 First Channel Antennas Image Detected by Lunar Radar

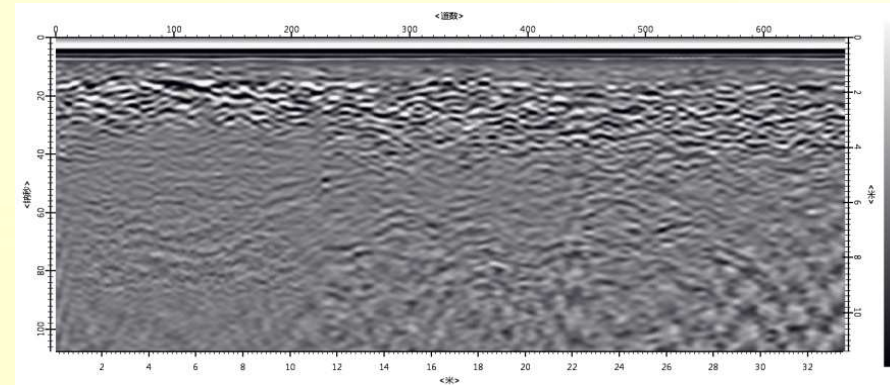


Fig.6-2 Second Channel Antennas Image Detected by Lunar Radar

## **II An Introduction of Chang'E-4 Probe**

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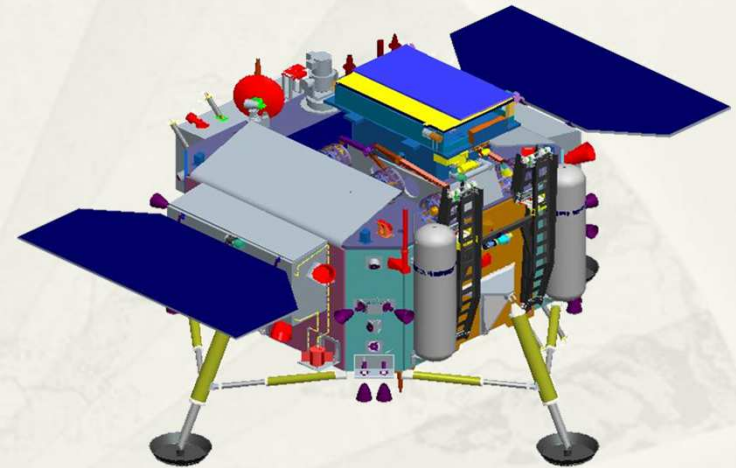
- Probe (Lander,Rover) + Relay Statellite
- Soft-landing on lunar farside
- Landing and roving exploration
- Will be launched between 2018 and 2019

## II An Introduction of Chang'E-4 Probe

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The probe:

- Chang'E-4 probe, lander and rover have the same technical status with the Chang'E -3; but exploration will be redesigned; the payload will be reconfigured; The name of the probe might be changed.
- Chang'E-4 probe is a backup spacecraft of Chang'E -3 probe. By now, all platform products of the probe have been manufactured, waiting for further AIT.
- The probe will be launched by a long March 3B rocket from the Xichang Statellite Launch Center(XSLC) which is the same way with the Chang'E-3 between 2018 and 2019.



## II An Introduction of Chang'E-4 Probe

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The relay satellite:

- will be first launched into a lunar transfer orbit about the end of 2018 in the whole mission, then starts its earth-to-moon journey alone, and will enter and run in a Halo orbit around the Earth-Moon L2 point; the design life is 3 years.
- would provide relay service for the probe and the Earth, and carry out exploration.





## **II An Introduction of Chang'E-4 Probe**

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Engineering objectives are as follow.

- To realize the first soft landing on the lunar farside and perform exploration in human history.
- To demonstrate technologies of lunar data relay, landing and roving on complicated terrains of the lunar farside, and lunar night power generation;
- To perform further detailed survey on lunar environment in order to lay a foundation for subsequent lunar exploration mission.

## **II An Introduction of Chang'E-4 Probe**

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Tentative Scientific objectives are as follow.

- To study lunar surface dust features and its formation mechanism;
- To perform in-situ measurement of lunar surface residual magnetism and study its interaction with solar wind;
- To study lunar surface temperature and particle radiation environment;
- To perform lunar surface topology and material composition analysis, shallow-layer structure survey and study;
- To explore and study lunar interior structure of spheres;
- To perform lunar based VLF astronomical observation and study.

### III International Cooperation Intentions

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We expect to promote international cooperation on Chinese future lunar exploration activities especially on present Chang'E-4 mission widely, and the Participant could be country, organization, and company.

Several possible ways of cooperation are proposed as followed.

- On mission level.
- On equipment.
- On other aspects.

# III International Cooperation Intentions

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## On mission level :

- Participants may respectively launch their probes, and construct communication network on lunar surface, then carry out joint exploration.
- Participants may respectively launch their probes, and carry out coordination landing test on lunar surface, realize high-precision landing, perform experimental verification for lunar base.



### III International Cooperation Intentions

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- **On equipment level :** Participants may provide some scientific payloads or other small experimental equipment which could be carried by Chinese lander, rover or satellite.
- **On other aspects:** Foreign side provides deep space network TT&C support during its visible pass; participants share the data of lunar exploration, and carry out data analysis and scientific research.

**Thank you !**

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