



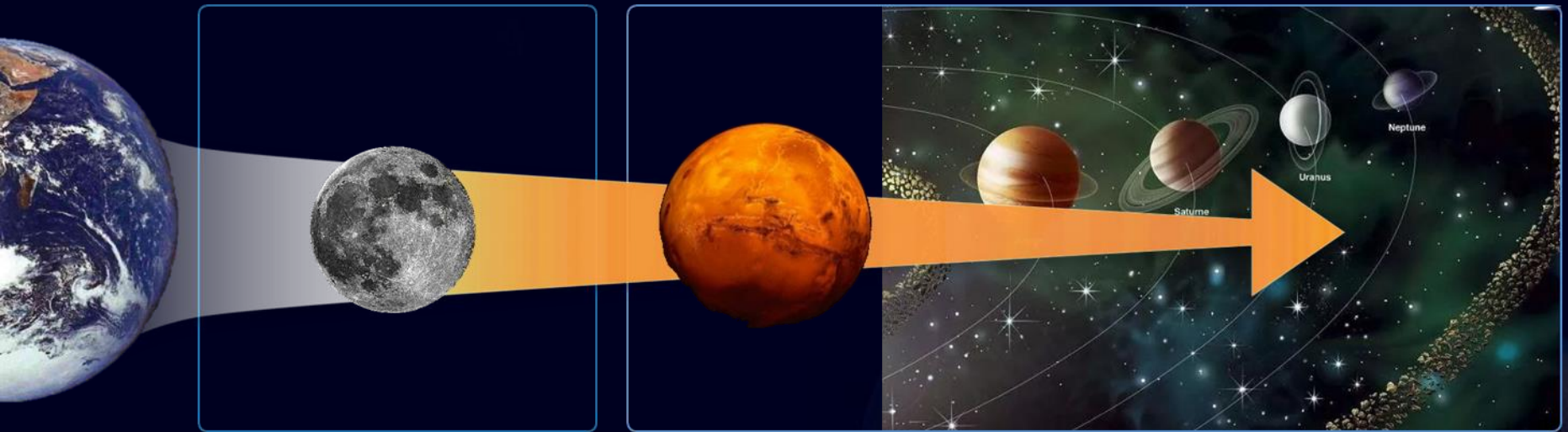
China Deep Space Exploration Prospects and Opportunities

Lunar Exploration and Space Engineering Center, CNSA
February 2020

Contents

- **Mission Progress**
- Plans and Prospects
- Cooperation Opportunities

Deep Space Exploration

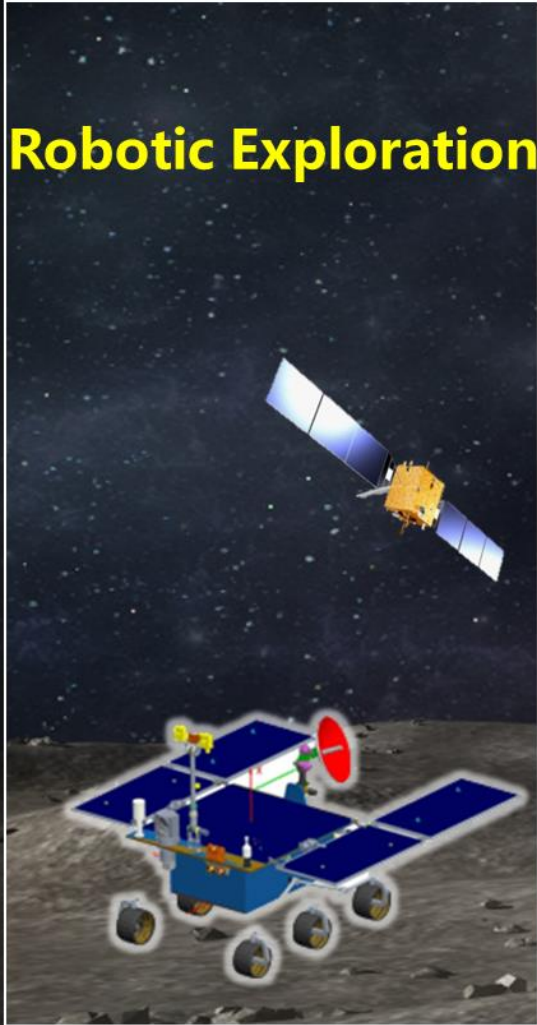


Lunar Exploration

Exploration beyond Moon

Three Major Steps of Lunar Exploration

Robotic Exploration



Manned Landing



Lunar Residence



Mission planned prior to 2020

Robotic Exploration

Orbiting

Landing

Sample Return

Chang'E-1
2007.10

Chang'E-2
2010.10

Chang'E-4
2018.12

Chang'E-5
2020.12

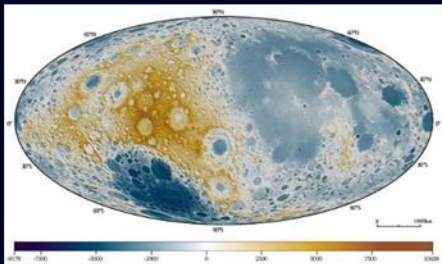
Chang'E-3 2013.12

T1 Reentry Test 2014.10

Well-accomplished Missions

Chang'E-1

- 2007.1 Launched ;
- Lunar global image and elevation map with 120m in resolution



Chang'E-2

- 2010.10 Launched ;
- Sun-Earth L2;
- 2012.12.13, Flyby Asteroid 4179 Toutatis.



Toutatis 小行星照片

CE-2卫星拍摄

分辨率 10m
成像距离 93km
交会距离 3.2km
相对速度 10.73km/s
小行星大小 4.2km x 2.0km x 1.7km

北京时间
2012年12月13日 16点30分09秒
相距地球7,000,000km

Chang'E-3

- 2013.12 Launched;
- 2013.12.14 Soft landing at designated area of Sinus Iridium



Well-accomplished Missions

Chang'E-4

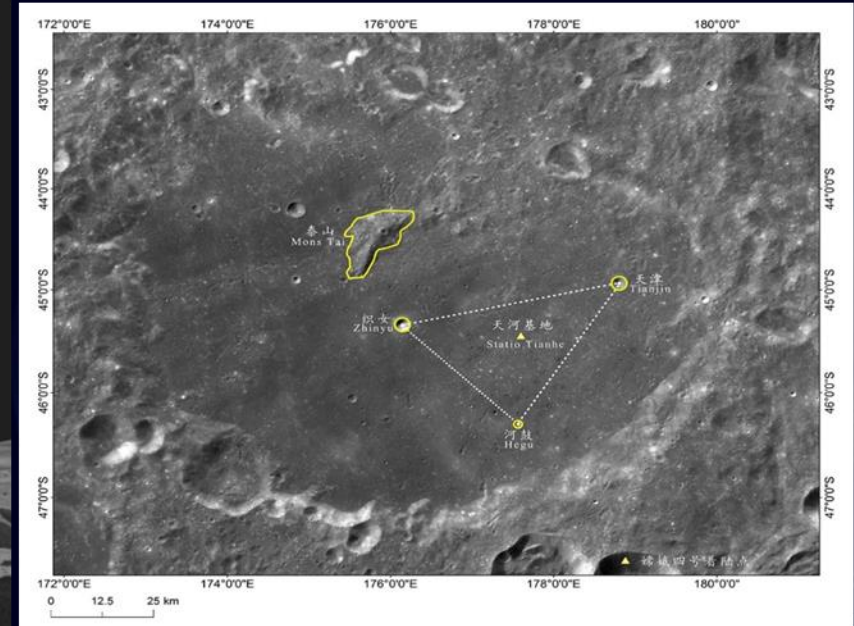
2018.05.21 Relay satellite

2018.12.08 Probe

2019.01.03 Landing on the far side



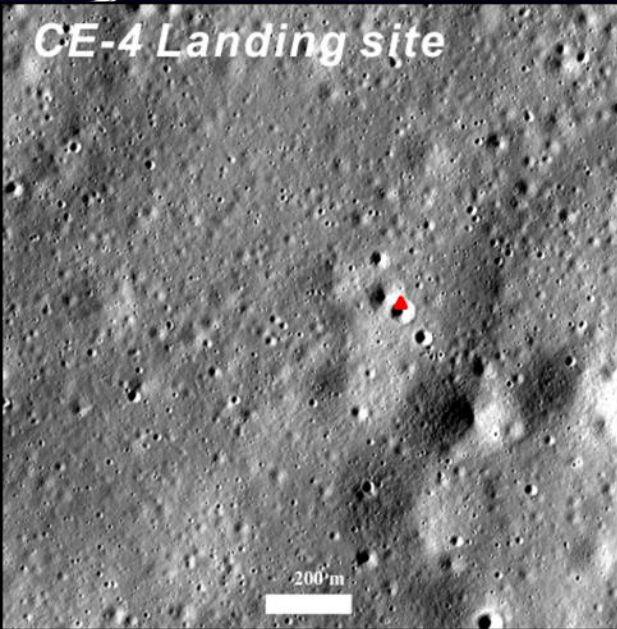
- 2019, IAU named landing site of CE-4 probe: StatioTianhe, Zhinyu, Hegu, Tianjin, Mons Tai.



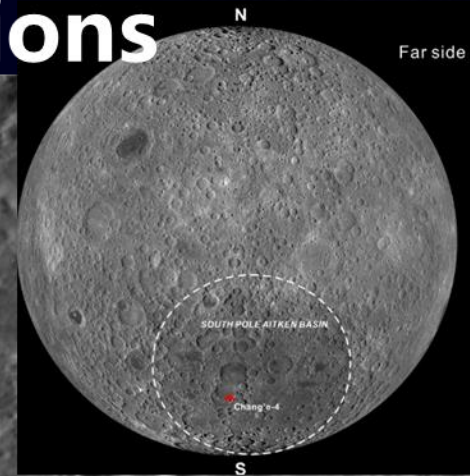


Well-accomplished Missions

CE-4 Landing site



Chang'E-4



Von Karman

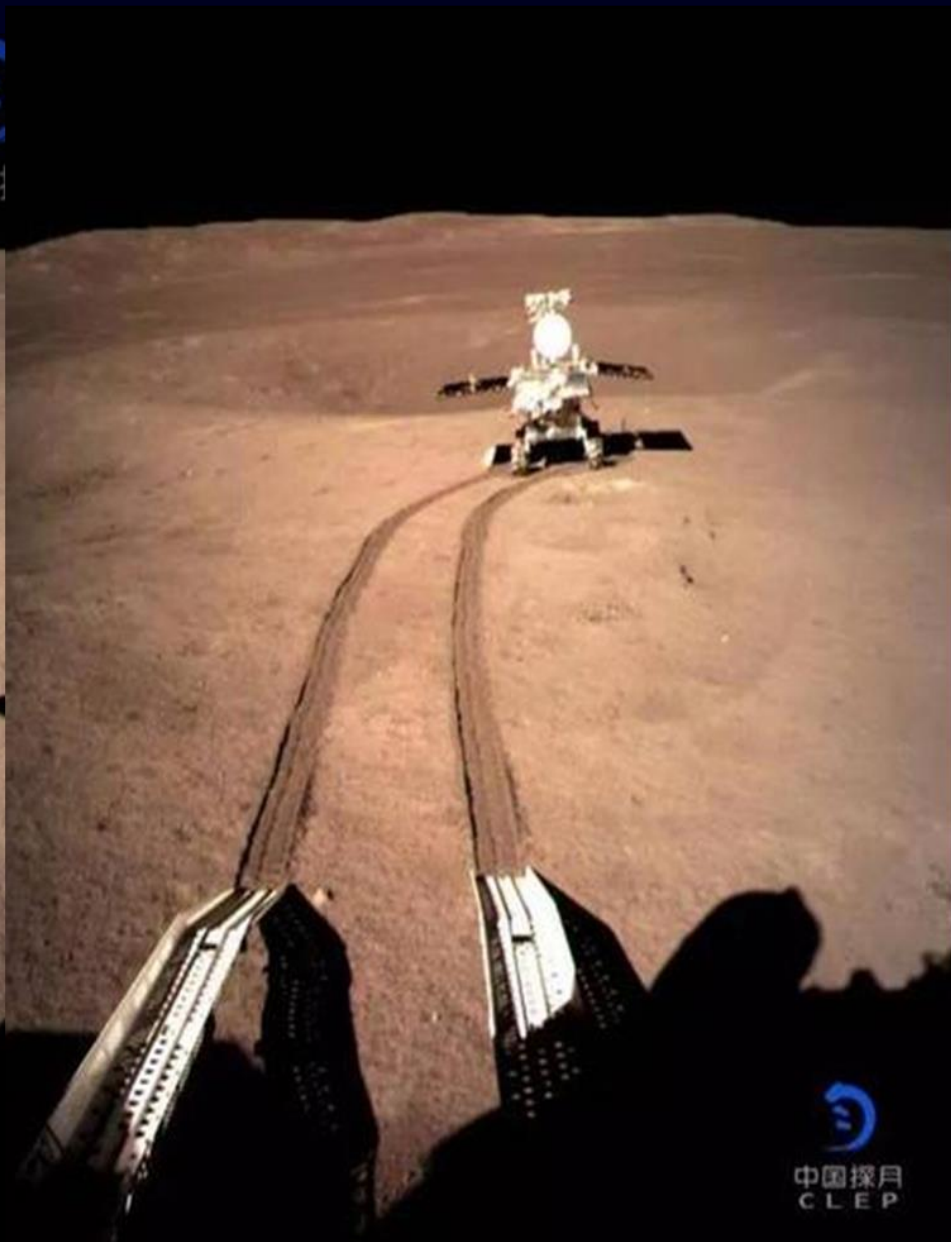
CE-4 Landing site

177.6°E, 45.457°S, -5935M

Chang'E-4

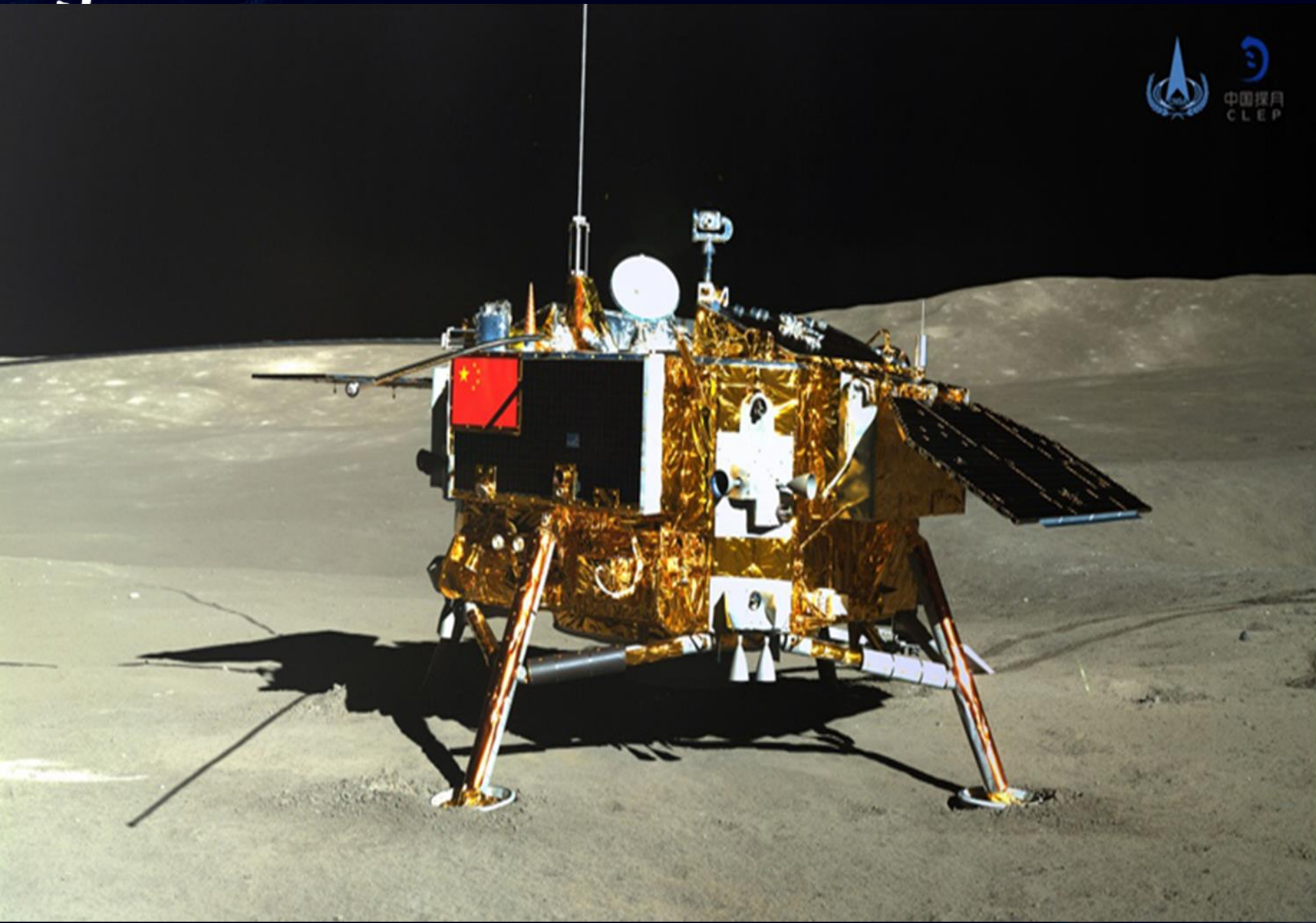


中国探月
CLEP



中国探月
CLEP

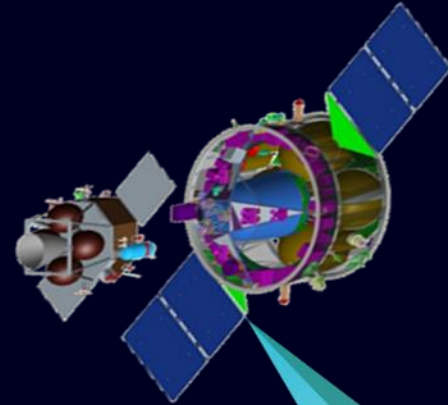
Chang'E-4



Upcoming Missions

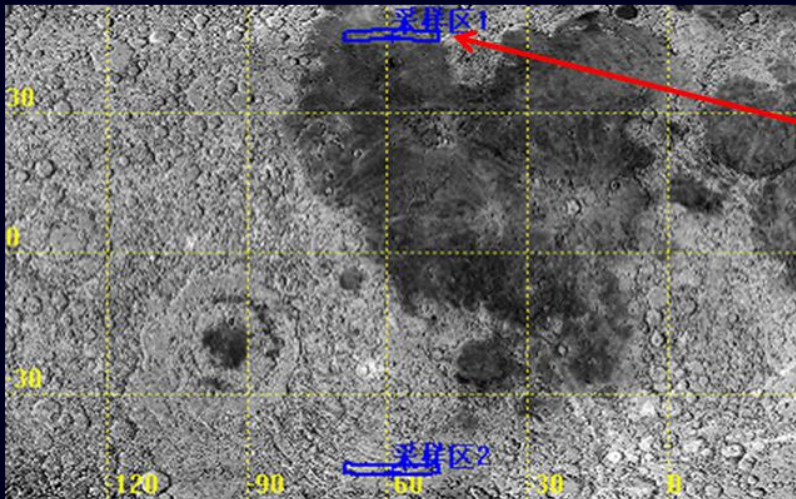
Chang'E-5

- To be implemented around 2020, with automatic sampling and sample return

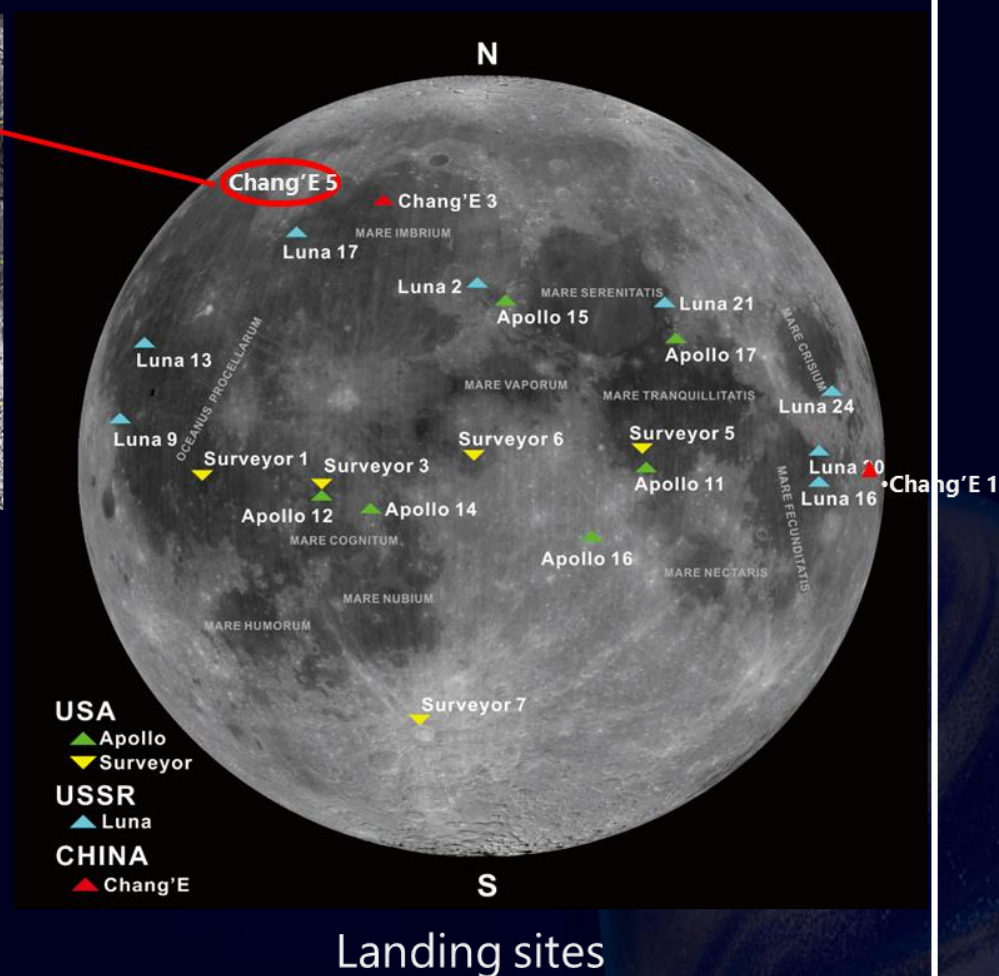


Upcoming Missions

Chang'E-5



Carry out research on lunar samples and deepen the study of the formation and evolution history of the moon



China First Mars Mission

Orbiting & Landing & Roving

All-in-one !

Started from Jan. 2016

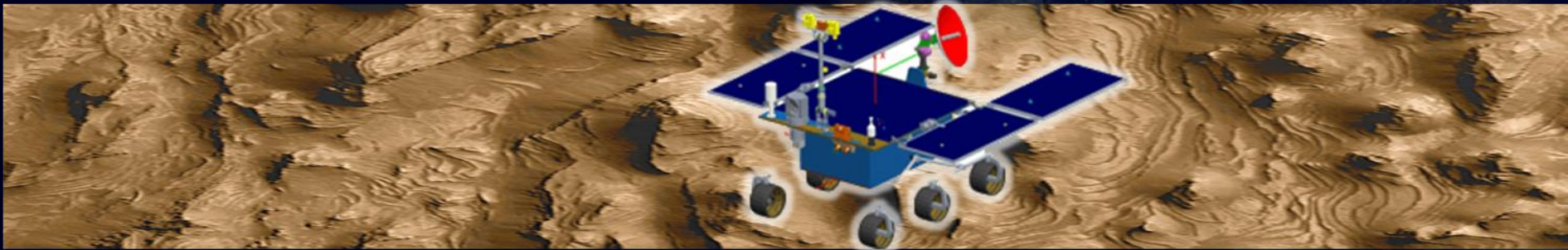
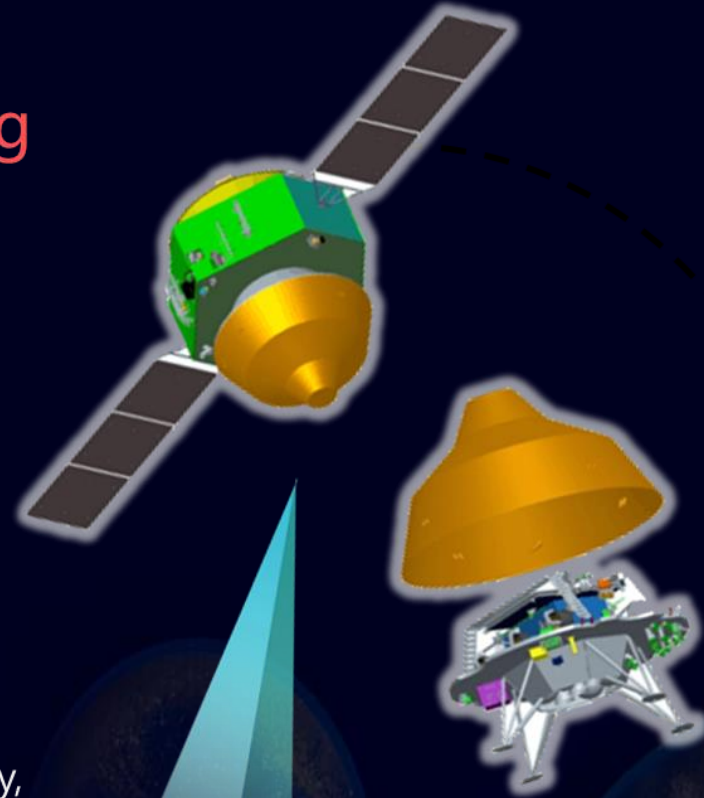
To be launched in July 2020

Engineering Objectives

Martian orbiting and roving

Scientific objectives

Scientific detection of Martian surface morphology, soil characteristics, material composition, water ice, atmosphere, ionosphere, magnetic field, etc.

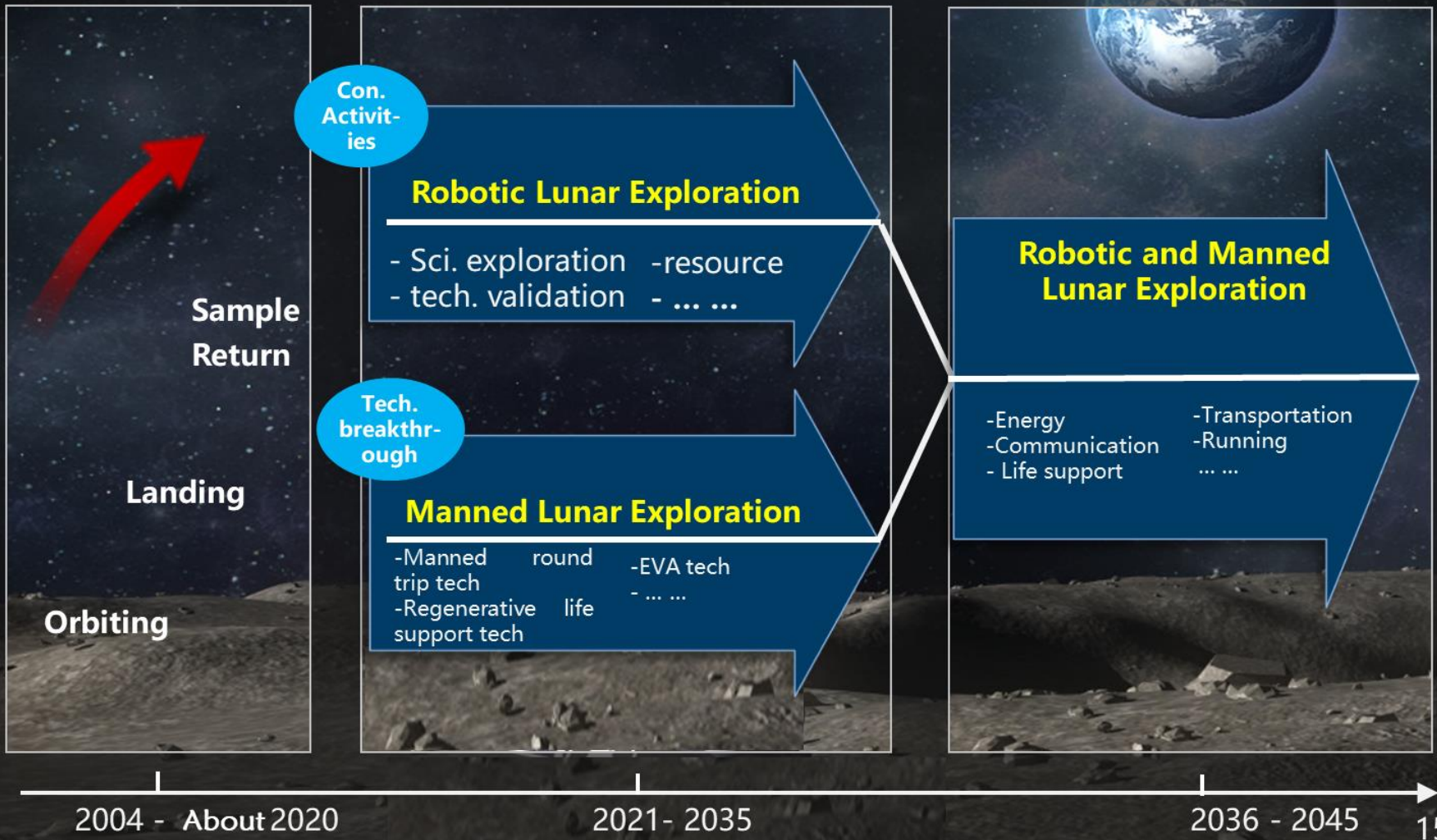


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- Cooperation Opportunities

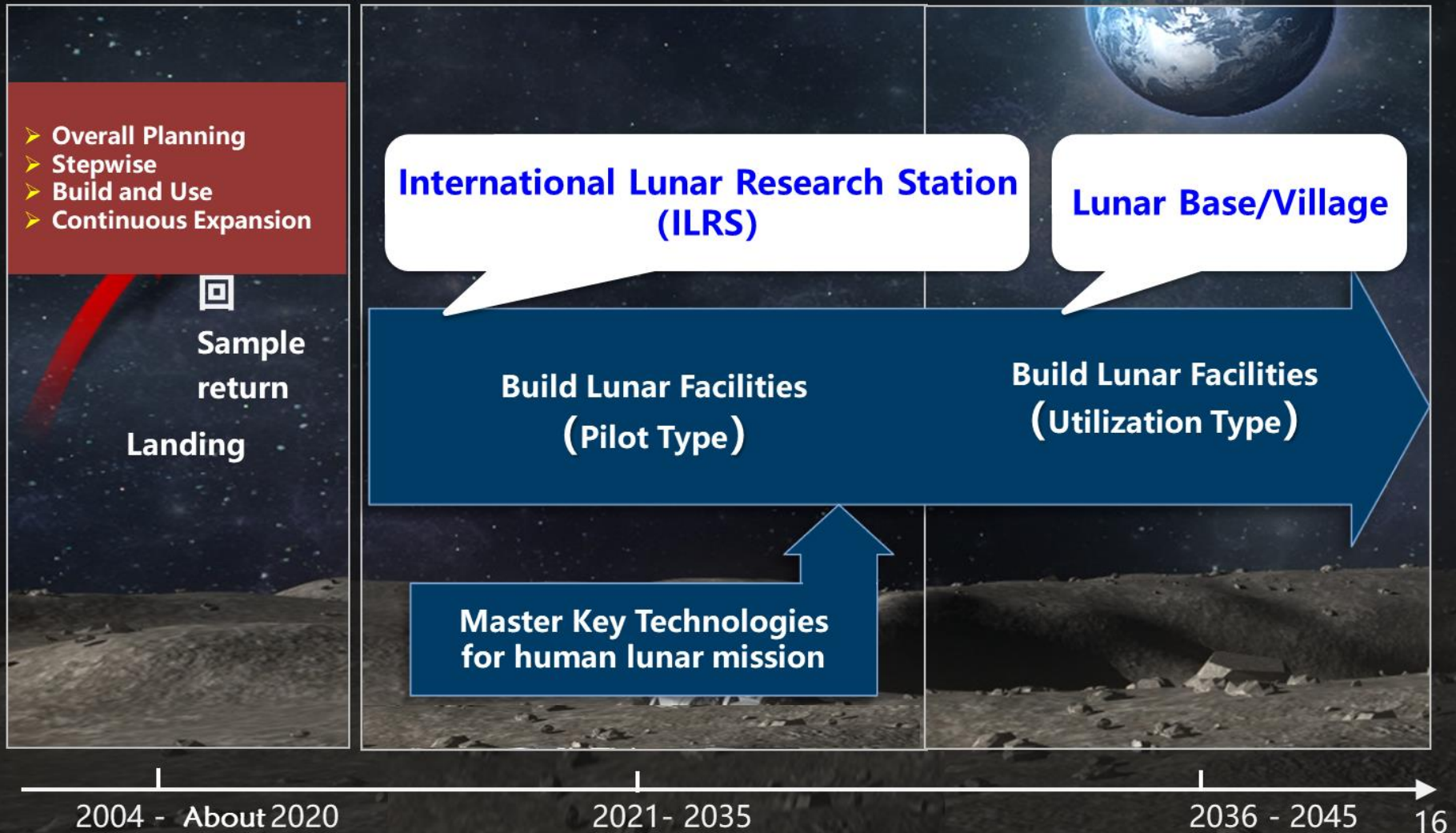
Lunar Exploration Prospects

Multiple Exploration Approaches



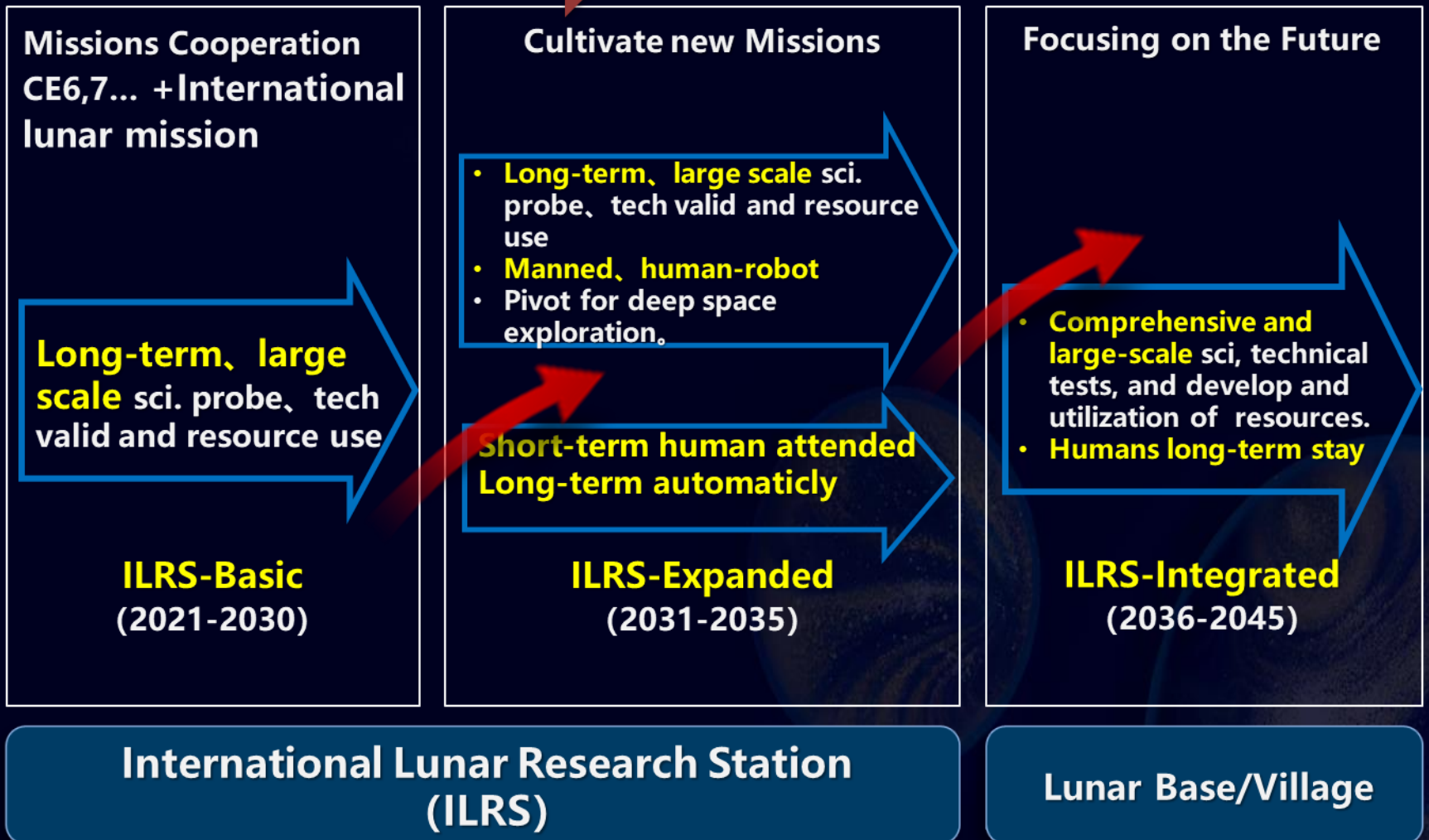
Lunar Exploration Prospects

Sustainable Development



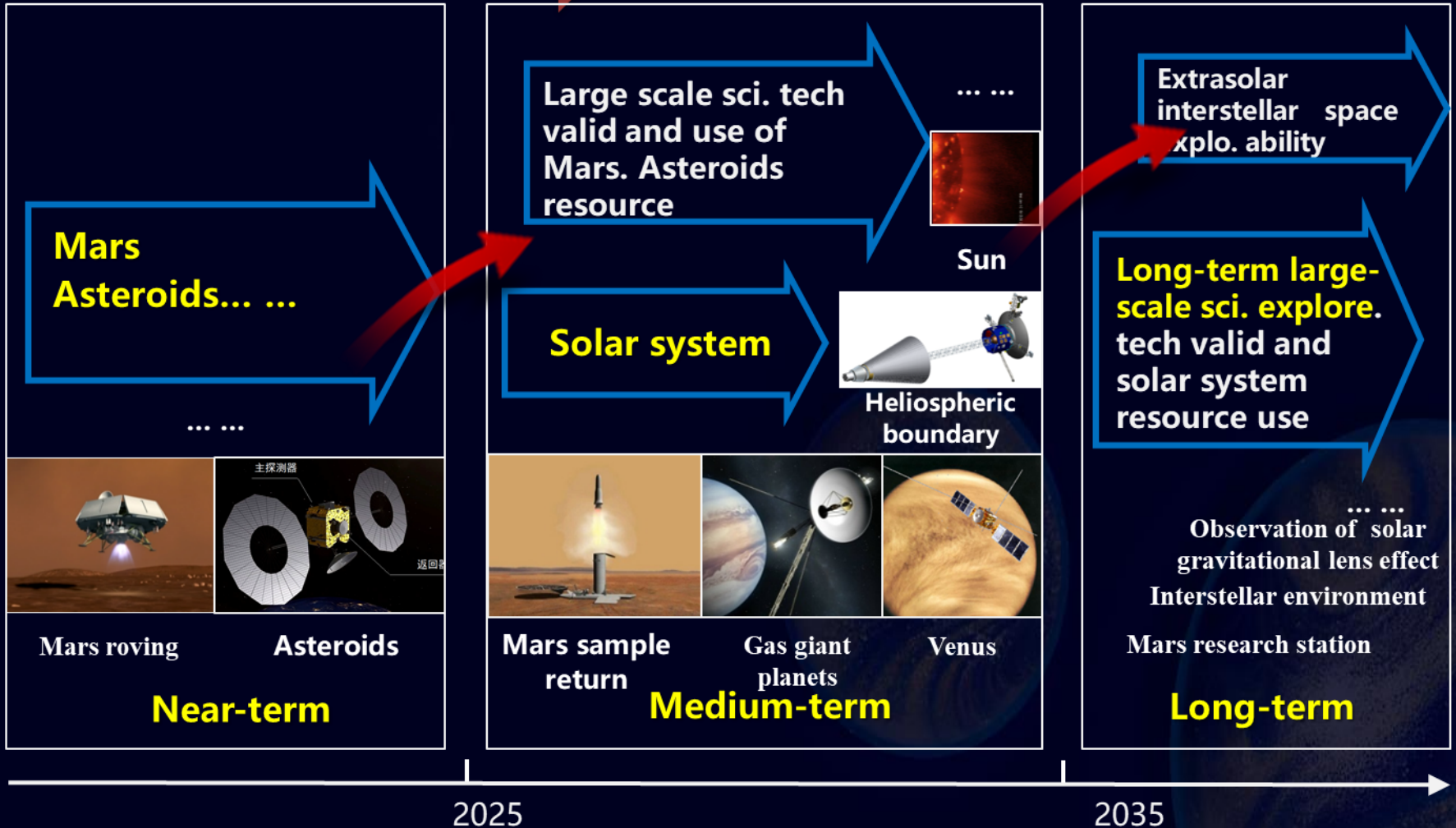
Lunar Exploration Prospects

Development Route



Exploration Prospects- Beyond Moon

Development Route



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- Mission Progress
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Three Transitions in China's Deep Space Exploration



Destination: From earth-moon system to interplanetary space

Purpose:

From space technology to full dimensions of space technology, space science and space application.

Space
technology

Space application
Space science
Space technology

Approach:

From "We do things on our own."
to "Let us do it together!"

Independence to International

Bilateral and multilateral and intergovernmental



联合国与中国国家航天局关于在中国月球和深空探测中开展合作的协定
Agreement between the United Nations and the China National Space Administration
Concerning Cooperation on China's Lunar and Deep Space Exploration

联合国/中国 航天助力可持续发展大会
United Nations/China Forum on Space Solutions: realizing the sustainable development goals

International Cooperation Progress

Chang'E-4

Piggyback 4 international payloads



月球中子及剂量探测仪
(着陆器)

Germany



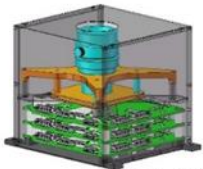
低频射电探测仪
(中继星)

Netherlands



中性原子探测仪
(巡视器)

Sweden



月球轨道光学成像仪
(KACST)

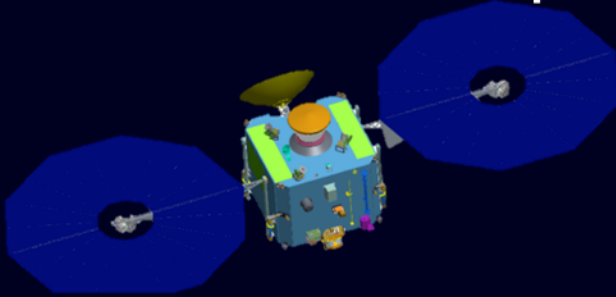
In principle of "free piggyback and data sharing"

Ongoing cooperation

Asteroid and Chang' E-6 missions

Asteroids Exploration Mission

- Near-earth asteroid 2016HO3 exploration
- Main-belt comet 133P exploration



- Call for 8 types of payloads
- Call for onboard project schemes

Chang' E-6 Exploration Mission

- Lunar samples return
- Call for payloads

For more information:
www.cnsa.gov.cn

Cooperation Initiatives for the ILRS

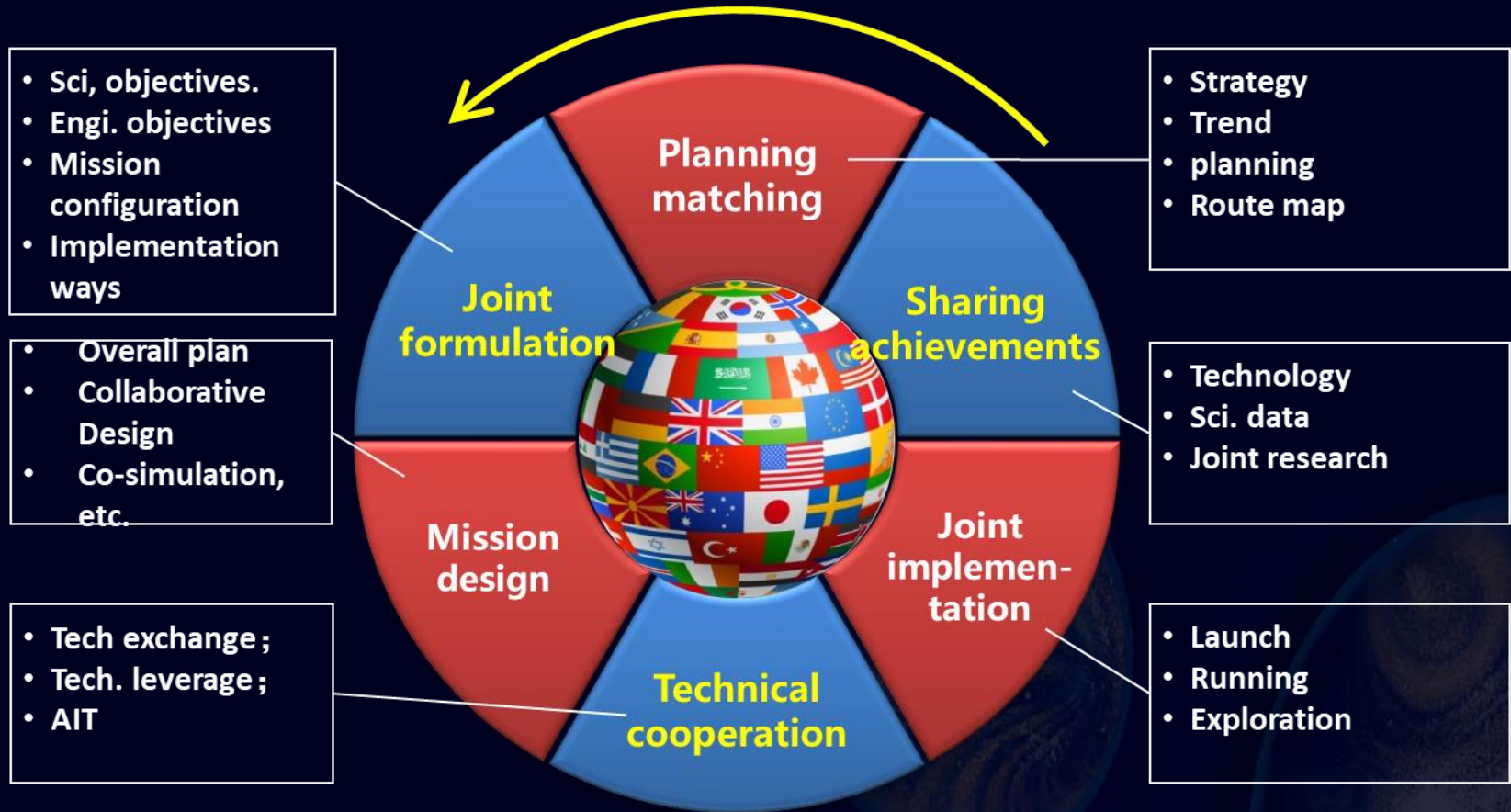
Cooperation initiatives

A shared growth through discussion and collaboration
A community of shared destiny in the earth-moon system

Objectives

Construction and operation of human 's first sharing platform in Lunar South Pole, supporting long-term, large-scale scientific exploration, technical experiments, and development and utilization of lunar resources.

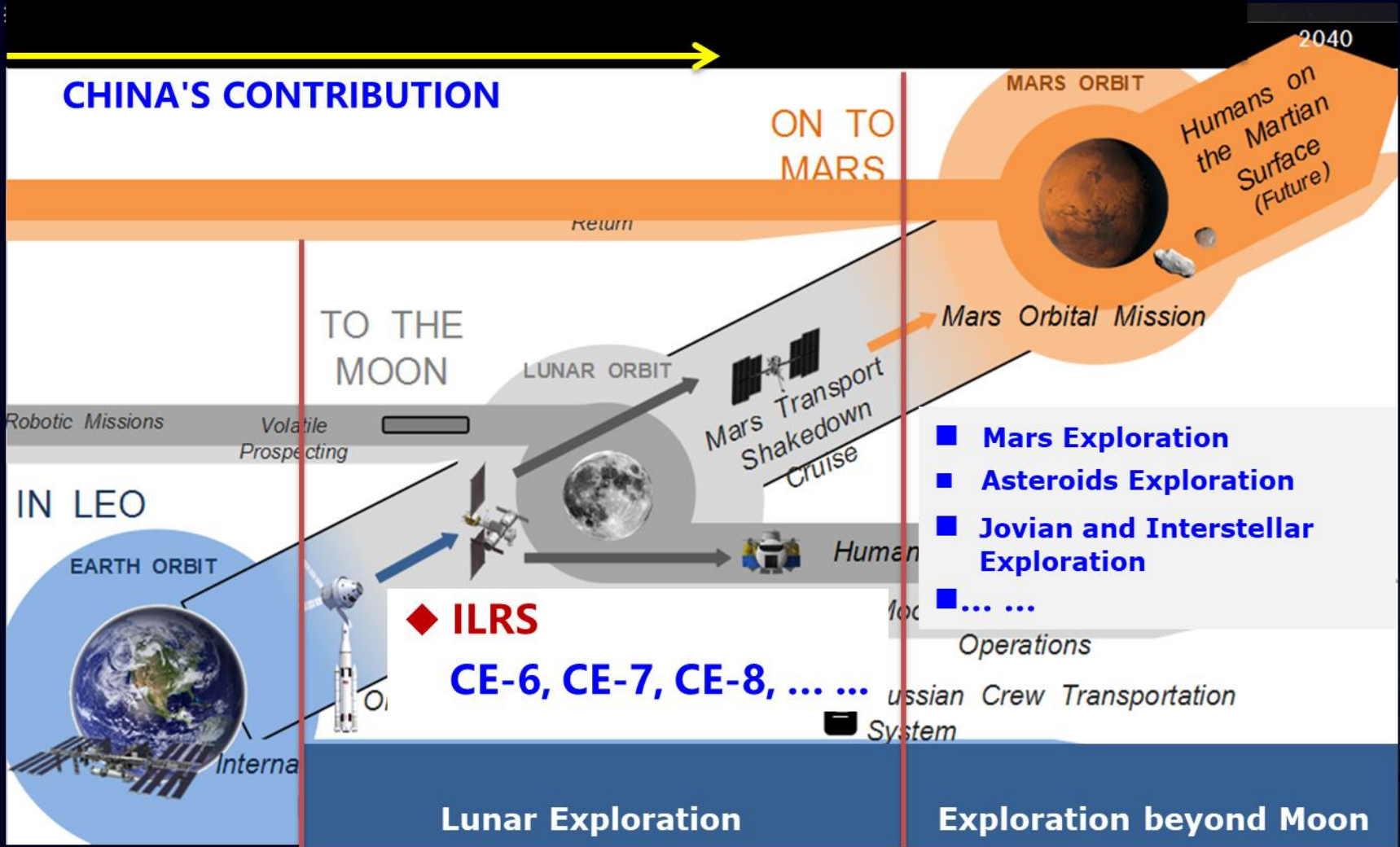
Cooperation Initiatives for the ILRS



Deep Space Exploration Prospects



中国
C L



ISECG GER3 (2018.2)

One Universe One Dream

A detailed illustration of the solar system. On the left, the Sun (Soleil) is a large, bright yellow-orange sphere. To its right, the inner planets are shown in order of increasing distance: Mercury (Mercure), Venus (Vénus), Earth (Terre), and Mars (Mars). A wide, curved band of grey rocks represents the Asteroid Belt (Ceinture d'astéroïdes). Beyond the belt are the gas giants: Jupiter (Jupiter), Saturn (Saturne), Uranus (Uranus), and Neptune (Neptune). Each planet is shown with its characteristic colors and rings. The background is a dark space filled with numerous stars of varying colors and sizes, and a few comets are visible in the upper right.

Lunar Exploration and Space Engineering Center, CNSA

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