

China's Deep Space Exploration

Lunar Exploration and Space Engineering Center, CNSA
January 30, 2024



C ONTENTS

- 1. Major Achievements**
- 2. A Blueprint for The Future**
- 3. Open International Cooperation**



1. Major Achievements



1.1 Lunar Exploration



China's Lunar Exploration Programme “Orbiting, Landing, Sample Return”

Chang'E-1

2007.10



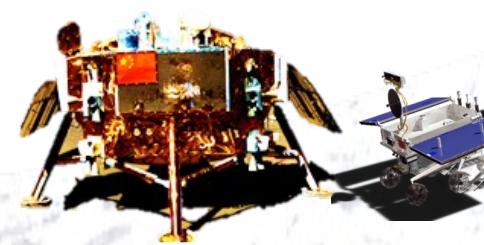
Chang'E-2

2010.10



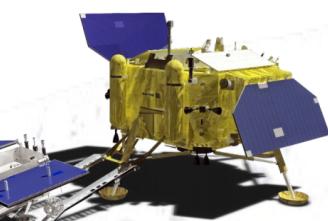
Chang'E-3

2013.12



Chang'E-4

2018.12



Chang'E-5T

2014.10



Chang'E-5

2020.11



Orbiting

Landing

Sample Return

In the past 20 years, China has successfully completed the three-step goal of “orbiting, landing and sample return”.

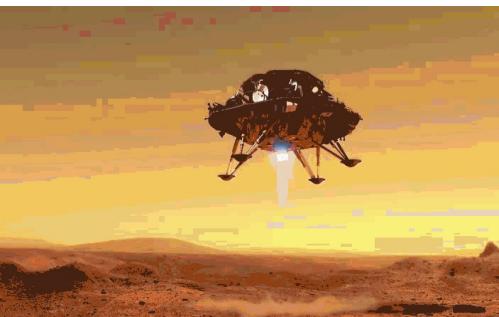


1.2 Mars Exploration

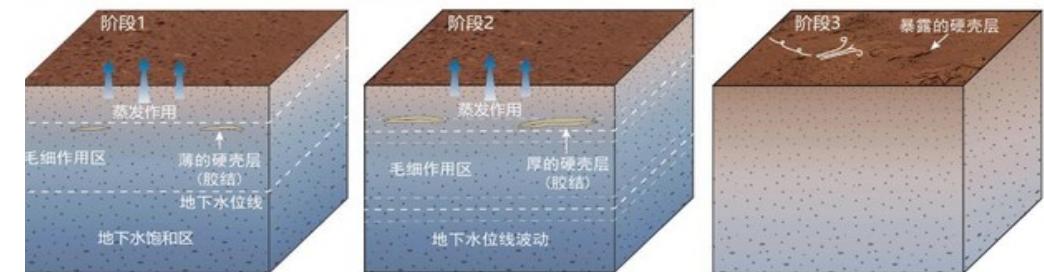


Tianwen-1

On May 15, 2021,
Landing



Since May 22, 2021,
Started Mars surface patrol

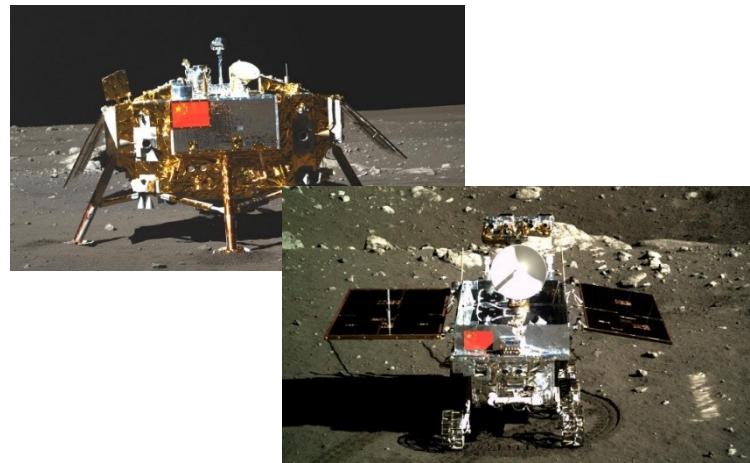
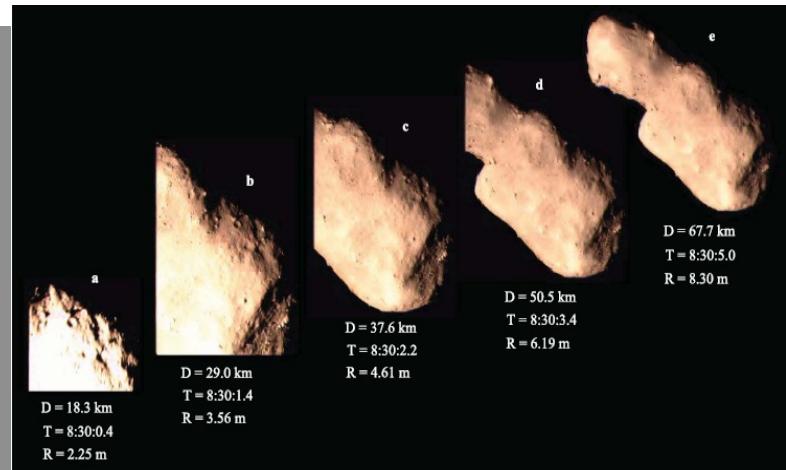
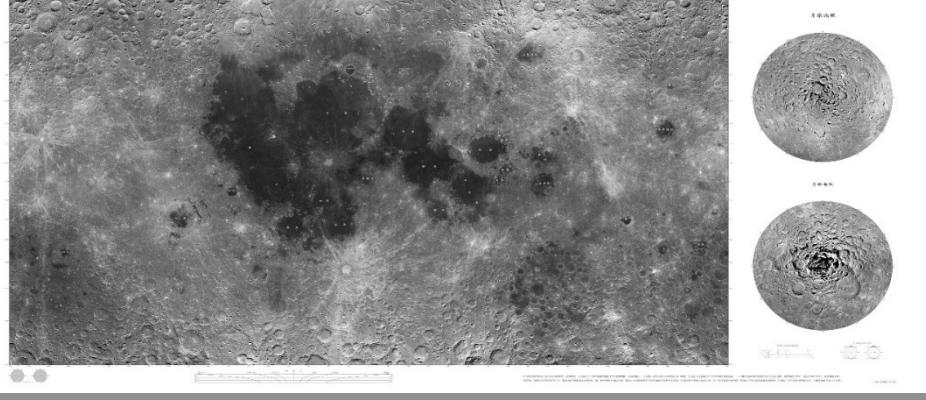


76m resolution color image of Mars in global scale

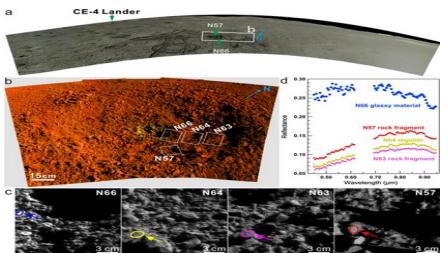
1.1 Lunar Exploration



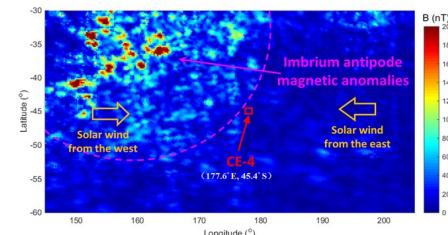
中国首次月球探测工程全月球影像图



Chang'E-1

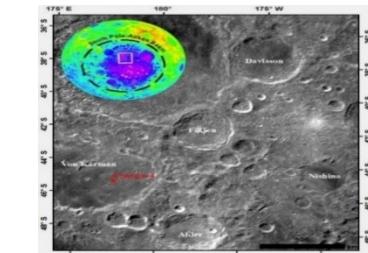


Impact remnants rich in carbonaceous chondrites

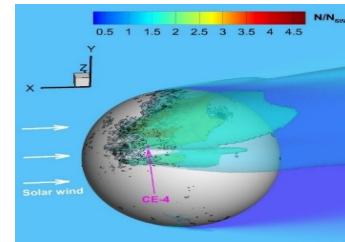


Measurements of energetic neutral atoms (ENAs)

Chang'E-4



Geologic age of Finsen Crater

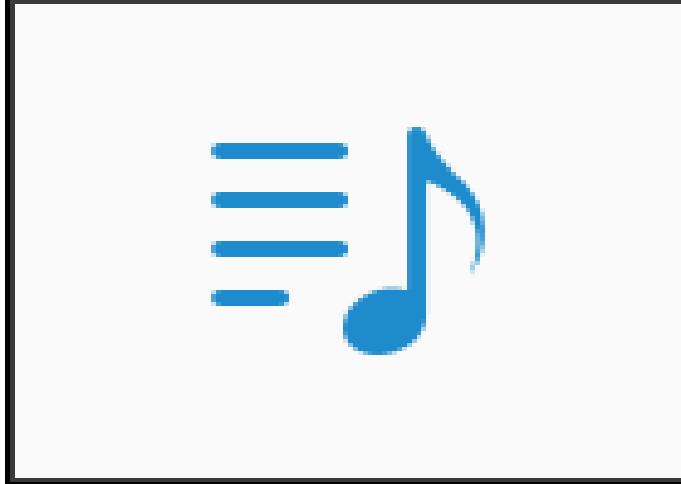


Mini-magnetosphere

Chang'E-2



Chang'E-3



Chang'E-5



1.3 Capacity Facilities



Extra-terrestrial s/c test facility



S/X/Ka deep space network



Wenchang space launch site



Sample storage facilities



Rendezvous docking simulation



Teleoperation test



2. A Blueprint for The Future



2.1 Lunar Exploration

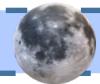


2024

2030

2040

2050



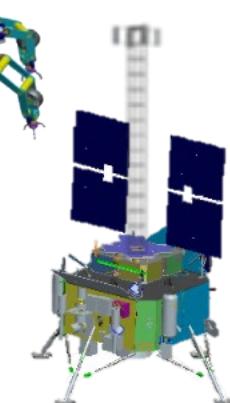
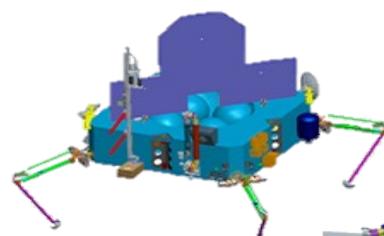
Queqiao-2 Chang'E-6 Chang'E-7 Chang'E-8

Around 2024

Around 2024

Around 2026

Around 2028

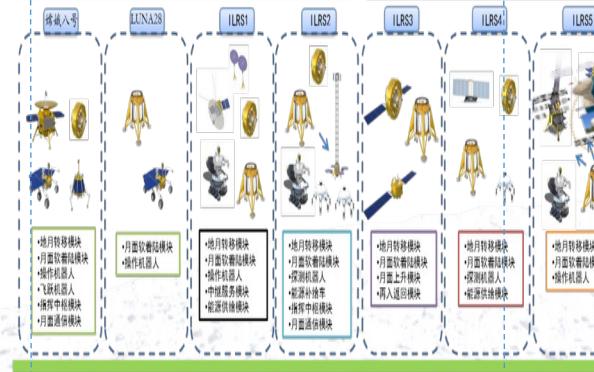
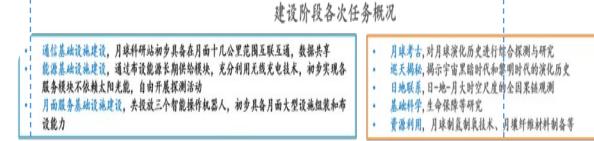


Manned Lunar Landing

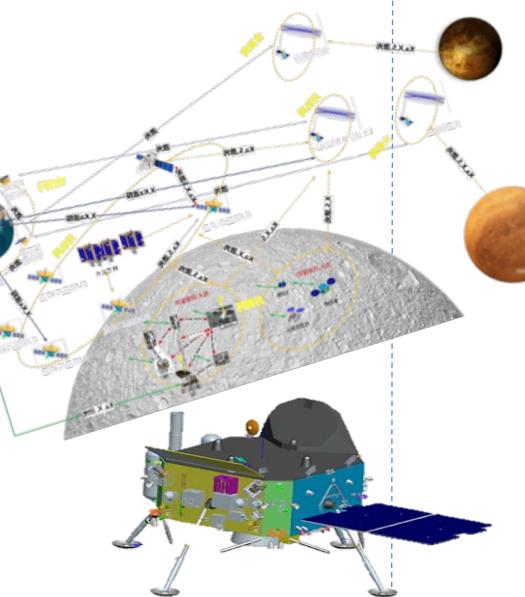
LUNA28



International Lunar Research Station



Queqiao Constellation



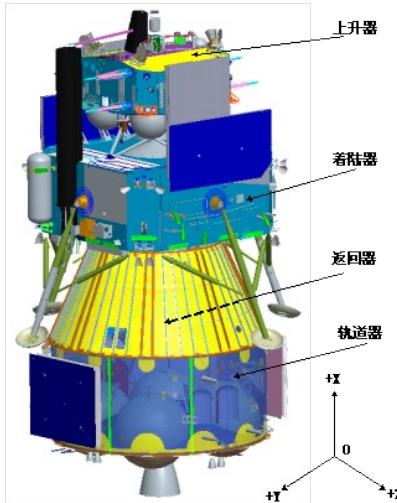


2.1 Lunar Exploration



Chang'E-6

- Launched in the first half of 2024 by CZ-5.
- Sample return from the far side of the Moon.
- The probe now at the launch site.

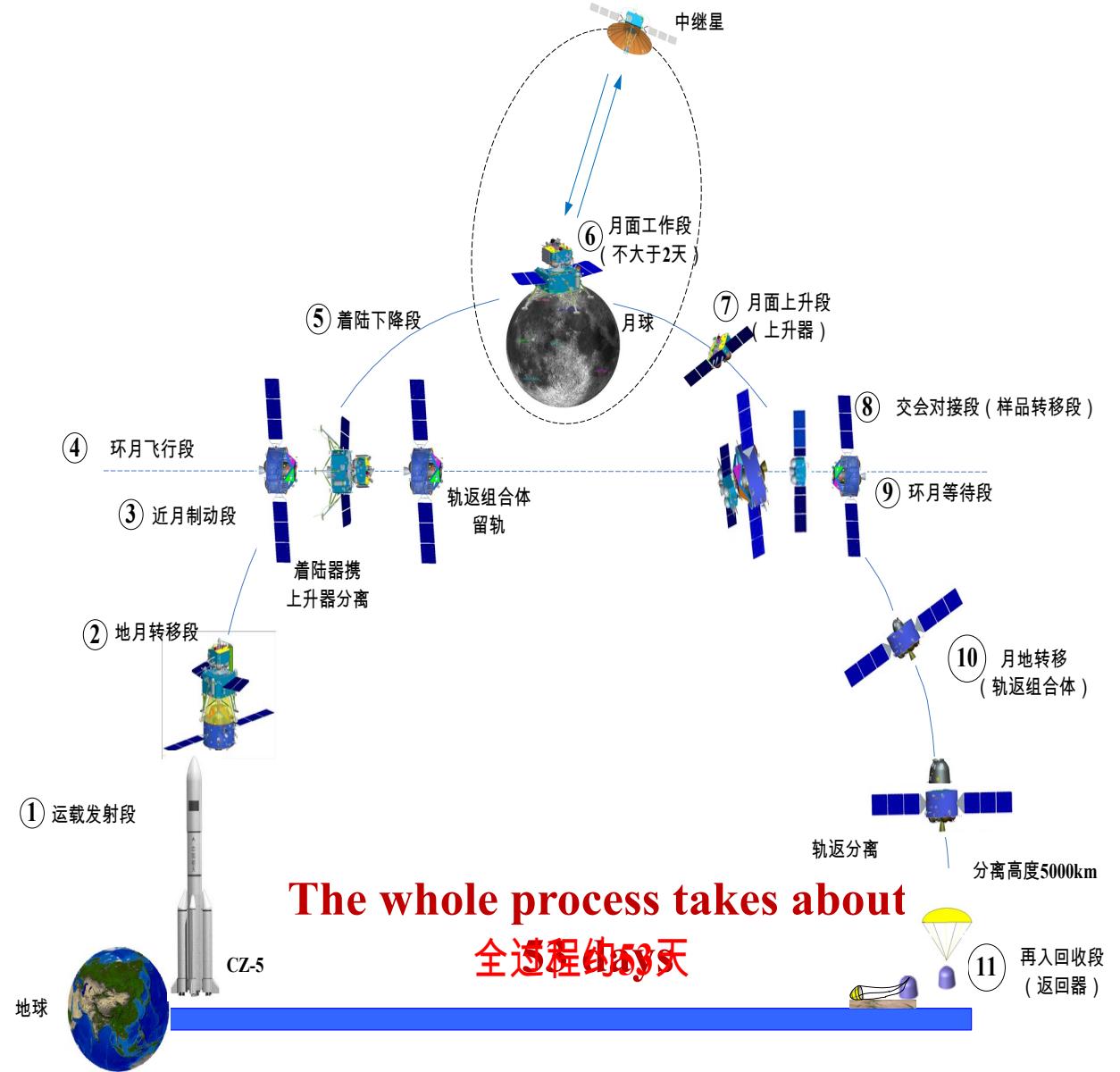


CZ-5

Detector assembly



Probe arrives at the launch site



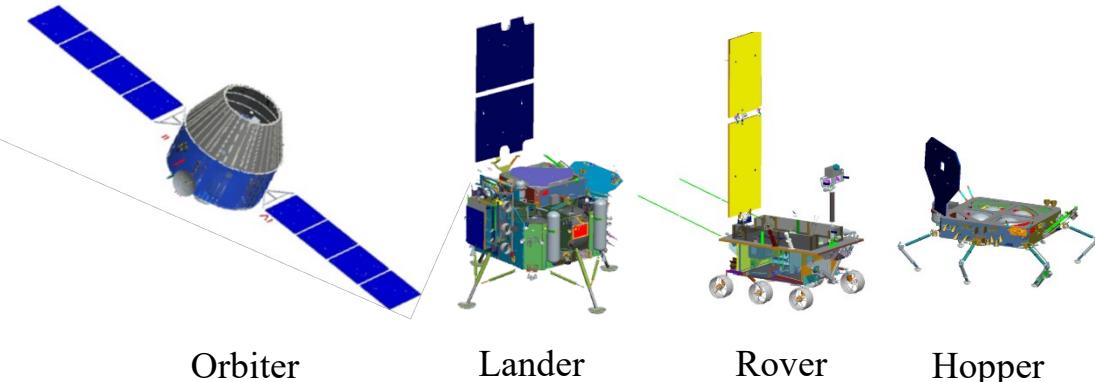


2.1 Lunar Exploration

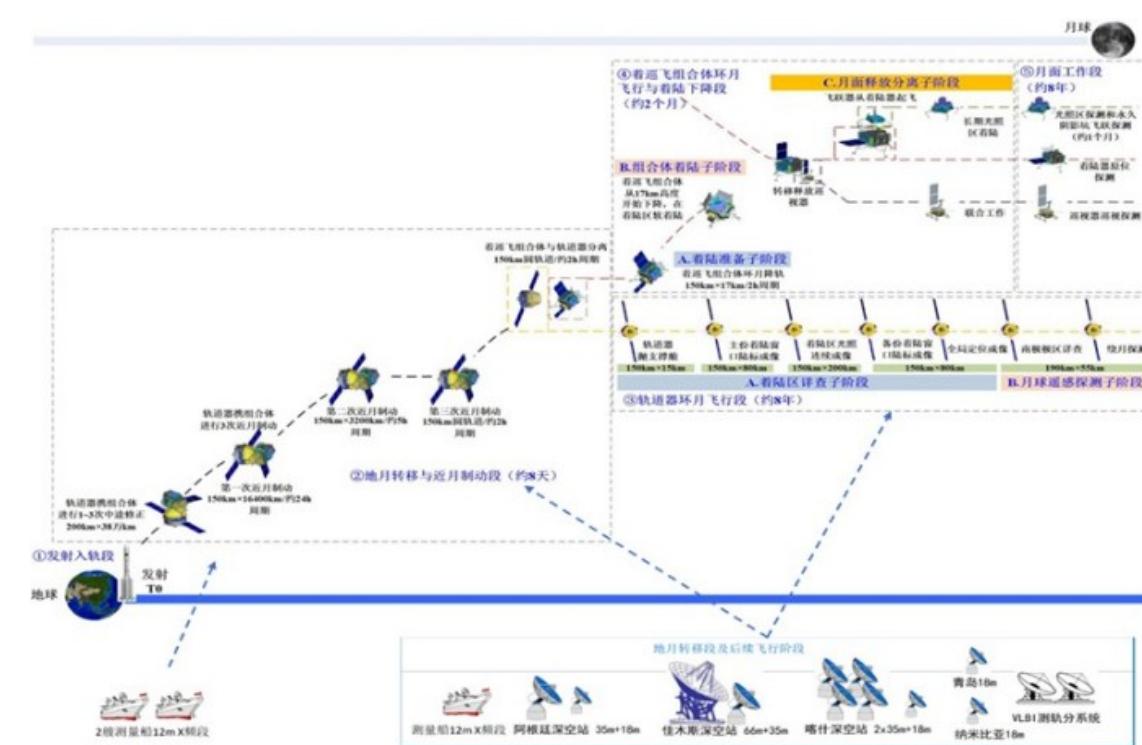


Chang'E-7

- Launched around 2026 by the CZ-5.
- To conduct environmental and resource surveys of the lunar south pole.



Chang'E-7 probe



Mission flight profile

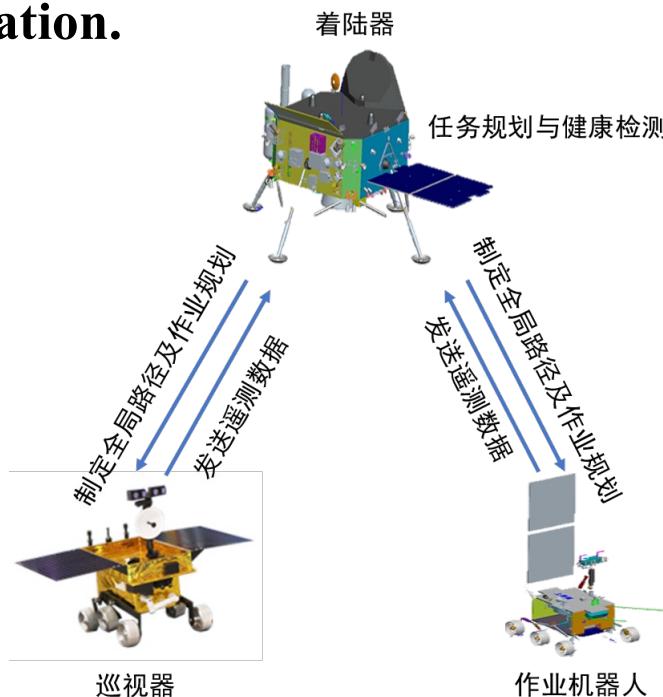


2.1 Lunar Exploration

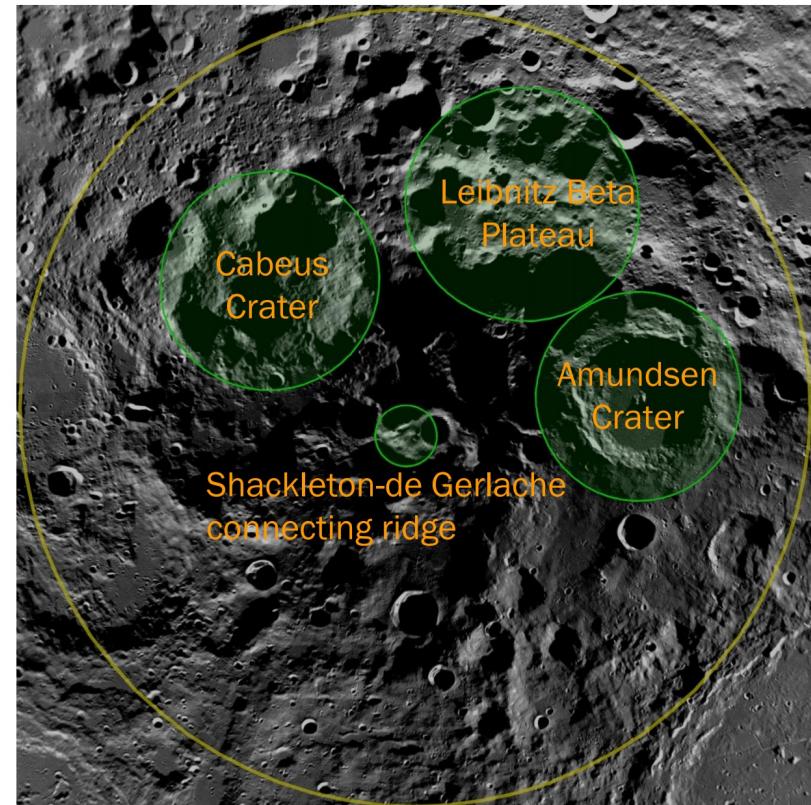


Chang'E-8

- Spacecrafts launched around **2028**.
- Laying the Foundation for the long-Term Sustainable Exploration of the Moon.
- Announcement of opportunities for international cooperation.



Intelligent planning of operations



Candidate Landing Zones

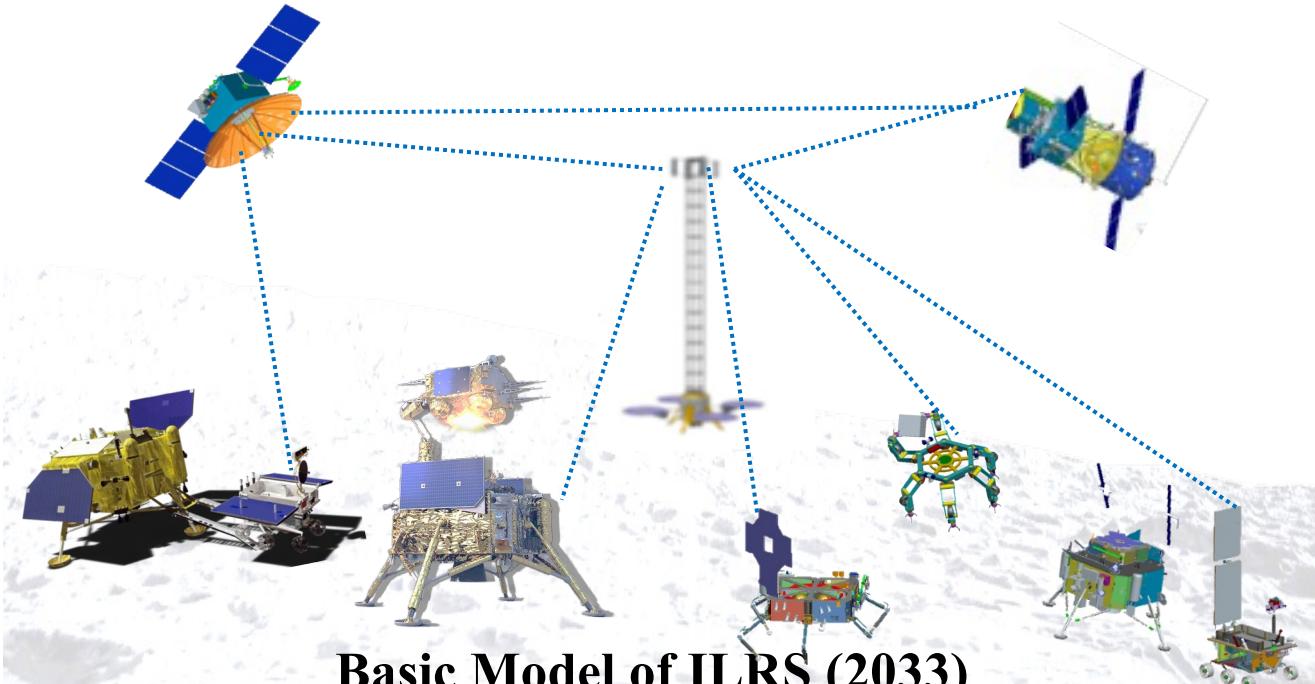


2.1 Lunar Exploration



International Lunar Research Station

- A comprehensive scientific experiment facility on the lunar surface and lunar orbit that operates autonomously in the long term and manned in the short term.
- With the capabilities of energy supply, central control, round-trip, and lunar surface research, carrying out multidisciplinary, multi-objective and large-scale scientific research activities continuously.



Basic Model of ILRS (2033)



Expansion Model of ILRS (2045)

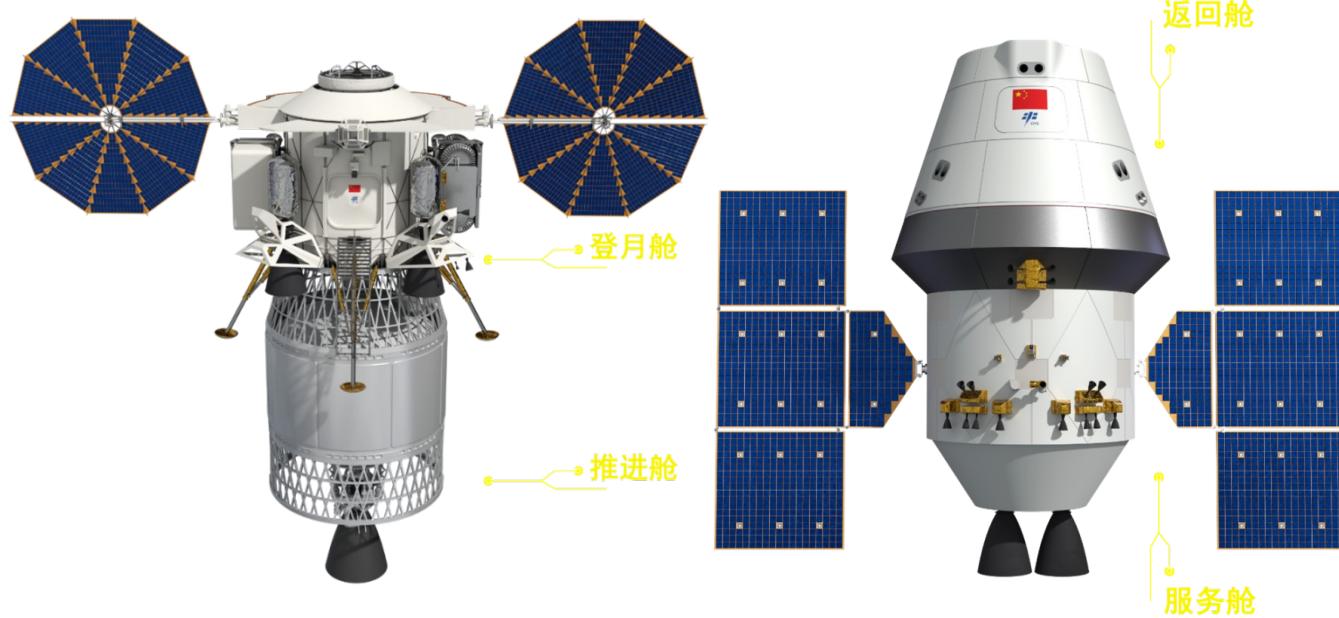
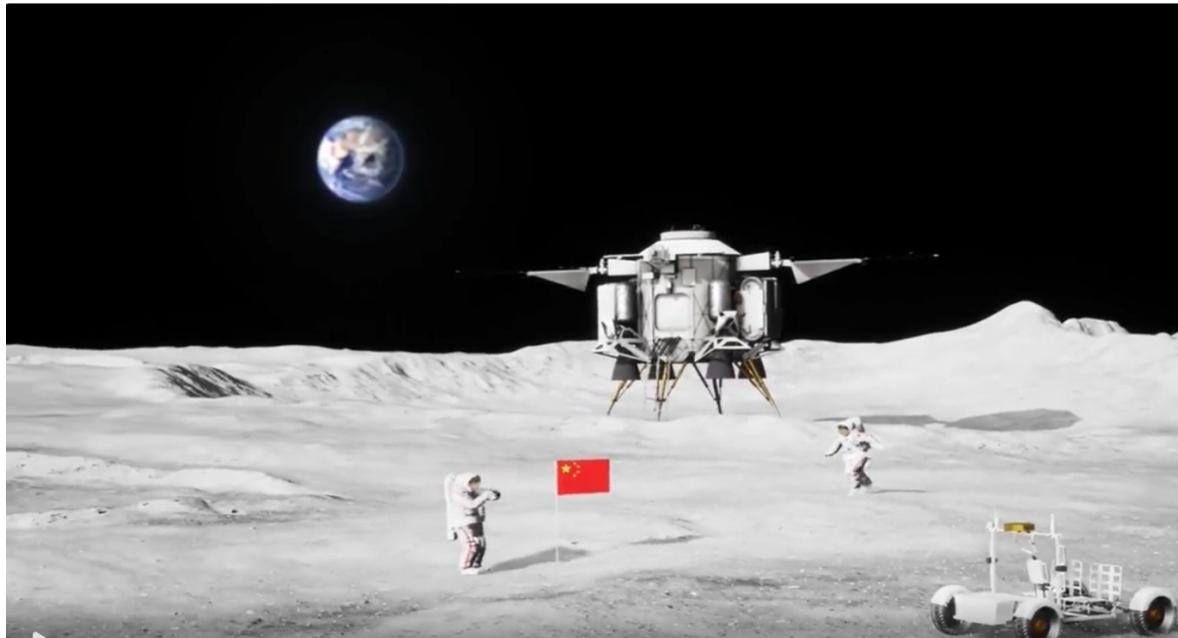


2.1 Lunar Exploration



Manned Lunar Landing

- To achieve manned lunar landing around 2030.

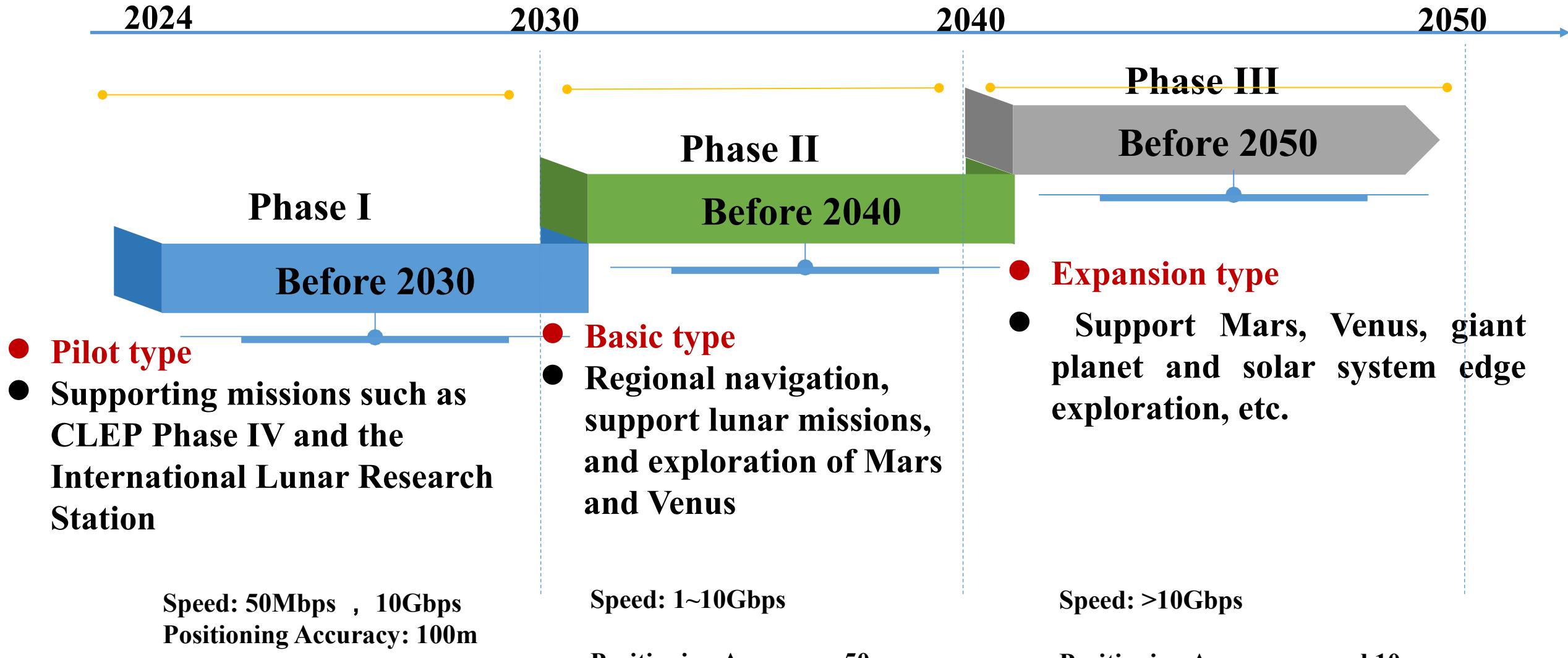




2.1 Lunar Exploration



Queqiao Constellation

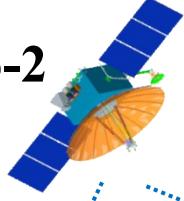




2.1 Lunar Exploration



Queqiao-2



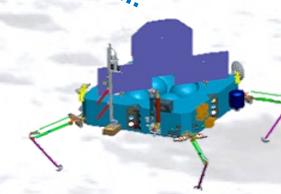
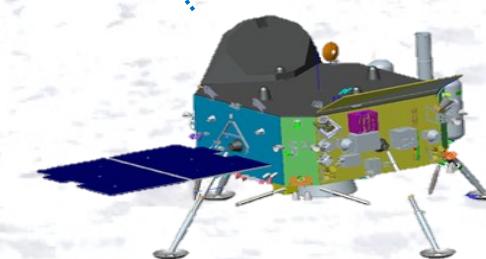
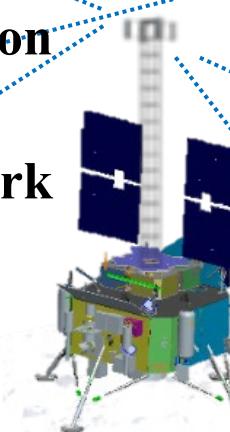
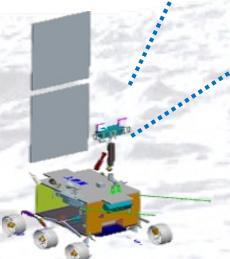
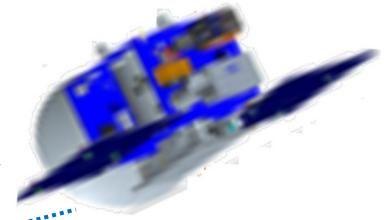
- Scheduled for launch around 2024, with a working life of 8 years.
- Service Chang'E-4, 6, 7 and 8 relay communications.
- Verification and application of Earth-Moon VLBI orbit determination technology.
- Verification of new communication network protocol technology.

Tiandu-1



- Technical validation for laser link, Ka link, etc.

Tiandu-2





2.2 Planetary Exploration

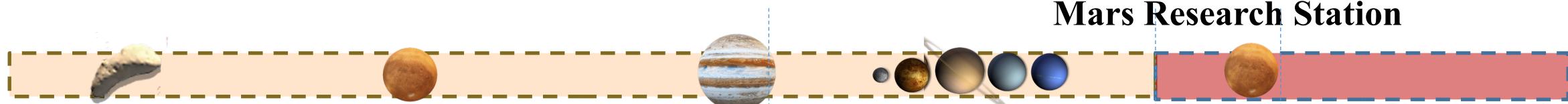


2025

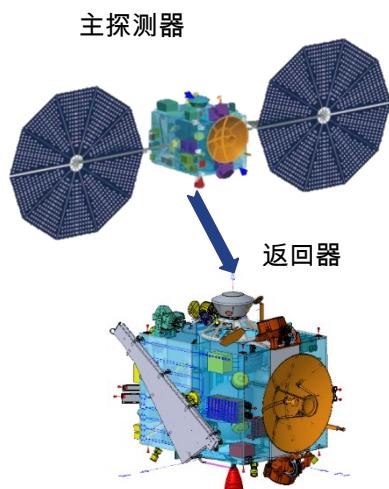
2030

2040

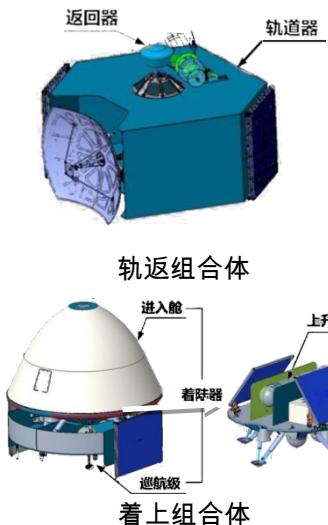
2050



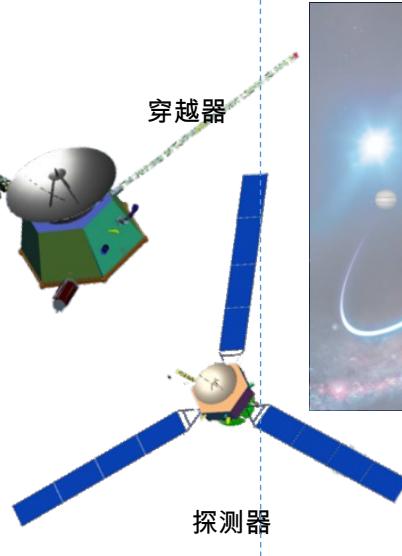
Tianwen-2



Tianwen-3



Tianwen-4



Tianwen.....



Manned Mars Exploration



- Asteroid sampling return

- Mars sampling return

- Jupiter System exploration

- Ice giant, Venus exploration, etc.

- Mars Research Station, etc.

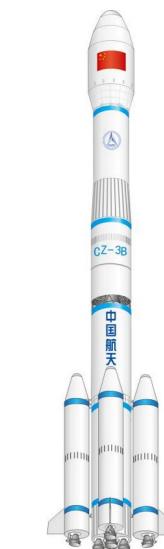
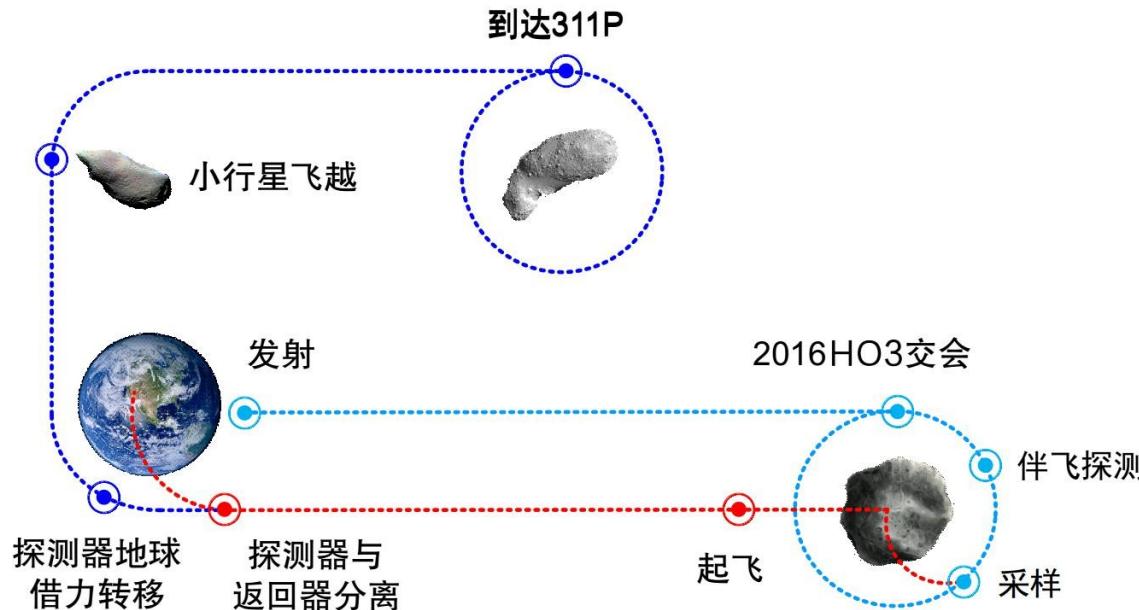


2.2 Planetary Exploration

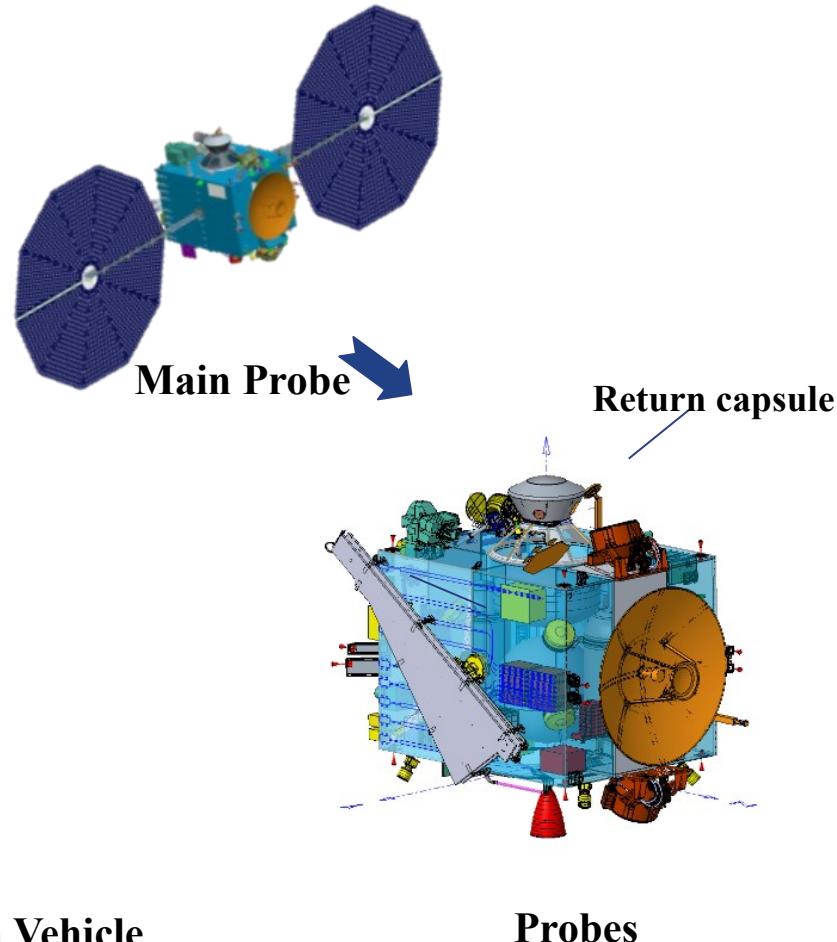


Tianwen-2

- Planned launch with CZ-3B around 2025.
- Sample return from near-Earth asteroid 2016HO3 around 2027.
- Exploration of main belt comet 311P around 2034.



CZ-3B Launch Vehicle



Probes

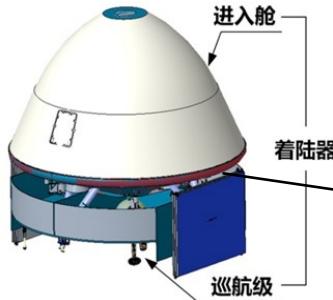


2.2 Planetary Exploration

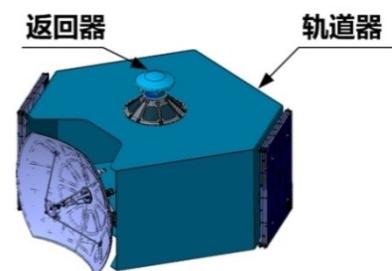


Tianwen-3

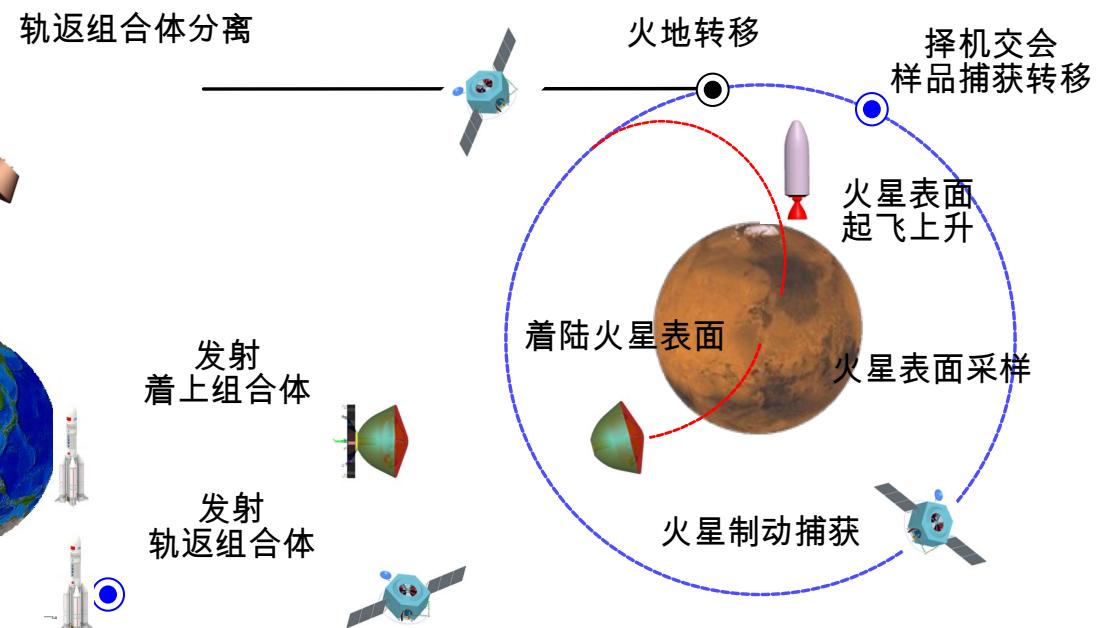
- Two launches by CZ-5 launch vehicle **around 2030.**
- Mars samples return to Earth.



Landing and ascent modules



Orbiter and return modules



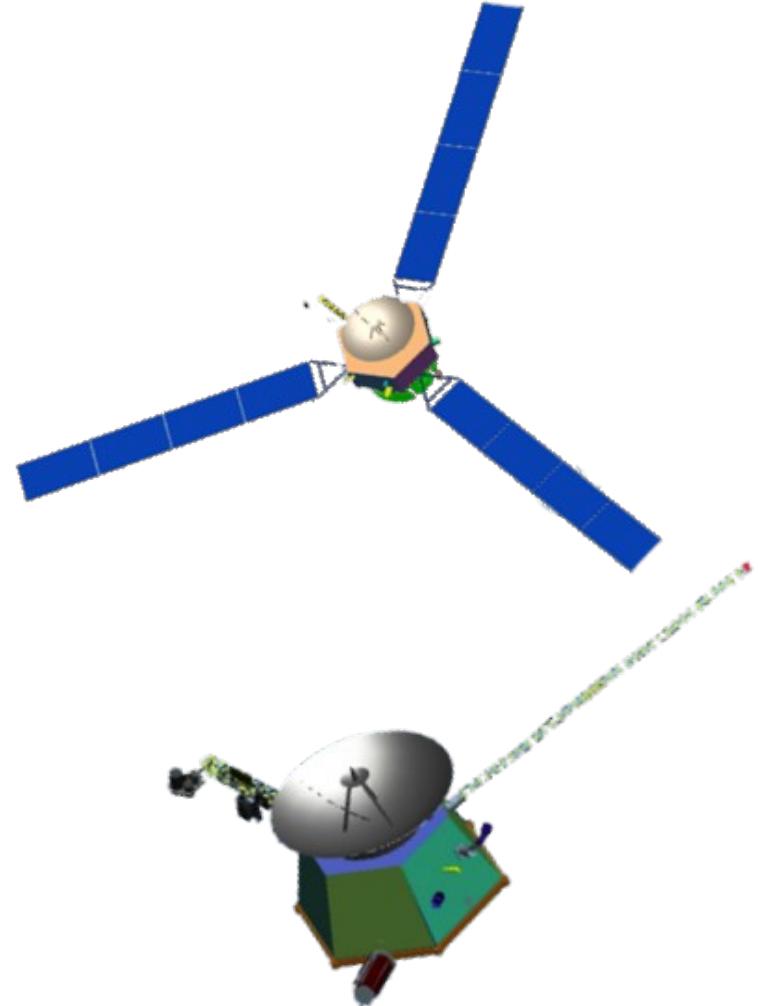
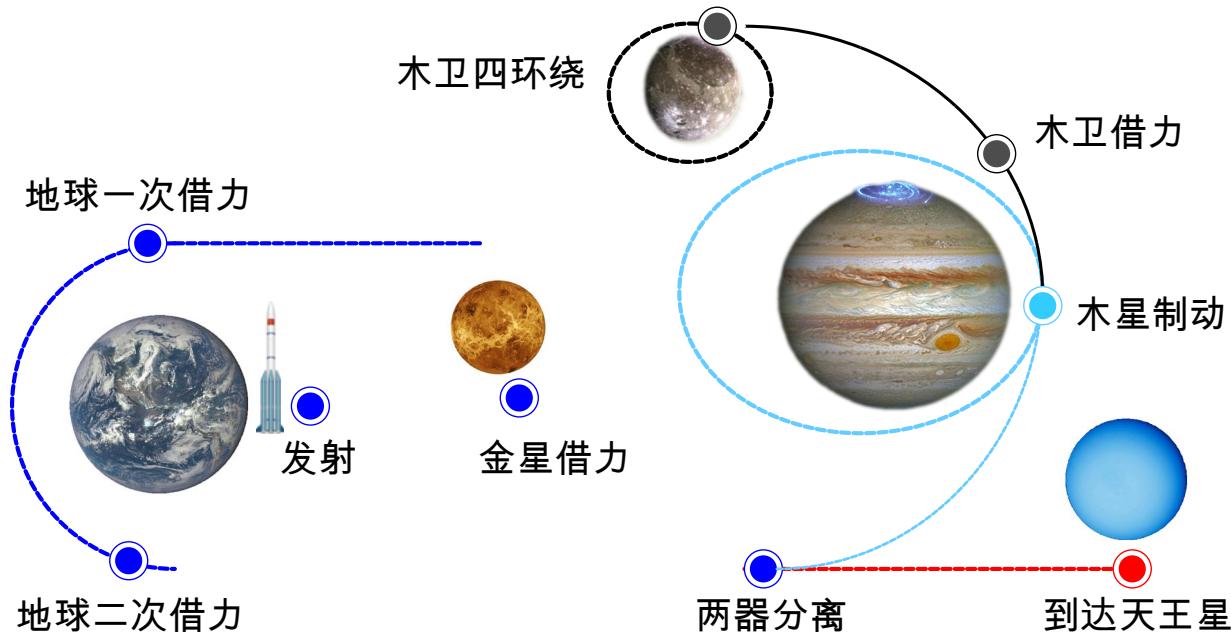


2.2 Planetary Exploration



Tianwen-4

- Launched by CZ5 around 2030.
- Orbiting Jupiter and its satellites around 2035.
- Reaching Uranus around 2046.



Probes



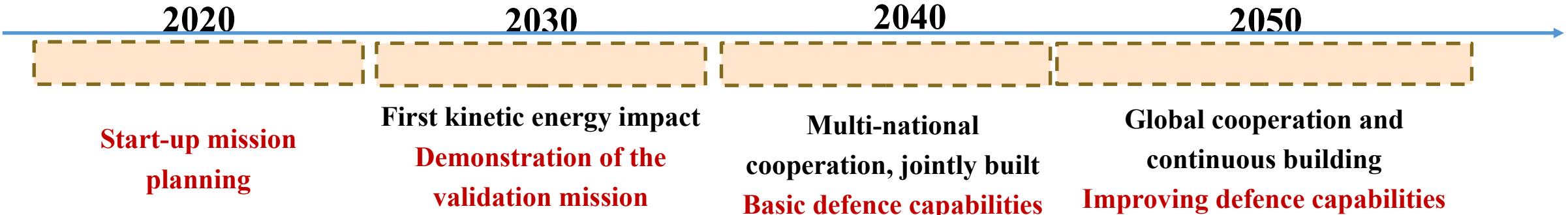
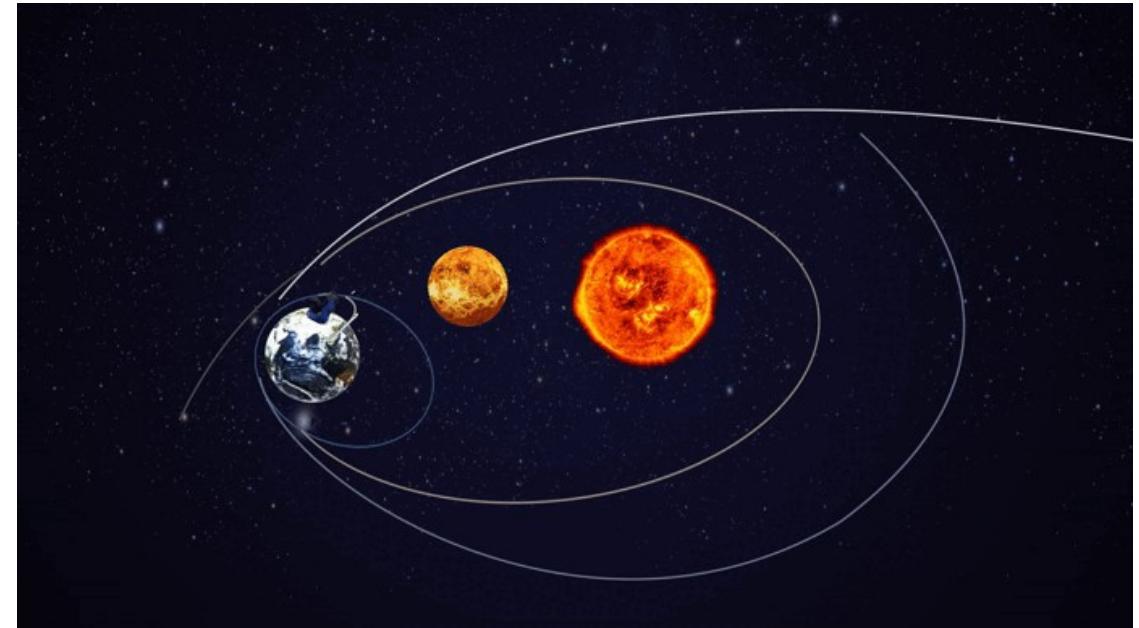
2.3 Near Earth Asteroid Defence



First Asteroid Defence Mission

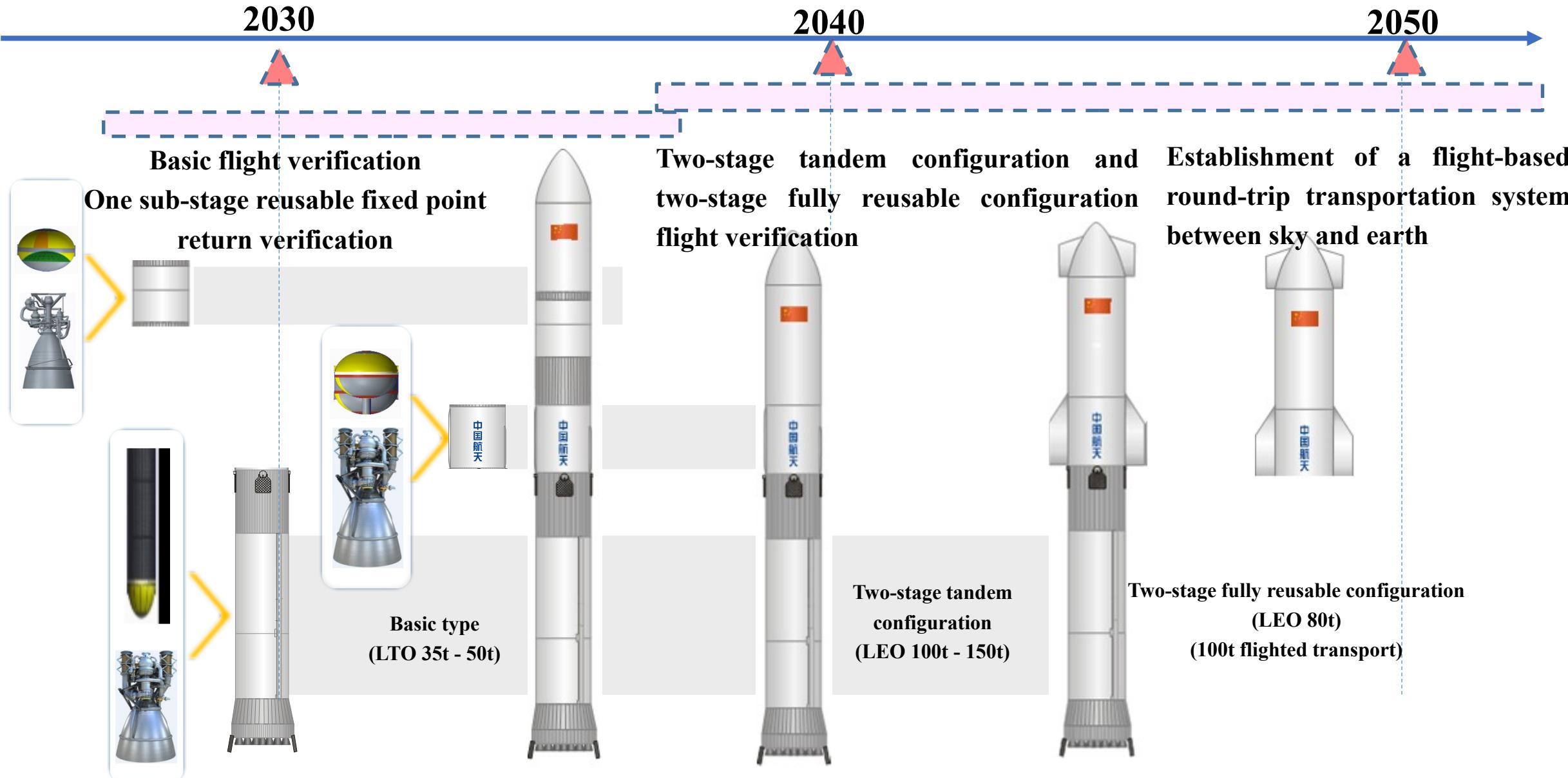
● Mission Objective

- ✓ Kinetic impacts on 50m-class asteroids.
- ✓ Deepen and expand international exchanges and cooperation, and realise high-precision assessment of defence effects.
- ✓ Build a mission support platform to lay the foundation for the construction of subsequent near-Earth asteroid defence systems.
- ✓ Enrich the understanding of asteroid orbital evolution and disposal mechanism law.





2.4 Heavy-Lift Launch Vehicle

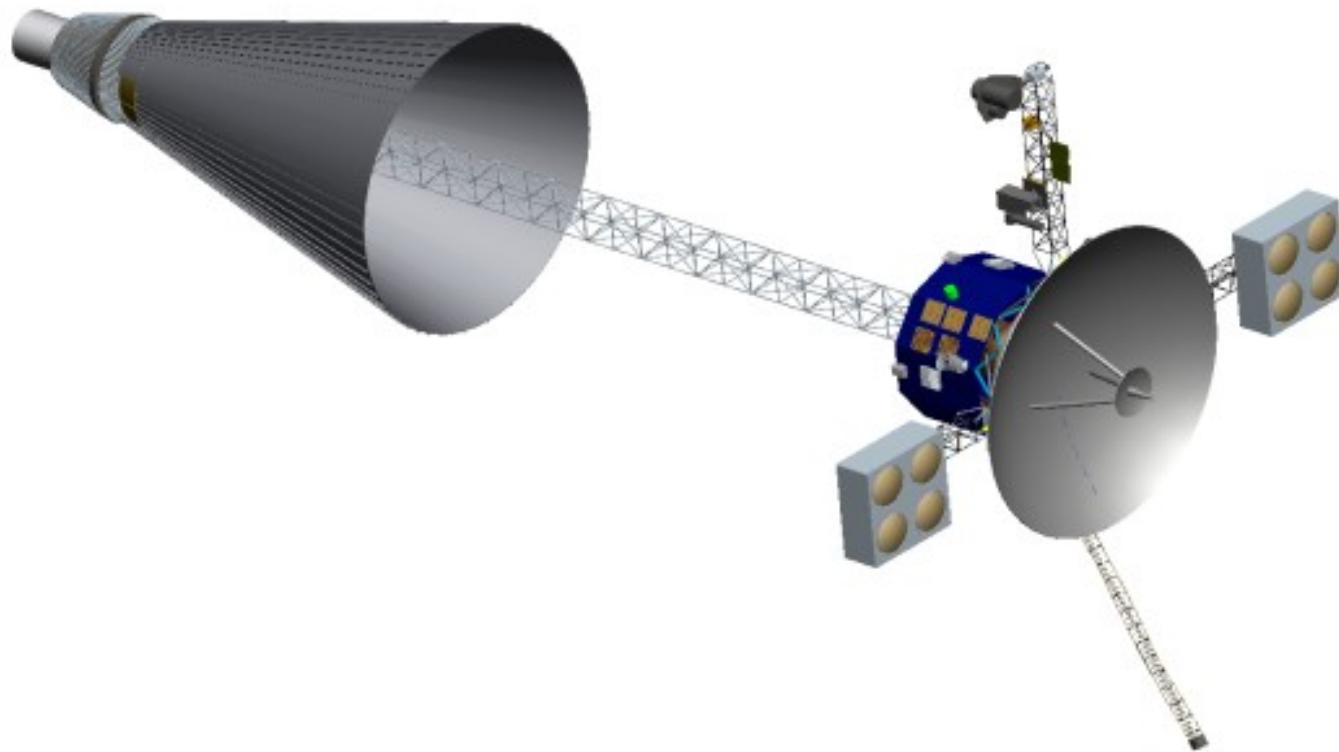




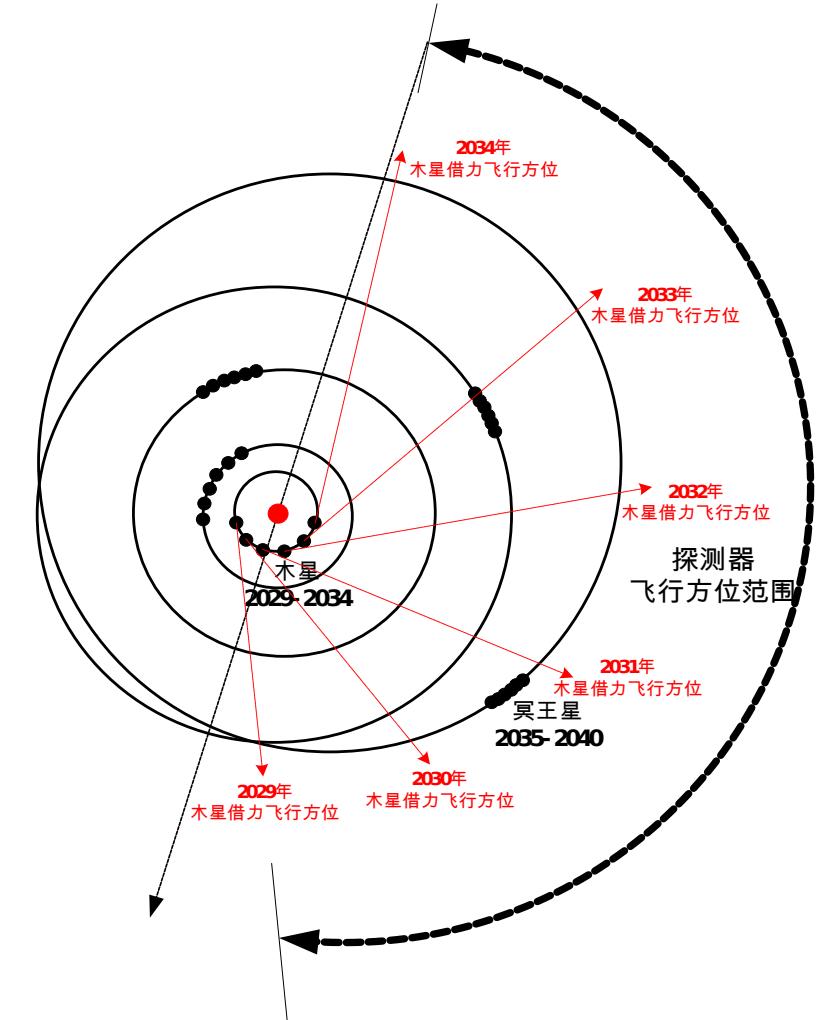
2.5 Solar Exploration



Edge of Solar System Exploration Scenario



Flying to the edge of the solar system at 80-100 AU
around 2050



Schematic diagram of solar
system edge exploration



3. Open International Cooperation



Principles of International Cooperation



Equality and Mutual Benefit Peaceful Use
Win-win Cooperation



Progress in International Cooperation

Lunar Exploration Cooperation

- **Scientific Payloads**

CE-4 : Sweden, Netherlands, Germany, Saudi Arabia.

CE-6: ESA, France, Italy, Pakistan.

CE-7、**CE-8**: under selection.

- **TT&C support**: ESA, Argentina, Chile, Namibia, etc.

- **Lunar sample and science data sharing**

Open international cooperation in accordance with the *Rules for the Management of International Cooperation on Lunar Samples and Scientific Data* of the CNSA.

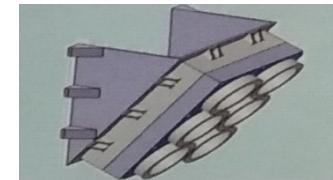
- **Exchagne Mars orbiter ephemeris data with NASA.**



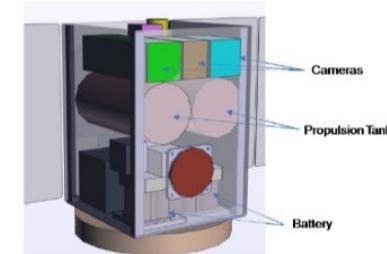
CE-4 payload scientific data handover



ESA NILS



France DORN



Pakistan ICUBE-Q



Italy INRRI
CE-6 International Payloads



International Cooperation Initiative

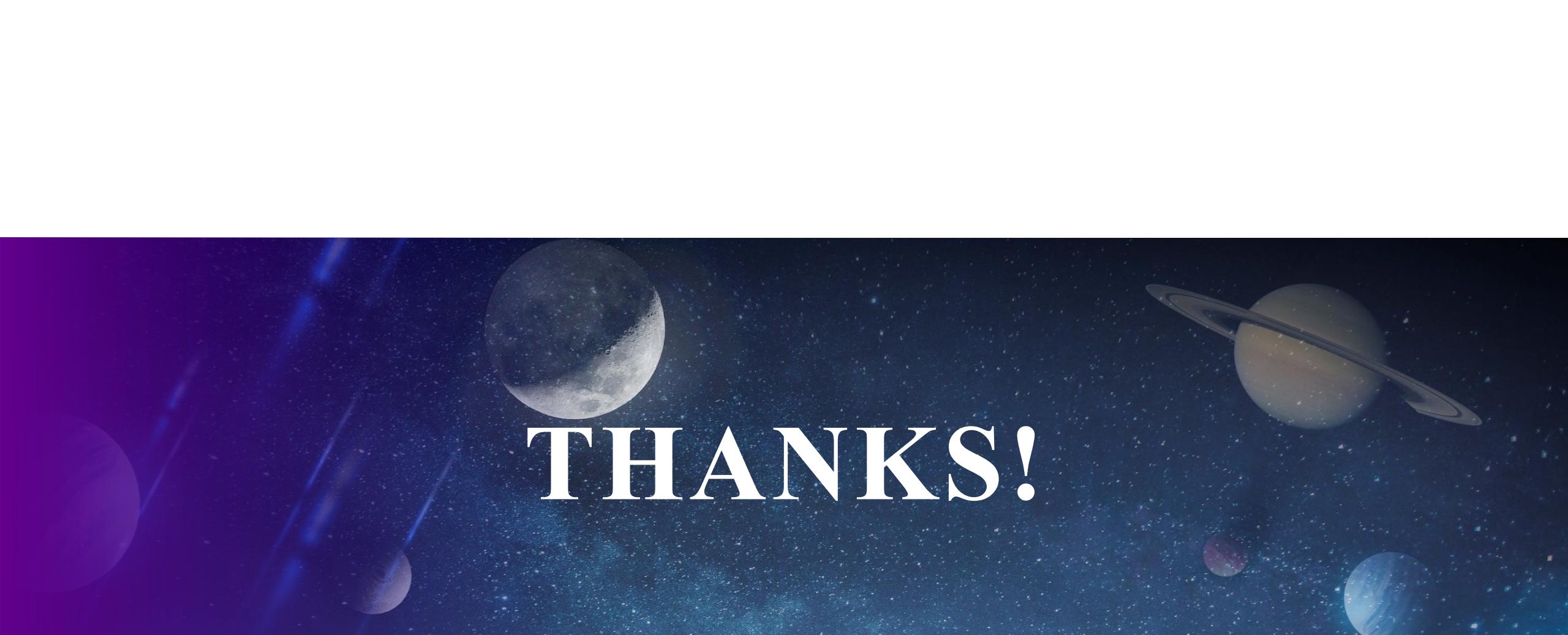


CNSA Action Statements

Discussing global governance
Deepening project cooperation
Sharing scientific achievements
Create a platform for cooperation

Promoting coordination of actions
Promoting innovative development
Encourage diversified participation
Maintaining Human Security





THANKS!