



China National Space Administration



# International Lunar Research Station ILRS

## Guide for Partnership

(V1.0)

June 2021





# Preface

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The vast universe sparks the exploration dream of humankind. As the closest celestial body to the earth, the Moon has always been the most important object for the exploring universe, and is the first step of human's footprint to deep space. With the deepening of exploration, the Moon shows its great potential values in scientific research. Many countries have released their own plans for lunar exploration. International cooperation in the lunar exploration and utilization is of benefit to better promote the well-being and interests of humankind.

Considering the fruitful experience from the People's Republic of China and the Russian Federation in the areas of space technology, space science and space application, China National Space Administration (CNSA) and the State Space Corporation "Roscosmos" (ROSCOSMOS) jointly initiated the International Lunar Research Station (ILRS) based on their each existing lunar exploration plan. Hereafter China and Russia, CNSA and ROSCOSMOS are mentioned in alphabetical order.

The most efficient and productive investigation, exploration and use of the Moon can be achieved only in a broad international partnership with an attraction of other countries, international organizations and international partners (hereinafter referred to as "Partners")

CNSA and ROSCOMOS jointly invite all interested international partners to cooperate and contribute more for the peaceful exploration and use of Moon in the interests of all humankind, adhering to the principles of equality, openness and integrity.

CNSA and ROSCOSMOS provide series of cooperative opportunities for all interested international partners in the phases of the plan, demonstration, design, development, implementation, operation and scientific research of ILRS project. China and Russia welcome international partners to participate in all above phases and all-hierarchy levels of each phase.

The definition, scientific areas, cooperation domain, and collaborative opportunities of ILRS were discussed and approved by China and Russia Joint Working Group (JWG) and are described in this Guide, which is used to facilitate the partners to find the applicable areas and missions to participate in.

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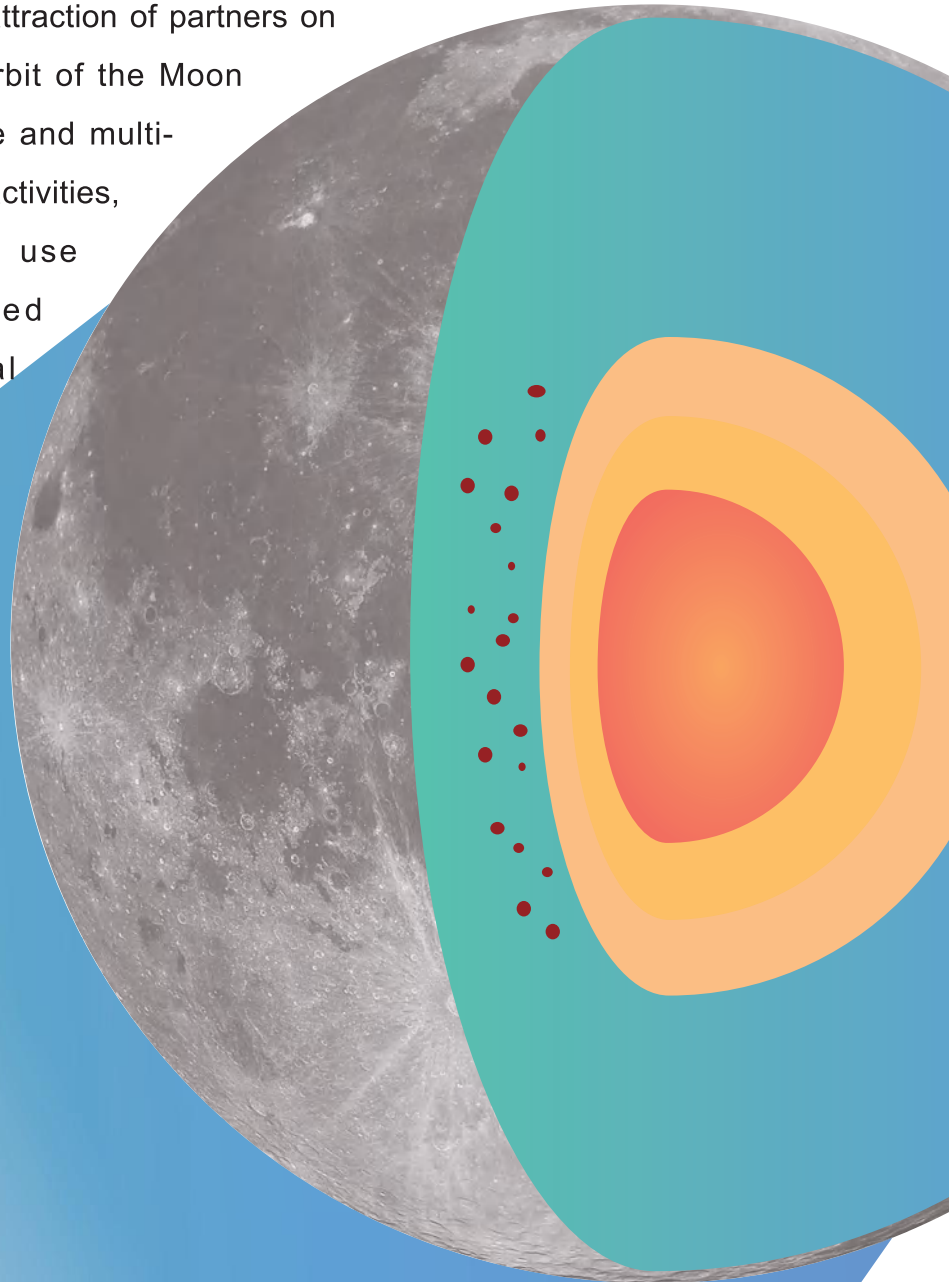
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# 01 ILRS Definition, Composition and Development Phases

## ● Definition of ILRS

ILRS is a complex experimental research facilities to be constructed with a possible attraction of partners on the surface and/or in the orbit of the Moon designed for multi-discipline and multi-purpose scientific research activities, including exploration and use of the Moon, moon-based observation, fundamental research experiments and technology verification, with the capability of long-term unmanned operation with the prospect of subsequent human presence.



## ● Scientific Objectives



**Lunar topography, geomorphology and geological structure**

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**Lunar physics and internal structure**

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**Lunar chemistry (materials and geochronology)**

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**Cis-lunar space environment**

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**Lunar-based astronomical observations**

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**Lunar-based Earth observations**

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**Lunar-based biological and medical experiment**

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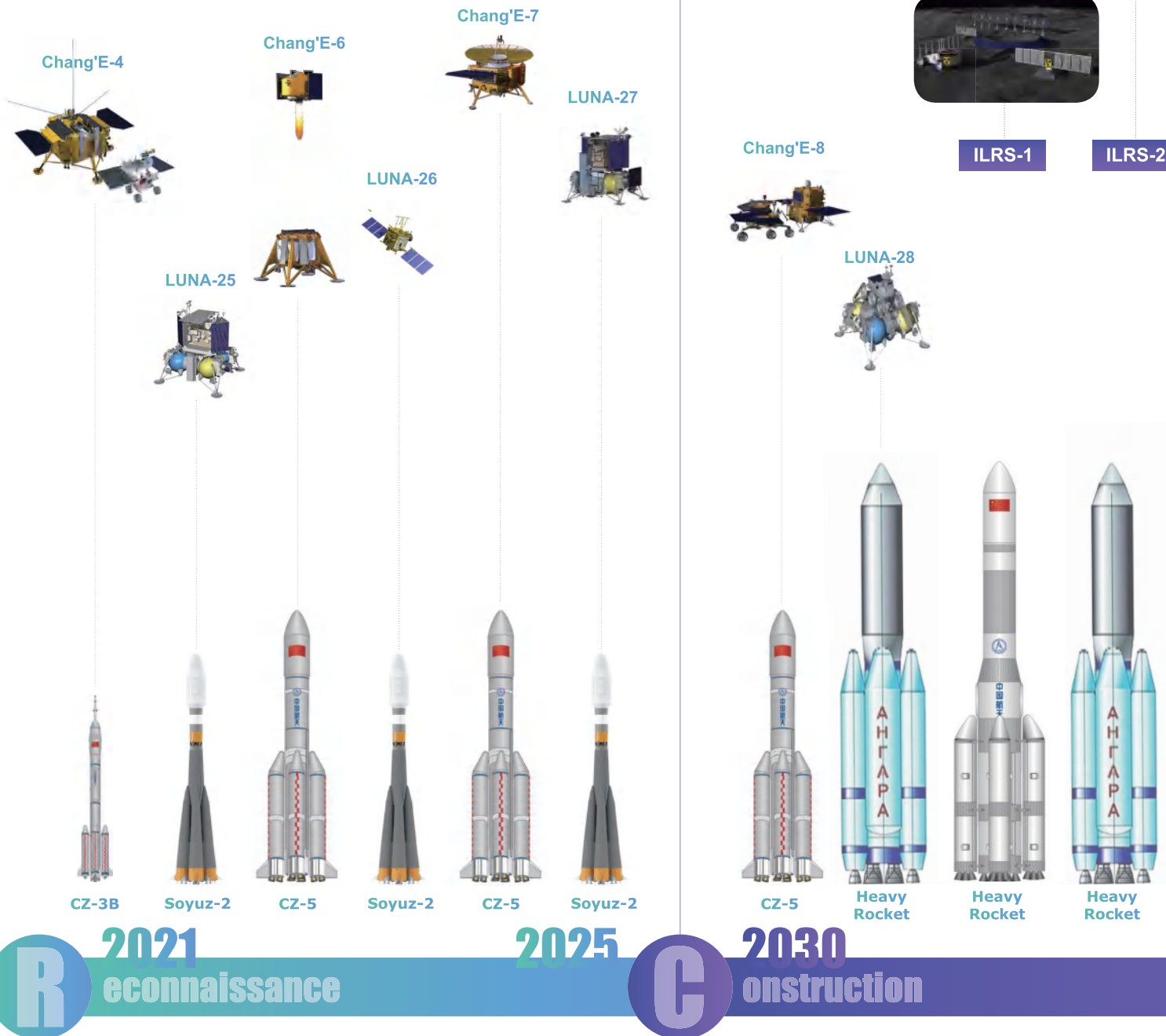
**Lunar resources in-situ utilization**

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# 01 ILRS Definition, Composition and Development Phases

## ● ILRS Development Phases and Mission Profile

The construction of ILRS is carried out in three phases:  
Reconnaissance, Construction, Utilization.



- Objectives:**
- Lunar reconnaissance with the missions, already planned.
  - ILRS design and selection of ILRS site (sites).
  - Technology verification for secure high-precision soft Landing.

Missions planned:

- Chinese CE-4, CE-6, CE-7
- Russian LUNA-25, LUNA-26, LUNA-27
- Potential missions of other partners.

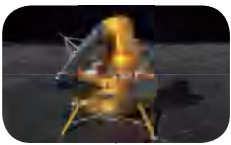
- Objectives:**
- Technology verification for the command center of ILRS.
  - Lunar sample return.
  - Massive-cargo delivery and secure high-precision soft Landing.
  - Start of joint operations.

Missions planned:

- Chinese CE-8.
- Russian LUNA-28.
- Potential missions of other partners.



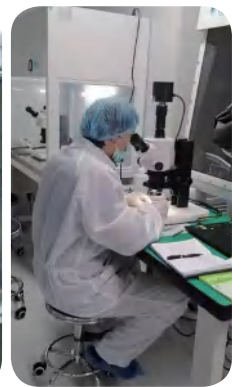
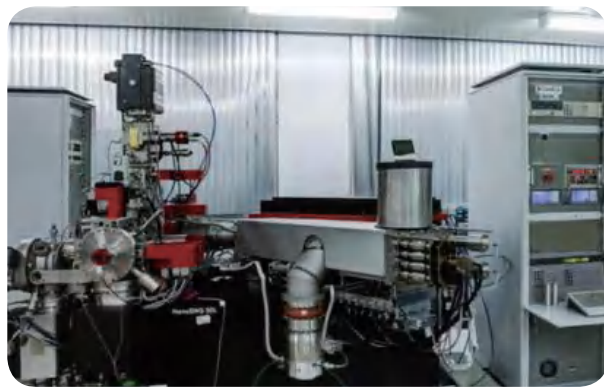
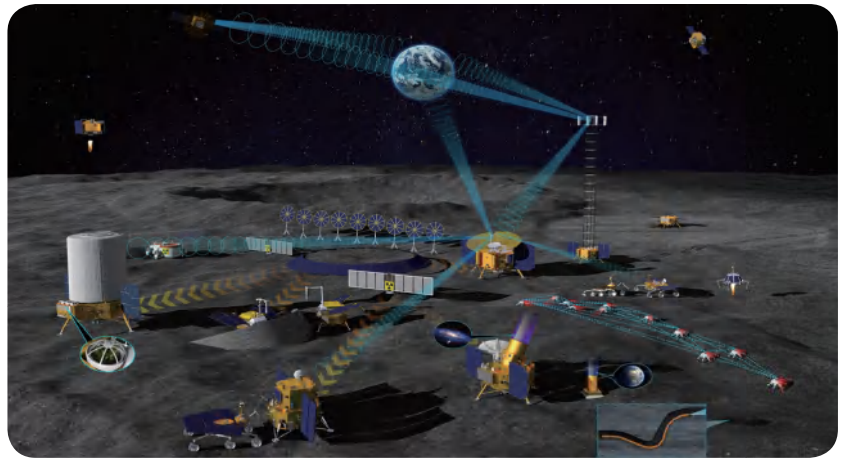
ILRS-4



ILRS-3



ILRS-5



Heavy Rocket



Heavy Rocket



Heavy Rocket



Heavy Rocket

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# Utilization

**Objectives:** Comprehensive establishment of ILRS to complete the in-orbit and surface facilities for energy, communication, transportation services as well as for research, exploration, and verification of in-situ utilization of resources, other potential common technologies.

Missions planned:

ILRS-1, ILRS-2, ILRS-3, ILRS-4, ILRS-5, etc.

**Objectives:** Lunar research and exploration, technology verification, supporting human lunar landing with the completed ILRS. Expanding and maintaining modules as needed.

# 01 ILRS Definition, Composition and Development Phases

## ● Facilities Description

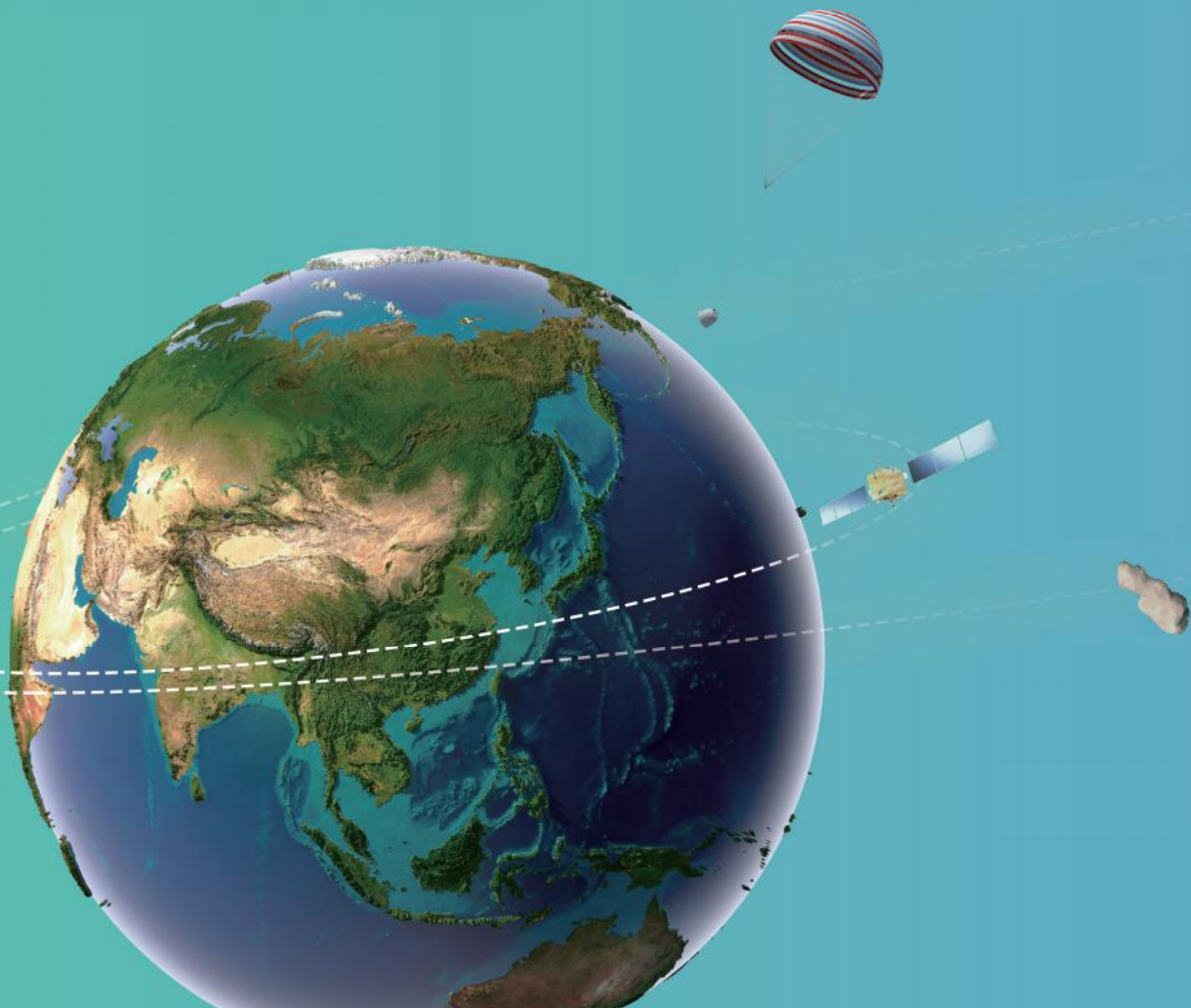
On a top level ILRS consists of Cislunar Transportation Facility, Long-term Support Facility on Lunar Surface, Lunar Transportation and Operation Facility, Scientific Facility, Ground Support and Application Facility, etc.

### 1 Cislunar Transportation Facility

Cislunar Transportation Facility will support cislunar round-trip transfer between the Earth and the Moon, lunar orbiting, soft landing, ascending on lunar surface, and re-entry to the Earth.

### 2 Long-term Support Facility on Lunar Surface

Long-term Support Facility on lunar surface will support command center, global TT&C net, energy supply, thermal management, etc., and various support modules if needed.





### 3 Lunar Transportation and Operation Facility

Lunar Transportation and Operation Facility will support various modules to move or hop on the lunar surface, lava tube exploration, for cargo transportation and operation for the long-term support system and scientific facilities system, such as excavation and sampling.

### 4 Lunar Scientific Facility

Lunar Scientific Facility will support in-orbit and surface scientific experiment, observations, technical verification and deep space exploration.

### 5 Ground Support and Application Facility

Ground Support and Application Facility will support launch, global TT&C support, long-term operating management, Lunar and deep space data center, data exchange and application etc.

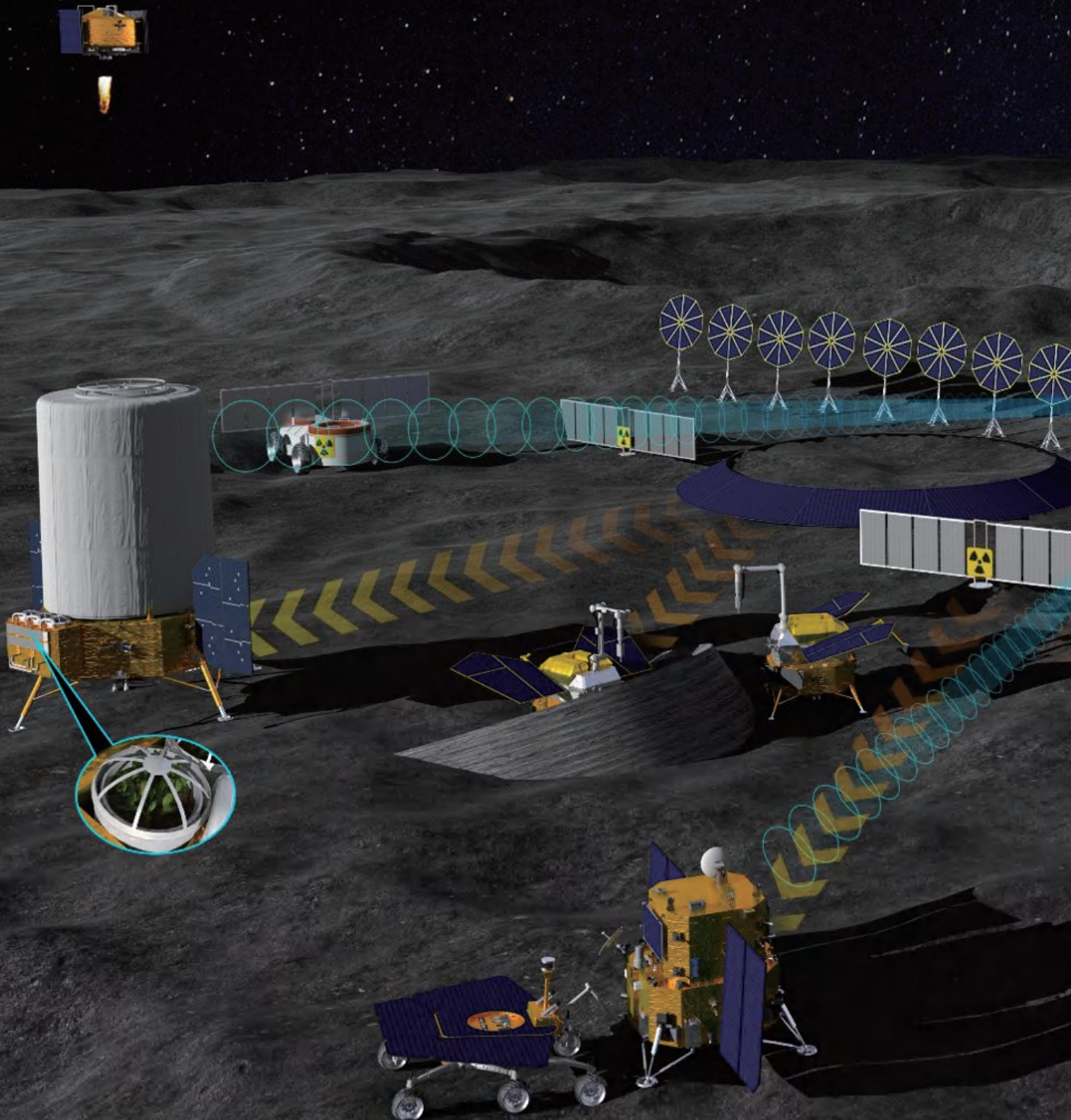


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# ILRS Definition, Composition and Development Phases

## ● Conceptual Design of the ILRS

An envisioned design of ILRS at a certain location (or at one of locations) is in Figure 1.



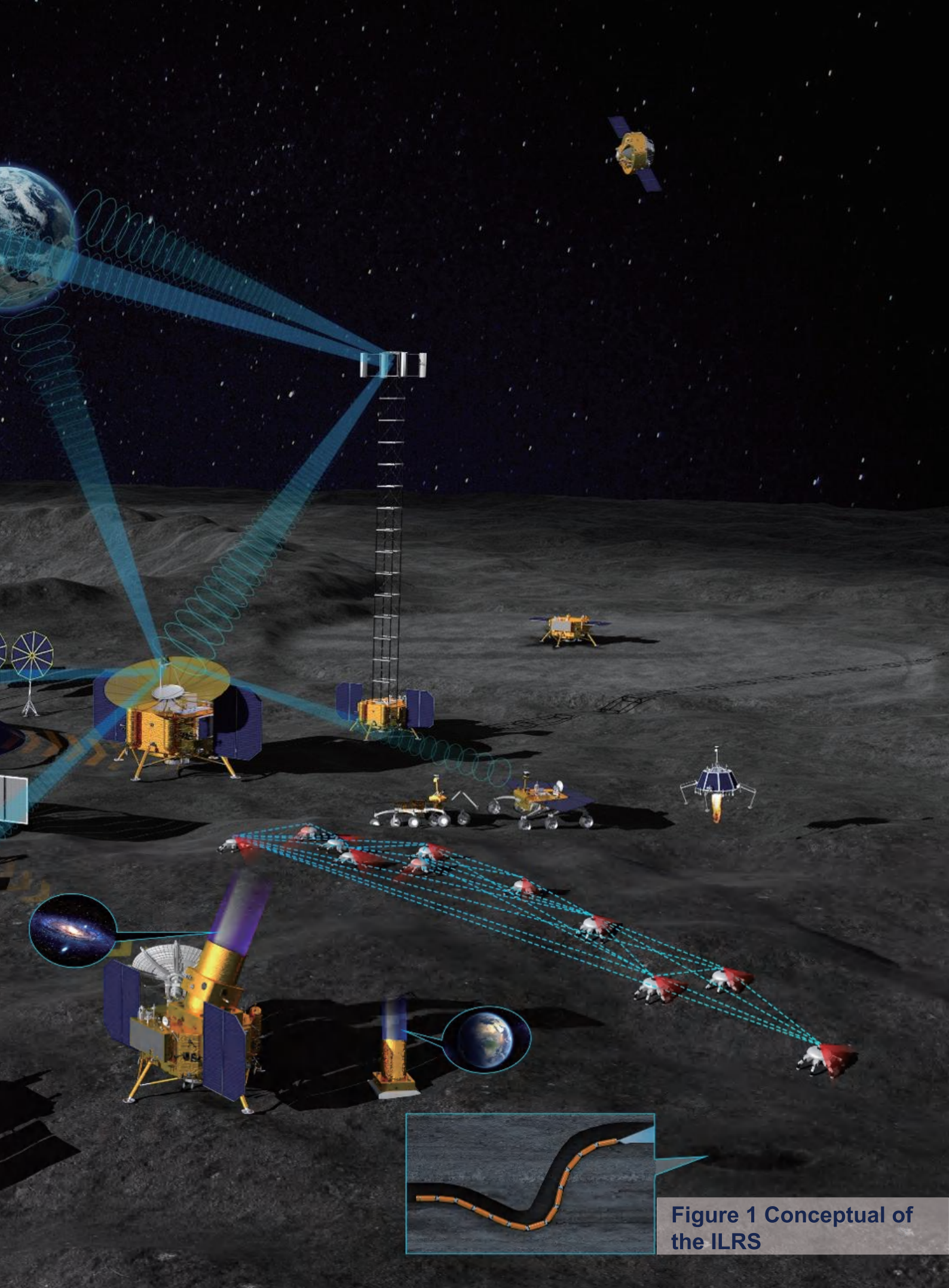


Figure 1 Conceptual of the ILRS

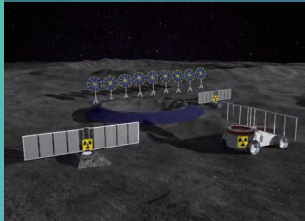
# 01

# ILRS Definition, Composition and Development Phases

## ● Conceptual Design of the ILRS

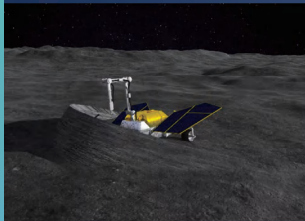
The set of missions of ILRS tentatively includes:

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### ILRS-1 mission

Establishment of command center, basic energy and telecommunication facilities, to satisfy the needs of lunar infrastructure, lunar autonomous operations and long-term research and exploration.



### ILRS-2 mission

Establishment of lunar research and exploration facilities, such as lunar physics, geological profiling, lava tube exploration, lunar sample collection.



### ILRS-3 mission

Establishment of lunar in-situ resource utilization technology verification facilities.



### ILRS-4 mission

Verification of the general technologies for following explorations such as lunar biomedical experiment, distributed sample collection and return.



### ILRS-5 mission

Establishment of lunar-based astronomy and earth observation capabilities.

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## ● Definitions of Mission, System and Equipment

### 1 Space Mission

Mission task is to fulfill a specific ILRS objective using one or several space systems. The examples of space mission are in Table 1.

**Table 1 List of space missions**

S/N	Mission	Responsible
1	CE-4, CE-6, CE-7, CE-8	CNSA
2	LUNA-25, LUNA-26, LUNA-27, LUNA-28	ROSCOSMOS
3	ILRS-1,ILRS-2,ILRS-3,ILRS-4,ILRS-5...	CNSA & ROSCOSMOS & Partners

### 2 Space System

The examples of space system are in Table 2.

**Table 2 List of Space Systems**

Categories	Space system	Responsible
Launch segment	Launch base	CNSA & ROSCOSMOS & Partners
	Flight control/tracking and remote sensing support	CNSA & ROSCOSMOS & Partners
	Long March-5 and heavy launch vehicle	CNSA
	Soyuz-2 and heavy launch vehicle	ROSCOSMOS
	Other launch vehicles	Partners
Space segment	Spacecraft, orbiter, lander, rover, returner, relay satellite, ascender, payload of ILRS-1 to ILRS-5	CNSA & ROSCOSMOS & Partners
Ground segment	Long-term in-orbit operating management, lunar and deep space data center, scientific research and ground application.	CNSA & ROSCOSMOS & Partners

### 3 Subsystem

Subsystem is an integrated set of equipment to fulfill one or several functions of a system, such as structure, electrical power supply, propulsion, attitude control, navigation and payload etc.

### 4 Equipment

Equipment is an integrated set of parts and components for accomplishing a specific function.



# Cooperation Guidelines

## ● Cooperation Domains

- ❖ Strategy development and coordination related to the Moon exploration and use, defining of areas of cooperation and planning including development of the road-map with regard to the exploration and use of the Moon.
- ❖ Joint substantiation of scientific and engineering objectives of ILRS, including configuration and development road-map of ILRS.
- ❖ Joint development of the legal documents regulating relations, including the involvement in cooperation of third parties, in the framework of creation of ILRS.
- ❖ Review of existing standards in the field of launch vehicle and spacecraft technology development and potential definition of future standards that may be used during the creation of ILRS.
- ❖ Coordination of conceptual and preliminary design, modeling, test and validation of ILRS and its component parts.
- ❖ Coordination of scientific and technical research, development and creation including the assembly integration testing of ILRS.
- ❖ Collaboration on launching of the component parts of ILRS, coordination of its operation, management, including ground station support and other activities.
- ❖ Scientific and technical data analysis and sharing in the framework of ILRS in accordance with the legislation of the participants for export control.

## ● Cooperation Classification

All Partners are encouraged to join ILRS project based on their own situation. Any Partner willing to contribute to the ILRS, through a jointly coordinated negotiation with China and Russia, can participate including co-lead status in any part of the project. The objective, plan, interface, standards, interoperability and scientific application of the participating project(s) or missions shall be aligned with general architecture and functions of ILRS.

Based on ILRS's general architecture, functions and road-map, international partners can choose any cooperation categorized with A, B, C, D, E listed as follows.

## 1 Category A. Space Mission Cooperation

Partners will systematically contribute in development of general architecture, scientific objectives, road-map of ILRS, and participate with scientific or engineering missions of ILRS. Another variant is mission coordination of two or more independent space missions to implement specific space objectives. For example, the coordination between CE-7 mission and LUNA-26.

## 2 Category B. Space System Cooperation

Partners will develop in cooperation with China and/or Russia at least one or several space systems based on the ILRS general architecture and functions.

Examples are:

ILRS's power system, which consists of space nuclear power source and solar power arrays can be developed through the cooperation of China, Russia and the third party.

One partner may contribute a launcher to deliver the spacecraft provided by another partner for a space mission.

Piggyback of probe system: to deliver an independent probe system from one partner by ride-sharing with another partner's space mission. Such as a lunar rover can be carried by CE-7 mission as a piggyback.

System cooperation can be divided into three sub-categories:

**Sub-Category B1:** Partners will develop at least one system of ILRS.

**Sub-Category B2:** Partners will participate in the missions led by CNSA, such as CE-4, CE-6, CE-7, CE-8. In this occasion, CNSA is responsible to discuss the cooperation with the participants.

**Sub-Category B3:** Partners will participate in the missions led by ROSCOSMOS, such as LUNA-25, LUNA-26, LUNA-27 and LUNA-28. In this occasion, ROSCOSMOS is responsible to discuss the cooperation with participants.

## 3 Category C. Subsystem Cooperation

Partners will develop at least one or sets of space subsystems based on the defined space mission and space system of ILRS. For example, payload of a spacecraft can be jointly developed by two or more partners.

The responsible party of the space system is in a position to discuss the cooperation with the partners.

## 4 Category D. Equipment Cooperation

Partners will supply one or sets of equipment according to defined space missions or subsystems of ILRS. Piggyback of scientific instrument for a payload subsystem is an example.

The responsible party of the space subsystem is in a position to discuss the cooperation with the partners.

## 5 Category E. Ground and Application Cooperation

Partners will cooperate on ground segment, in-orbit operation and maintenance, construction of the joint data center, data analysis and applications.

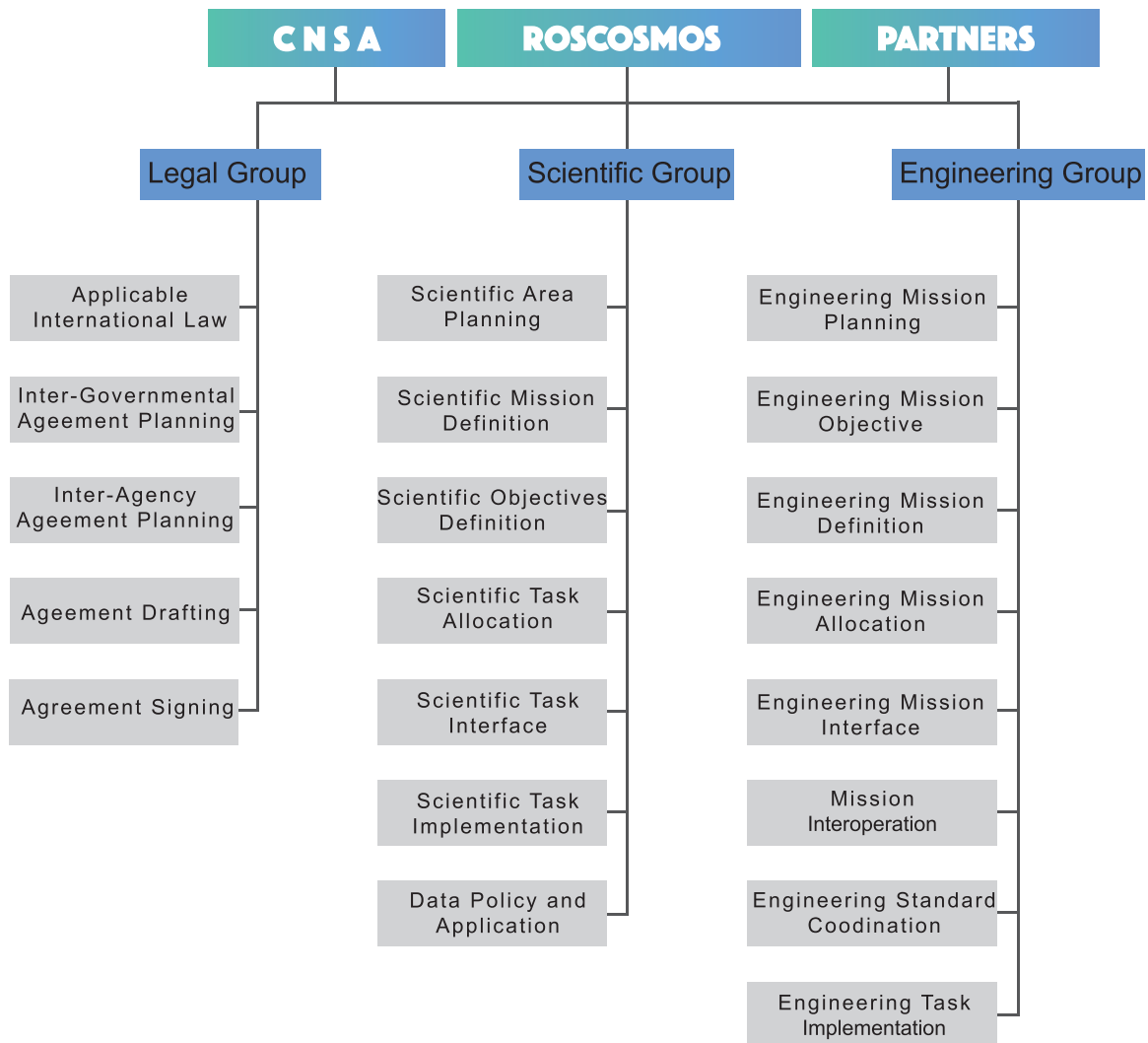


# Cooperation Guidelines

## ● Cooperation Organization

The inter-agency JWG of ILRS was established. Currently, the JWG consists of space agencies from China and Russia, under which the subgroups for legal affairs, science and engineering are operative as per their each functions. The organization structure of the JWG is illustrated in Fig.2.

Fig.2 ILRS Organization Structure





# Proposals of Cooperation Opportunity

Any country or international organization is welcome to cooperate on the levels of space mission, system, subsystem, equipment, and ground application according to the general architecture, function, scientific area and roadmap of ILRS. The proposed cooperation opportunities are listed in Table 3 to Table 6.

**Table 3 Opportunities for CNSA Missions**

Mission	CE-4	CE-6	CE-7	CE-8
Cat. A	Closed	Closed	Mission coordination*	Mission coordination
Cat. B	Closed	Closed	Piggyback of probe system	Piggyback of probe system
Cat. C	Closed	Closed	Joint development	Joint development
Cat. D	Closed	Closed	Piggyback of scientific instrument/ equipment supply	Piggyback of scientific instrument/ equipment supply
Cat. E	Data analysis &sharing	Data analysis &sharing	Data analysis &sharing	Data analysis &sharing

\*CE-7 and LUNA-26 cooperate on mission level.

**Table 4 Opportunities for ROSCOSMOS Missions**

Mission	LUNA-25	LUNA-26	LUNA-27	LUNA-28
Cat. A	Closed	Closed*	Closed	Mission coordination
Cat. B	Closed	Closed	Closed	Piggyback of probe system
Cat. C	Closed	Closed	Closed	Joint development
Cat. D	Closed	Piggyback of scientific instrument	Closed	Piggyback of scientific instrument
Cat. E	Data analysis &sharing	Data analysis &sharing	Data analysis &sharing	Data analysis &sharing

\* LUNA-26 and CE-7 cooperate on mission level.



# Proposals of Cooperation Opportunity

**Table 5 Opportunities for Future Missions by China, Russia and Partners**

Mission	ILRS-1	ILRS-2	ILRS-3	ILRS-4	ILRS-5
Cat. A	Mission coordination and/or joint development	Mission coordination and/or joint development	Mission coordination and/or joint development	Mission coordination and/or joint development	Mission coordination and/or joint development
Cat. B	System cooperation and/or joint development	System cooperation and/or joint development	System cooperation and/or joint development	System cooperation and/or joint development	System cooperation and/or joint development
Cat. C	Joint development	Joint development	Joint development	Joint development	Joint development
Cat. D	Joint development	Joint development	Joint development	Joint development	Joint development
Cat. E	Data analysis & sharing	Data analysis & sharing	Data analysis & sharing	Data analysis & sharing	Data analysis & sharing

**Table 6 Contacts for Missions**

Missions	Contacts
CE-4, CE-6, CE-7, CE-8	Ms. Jiang Hui, Division Director, Department of International Cooperation, CNSA Tel.: +8610 88581203, E-mail: jiangh@cnsa.gov.cn
LUNA-25, LUNA-26, LUNA-27, LUNA-28	Ms. Marina Kuzmina, Division Head, Department of International Cooperation, ROSCOSMOS Tel.: +7495 6319000 ext. 3314, E-mail: Kuzmina.MA@Roscosmos.ru
ILRS-1, ILRS-2, ILRS-3, ILRS-4, ILRS-5	Ms. Marina Kuzmina, Division Head, Department of International Cooperation, ROSCOSMOS Tel.: +7495 6319000 ext. 3314, E-mail: Kuzmina.MA@Roscosmos.ru and Ms. Jiang Hui, Division Director, Department of International Cooperation, CNSA Tel.: +8610 88581203, E-mail: jiangh@cnsa.gov.cn

