



The Latest Progress, Future Planning and International Cooperation of **China's Human Space Program**

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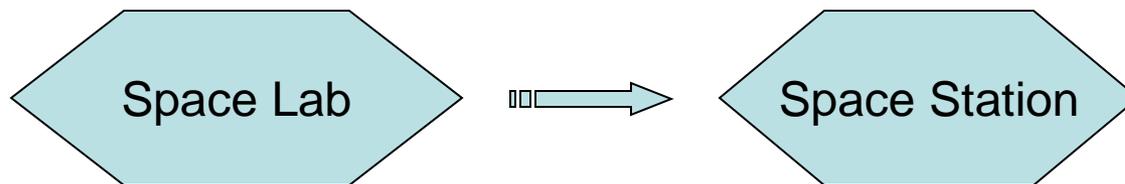
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- Future Planning of Chinese Space Station
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Part I. Recent Progress of Space Laboratory Missions

In September 2010, Chinese government approved China Space Station project.



Two phases for implementation



Objectives of Phase “Space Lab”

- Verify key technologies in
 - ◆ cargo transportation
 - ◆ accommodation of mid-term stay of astronauts
 - ◆ on-orbit propellant re-supply
 - ◆ ground-based mission long-term support
- Carry out space experiments and applications
- Accumulate experience for constructing Space Station.



TG-1 Space Lab



TG-2 Space Lab



Conducted Missions for Phase “Space Lab”

- Maiden flight of LM-7 rocket in June 2016
- Launch of Tiangong-2 Space Lab in September 2016
- Launch of Shenzhou-11 manned spacecraft in October 2016
- Launch of Tianzhou-1 cargo spacecraft in April 2017



1. The Maiden Flight of Long March-7 Rocket

- On 25 June 2016, China conducted the maiden launch of the Long March 7 (CZ-7) rocket;
- The launch also involved the inauguration of the newly built Launch Site.





- Medium-lift launch vehicle.
- Two stages and four boosters.
- Engines running kerosene and liquid oxygen.
- Length: 53.1 meters.
- Takeoff mass: 597 tons.
- Capable of orbiting 13.5 tons into a LEO.
- Used for orbiting cargo vehicles for the construction and operation of China's space station.





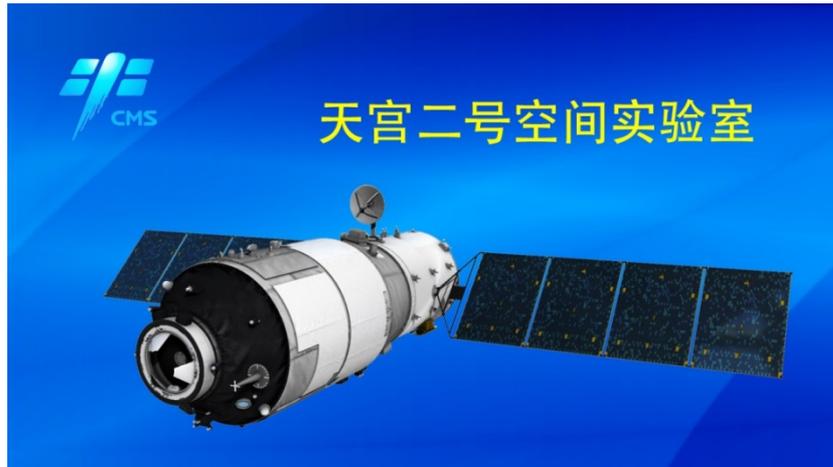
Results of the LM-7 Flight

- Verified the design correctness and technical specification of the rocket
- Tested the launching capability of the launch site system, and coordination with other systems.
- Examined the compatibility among engineering systems related.
- In addition, the multipurpose spaceship verified other key technologies.





2. TG-2 Space Flight Mission



Length: 10.4m

Max diameter: 3.35m

Width of solar arrays' deployment :
8.4m

Lifetime: ≥ 2 years

Support 3 astronauts's 60 days stay
with Shenzhou Space ship; support
propellant refueling.

China's first space laboratory, carrying a number of science and application payloads.

Covers micro-gravity basic physics, space astronomical observation, space life science, space materials science and other disciplinary fields.

2 International projects: project POLAR(CMSA-ESA), CADIO space(CMSA-CNES).



- At 22:04, 15 September 2016 Beijing time, TG-2 Space Lab was launched atop CZ-2F carrier rocket at China Jiuquan Satellite Launch Center.
- After orbital maneuver, TG-2 entered into 380km orbit and then underwent the on-orbit test.



- TG-2 was running normally and waiting for the visit of Shenzhou-11 manned spaceship.



3. ShenZhou 11 manned flight mission

Launch time and place:

October 17, 2016, Jiuquan Satellite Launch Center

Astronaut crew:

Mr. Jing Haipeng (3rd mission in career)

Mr. Chen Dong (1st mission)

Mission duration:

33 Days

Return:

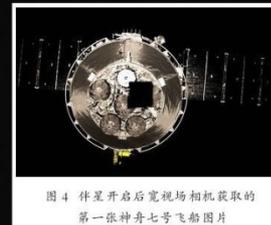
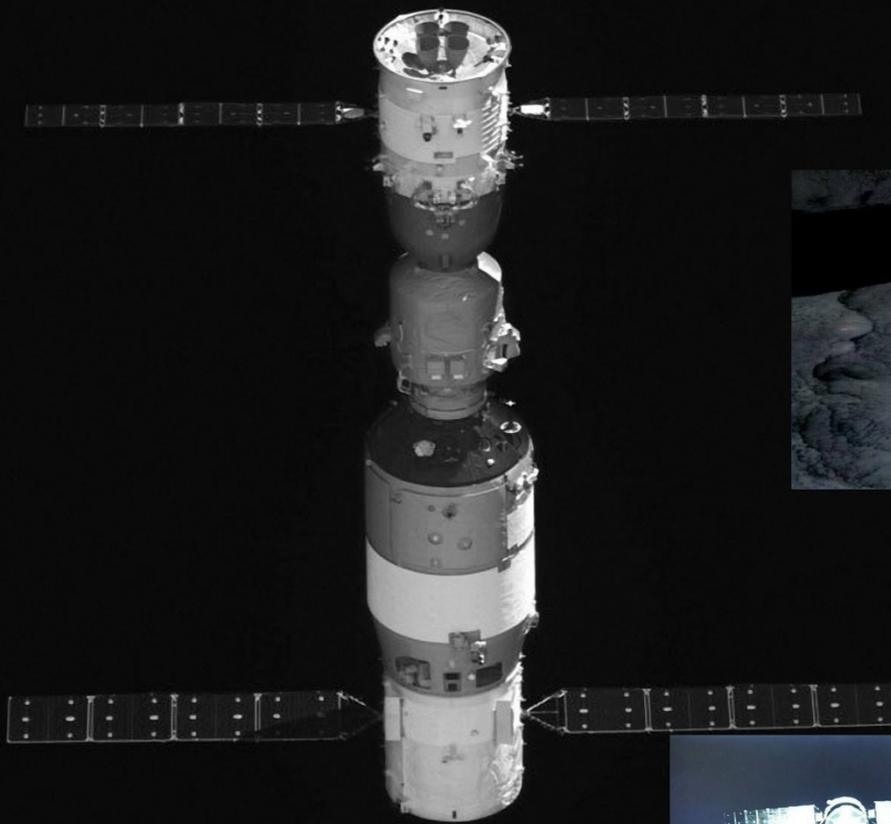
November 18, 2016, in Inner Mongolia Province, China





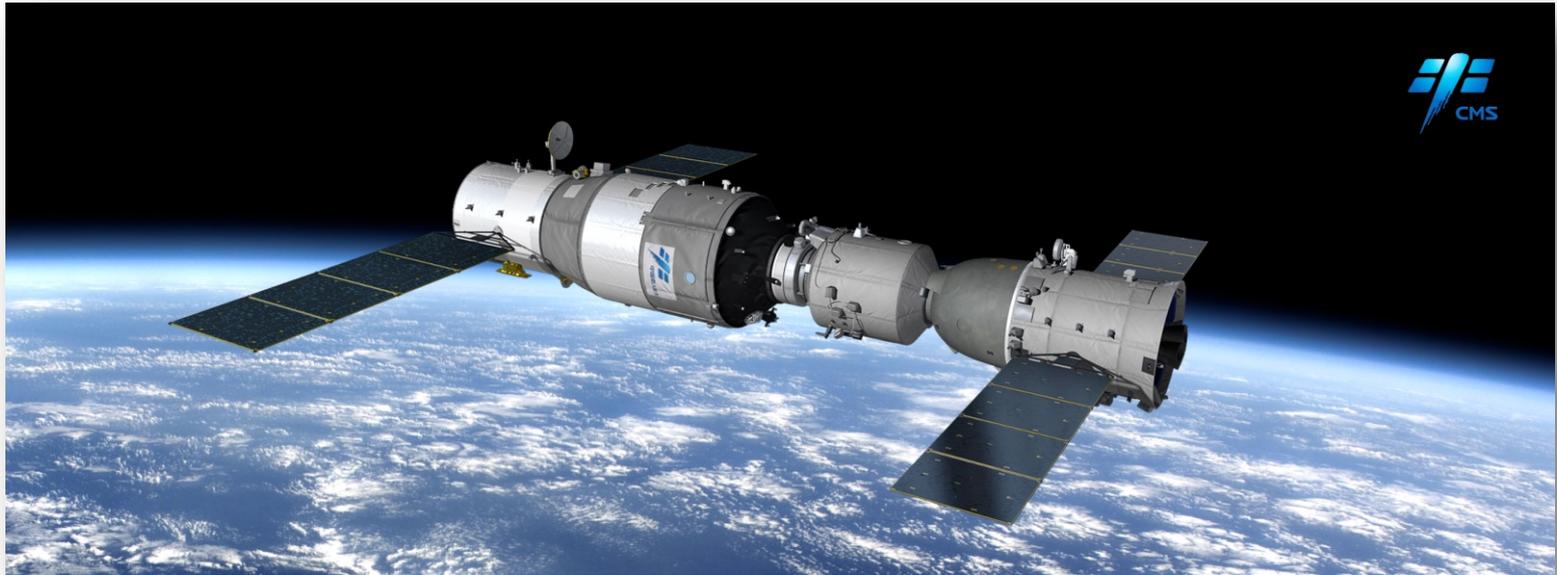
Image taken by accompany satellite

天宫二号伴星可见光相机拍摄组合体



距离：419米
分辨率：10.5毫米
太阳高度角：74.749度
拍摄时间：2016年10月23日7时42分39秒

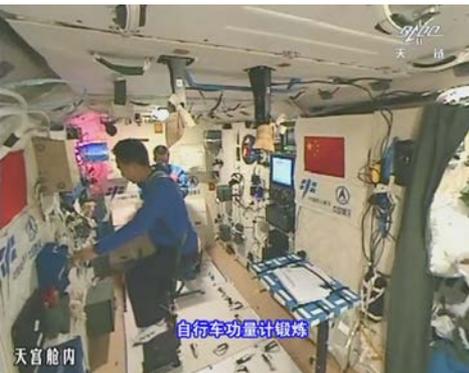
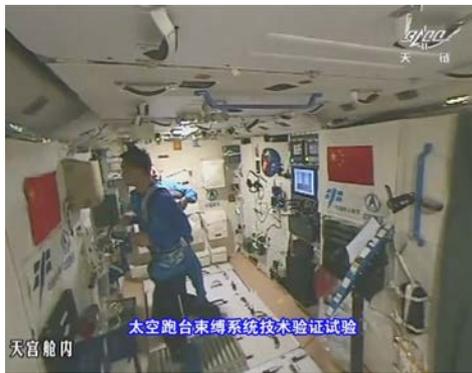
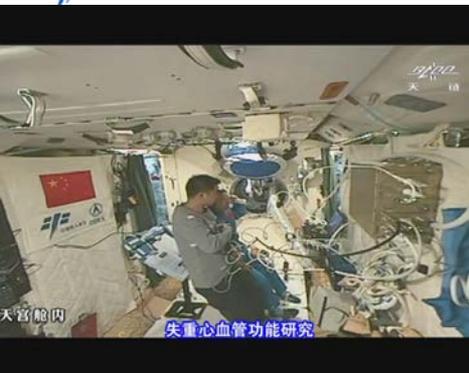




42 on-orbit experiments conducted in TianGong-2 and ShenZhou 11 mission.
Wealth of experimental data and important results achieved.

- Space science and application.
- Space medicine experiment.
- Educational science projects.
-







4. TianZhou-1 flight mission

Tianzhou-1 Cargo spaceship

Two modules: cargo module (fully sealed state) and propelling module

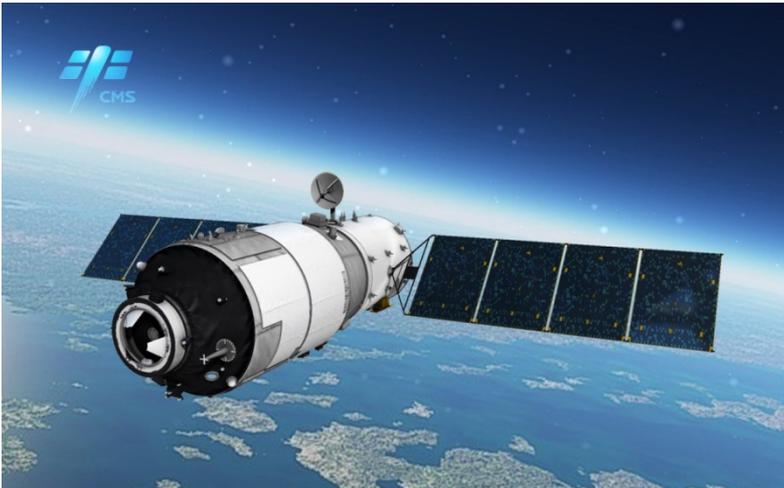
Length: 10.6m

Max diameter: 3.35m

Width of solar arrays' deployment : 14.9m

Launch weight:13 t

Mass of cargo:6 t





Launch time and place:

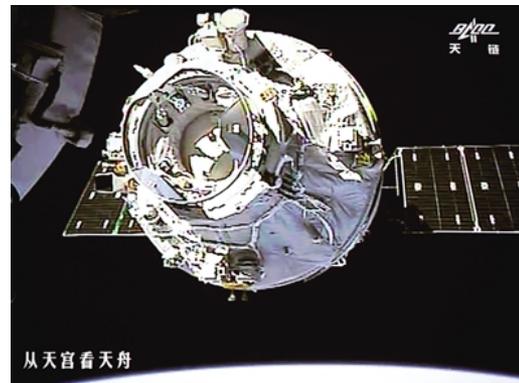
April 20, 2017, Wenchang Space Launch Site

1st Docking:

April 22 2017

Main objectives:

Propellant refueling, scientific experiments and technical tests, autonomic fast rendezvous and other series of expansion tests.

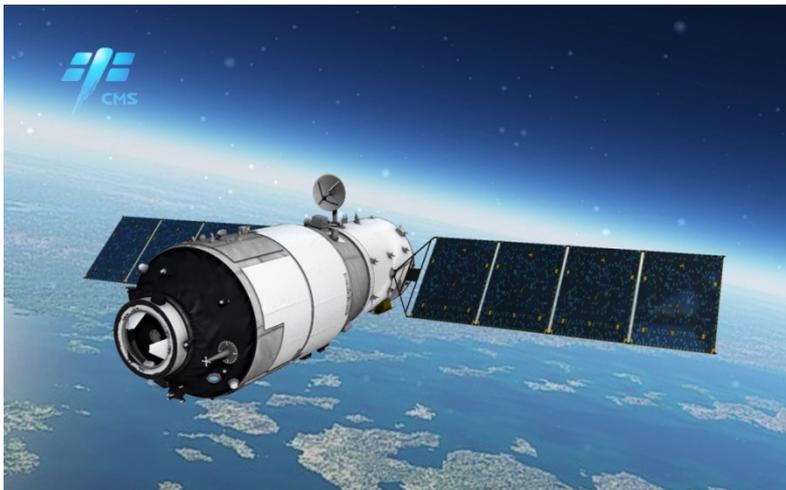




Future schedule

The combination of Tianzhou-1 and the Tiangong-2 continue to fly to late June; later two spacecraft will independently fly.

During this period, space science experiments and technical tests will be carried out and as appropriate to carry out fly around, autonomic fast rendezvous and other series of expansion tests.





Results of space laboratory missions

- ◆ Mastered the astronauts mid-term on orbit staying guarantee technology, formed a complete and effective astronaut selection and training system.
- ◆ The Manned earth-to-orbit transportation system successfully completed the second application of flight, and passed an evaluation of rendezvous and docking on orbit of space station, the assembly runs and return.
- ◆ The first flight test of the space station cargo transport system achieved complete success, laid the foundation for the supply for the space station operation.
- ◆ The success of operating the first space laboratory accumulated for us manned mid-term space flight life supports and guarantee, experience of implementation of large scale space science and application.

The above results mark the second step strategic objectives of China manned space program have been fully realized, Space laboratory missions have completed success, the program has been fully transferred to the space station development and construction stage.



Part II. The future planning of Chinese space station

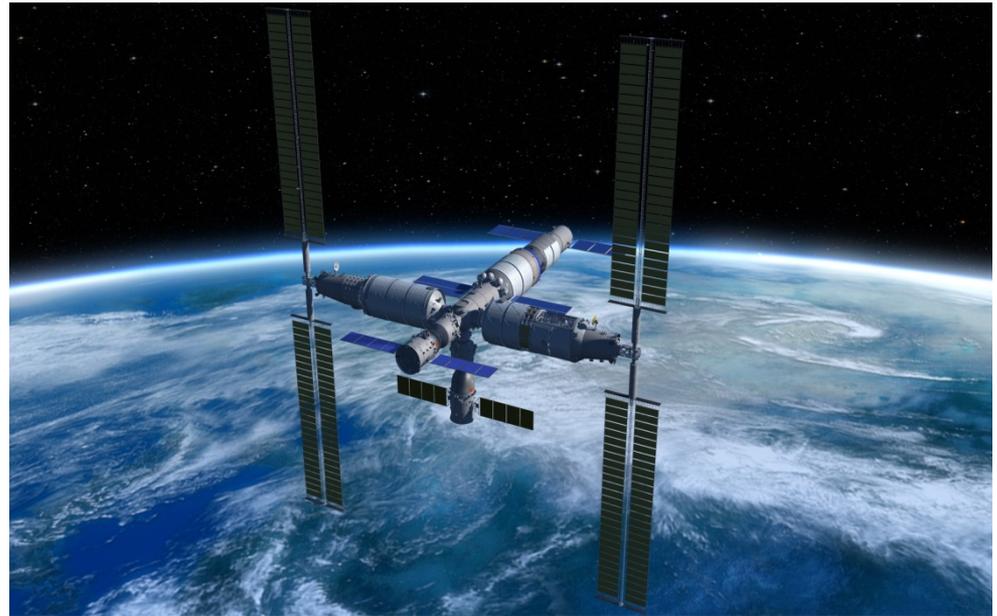




◆ Space Station

Basic Configuration

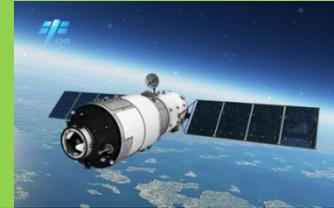
- Modules:** 3, T Shape
- Inclination:** $41^{\circ} \sim 43^{\circ}$;
- Altitude:** 340~450 km;
- Lifetime:** more than 10 years;
- Crew members:** 3, Maximum 6 during rotation
- Module segment launched in Wenchang launch site





■ Cargo transportation

- Pressurized, semi-pressurized, unpressurized
- Transport airtight cargo, large extravehicular payloads, experiment platform
- To be launched by CZ-7
- At China Wenchang Space Launch Site



■ Crew transportation

- Shenzhou (SZ) Spaceship
- CZ-2F launch vehicle
- Crew members: 3
- Crew rotation: up to 6 months
- Launch site: Jiuquan



■ Station modules

- To be launched by the CZ-5B
- At China Wenchang Space Launch Site.
- Complete construction in 2022





Space Science Experiments

The three modules of CSS will be featured with advanced technologies and equipped with multi-purpose facilities in international standards for space science.

Space life sciences and biotechnology

- Ecology Science Experiment Rack (ESER)
- Biotechnology Experiment Rack (BER)
- Science Glove-box and Refrigerator Rack (SGRR)

Microgravity fluid physics & combustion

- Fluids Physics Experiment Rack (FPER)
- Two-phase System Experiment Rack (TSER)
- Combustion Experiment Rack (CER)

Material science in space

- Material Furnace Experiment Rack (MFER)
- Container-less Material Experiment Rack (CMER)

Fundamental Physics in Microgravity

- Cold Atom Experiment Rack (CAER)
- High-precision Time-Frequency Rack (HTFR)

Multipurpose Facilities

- High Micro-gravity Level Rack (HMGR)
- Varying-Gravity Experiment Rack (VGER)
- Modularized Experiment Rack (RACK)



Part III: International Cooperation

Previous Cooperation

- Principle:

- ✓Peaceful use of outer space,
- ✓Equality and mutual benefit,
- ✓Joint development

- Countries and organizations

- ✓Russia, Germany, France, Italy.....
- ✓United Nations, Office for Outer Space Affairs
- ✓European Space Agency
- ✓IAF, IAA



International Cooperation concerning Utilization of China Space Station

Principles:

- Peaceful use of outer space
- Equality and mutual benefit
- Joint development

Cooperation areas

- Collaborative development of devices, components, subsystems, modules
- Space science experiments and utilization onboard Station
- Astronaut selection / training / flight
- Spinoff of human space technology

UN Member States

Human Space Technology Initiative (HSTI)

UNITED NATIONS
Office for Outer Space Affairs



Others



Part IV. Cooperation with UNOOSA

Framework Agreement

to the date of termination under this Agreement or legal instrument executed pursuant to this Agreement.

This Agreement shall enter into force upon signature.

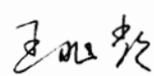
IN WITNESS WHEREOF, the duly authorized representatives of the Parties affix their signatures on the present Agreement in the English language in two originals.

Done at Vienna, Austria this 31 March of 2016
(place) (day / month) (year)

For the United Nations

For the China Manned Space Agency


.....
Ms. Simonetta Di Pippo
Director
Office for Outer Space Affairs
United Nations Office at Vienna



.....
Mr. WANG Zhaoyao
Director General
China Manned Space Agency

Funding Agreement

Article XIII

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have signed the present Agreement in the English language in two originals.

DONE at Vienna, Austria this 31 March of 2016
(place) (day / month) (year)

For the United Nations

For the China Manned Space Agency


.....
Ms. Simonetta Di Pippo
Director
Office for Outer Space Affairs
United Nations Office at Vienna



.....
Mr. WANG Zhaoyao
Director General
China Manned Space Agency



Objectives of the Cooperation

- Under the Agreements, CMSA will provide opportunities to use infrastructures and resources of China's Space Station, and funding support to UNOOSA.
- Both parties will work together for the following purposes:
 - To continue implementing the Human Space Technology Initiative (HSTI);
 - To provide opportunities for Member States to conduct space experiments on board China's Space Station;
 - To provide opportunities for Member States to fly their astronauts/payload experts on board China's Space Station.

**Contribute
China's Space Station to ...**





Over-arching Cooperation Areas

1. Promoting international cooperation in human space flight and activities related to space exploration;
2. Promoting increased awareness among United Nations Member States of the benefits of utilizing human space technology and its applications;
3. Providing flight experiment and space application opportunities on board China's space station for scientists from around the world;
4. Providing flight opportunities for astronauts and/or payload engineers from other countries to conduct hands-on experiments on-board China's Space Station;
5. Promoting capacity building activities by making use of human space technologies, including facilities and resources from China's manned space programme.



Cooperation Mechanism

- CMSA and UNOOSA will work closely to define procedures for the cooperation. The basic procedures would be:
 - UNOOSA, in cooperation with CMSA, to publicise **Announcement of Opportunity (AO)**;
 - UNOOSA to **solicit proposals** from scientists all over the world;
 - International Selection Committees, to **select projects**;
 - **Bilateral agreements** between the selected partners and CMSA/Chinese counterparts to be signed for implementation;
 - UNOOSA to provide opportunities such as workshops and expert meetings for partners to **exchange progresses**.
- "China Space Station Manual" and "Space science experimental resource information of China Space Station" technical documents will be published in the 3rd quarter of 2017.



Conclusion



- CMSA is also considering further and long-term development in human space exploration after the forthcoming accomplishment of the present three-step strategy
- It is certain that China will never halt its footsteps in human space exploration and will continue to explore the vast space, deeper and further!



***Thank you for
attentions!***

