China Manned Space Programme Achievements and future Developments

Mr. HAO Chun

Director
Scientific and Planning Division
China Manned Space Agency

chao_chun@cmse.gov.cn

March. 2016

The United Nations/Costa Rica Workshop on Human Space Technology

Content

- Introduction
- Achievements up to date
- Chinese Space Station and its latest development
- International cooperation

Part I: Introduction

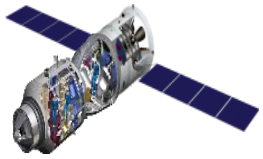
- 1992

Chinese government decided to implement manned space program following the “three-step” strategy.

Three-step strategy of China Manned Space Programme

3rd step: To construct Chinese space station to accommodate long-term man-tended utilization on a large scale

The 2nd step: To launch space labs to make technological breakthrough in EVA, R&D, and accommodation of long-term man-tended utilization on a modest scale

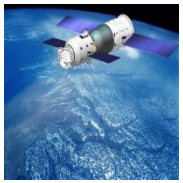


The 1st step: To launch manned spaceships to master basic human space technology

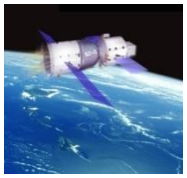
Part II: Achievements up to date

- Unmanned spaceflight missions
  - SZ-1, 20 Nov 1999, 1st unmanned spaceflight
  - SZ-2, 10 Jan 2001, 2nd unmanned spaceflight
  - SZ-3, 25 Mar 2002, 3rd unmanned spaceflight
  - SZ-4, 30 Dec 2002, 4th unmanned spaceflight

SZ-1

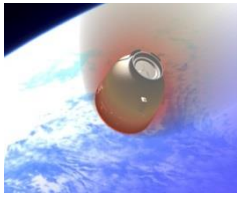


SZ-2



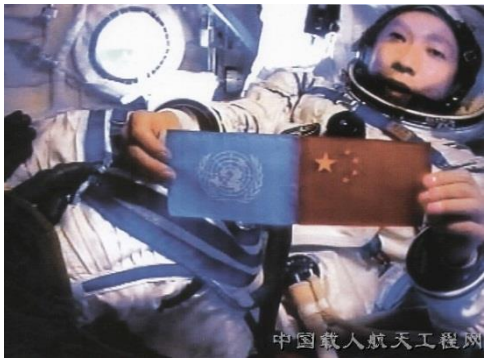
SZ-3

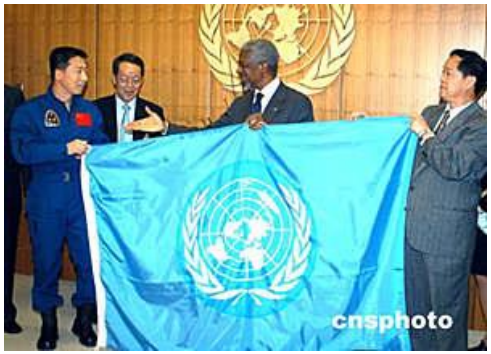
SZ-4



- Achieved goals:
  - Laying a solid foundation for manned missions

- Manned spaceflight missions – **Basic Human Spaceflights**



Shenzhou-5, 2003, 1st manned spaceflight mission


Shenzhou-6, 2005, 1st multiple-crew and multiple-day spaceflight mission

- Achieved goals:
  - Fulfilled the task of the 1st step of the three-step strategy

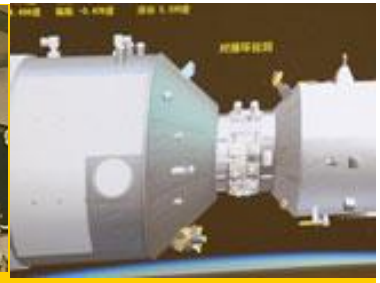
- Manned spaceflight missions – **Space Walk**

Shenzhou-7, 2008, 1st Extravehicular Activity (EVA)

- Manned spaceflight missions – **Rendezvous & Docking**

2011, TG-1 Space Lab

2011, SZ-8 docking with TG-1



2012, SZ-9 docking with TG-1,
1st Chinese Female Astronaut,
LIU Yang

2013, SZ-10 docking with TG-1,
2nd Chinese Female Astronaut,
WANG Yaping, Space class

6 Rendezvous and Docking Missions in total

China Manned Space Agency (CMSA)

YANG Liwei

SZ-5, 15 Oct 2003

FEI Junlong

NIE Haisheng

SZ-6, 12 Oct 2005

ZHAI Zhigang

LIU Boming

JING Haipeng

SZ-7, EVA, 25 Sep 2008

JING Haipeng

LIU Yang

LIU Wang

SZ-9, Manual RVD with TG-1 , 16 Jun 2012

NIE Haisheng,

WANG Yaping

ZHANG Xiaoguang

SZ-10, Manual RVD with TG-1, 11 Jun 2013

So far, China has carried out 11 spaceflight missions in total, 5 of which were manned missions, sending 10 Chinese astronauts into space and returning them safely.

Part III: The future developments

In September 2010, Chinese government approved its space station project.

Objectives: Finish building China space station around 2020, mastering long term human spaceflight technology independently, acquiring the abilities of long term man tender space science and technology test and exploit the space resources comprehensively.

Two phases to implement China space station project

- China's manned space programme has comprehensively entered into the stage of Space Station construction. The construction is well under way following the two-phase plan:
  - **Phase 1: Space Lab**
  - **Phase 2: Space Station**

◆Space lab

- **Mission objectives：**

•testify the key technologies in cargo transportation, on-orbit propellant re-supply, long-term stay of astronauts in space, and space science and applications in larger scale.

✓T G-2 space lab, CZ-7 launch vehicle, and cargo spaceship are being developed;

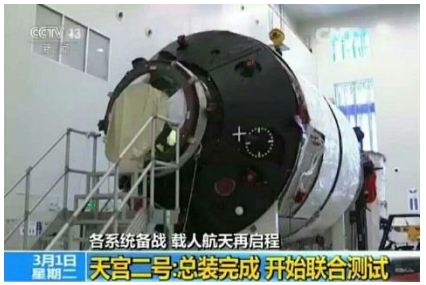
✓Wenchang Launch Site in Hainan was established.

✓Four space flight missions have been planned.

◆Space lab

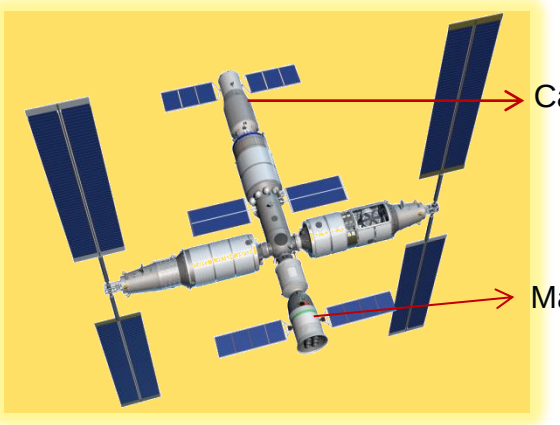
– Mission plan:

- 3rd quarter 2016, launch TG-2 space lab ;
- 4th quarter 2016, launch SZ-11 spaceship to dock with TG-2. Two crew members will stay in space for medium term ;
- 1st half 2017, TZ-1 cargo spaceship to test on-orbit propellant re-supply technology;
- before the above missions, CZ-7 test-flight mission will be carried out.



Space Station

- Design specification
  - Modules: 3
  - Inclination: 42° ~ 43°
  - Altitude: 340~450 km
  - Lifetime: ≥10 years
  - Crew members: 3, Maximum 6



- Core module
  - Control and manage the complex
  - Provide accommodation and working place for astronauts

- Experiment module I and II
  - Space science experiments
  - Space applications
  - Space technology demonstration

Station Expansion Capability

- According to future requirements for utilization and international cooperation, newly built modules can be added, and aboard payloads can be exchanged.

- Station modules
  - To be launched by the CZ-5B
  - At Hainan Space Launch Site.

- Cargo transportation
  - Pressurized, semi-pressurized, un-presurrized
  - To transport airtight cargo, large extravehicular payloads, experiment platform
  - To be launched by CZ-7
  - At Hainan Space Launch Site

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

China Space Station (CSS) construction plan

- The Testing Core Module is scheduled to be launched in 2018, several manned spaceships and cargo spaceship will be launched to visit the Testing Core Module, conducting key technique tests such as on-orbit assembly, EVA, long-term manned flight, etc.
- The Experiment Module I and II will follow afterwards
- The Space Station with 3 modules will be put into operation around 2020.

Currently, The CSS project is well under way. The modules of CSS and new types of launch vehicles as well as other related facilitates are under development

Space Science Experiments

The three modules of CSS are all designed to feature advanced technology and multi-purpose facilities for space science.

Utilization Support Capability of CSS

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

A ***Space life sciences and biotechnology***

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

B ***Microgravity fluid physics & combustion***

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

C ***Material science in space***

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

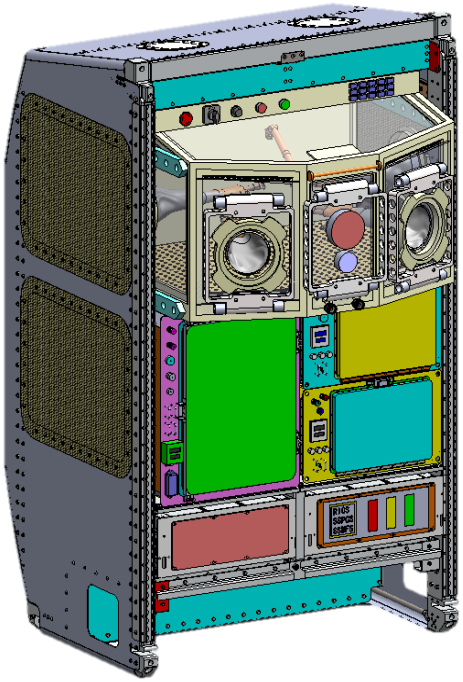
D ***Fundamental Physics in Microgravity***

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

E ***Multipurpose Facilities***

Ecology Science Exp. Rack (ESER)

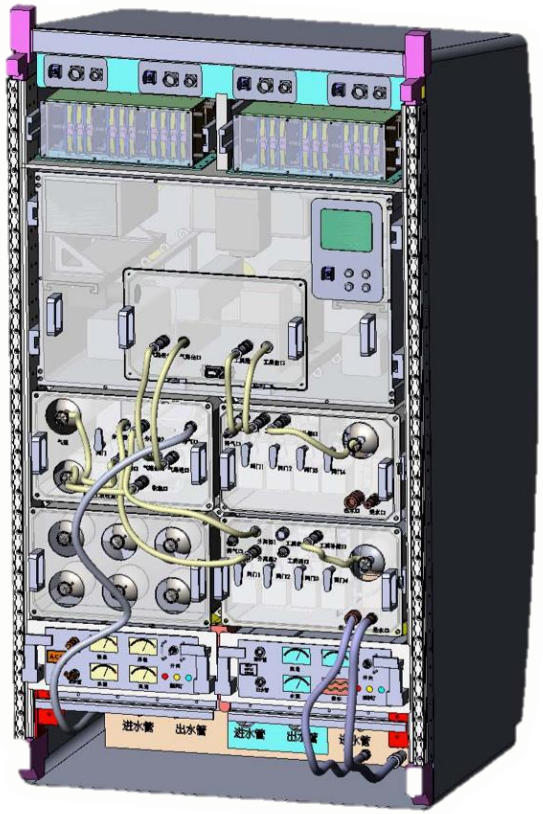
Science Glove-box and Refrigerator Rack (SGRR)



Biotechnology Exp. Rack (BER)

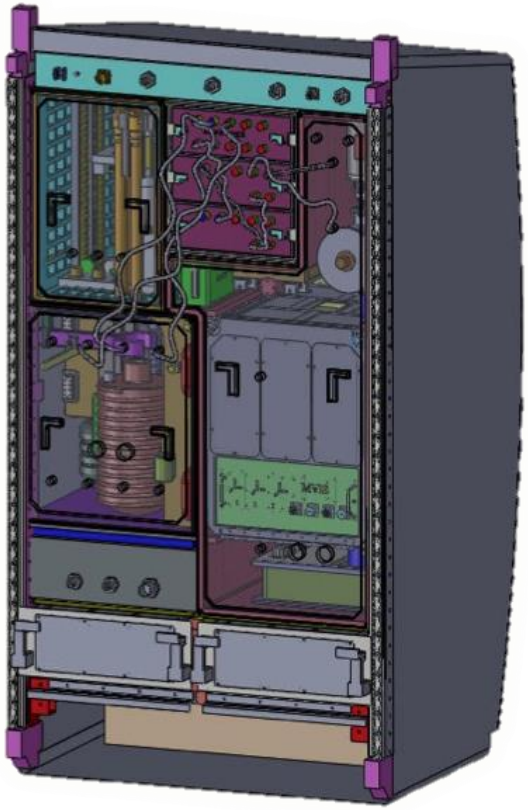
Fluid Physics Exp. Rack (FPER)

Two-phase System Exp. Rack (TSER)



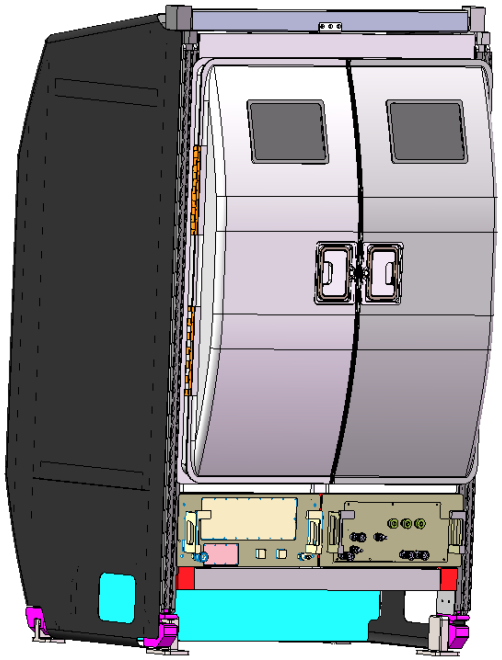
Combustion Exp. Rack (CER)

Material Furnace Exp. Rack (MFER)

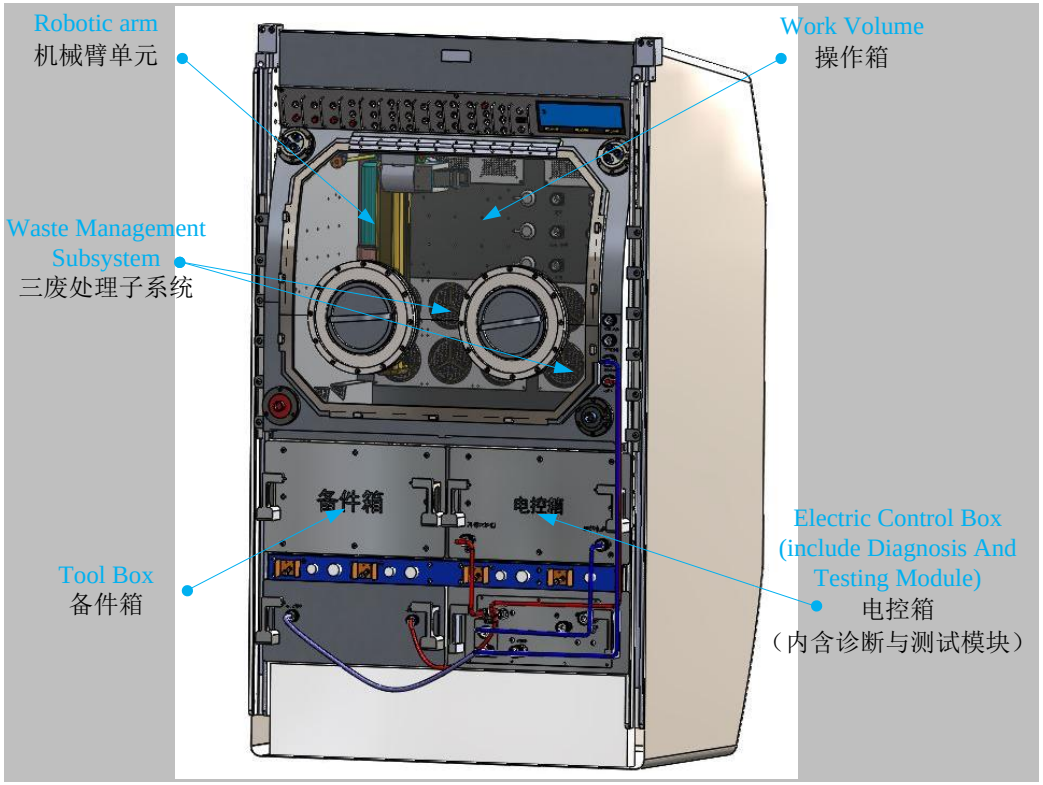


Container-less Material Exp. Rack (CMER)

Varying-Gravity Exp. Rack (VGER)

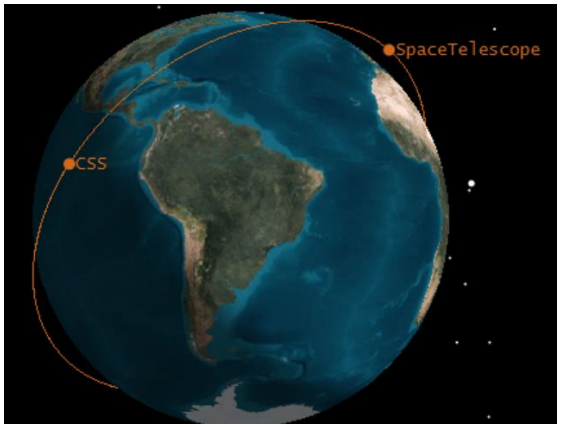


In-situ Maintenance and operation Rack (IMOR)



Space Telescope

Chinese first maintainable and repairable large-aperture space telescope for astronomy.

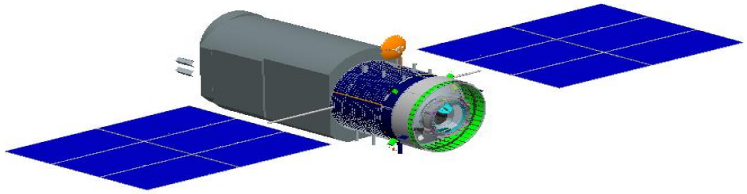


Science of sky survey:

➢Formation and evolution of faraway celestial bodies: stars, planets, galaxies, black holes, quasars …

➢Dark energy and dark mass research: nuance distortion of galaxies caused by gravity lensing by dark mass ；

➢Cosmology research: Restruction of perturbation to density of cosmos in earlier stage；



Engineering feature:

- RVD with CSS in case of maintenance or updating science instruments
- Shares resource (crew flights and cargo-ships) with CSS.

Part IV: International cooperation

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

UN Member States

UN-HSTI

UNITED NATIONS Office for Outer Space Affairs

Cooperation areas

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

ROSCOSMOS

esa

Others

Thank you very much for attention !

Website: en.cmse.gov.cn