

# China's Manned Space

中国载人航天

Yang Liwei, Deputy Director of  
China Manned Space Engineering Office (CMSEO)

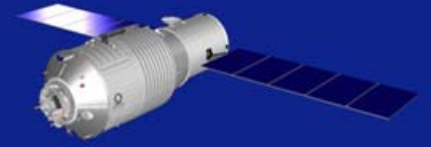
中国载人航天工程办公室 杨利伟

Nov.2011, Malaysia

2011年11月 于马来西亚



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CHINA MANNED-SPACE ENGINEERING

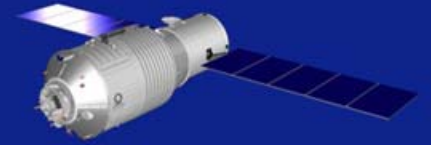


**The space belongs to all mankind,  
and the space exploration is our  
common dream.**

无垠的太空是人类共同的财富，探索太空是人类共同追求



中国载人航天工程  
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# Overview

主要内容

## 1 Development History

发展历程

## 2 Rendezvous & docking mission in 2011

2011年交会对接任务

## 3 Future Programs

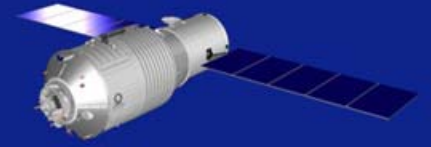
未来发展

## 4 International Cooperation

国际合作



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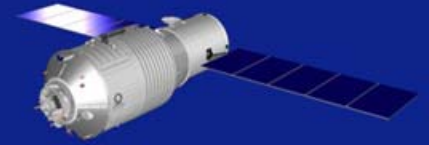
# 1 Development History

## 发展历程



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# 1 Development History 发展历程

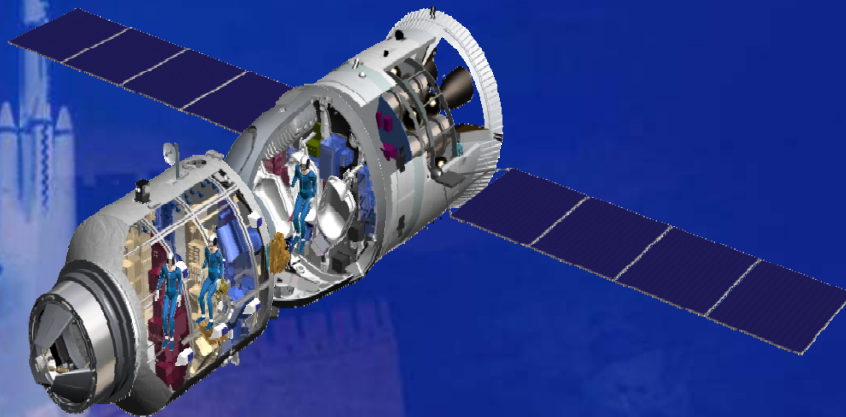


- On Sep.21, 1992, Chinese government approved the “three steps” development strategy

1992年9月21日，中国政府批准中国载人航天“三步走”的发展战略。

## Step 1: Manned Spaceship

第一步：载人飞船工程



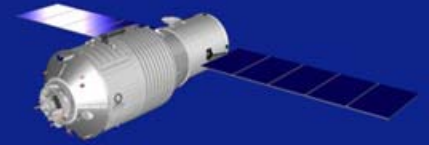
*To complete preliminary experimental manned spaceship engineering and to carry out experiments for space application*

建成初步配套的试验性载人飞船工程，开展空间应用实验。



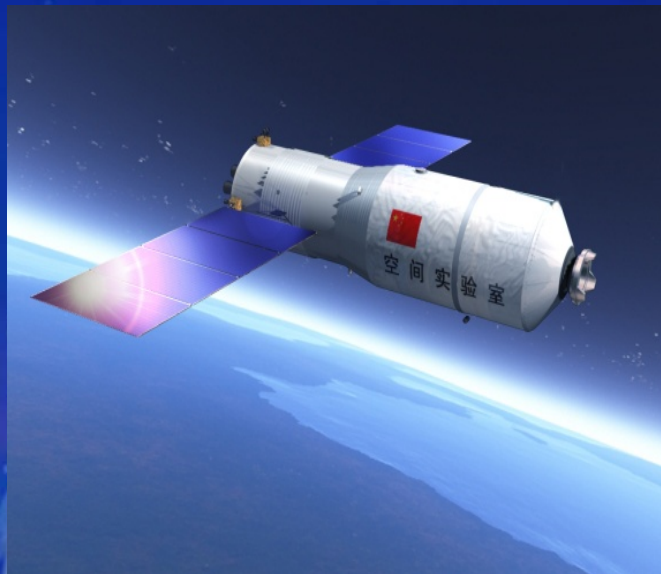
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# 1 Development History 发展历程



## Step 2: Space Lab

第二步：空间实验室工程



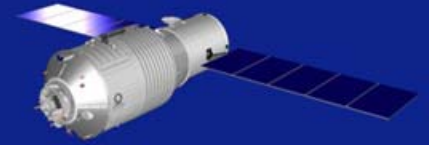
*To break through and master the technology of EVA and rendezvous & docking of manned spaceship and spacecraft, launch space labs, and solve short-term man tended space application problems with a certain scale.*

突破航天员出舱活动技术、载人飞船和空间飞行器的交会对接技术，发射空间实验室，解决有一定规模的、短期有人照料的空间应用问题。



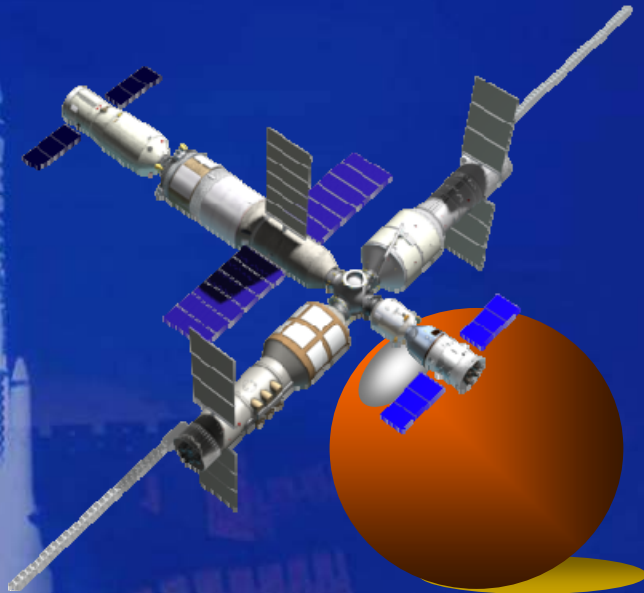
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# 1 Development History 发展历程



## Step 3: Space Station

第三步：空间站工程



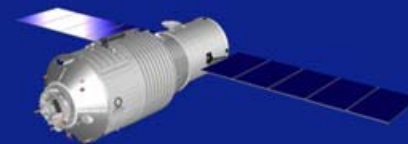
*To build a space station consisting of 20-ton scale modules , and solve long-term man tended space application problems with a larger scale*

建造模块为20吨级的空间站，解决有较大规模的、长期有人照料的空间应用问题。



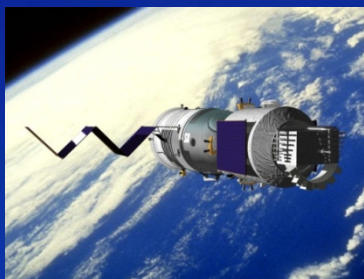
中国载人航天工程  
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# 1 Development History 发展历程

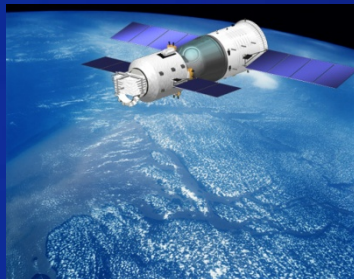


- **Four Unmanned Space Flights**

四次无人飞行试验



神舟一号



神舟二号



神舟三号



神舟四号

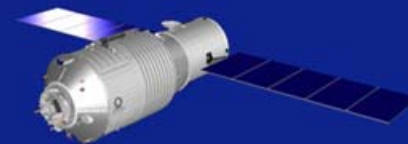
*From November 1999 to January 2003, China conducted four unmanned space flights, having testified the whole engineering and various subsystems covering the whole process including the launching, operating, reentry as well as staying in orbit.*

1999年11月至2003年1月，工程共进行了四次无人飞行，对工程总体和各系统从发射到运行、返回、留轨的全过程进行了考核。





# 1 Development History 发展历程

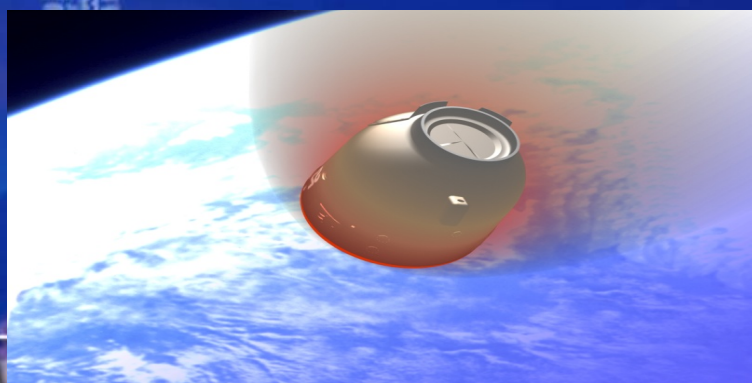


- **Four Unmanned Space Flights**

四次无人飞行试验



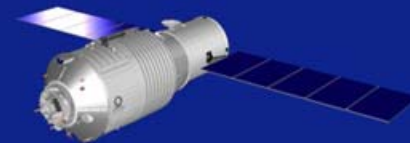
*Space science and application experiments such as space remote-sensing, space astronomy, space material and life science were carried out and a lot of scientific experimental data were achieved through these experiments.*



这四次飞行完成了空间遥感、空间天文、空间材料、生命科学等空间科学与应用试验，取得了一大批科学实验数据。



# 1 Development History 发展历程



- **Three Manned Space Flights**

三次载人航天飞行



## Shenzhou-5

神舟五号载人航天飞行任务

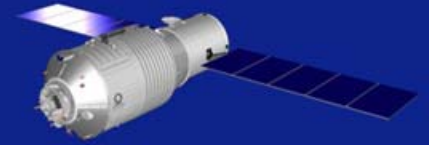
*From Oct. 15th to 16th , 2003,  
China successfully accomplished  
the first manned spaceflight.*

2003年10月15日至16日，成功进行了中国  
首次载人航天飞行。



中国载人航天工程  
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# 1 Development History 发展历程

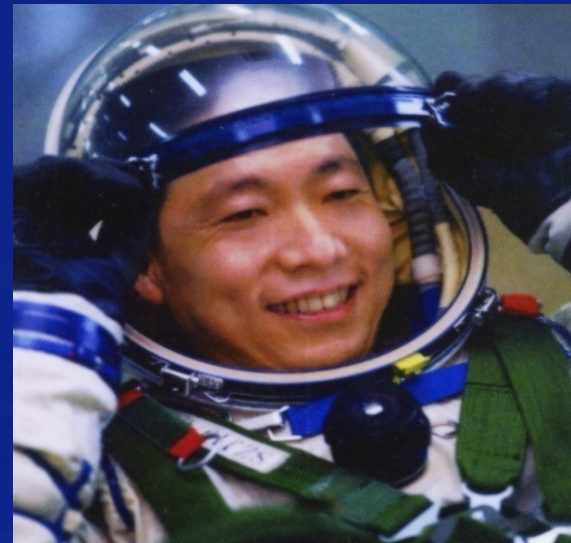


- **Shenzhou-5**

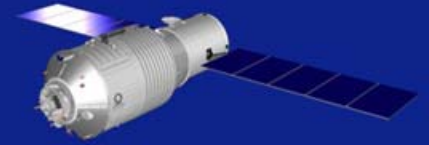
神舟五号载人航天飞行任务

*Yang Liwei, aboard the Shenzhou-5 spaceship, made 15 rounds for 22 hours and safely landed on the main landing site in Inner Mongolia.*

航天员杨利伟乘坐“神舟”五号载人飞船，历时22小时，在绕地球飞行15圈后，安全返回内蒙古主着陆场。



# 1 Development History 发展历程



- **Shenzhou-6**

神舟六号载人航天飞行任务

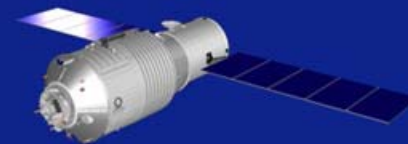
*From Oct. 12th to 17th ,  
2005, China successfully  
accomplished the second  
manned spaceflight  
Shenzhou-6. It was  
China's first multi-man  
and multi-day spaceflight.*



2005年10月12日至17日，成功进行了神舟六号载人航天飞行。这次飞行首次实现了“多人多天”太空飞行。



# 1 Development History 发展历程



- **Shenzhou-6**

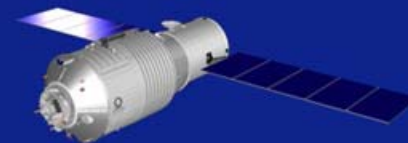
## 神舟六号载人航天飞行任务

*The astronauts for the first time entered the orbital module, operated facilities and conducted related scientific experiments. Shenzhou-6 made 76 rounds for 105 hours. After completing a series of preset scientific experiments, astronauts Fei Junlong and Nie Haisheng returned safely.*

这次飞行中，航天员首次进入轨道舱，操作有关设施设备，进行相关科学实验。飞船绕地球飞行76圈，历时105小时。在完成一系列预定科学试验任务后，航天员费俊龙、聂海胜安全返回，健康出舱。



# 1 Development History 发展历程



- **Shenzhou-7**

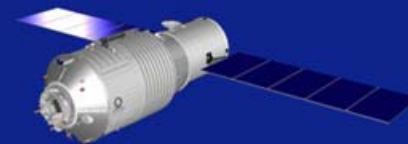
神舟七号载人航天飞行任务

*From Sep. 25th to 28th, 2008, China successfully accomplished Shenzhou-7 manned spaceflight. Astronauts Zhai Zhigang, Liu Boming and Jing Haipeng made 46 rounds for 68 hours in space and returned safely.*

2008年9月25日至28日成功进行了神舟七号载人航天飞行。航天员翟志刚与刘伯明、景海鹏在太空飞行46圈，历时68小时，安全返回。



# 1 Development History 发展历程



- *Shenzhou-1 to 6 achieved the goals of step 1 of China “three steps” development strategy*

神舟一号至神舟六号飞行任务，实现了中国载人航天发展战略第一步任务目标。

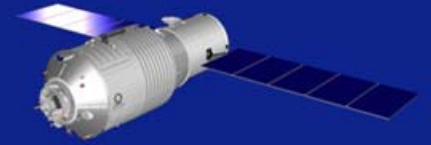
- *Shenzhou-7 was the first flight of step 2 of the strategy*

神舟七号载人航天飞行是中国载人航天工程第二步任务的首次飞行。

- *The four unmanned space flights and three manned space flights marked China having preliminarily mastered the key technologies, including launch and reentry, short-term residence, EVA and etc.*

中国通过四次无人飞行试验和三次载人航天飞行，初步掌握了进入太空返回地面、短期驻留、出舱活动等关键技术。





# 2 Rendezvous & docking mission in 2011

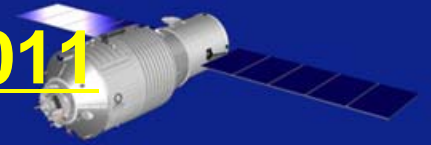
2011年交会对接任务



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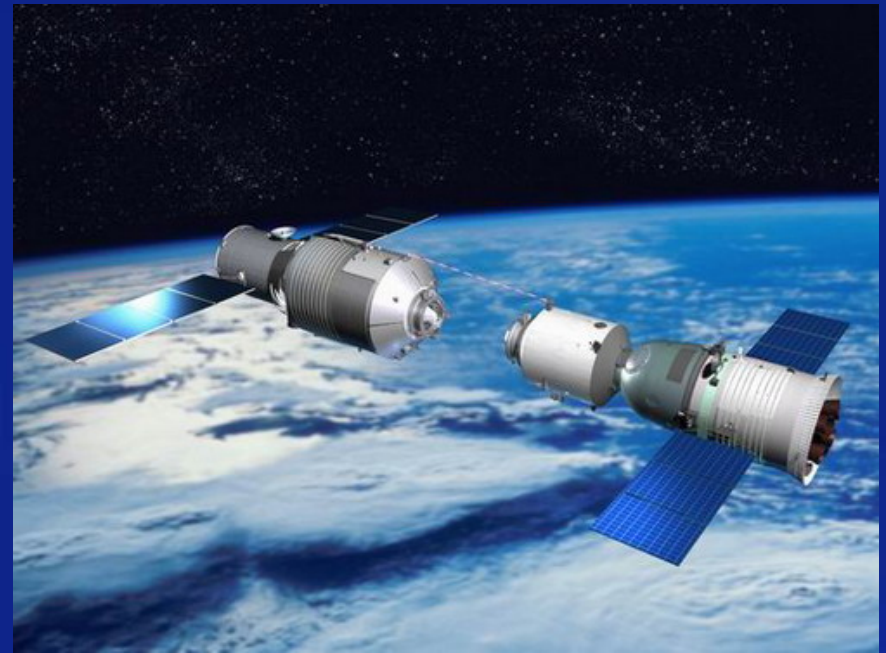


## 2 Rendezvous & docking mission in 2011



■ *The rendezvous & docking mission has been carried out successfully In November 2011, which is aim to master this basic technology for continuable manned space activities.*

2011年11月，中国已成功实施无人空间交会对接，目的是实现中国载人航天工程第二步任务的重要目标。



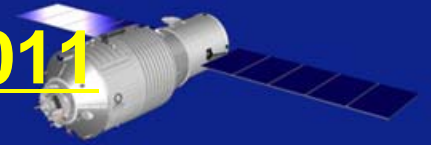
*Rendezvous and Docking of  
Tiangong-1 and Shenzhou-8*

天宫一号和神舟八号对接示意图



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## 2 Rendezvous & docking mission in 2011

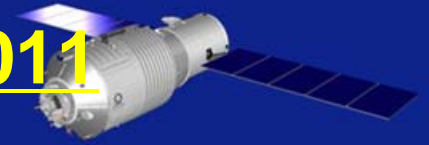


■ *China's manned space project is composed of eight systems : space lab, astronauts, space application, manned spaceship, launch vehicle, launch site, TT&C, landing site and etc. All these systems take part in the rendezvous and docking experiments.*

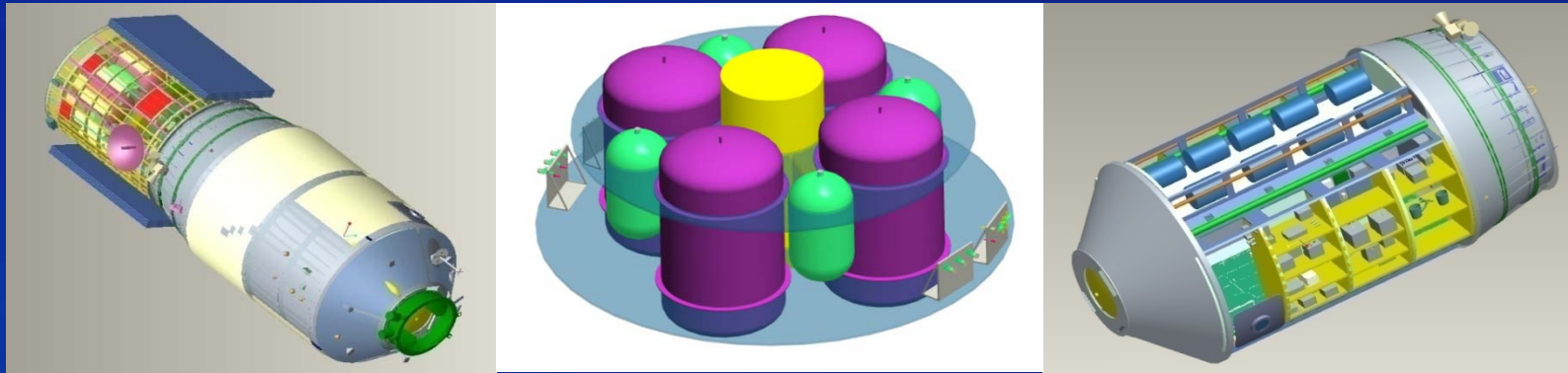
载人航天工程空间实验室、航天员、空间应用、载人飞船、运载火箭、发射场、测控通信系统、着陆场八个系统参加交会对接任务。



## 2 Rendezvous & docking mission in 2011



### The Space Lab System

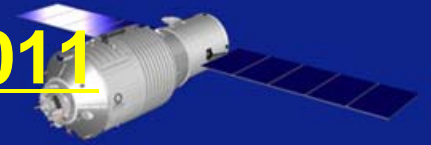


*The Space Laboratory System is mainly responsible for the development of space laboratory, including the target spacecraft "Tiangong-1" with the function of rendezvous and docking, providing a platform for space scientific experiments with man-tending on short term basis, and accumulating experiences for the development of space station.*

主要任务是研制空间实验室，包括具有交会对接功能的8吨级天宫一号目标飞行器，为开展短期有人照料的空间科学和技术实验提供基本平台，为研制空间站积累经验。



## 2 Rendezvous & docking mission in 2011

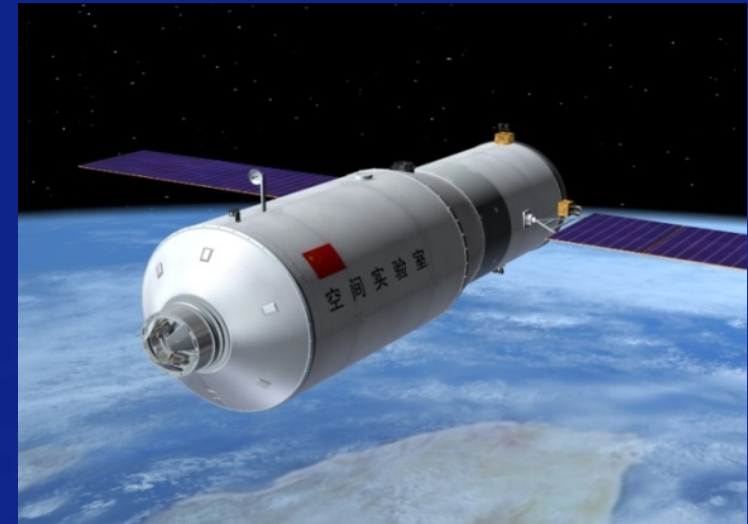


- *Tiangong-1 is not only a target spacecraft of rendezvous & docking, but also a simple space lab.*

“天宫一号”既是交会对接目标飞行器，也是一个简易空间实验室。

- *Tiangong-1 space lab consists of an experiment module and a resource module. The main design parameters are as follows: 3.35m diameter, 8.5t weight, 2-year lifetime. It can realize astronaut medium-term on-orbit residence and long-term autonomous flight.*

空间实验室直径为3.35米、重量为8.5吨，寿命2年，由实验舱和资源舱两部分组成，可实现航天员中期在轨驻留，并长期自主飞行。

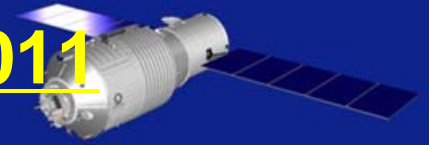


*Tiangong-1 Space Lab*

天宫一号空间实验室



## 2 Rendezvous & docking mission in 2011



### The Astronaut System

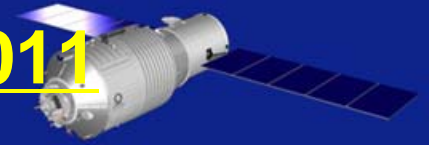


*The Astronaut System is mainly responsible for selecting and training astronauts and conducting medical monitoring and providing supports to astronauts during trainings and flight tasks. An astronaut selection and training center has been set up in Beijing; such spacecraft-borne facilities as IVA spacesuit, EVA spacesuit, and personal life-saving appliance have been developed.*

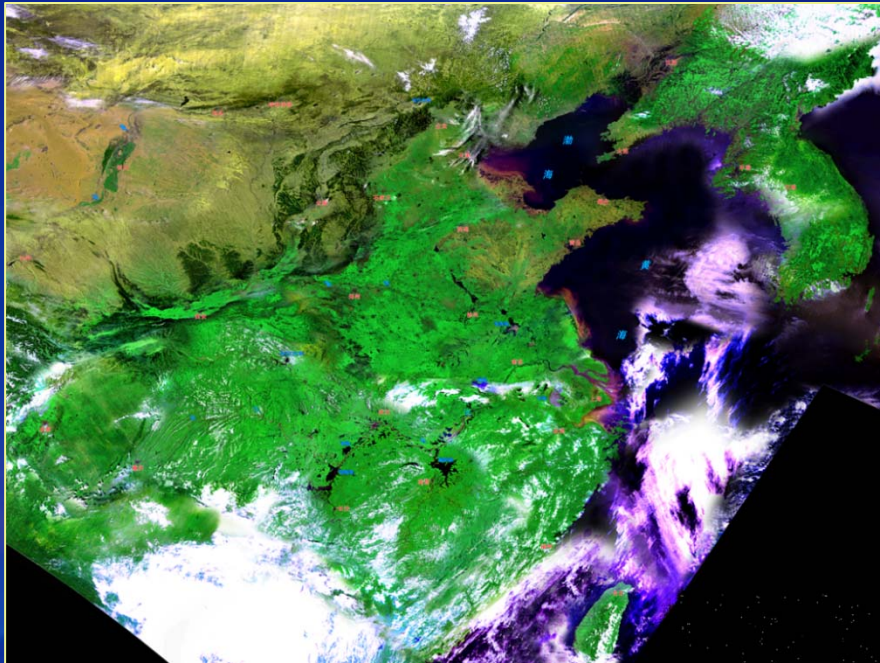
主要任务是选拔、训练航天员，实施航天员医学监督和医学保障；研制舱内航天服、舱外航天服、乘员装备，以及地面试验和训练设备。



## 2 Rendezvous & docking mission in 2011



### The Space Application System

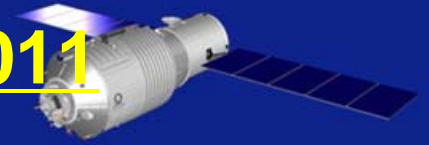


*The Space Application System is mainly responsible for developing the space payloads, conducting the earth and space environment observation, carrying out space scientific experiments, such as space material, space life science, and space microgravity science.*

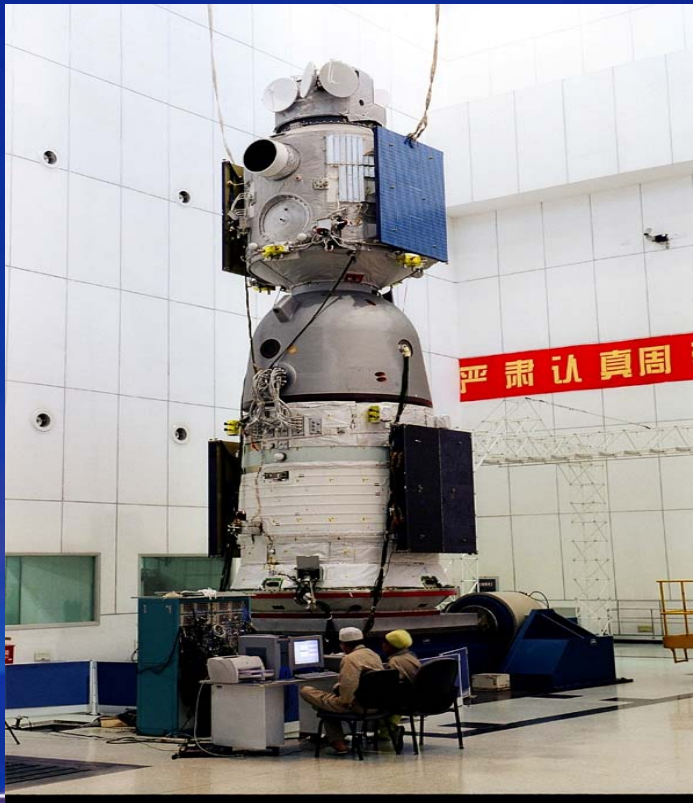
主要任务是研制空间应用有效载荷，开展地球和空间环境监测、空间材料、空间生命、微重力流体物理等空间科学研究及应用试验。



## 2 Rendezvous & docking mission in 2011



### The Manned Spaceship System

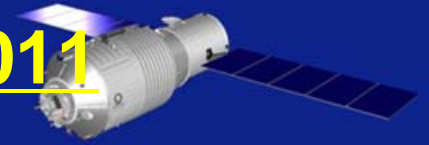


*The Manned Spaceship System is mainly responsible for the development of Shenzhou manned spaceship, the first kind of manned spaceflight vehicle independently developed by China. Shenzhou spaceship consists of propelling module, re-entry module, and orbital module. It weighs about 8 tons, can accommodate 3 astronauts and dock with other spacecrafts.*

主要任务是研制具有天地往返运输能力的神舟载人飞船。飞船由轨道舱、返回舱和推进舱构成，可乘载3名航天员，具有交会对接功能，并上下行运送部分货物。



## 2 Rendezvous & docking mission in 2011



### The Launch Vehicle System



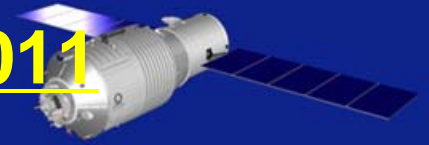
*The Launch Vehicle System is mainly responsible for manufacturing rockets with high reliability and safety for the astronauts. The manned rocket can send the effective load up to 8 tons into LEO.*

主要任务是研制满足载人航天高可靠性要求的运载火箭。





## 2 Rendezvous & docking mission in 2011



### The Launch Site System

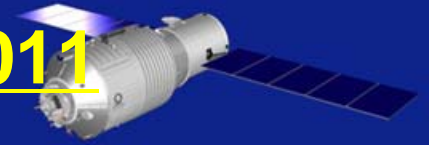


*The Launch Site System is mainly responsible for testing and launching the rocket, the spaceship with payloads, Tiangong-1 and providing the corresponding support conditions. The manned spaceship launch site of China is located in Jiuquan Satellite Launch Center.*

主要任务是负责火箭、飞船、目标飞行器和应用有效载荷在发射场的测试和发射。载人航天发射场位于酒泉卫星发射中心。



## 2 Rendezvous & docking mission in 2011



### The TT&C System

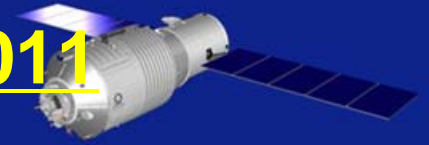


*The Tracking, Telemetry & Command and Communication System is mainly designed for carrying out the measurements of and the control over spacecraft. A land-sea-space-based TT&C network has already been established, which is consist of fixed TT&C stations, tracking ships and relay satellites.*

主要任务是在飞行试验中完成对飞行器的测量和控制。由地面测控站、海上测量船与中继卫星组成了陆、海、天基测控网。



## 2 Rendezvous & docking mission in 2011



### The landing site System

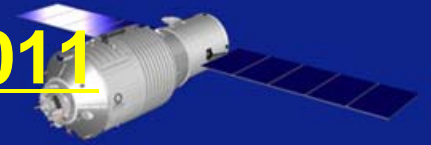


主要任务是搜救航天员和回收飞船返回舱，建设了主、副着陆场，设立了上升段陆上、海上应急救生区和运行段应急着陆区。

*The Landing Site System is mainly responsible for the searching and recovering of the landed re-entry module, and the rescuing of astronauts. The main landing site is located in the middle area of Inner Mongolia, and a backup site is located to the east of Jiuquan Satellite Launch Center. Furthermore, some landing zones of emergency rescue during the ascending phase and the orbiting phase have been set up on the land, as well as in sea areas.*



## 2 Rendezvous & docking mission in 2011

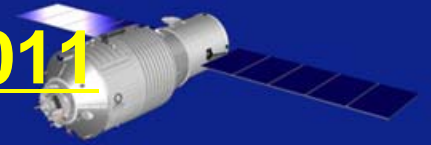


- *On September 29th, 2011, Tiangong-1 spacecraft was launched and sent into 350km height low Earth orbit.*

2011年9月29日，“天宫一号”空间实验室发射进入高度为350km的近地轨道。



## 2 Rendezvous & docking mission in 2011

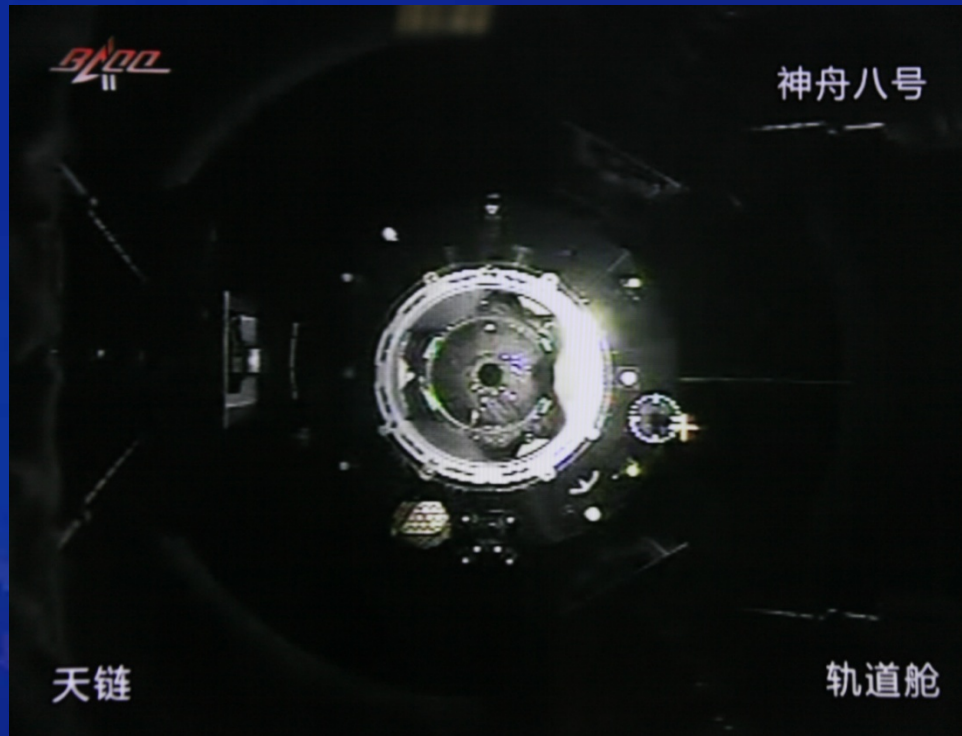
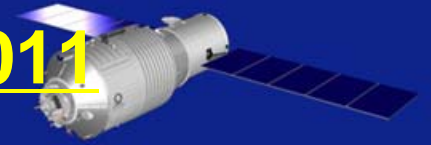


- *Shenzhou-8 was launched on November 1th, 2011, and had conducted the first unmanned rendezvous and docking test successfully on Nov 3th, 2011.*

2011年11月1日，发射神舟八号飞船，  
11月3日成功实施了第一次无人交会对接试验。



## 2 Rendezvous & docking mission in 2011



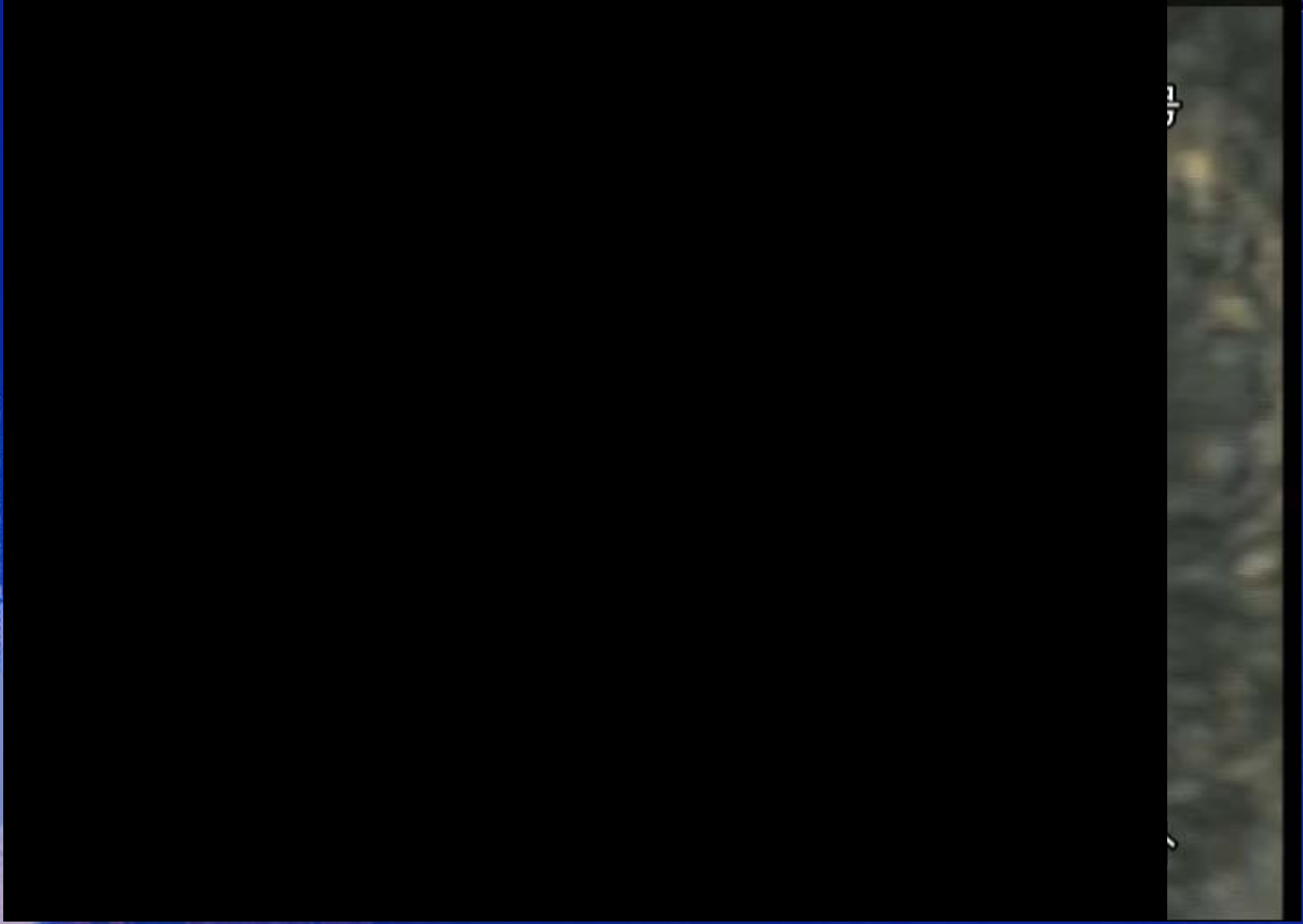
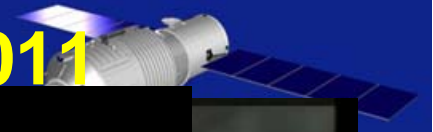
*Docking*

即将对接实况图



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING

## 2 Rendezvous & docking mission in 2011

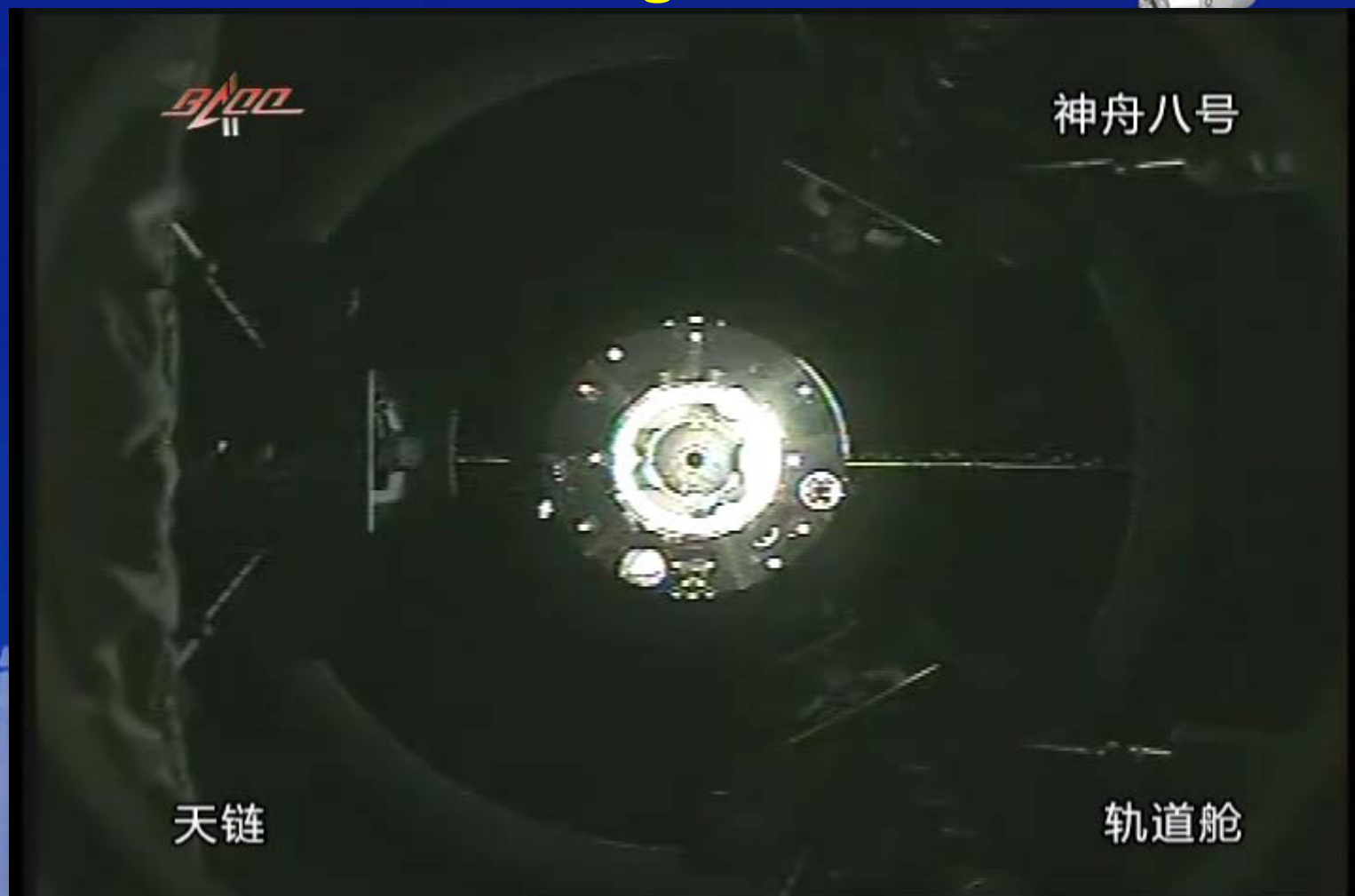
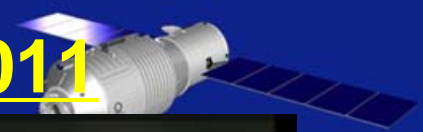


即将对接实况图



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING

## 2 Rendezvous & docking mission in 2011



*Docking*

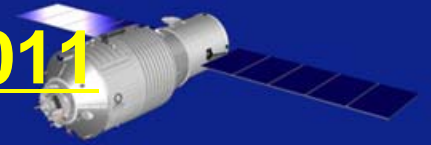
即将对接实况图



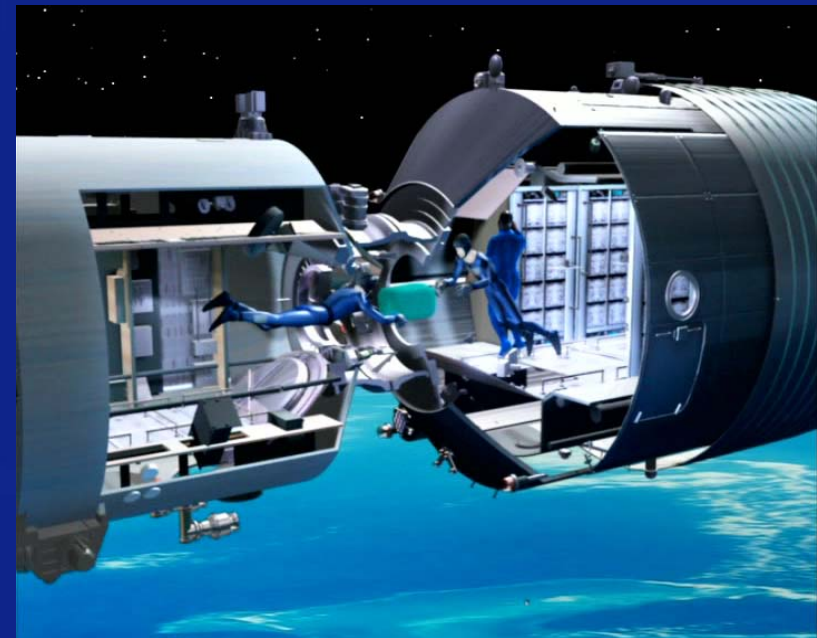
中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING



## 2 Rendezvous & docking mission in 2011



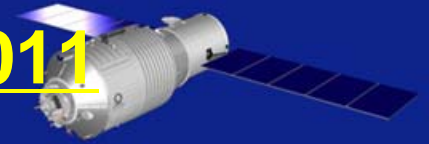
- *Shenzhou-9 and Shenzhou-10 spaceships are scheduled to launch in the first half and second half of 2012. These two launch missions aim to master the technology of manned rendezvous & docking.*



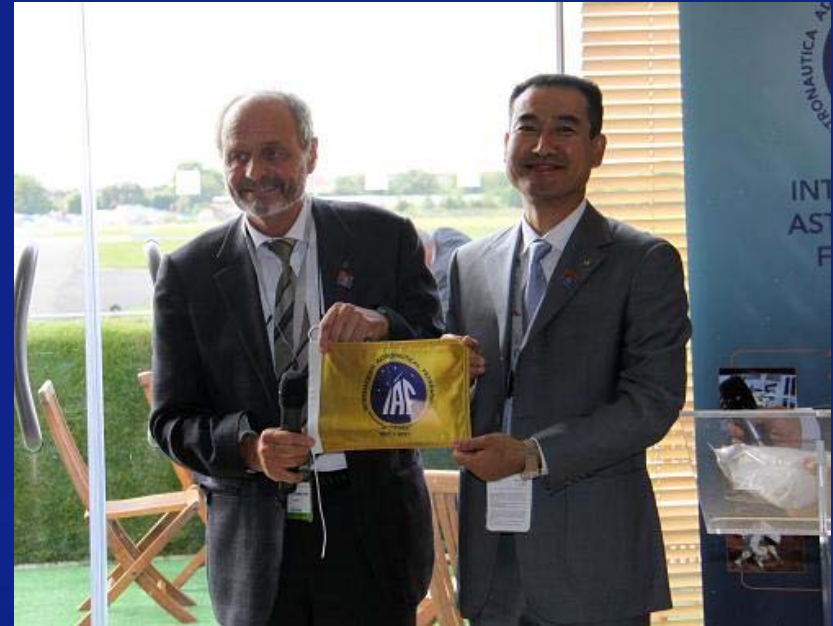
计划于2012年上半年和下半年分别发射神舟九号、神舟十号飞船，与目标飞行器进行无人或载人交会对接，以掌握飞行器空间交会对接技术。



## 2 Rendezvous & docking mission in 2011



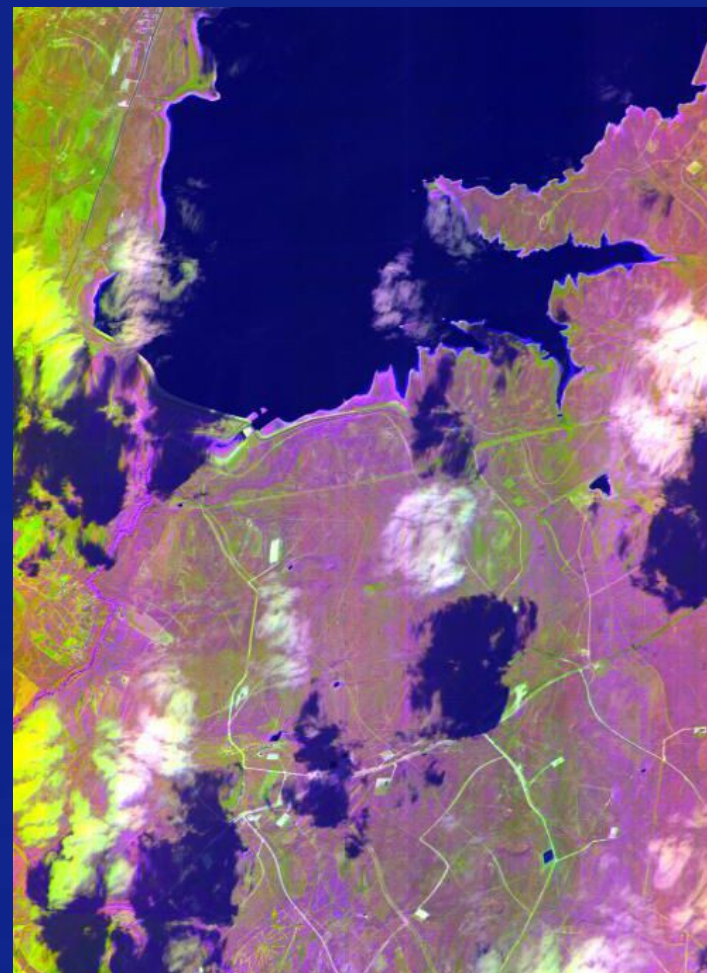
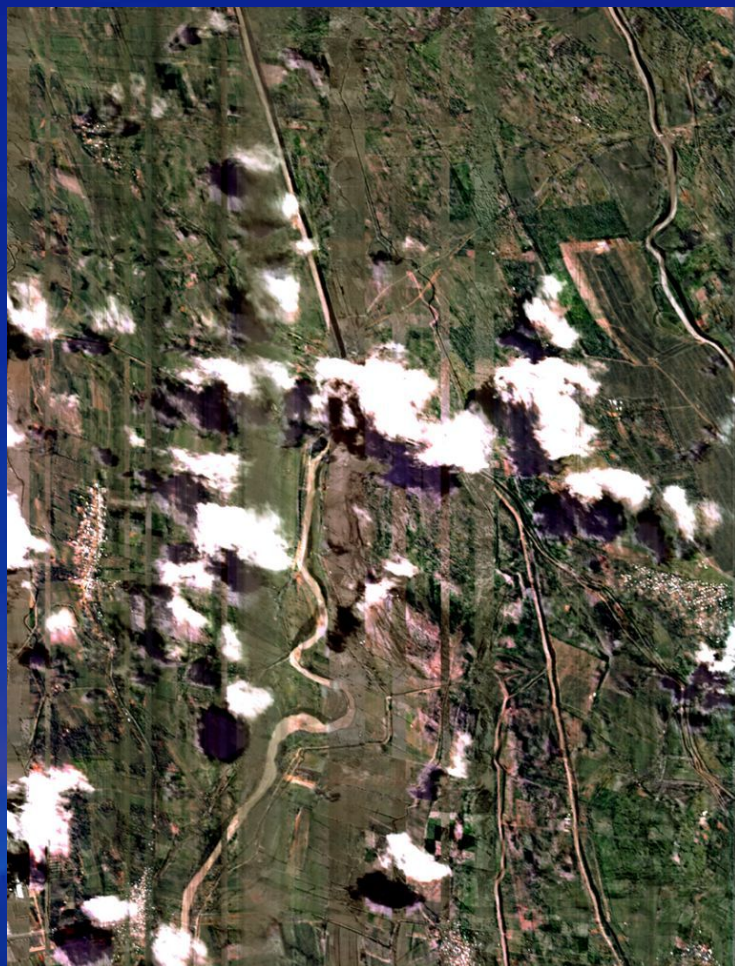
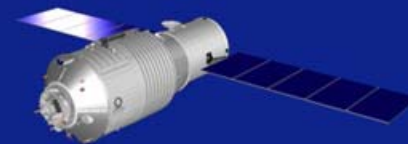
*During the Paris Air Show 2011, CMSEO delegation received 300 IAF flags from Berndt Feuerbacher, President of IAF. These flags have been sent into space on board of Tiangong-1 spacecraft. Afterwards, Chinese astronauts will take them back to the ground after implementing China's first manned rendezvous and docking mission in 2012. The 300 IAF flags had been brought to ISS by Soyuz spaceship in Dec 2010, and taken back to ground by space shuttle in Jun 2011.*



巴黎航展期间，中国代表团接受了国际宇航联合会主席贝恩特·费尔巴哈移交的300面会旗，并由“天宫一号”发射搭载升空，明年将由执行我国首次载人交会对接任务的中国航天员带回地面。之前，这些会旗曾由联盟号飞船在2010年12月送往国际空间站，由航天飞机于2011年6月带回地面。



# Tiangong-1 space payloads

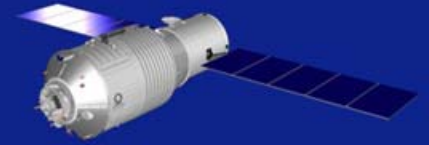


中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING

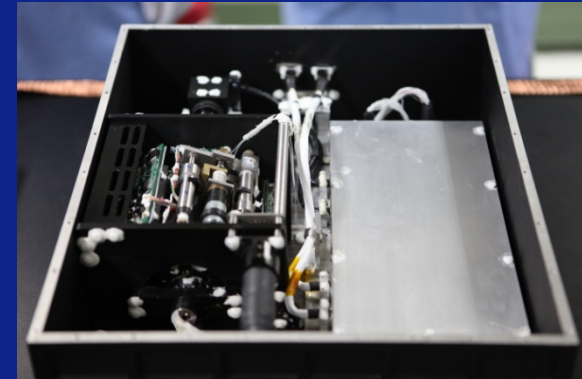
*Images of Hyperspectral Imager.*

高光谱成像仪获取的图像

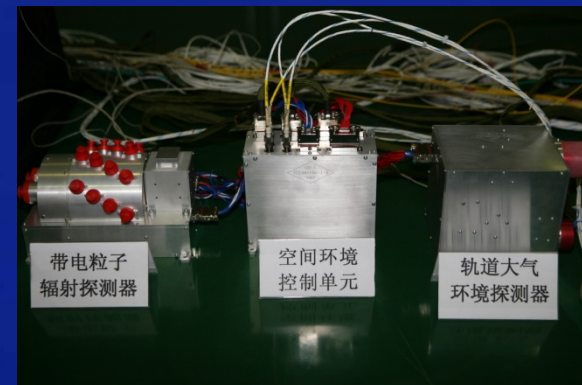
## Tiangong-1 space payloads



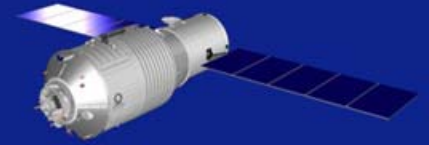
*Other space payloads in Tiangong-1 are multi-direction particle detector, GNSS radio occultation instrument, neutral atmosphere environment detector, growth of composite 363636 colloidal crystals in space and etc.*



在天宫一号安装的其他载荷有带电粒子辐射探测器、电离层探测器、轨道大气环境探测器、复合胶体晶体生长装置等



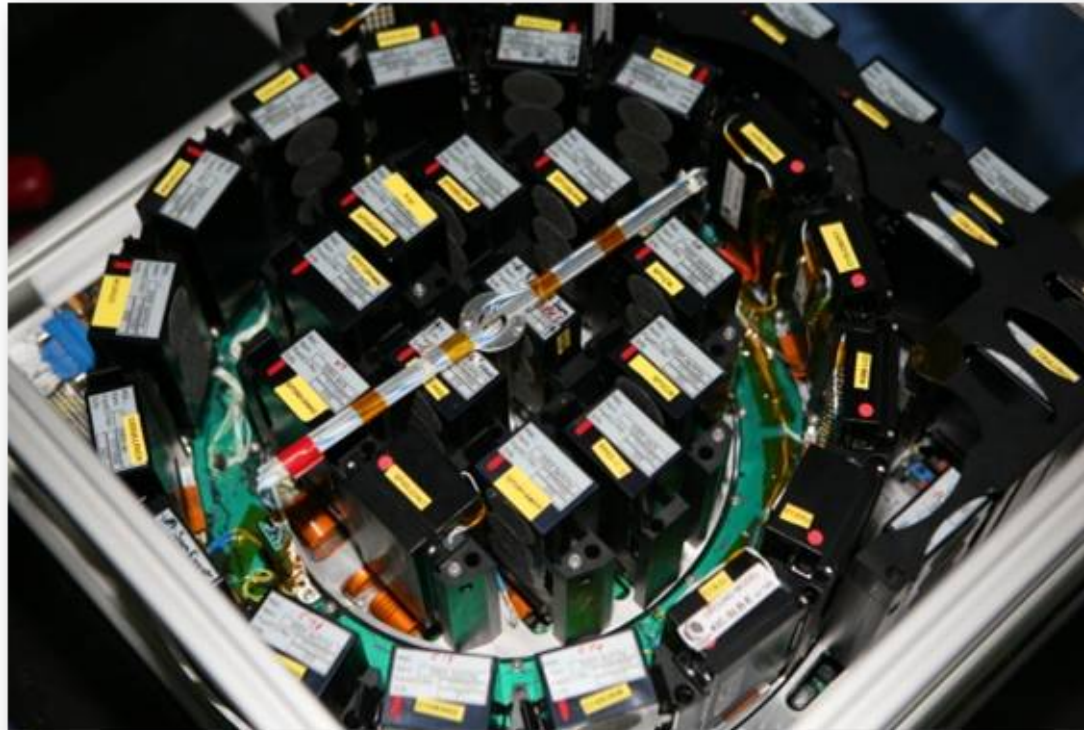
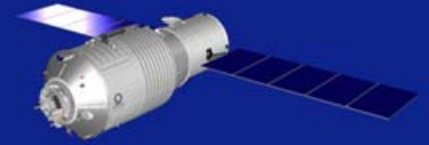
## Shenzhou-8 space payload



*One space science experiment, Biobox, cooperated by Germany and China, is being carried out in Shenzhou-8. This is the first international cooperation in the field of manned space applications in China.*

中国在神舟八号飞船上开展了中德合作生物培养实验，这是我国首次在空间应用领域的国际合作。

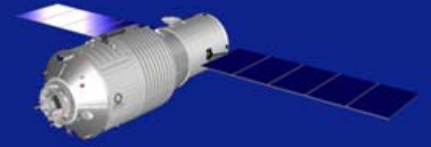




*Biobox including 17 experiments, 10 from China, 6 from Germany, 1 cooperated.*

中德合作生物培养装置，包含17个项目，其中10个来自中国，6个来自德国，1个中德合作。





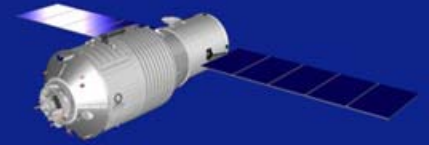
# 3 Vision and Future Program

未来发展



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING

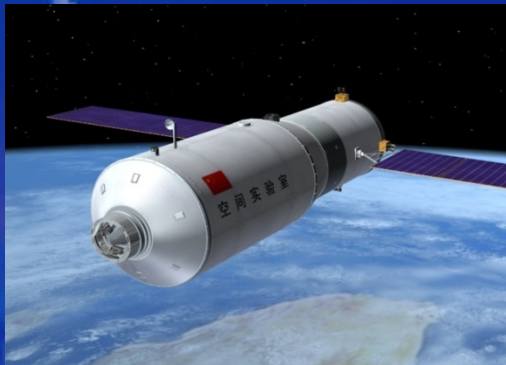
### 3 Vision and Future Program 未来发展



- Space Lab 空间实验室

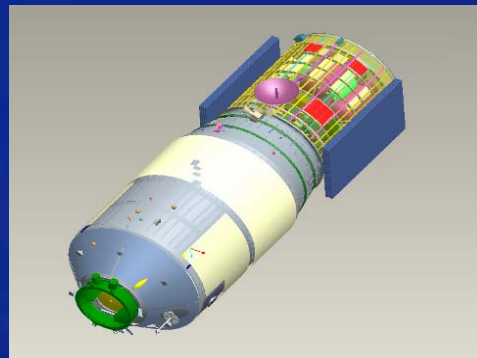
■ One or two space labs and some manned spaceships and cargo ships will be launched before 2016, preparing for building of space station.

计划于2016年前再发射1-2个空间实验室及若干艘载人飞船和货运飞船，为空间站建造进行技术准备。



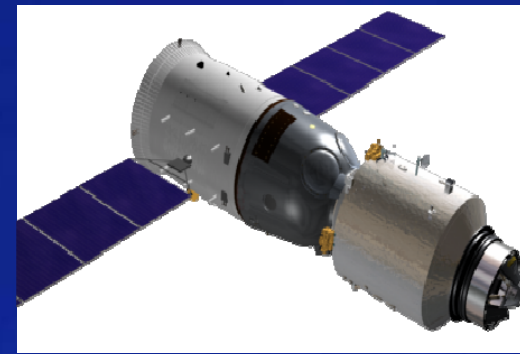
Space Lab

空间实验室



Cargo Spaceship

货运飞船



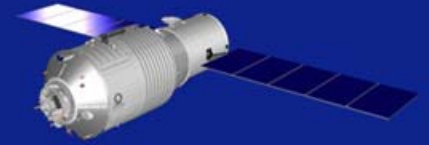
Manned spaceship

载人运输飞船





### 3 Vision and Future Programs 未来发展



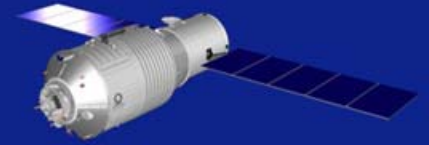
- **Space Lab 空间实验室**

*The space lab has the function of on-orbit refueling, and can realize astronaut medium-term on-orbit residence and long-term autonomous flight. It will solve the problems of space applications with a certain scale and medium-term or short-term man tended, preparing for building, management and operation of the space station.*

空间实验室具备推进剂在轨补加功能，可实现航天员中期在轨驻留，并长期自主飞行，将解决有一定规模的、中短期有人照料的空间应用问题，为空间站建造、管理和运营积累经验。

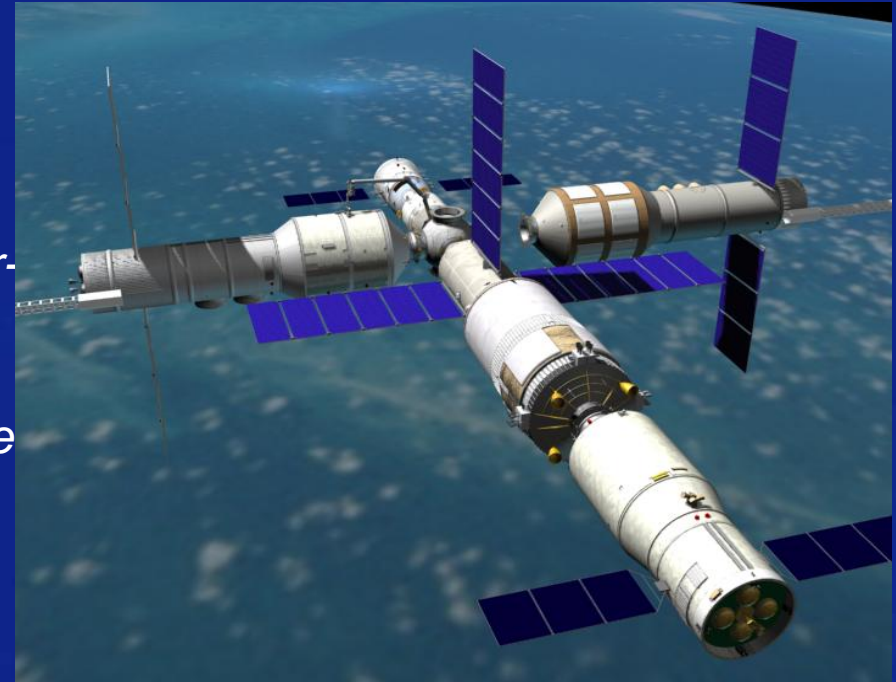


### 3 Vision and Future Programs 未来发展



- **Manned Space Station 载人空间站**

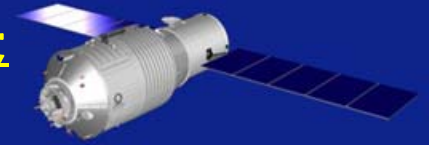
■ *Around 2020, the space station composed of 20-ton modules will be developed and launched, thus mastering the technology to build and operate combination modules for near-earth space station to acquire capability for astronauts to stay in space for long term, to carry out space application and technological experiments of a large scale.*



计划于2020年前后，研制并发射基本模块为20吨级舱段组合的空间站，突破和掌握近地空间站组合体的建造和运营技术，具备航天员在轨长期驻留能力，开展较大规模的空间应用和空间技术试验。

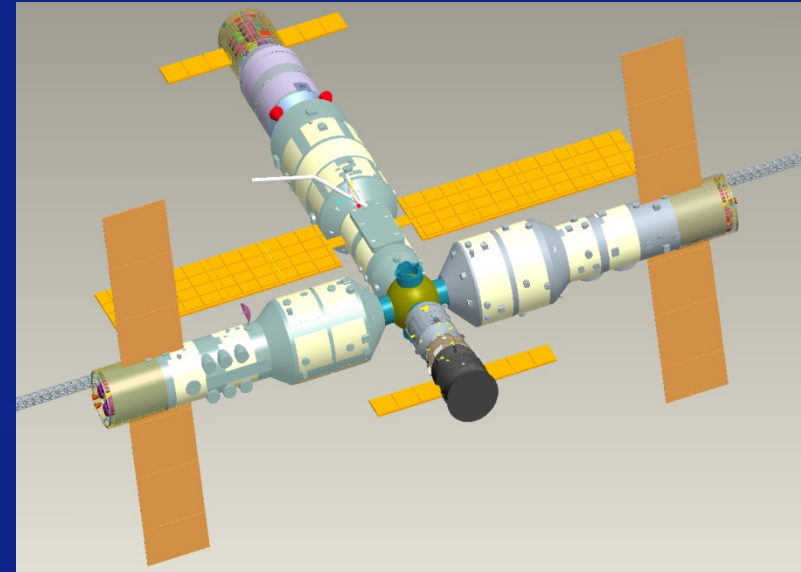


### 3 Vision and Future Programs 未来发展



- Manned Space Station 载人空间站

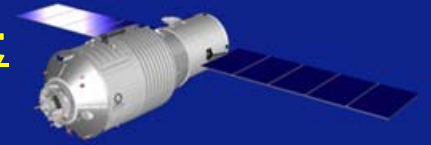
- *The manned space station will be operating at 340km~450km orbit altitude and 42°~43° inclination, with 10-year designed lifetime. It can accommodate 3 astronauts for long-term residence. Large-scale space application and technological experiments can be carried out on the space station.*



载人空间站运行轨道高度为400-450km，轨道倾角为42°~43°，额定乘员3人，航天员可长期驻留，并开展较大规模的空间科学与应用实验，设计寿命10年。



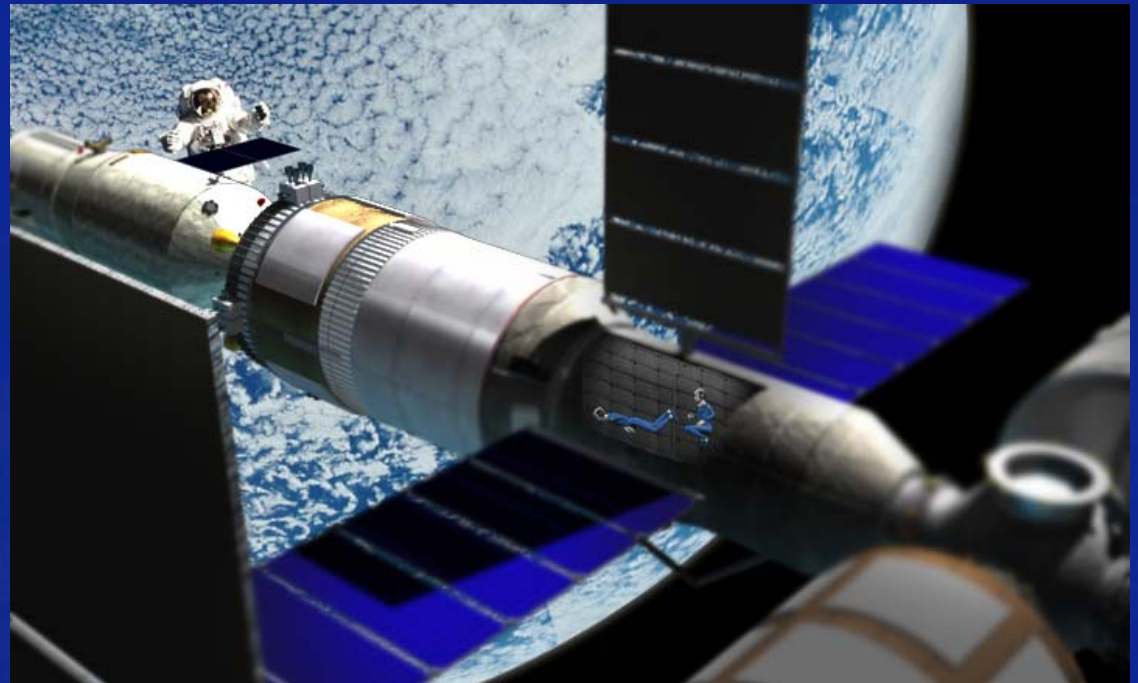
### 3 Vision and Future Programs 未来发展



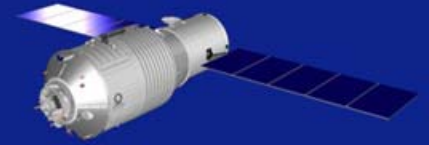
- **Manned Space Station 载人空间站**

- *With the manned space station to be maintained, updated, it is able to be expanded to a permanent manned vehicle in LEO. China will further advance space technology and promote capabilities in space resource exploration, making the contributions to peaceful use of space resources and exploration of the deep space.*

此后，将对载人空间站进行维护、更新和扩展，建成长期近地空间载人平台，以进一步提高航天技术水平和开发空间资源的能力，为和平利用空间资源、探索广袤无垠的宇宙做出中国应有的贡献。



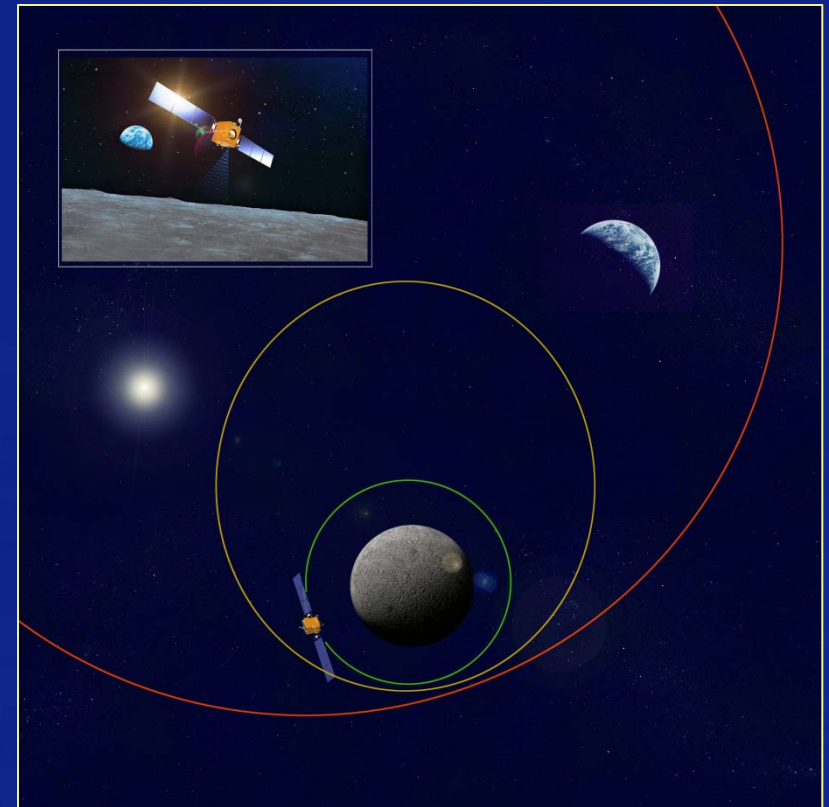
### 3 Vision and Future Programs 未来发展



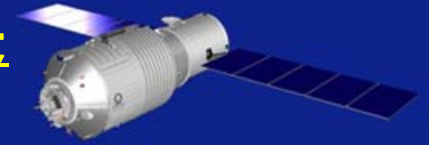
- **Research on Manned Lunar Landing Concept**  
开展载人登月概念研究

■ *Chinese government established a development strategy for lunar exploration, including orbiting, landing and re-entry. China have successively launched Chang'e-1 and Chang'e-2 satellites, making important achievements and successfully achieving the goals of lunar orbiting exploration. The following exploration is in progress.*

中国政府制定了探月工程“绕、落、回”的发展战略，已先后成功发射嫦娥一号和二号卫星，成功实现了探月工程第一步任务目标，正在实施第二步任务目标。

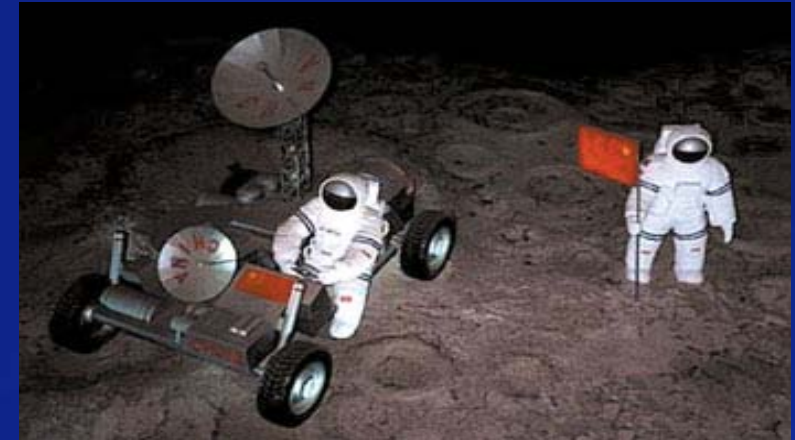


### 3 Vision and Future Programs 未来发展



- **Research on Manned Lunar Landing Concept**  
开展载人登月概念研究

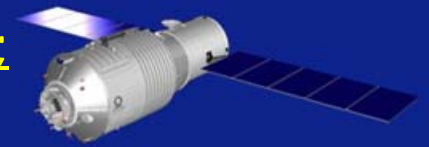
■ *The CMSEO has organized the concept research of manned lunar landing.*



CMSEO组织开展了载人登月的概念研究。



### 3 Vision and Future Programs 未来发展

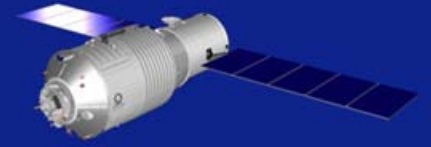


*The manned space program and the unmanned lunar exploration will lay a technology foundation for the future development of china manned space.*

通过载人航天和探月工程战略的实施，可为中国载人航天奠定较好的技术基础。



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING



# 4 International Cooperation

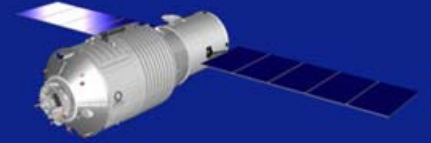
## 国际合作



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING



## 4 International Cooperation 国际合作



- *The purpose for China to develop manned space cause is to explore the universe and make peaceful use of outer space for the benefit of mankind.*

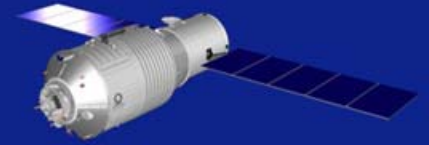
中国发展载人航天工程的目的，是和平开发与利用太空，造福全人类。

- *China is willing to engage in international cooperation on the basis of mutual respect, equality and benefit.*

中国愿意在相互尊重、平等互利原则基础上，与世界其他国家开展国际合作。



## 4 International Cooperation 国际合作

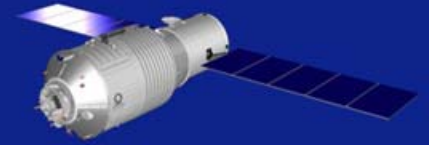


■ *China has organized a lots of practical cooperation in wide fields with many space agencies and international organizations. We are willing to enhance international cooperation, and make the manned space technological progress benefit to China and other countries, especially developing countries.*

我们已与各国航天机构及国际航天组织开展了广泛的务实合作，未来我们愿意加强国际合作，使空间科技的进步惠及各国，特别是发展中国家。



## 4 International Cooperation 国际合作



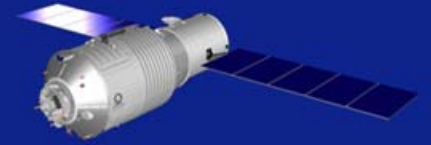
■ *China is willing to respond to “Human Space Technology Initiative, HSTI ” proposed by UNOOSA and to engage in international cooperation and communication in the fields of space application, selecting and training astronauts, sharing technologies and experiences of spacecraft and payload.*

中方将积极响应外空司提出的“载人航天技术倡议”，在空间应用合作、航天员选训与交流、载人航天技术和应用技术和经验共享等方面作出努力。



# Conclusion

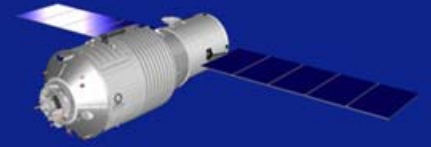
## 结束语



- *The CMSEO is willing to have exchanges with other space agencies and international space organizations in the world, actively explore and have international cooperation in building, operation and application of space station, thus making joint efforts to advance world space technology, and making contribution to the peaceful use of outer space and for the benefit of human beings.*

中国载人航天工程办公室作为中国政府负责载人航天的专项管理机构，愿意与世界各国航天机构加强交流，在载人空间站建设、运行和应用等多个方面，积极探讨和开展合作，共同促进世界航天技术的发展与进步，为和平利用太空、造福全人类做出积极的贡献！





# Thank you!

## 谢谢!



中国载人航天工程  
CHINA MANNED-SPACE ENGINEERING