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Core capsule of space station launched

President extends congratulations on major project's start

By ZHAO LEI in Wenchang, Hainan
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Sixty years after Yuri Gagarin undertook mankind's first space journey, China launched the core capsule of its space station on Thursday morning, formally embarking on the construction of one of the world's largest and most sophisticated space-based facilities.

President Xi Jinping sent a letter after the launch, extending congratulations and greetings to those involved in the landmark mission.

Xi, who is also general secretary of the Communist Party of China Central Committee and chairman of the Central Military Commission, said that building the station, which will also serve as a space-based national laboratory, is a significant goal in China's manned space endeavor and a major project that will help to push China toward being a strong power of science, technology and space.

The successful launch of the core capsule marked the commencement of the space station's construction, he said.

Xi encouraged mission workers to continue striving for the ultimate success of the space station program.

As the countdown ticked down to zero at 11:23 am at the Wenchang Space Launch Center in Hainan province, 10 engines at the bottom of a Long March 5B heavy-lift carrier rocket roared to life, generating a thrust power of 1,068 metric tons to lift the 16-story-tall vehicle through thick rain clouds covering the coastal city of Wenchang.

After flying more than eight minutes, the rocket successfully put the 22.5-ton capsule, the biggest and heaviest spacecraft China has ever constructed, in a low-Earth orbit about 400 kilometers above the Earth, settling the first piece of the country's space station in place.



The core capsule of China's space station is launched as people watch near the Wenchang Space Launch Center in Hainan province on Thursday. TAO RAN / FOR CHINA DAILY

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The capsule's solar panels unfolded at 12:36 pm and began generating power for the spacecraft.

Premier Li Keqiang and member of the Secretariat of the CPC Central Committee Wang Huning, both also members of the Standing Committee of the Political Bureau of the CPC Central Committee, and a group of high-ranking leaders witnessed the launch at the Beijing Aerospace Control Center in the capital's northwestern suburbs.

China's most adventurous space endeavor, the multimodule space station, named Tiangong, or Heavenly Palace, will have three main components — a core module attached to two space laboratories — with a combined weight of nearly 70 tons.

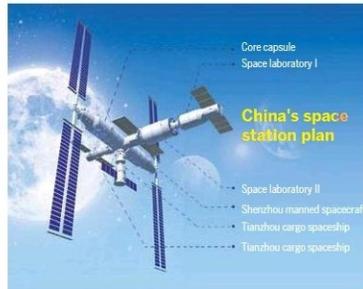
The core capsule, named Tianhe,

or Harmony of Heavens, is 16.6 meters long and has a diameter of 4.2 meters. The craft's weight is equal to the combined weight of 15 standard-size automobiles. It has three parts — a connecting section, a life-support and control section and a resources section.

The capsule will be central to the space station's future operations, given that astronauts will live there and control the entire station from inside. It will also be used to host scientific and technological experiments.

Thursday's launch marked the second flight of a Long March 5B, the most powerful Chinese rocket when it comes to carrying capacity to low-Earth orbit.

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Core capsule
Space laboratory I

China's space station plan

Space laboratory II
Shenzhou manned spacecraft
Tianzhou cargo spacecraft
Tianzhou cargo spacecraft

Launch: Station set to accommodate up to 6 astronauts

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With a core stage and four side boosters, the rocket has a liftoff weight of 849 tons and is capable of putting a 25-ton payload into orbit near Earth.

It is now the only rocket in China that can launch Tiangong's heavy-weight components.

The launch vehicle is so big that each of its side boosters is nearly 28 meters tall — the height of a nine-story building — and 3.35 meters wide. Each has a thrust power of 240 tons.

To hold huge spacecraft, the rocket has China's largest payload fairing — a type of nose cone used to protect a spacecraft against dynamic pressure and aerodynamic heating during launch — at 20.5 meters tall and 5.2 meters wide.

Long March 5B made its debut flight in May 2020 at the Wenchang space complex, deploying the prototype of China's new-generation manned spacecraft, an experimental cargo retrieval craft, and more than 10 experimental payloads into low-Earth orbit.

Future arrangements

Construction of the space station marks the beginning of the third stage of China's manned space program, which was approved by the government in 1992.

The program's first two stages had concluded successfully with six

manned spaceflights and two experimental space lab missions.

After the core capsule was launched, astronauts on the Shenzhou XII and XIII missions and two cargo ships will be launched within a few months to prepare the module for docking with other parts of the station.

Next year, Tiangong's two space labs, two manned missions and two robotic cargo flights will be made to continue construction of the station.

The entire station is expected to become fully operational around the end of 2022 and is set to work for about 15 years, mission planners have said.

Once completed, the facility will be capable of docking with multiple crewed and cargo spacecrafts at the same time and will also be able to link with foreign spacecraft if they have a Chinese-standard docking hatch.

Upon its completion, the station will be manned regularly by groups of three astronauts in periods lasting several months. During handovers to new three-astronaut groups, the station will accommodate up to six astronauts.

In addition to its own components, the station will also be accompanied by an optical telescope that will be lifted after the station's completion to fly together with it, according to mission planners.

Currently, astronauts taking part in the coming four manned spaceflights are undergoing intensive

training and preparation. Ji Qiming, a senior mission manager at the China Manned Space Agency, said at a news conference on Thursday afternoon at the Wenchang center.

The Tianzhou 2 cargo ship was transported to the Wenchang facility in mid-April, and the Shenzhou XII manned spacecraft arrived in the Jiuquan Satellite Launch Center in northwestern China at the same time.

Comfortable environment

Yang Hong, the core capsule's chief designer at the China Academy of Space Technology, said the Tianhe allows for astronauts' long-term stay and their extravehicular activities, which will be needed for them to assemble the station, examine its external condition or repair broken parts.

About 50 cubic meters are available inside the vehicle for occupants' living and work activities — much more room than in the previous Chinese manned spacecraft. Once the two space labs are connected with the capsule to complete the Tiangong station, astronauts will have as much as 110 cubic meters in their usable space, he said.

By comparison, the usable space in the Shenzhou-series crewed spacecraft is about 7 cubic meters.

Yang added that outside the capsule are large mechanical arms that will assist astronauts in

assembling, operating and maintaining the station.

Zhang Hao, a senior designer at the academy who took part in the capsule's development, said that compared with previous Chinese manned spacecrafts, the capsule features better living conditions for astronauts.

"There are separate quarters for working, sleeping, personal hygiene, dining, healthcare and physical exercises," Zhang said. "Each astronaut will have their own bed and will share a dedicated washroom, which appears in a Chinese spacecraft for the first time. We installed many appliances inside the craft to make their stay easier, such as an air conditioner, microwave oven, refrigerator, water dispenser and treadmill."

Each astronaut will have a specially designed mobile phone capable of not only making calls between astronauts and with people on the ground, but also remotely controlling the capsule's internal apparatus, according to Zhang.

Luo Bin, a senior designer at the Shanghai Academy of Spaceflight Technology who participated in the program, said solar panels are one of the capsule's technical highlights.

"The panels were made of highly flexible materials," Luo said. "That means that even though their overall area is as much as 134 square meters, once they are folded, the thickness is similar to that of an ordinary book."

Opinion Line

China's space station takes shared future concept to space

China successfully launched the core module of its space station on Thursday, giving humankind a new foothold in space.

The space station will become a common outpost for space-faring countries to explore the universe through cooperation. Tianhe, the name of the core module, means "Harmony of the Heavens" in Chinese, and it conveys China's sincere efforts to promote mutual trust and peace through international partnerships aboard the space station.

The universe is vast and its exploration will never end. As humankind has developed technologies to live and work in space, political bias and the cost of space exploration are holding some countries back from venturing into space. However, China sees its space dream as part of a dream for all humankind, and its space station as a common home in space for everyone. It remains committed to maintaining

peace in outer space.

A white paper published in 2016 stated that China adheres to the principle of using outer space for peaceful purposes and opposes the weaponization of, or an arms race, in outer space.

Also, in 2016, China signed an agreement with the United Nations Office for Outer Space Affairs to offer its space-related technologies and experience to UN member states, in particular developing countries.

In 2018, China welcomed all UN member states to use the space station for activities ranging from growing plants to accommodating astronauts. The move demonstrates China's unwavering belief that outer space is a common resource for humankind.

In 2019, the China Manned Space Agency and the UN Office for Outer Space Affairs announced nine international projects selected for

China's space station.

As some foreign space agencies have proposed cooperative initiatives, China is looking forward to seeing foreign astronauts participate in its space flight missions, and working and living on its space station in the future.

Well-structured international cooperation can lower the costs for individual nations' space programs, promote better international understanding and help build a peaceful future.

Space exploration gives us a better perspective on the challenges and problems on Earth. Research and development in space has helped significantly advance many technologies and realize some goals that initially appeared audacious.

Through cooperation, China's space station is bound to become a scientific research platform shared by the world, benefiting all humankind.

— XINHUA

CHINA

CHINA'S SPACE STATION

China open to working with other countries

By ZHAO LEI
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China is open to cooperating with other nations on its space station project, an official said. According to Hao Chun, director of the China Manned Space Agency, the agency has signed agreements with the United Nations Office for Outer Space Affairs on space station cooperation. The two organizations have jointly issued a statement inviting scientists from around the world to submit their research proposals for an opportunity to conduct their own experiments aboard the Chinese station. "At the moment, 17 nations have confirmed their participation in nine scientific tasks on our station, with related work proceeding well," Hao said. "We will continue working with the UN's outer space office to solicit proposals for future scientific collaborations."

The official said there will be more than 20 cabinets aboard the station reserved for scientific instruments that were designed in accordance with international standards, adding that they will be available for collaboration. Moreover, Hao said it definitely will be foreign astronauts on the Chinese station.

"A lot of foreign space organizations have told us that they hoped we could open our station to their astronauts. Some foreign astronauts have begun to learn Chinese. We will start selecting foreign participants and preparing for joint flights in due course according to the conditions on the station," Hao said.

"We are determined to make our space station a global platform for scientific and technological research to benefit all people around the world," he added. Hao also said his agency will strive to make sure that it makes the best use of the station to advance space science, technology and application.

He said scientists will be able to take advantage of the facility's unique environment to perform mutation breeding experiments, produce special medicines and create new materials, thus generating scientific, technological and economic benefits.

Launch viewers



People watch and film as a Long March 5B carrier rocket blasts off with Tianhe, the core capsule of China's space station, in Wenchang, Hainan province, on Thursday. LIU YANG AND ZHANG MAO / FOR CHINA DAILY

Purified urine provides clean drinking water for astronauts

Special apparatus cuts resupply costs, allows for longer durations, designer says

By ZHAO LEI in Wenchang, Hainan
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Researchers and engineers at the China Aerospace Science and Industry Corp, a major defense contractor, have several sets of its instruments inside the core capsule of the country's space station that was launched on Thursday.

Rather than lethal weapons, those instruments will serve astronauts who live and work inside the station. One is especially indispensable — the urine treatment and water recovery apparatus.

Developed and built by engineers at the CASIC Second Academy's 206th Institute, the apparatus was activated for in-orbit testing shortly after the capsule entered orbit, and the results showed it functions well.

"We sent signals from ground control to start the machine for a certain period of time to check whether it can dispose of simulated urine as we had designed. The readings were normal, which means our design works," said Cui Guangzhi, chief designer of the apparatus at the institute.

"Urine treatment and water recovery are among the most important parts in a space station's environmental control and life support system, being vital to astronauts. Long-term manned space missions rely heavily on regenerative life support systems, and resupplying water, oxygen and food poses challenges. A reliable urine treatment and water recovery apparatus will help extensively reduce resupply costs and allow for longer-term missions."

Once astronauts of the Shenzhou XII mission enter the core capsule in the near future, the apparatus will formally begin operation, Cui said.

The machine's processing method sounds simple — urine will be mixed with chemical agents for initial disposal and then pumped into a vacuum container, where it will be boiled for evaporation. Then water molecules will be collected from the steam and be further purified. However, engineers had to overcome a number of technical difficulties to make sure the process can occur smoothly in the space station's unique environment, which differs from Earth's in various ways, according to Wang Tianhao, a member of Cui's team.

"For instance, in the station's microgravity environment, it is very hard to extract and concentrate water molecules from the vapor, so we developed a special device to separate them," he explained.

Wang said the apparatus is capable of recovering more than 80 percent of the water in urine and can produce 2.5 liters of pure water each hour.

Cui said that the processed water will not only be drinkable, but even cleaner than standard drinking water in China. It will mainly be used for astronauts' consumption, cleaning and oxygen production.

The 206th Institute began to design the prototype of the apparatus in August 2012 and finished the design work in early 2013. Engineers then manufactured several prototypes and started to conduct a great number of ground tests to examine their capability and performance.

Previous Chinese manned missions kept astronauts' urine in a special container, which would burn along with the spacecraft's unmanned section as it fell back to Earth.

Private firms expected to help build space station

By ZHAO LEI

Commercial enterprises will have opportunities to take part in the construction and operation of the nation's space station, according to a senior space official.

Hao Chun, head of the China Manned Space Agency, told China Daily in an interview earlier this month that his agency, which administers the space station program, will take advantage of private space companies' technologies and capabilities to help State-owned contractors build and maintain the station.

"Actually, we have already started inviting private companies to offer their solutions to us. For instance, we invited bids for new concepts of cargo transportation to our space station and then received proposals from more than 10 private enterprises," Hao said. "Next, we will review these proposals and select and support the good ones."

"The participation of commercial space enterprises will give us greater flexibility and offer us more convenience in terms of the operation and maintenance of the space station."

Hao Chun, head of the China Manned Space Agency

If the selected companies prove to be competent and qualified, the agency will consider commissioning them to fulfill cargo transportation missions for the station according to plan. Currently, China has only one type of cargo spacecraft — the Tianzhou, which was developed by State-owned space giant China Aerospace Science and Technology Corp. Tianzhou 1 performed resupply and refueling tests with the station's space lab on orbit in 2017, while Tianzhou 2 is scheduled to be launched in the coming months to dock with the core capsule of the space station.

"The participation of commercial space enterprises will give us greater flexibility and offers us more convenience in terms of the operation and maintenance of the space station, and it will also help us reduce our overall costs," Hao said, also suggesting that private companies should understand the space station program's requirements and look into available opportunities to make the best use of their expertise.

The official also said that the rapidly expanding commercial space sector will become a major driving force for China's space industry.

In the wake of the intensifying contest in the global space arena, China has realized that it is necessary to introduce new players to stimulate innovation and competition and to fill in market gaps left by established contractors. As an important part of his endeavor to strengthen China's space industry, President Xi Jinping has requested that the long sheltered industry open its doors to private enterprises and capitalize on their participation to boost sustainable growth.

Meanwhile, several government departments have published policies and guidelines that encourage private enterprises to take part in space-related businesses.

Due to the government's support and thriving business demands, dozens of domestic private space companies have emerged and obtained some market share in the carrier rocket and satellite industries.

Labs play key role in mission preparation

By ZHAO LEI

Though China launched the first module of its manned space station into orbit on Thursday, the nation had conducted a series of preparatory work and accumulated experience through two previous space laboratory missions.

China's first space lab — Tiangong 1, which was regarded by foreign space observers as the nation's first prototype space station, was launched in September 2011 by a Long March 2F carrier rocket at Jiuquan Satellite Launch Center in northwestern China.

Meant to last two years, the spacecraft was actually in service for four and a half years before its retirement was announced by authorities in March 2016.

During its operation, the 8.5-metric-ton space lab, about the size of a school bus, served as both a manned laboratory and an experimental test bed to demonstrate orbital rendezvous and docking techniques.

It conducted six automatic and astronaut-controlled dockings with the nation's Shenzhou VII, Shenzhou IX and Shenzhou X spacecraft. Tiangong 1 hosted Liu Yang, China's first female astronaut, during the Shenzhou IX mission.



The Tiangong 1 space lab docks with the Shenzhou IX manned spacecraft as it is monitored at a control center in Beijing in 2012. ZHA CHUNMING / XINHUA

The country's second woman in space, Wang Yaping, also spent time in the lab during the Shenzhou X mission. From the lab, she gave a 40-minute televised science lecture that was watched by more than 60 million Chinese students from about 80,000 schools.

The lab returned Earth's atmosphere before breaking apart in a fireball over the South Pacific Ocean in April 2018.

China's second space lab, Tiangong II, was put into orbit in September 2016 atop a Long March 2F carrier rocket at Jiuquan Satellite Launch Center in northwestern China.

It carried two Chinese astronauts from the Shenzhou XI mission in October and November 2016.

More than 1,000 days into its orbit 393 kilometers above the ground,

the lab substantially outlived its two-year designed life span and completed all of its assigned tasks.

During its stay in orbit, Tiangong II carried out four dockings with the Shenzhou XI manned spacecraft and Tianzhou 1 cargo spaceship, enabled engineers to verify a series of technologies such as midterm life support and in-orbit refueling, and executed multiple extended experiments.

It carried about 600 kilograms of scientific payloads and conducted more than 60 experiments and technology tests.

Tiangong II returned the atmosphere in July 2019, with some debris falling into the South Pacific Ocean.

The China Manned Space Agency said the Tiangong I and II labs helped it gain significant experience for the construction and operation of the country's future space station.

Program's origin began at symposium in Hebei

By ZHAO LEI

The origin of China's aspirations to operate its own space station can be traced back to July 1985, when the Ministry of Aerospace Industry — predecessor of the China National Space Administration — arranged the first symposium on the space station in Qinhuangdao, Hebei province.

Space officials, mission planners and engineers set two major goals for China's space sector in the coming decades: one was to build large carrier rockets and reusable aerospace vehicles; the other was to construct a space station.

Since then, scientists, designers and engineers from domestic space organizations started making plans for the space station and manned spaceship programs. They had several rounds of discussions and debates on the programs' technological and technical road maps.

In August 1992, a special committee decided that China will use manned spacecraft to assemble a space station in orbit in the near future. The plan was approved in September that year by the Standing Committee of the Political Bureau of the Communist Party of China Central Committee, officially debating the nation's manned space program.

In September 2010, the construction plan for the space station was approved by the government. After that, R&D for the nation's largest and most sophisticated space-based facility officially started.

Deng endorsed the suggestion and requested that related central government departments immediately solicit advice and begin research and planning work.

The national high-tech project became reality in November 1986 as the government launched what later became known as Project 863. The national high-tech project covered seven major fields, ranging from biology to new energy.

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In March 1986, four distinguished scientists — Wang Debing, Wang Ganchang, Yang Jiachi and Chen Rangyun — wrote a letter to then Chinese leader Deng Xiaoping, submitting their suggestion that China should invest in strategically important science and technology.