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Wentian space lab goes into orbit

Rocket blasts off and carries craft to nearly 400 km above the ground

By ZHAO LEI in Wenchang, Hainan
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China launched its Wentian space laboratory on Sunday afternoon, sending the country's largest-ever spacecraft into Earth's orbit to become part of the Tiangong space station.

Encased in a 20.5-meter-long payload, the space lab was carried by a Long March 5B rocket that blasted off at 2:23 pm from a coastal service tower in the Wenchang Space Launch Center in Hainan province.

After a flight of about eight minutes, the rocket placed the craft into a low-Earth orbit nearly 400 kilometers above the ground.

After about 13 hours, Wentian was scheduled to rendezvous and then dock with the Tiangong station's Tianhe core module, according to the China Manned Space Agency.

The Shenzhou XIV mission crew now flying with the Tiangong — mission commander Senior Colonel Chen Dong, Senior Colonel Liu Yang and Senior Colonel Cai Xuzhe — will then enter the lab module to check its condition and internal equipment, it said.

In the coming weeks, Wentian will be repositioned by a robot apparatus from the forward docking port to a lateral port, where it will remain and be prepared for long-term operations, mission planners said.

To prepare for Wentian's arrival,



The Wentian space laboratory was launched on Sunday from a coastal service tower in the Wenchang Space Launch Center in Hainan province. It is China's largest-ever spacecraft to go into Earth's orbit and is to become a part of the Tiangong space station. ZHU JINXIONG / CHINA DAILY

the Tianzhou 3 cargo spacecraft departed from the Tiangong station on July 17 to leave its docking hatch for the lab. The cargo ship, which was launched in September and had remained connected to Tiangong since then, will be guided by ground controllers to eventually fall back to Earth.

Before Wentian's docking, Tiangong consisted of the Tianhe module, the Tianzhou 4 cargo ship and the Shenzhou XIV spacecraft.

Assembled at a manufacturing and testing complex in the northern municipality of Tianjin, Wentian was transported by ship and arrived in Wenchang in late April. It underwent function and prelaunch checks over the past three months at the launch center.

Platform for science

The first lab component of the Tiangong station, Wentian features cutting-edge technologies, strong

capabilities, sophisticated design and represents a new milestone in China's space industry. It incorporates the wisdom, dedication and hard work of numerous scientists, engineers and technicians, according to the China Academy of Space Technology, which was responsible for designing and making the craft.

The vehicle consists of three major parts — a crew working compartment, an airlock cabin and an unpressurized service module.

Weighing 23 metric tons, the space lab is 17.9 meters tall, roughly equivalent to a six-story residential building, and has a diameter of 4.2 meters. It is the largest and heaviest spacecraft China has ever built and also the world's heaviest self-propelled spaceship in service, said Zhang Qiao, head designer of Wentian's overall structure.

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Space station expanding R&D ability, scientist says

By ZHAO LEI in Wenchang, Hainan
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The Wentian space lab will help to greatly advance scientific research and the development of technology in China, providing a unique platform for experiments that are difficult or impossible to be done on Earth, a senior scientist said.

Zhang Wei, director of the Chinese Academy of Sciences' Technology and Engineering Center for Space Utilization, said on Sunday in Wenchang, Hainan province, that although there are so many laboratories on the ground, a permanent space station has advantages.

Zhang's center is responsible for making and implementing plans and schedules for scientific work on the Tiangong space station.

"First of all, a space station has a unique environment with physical features like microgravity." The microgravity, the result of the spacecraft's fast orbiting speed, can help scientists to reveal some physical traits that 'hide' behind the gravity on Earth," he said. "The microgravity will also allow for the development and mass production of special materials."

Secondly, the orbiting infrastructure is an ideal place for



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Zhang Wei, director of the Chinese Academy of Sciences' Technology and Engineering Center for Space Utilization

astronomical and Earth observations, Zhang said.

"For instance, it has proved difficult to detect and record gamma ray, X-ray, ultraviolet, infrared and ultralong wave emissions on the ground due to the atmospheric absorption and interference, as well as the effects of human activities. In contrast, sensors on a space station can easily detect those astronomical elements.

"Similarly, observation with instruments in a space lab can cover as much as 90 percent of all land on Earth within just three days, enabling geoscience researchers to follow Earth movements in an efficient and timely



The Wentian space lab, shown as it was being assembled, is expected to advance space science, technology and research applications. PHOTO PROVIDED BY THE CHINA ACADEMY OF SPACE TECHNOLOGY

manner," the scientist said.

In addition, the long-term presence of astronauts means scientific hardware and experiments inside the space station can be taken better care of than on crewless spacecraft, and can also be repaired or adjusted any time if necessary.

Meanwhile, regular flights between Earth and the space station make it convenient to send new experiments and materials up and retrieve them, enabling scientists to observe and study what may have happened to them in outer space, Zhang said.

Hao Chun, director of the China Manned Space Agency, has pledged to make the best use of the Tiangong space station to advance space science, technology and application.

He said scientists can take advantage of the space environment to perform mutation breeding experiments, produce special medicines and create new materials, thus generating scientific, technological and economic benefits.

The agency has signed agreements with the United Nations Office for Outer Space Affairs on space station cooperation.

The two organizations have jointly invited scientists from around the world to submit research proposals for an opportunity to conduct their own experiments aboard Tiangong.

The scientists from a number of foreign nations have started to participate in experiments on Tiangong, according to the official.

Nation to put large telescope in orbit next year

By ZHAO LEI

China plans to launch a large space telescope next year to fly alongside the Tiangong space station, according to the China Academy of Launch Vehicle Technology.

The academy said a Long March 5B heavy-lift carrier rocket will deploy the Xuntian space telescope in a low-Earth orbit similar to the track of the Tiangong station as they both circle Earth. The telescope will carry out deep-space observation and research in the frontier fields of science, it said.

The academy is the designer and builder of the Long March 5B, the

most powerful Chinese rocket when it comes to carrying capacity for low-Earth orbit. The rocket is central to China's space station program because it is now the only Chinese launch vehicle capable of carrying large space station parts into orbit.

The China Space Station Telescope, or Xuntian, is now being developed by the Chinese Academy of Sciences.

After being placed in orbit, the telescope is scheduled to start formal scientific operations around 2026. It has a designed life span of 10 years and will be able to extend its service through in-orbit maintenance, said

Zhan Hu, the scientist in charge of the program at the Chinese Academy of Sciences' National Astronomical Observatories.

Zhan said Xuntian is about the size of a large bus and will weigh more than 10 metric tons.

The observatory will consist of two major parts — an optical telescope and an orbiting platform. It will have an optical aperture of two meters and state-of-the-art detectors, boasting a large field of view and high-definition imaging capability, he added.

Upon its deployment next year, the telescope will carry five mission payloads — a wide-field camera, a

terahertz module, a multichannel imager, an integral field spectrograph and an extrasolar planetary imaging coronagraph.

As its tasks evolve, scientists will send new equipment to be mounted on it, he said.

Zhang Wei, director of the Chinese Academy of Sciences' Technology and Engineering Center for Space Utilization, said the space observatory is expected to help scientists around the world unravel a series of cosmic mysteries such as the composition of the universe, history of planetary systems, black holes and dark energy.

Wentian: New challenges are emerging after launch success

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The flexible solar panels of the lab are the largest of their kind in China. When fully unfolded, they are more than 55 meters long and have a combined area of nearly 280 square meters.

After Wentian is connected to the Tianhe module, its airlock cabin will replace the one on Tianhe to become the main place for astronauts to put on their spacewalk suits and move out of the space station.

"Its inner space is bigger than that of the airlock cabin on the core module while its hatch is wider, making it easier for astronauts to make preparations and carry out spacewalks," Zhang said.

Inside the gigantic lab, there are eight scientific cabinets. They will mainly be used for biological and life science studies and can support research on the growth, aging and genetic traits of plants, animals and microbes in the environment of space, he said.

Outside the airlock cabin, there are 22 extravehicular payload adapters capable of carrying scientific equipment needed for experiments that require exposure to the space environment, cosmic rays, vacuum and solar winds, Zhang added.

"In addition to its scientific functions, Wentian also serves as a backup control station to the Tianhe core module in case of emergencies or malfunctions. It has all the same flight-control devices as those inside the core module to operate the entire Tiangong station," Zhang said.

The designer added that the craft also has three separate sleeping quarters and an independent section for personal hygiene. They can be used in emergencies or handovers by two crews.

Wentian also has a five-meter robotic arm that can be used to move small and medium-sized equipment. It can be linked with the 10-meter robotic arm on the Tianhe module to create a joint arm capable of reaching all major parts of the Tiangong station, according to the designer.

Pang Zhilun, an observer of manned spaceflights, said the Wentian program is one of the most chal-

lenging and sophisticated space programs China has embarked on.

"You can imagine just how difficult it must have been to design, manufacture and deploy such a massive, advanced space lab," he said.

"Now that it has been successfully launched, the next challenge is emerging in terms of its flight control, trajectory maneuvers and docking. Both Wentian and Tianhe are big and heavy while there are astronauts inside the Tianhe. We have no prior experience of connecting two spacecraft of this size."

Wang Yanan, editor-in-chief of Aerospace Knowledge magazine, called the space lab a "marvel of modern engineering and technology." He said that once scientific equipment inside Wentian begins to operate, the equipment will become valuable assets for scientists around the world by making many new science ideas possible and fostering international cooperation.

Mission planners said the Tiangong station's second lab, Mengtian, will be lifted by a Long March 5B from Wenchang in October.

After it is connected with the Tiangong, the station will form a T-shaped structure and astronauts will have as much as 110 cubic meters of usable space.

After the labs, the Tianzhou 5 cargo craft and the Shenzhou XV crew are scheduled to arrive at the massive orbiting outpost around the end of the year.

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

In the long run, the orbiting outpost will be capable of docking with multiple crewed and cargo ships at the same time and will also be able to link with foreign spacecraft if they have a Chinese-standard docking hatch.

Currently, Tiangong is manned by the Shenzhou XIV mission crew, who entered the station late on June 5, several hours after their spacecraft was launched from the Jiuquan Satellite Launch Center in northwestern China.