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New lab module to assist space station's completion

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China's Mengtian space lab module, the third major component of the nation's Tiangong space station, was launched on Monday afternoon in a key step to complete the in-orbit assembly of Tiangong.

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The lab module's carrier — a Long March 5B heavy-lift rocket — blasted off at 3:37 pm from the Wenchang Space Launch Center in the southernmost island province of Hainan.

After flying more than eight minutes, the rocket placed the spacecraft into a low-Earth orbit nearly 400 kilometers above the ground.

Mengtian, the world's largest single-body spacecraft now in active service, was then scheduled to rendezvous and dock with the Tiangong station's Tianhe core module, according to the China Manned Space Agency.

The three crew members of the Shenzhou XIV mission, who have been staying in Tiangong for nearly five months, were ready for Mengtian's arrival, the agency said in a news release.

Mengtian was transported to the Wenchang Space Launch Center by ship in early August. It underwent function and pre-launch checks over the past three months at the launch center. The craft received fuel earlier this month at the center.

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The Tiangong Space Station is shown after docking with the Mengtian lab module in this artist's drawing. PROVIDED TO CHINA DAILY

Mengtian carries humankind's dream of space

A Long March-5B Y4 carrier rocket blasted off from a launchpad at the Wenchang spaceport in South China's Hainan province on Monday carrying a second lab module for China's space station. When in place, the Mengtian lab module will complete the space station's basic T-shaped structure, which means that the space station will be able to perform all its designated functions.

Mengtian is the second lab module for the space station. The first is the Wentian module which is already docked with the Tianhe core module.

While Wentian is to be used for biological and space life science projects, such as observing the growth of multiple kinds of plants, animals and microbes in space, Mengtian will be used for in-orbit experiments dedicated to physics and material sciences and will focus on micro-gravity experiments.

As well as being a lab module, Mengtian will also act as a backup for the core module when it is undergoing maintenance. And with Mengtian in place, the space station will be able to host more astronauts. There are three astronauts on board the space station at the moment. When Shenzhou XV arrives with a change of crew, scheduled for early December, there will be six Chinese astronauts living on the space station for a time until the return of the Shenzhou XIV mission crew members.

China's space station will be the only one in space in 2024, if an agreement can't be reached on extending the life of the International Space Station. The ISS was due to be decommissioned in 2031, but that might not be feasible since it requires the cooperation of the United States and the European Union with Russia.

That the ISS is even still operational at this point is a testament to its design and engineering. Like the ISS, China's space station will have to withstand tremendous stresses and strain. While the power, environmental control and life support, and communications systems are all repairable or replaceable in orbit, the operational lifetime of the spacecraft is limited by the integrity of the primary structure. This has to bear the strain of repeated vehicle dockings and undockings, and the stress effects of daily temperature swings of about 278 degrees Celsius in either direction.

Mengtian means "dreaming of heaven" in Chinese. And China's space station will not only carry the nation's dream of exploring space, but also that of humankind as a whole when the ISS meets its fiery fate.

China views learning more about the vast cosmos as a common dream of humankind, and researchers from other countries already have access to China's orbiting laboratory. China has selected nine initial international experiments for the space station through a collaborative project with the United Nations, and more are to follow. It is also anticipated that the space station will host astronauts of various nationalities during its lifetime as China is encouraging international space exchanges and cooperation to help protect the Earth, improve people's well-being and serve human progress.

China's Mengtian space lab module is launched at the Wenchang Space Launch Center in the southernmost island province of Hainan on Monday. SU DONG / FOR CHINA DAILY

Space lab: Experiments set to achieve world-class findings

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The lab module is about 17.9 meters long, has a diameter of 4.2 meters and weighs more than 23 metric tons. It has 32 cubic meters of internal space that can be used by the astronauts, according to its designers at the Shanghai Academy of Spaceflight Technology.

Gan Keli, Mengtian's project manager at the Shanghai academy, said that the spacecraft consists of four sections — a crew working compartment, a payload section, an airlock cabin and a service module.

"There are 13 scientific cabinets inside the craft to hold scientific equipment. It also carries 37 extra-vehicular payload adapters capable of carrying scientific experiments that need to be exposed to the space environment, cosmic rays, a vacuum and solar winds," Gan said.

Gan noted that scientific equipment onboard will be used for micro-gravity studies and to carry out experiments in fluid physics, materials science, combustion science and fundamental physics.

A major technical feature of Mengtian is that it can move scientific apparatus out of the Tiangong station without being handled by the astronauts, to conduct extravehicular experiments and bring them back inside the station after experiments, according to the designer.

Moreover, the lab module is capable of deploying miniature spacecraft such as CubeSats into orbit, he added.

Liu Guoning, deputy chief designer of the scientific cabinet system at the Chinese Academy of Sciences' Technology and Engineering Center for Space Utilization, said the scientific experiments to be carried out in Mengtian are expected to enable scientists to conduct cutting-edge studies and achieve world-class findings.

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

The results of the experiments can also boost the application and transfer of advanced space science and technology to other research fields, Liu said.

"So far, we have arranged about 40 experiments in those eight cabinets and will gradually carry them out in accordance with the overall plan," he said.

Liu said three experiments that will take place in Mengtian will involve cooperation with researchers from the European Space Agency, and these will help to increase the status of the Tiangong station in the international science community.

"The Tiangong station will be our country's largest space-based platform for science and technology in the coming decade. We are determined to make full use of the asset to obtain breakthroughs in science and technology and to generate comprehensive benefits," he said.

Wentian, the Tiangong station's first lab module, was launched on July 24 on a Long March 5B rocket from the Wenchang center.

Tiangong is currently composed of four sections: the Tianhe core module, the Wentian lab, the Tianzhou 4 cargo ship and the Shenzhou XIV spacecraft.

After Mengtian 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 this year.

Monday's launch mission marked the 446th flight of the Long March rocket family and the country's 47th space mission this year. China plans to undertake more than 60 rocket launches in 2022.