

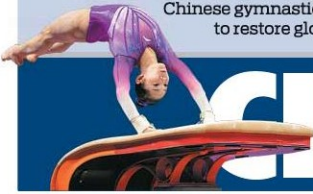
Olympic hopes

Chinese gymnastics squad determined to restore glory days **SPORTS, PAGE 20**

Pudong to have big role in new reform moves **BUSINESS, PAGE 13**

Double blow

South Africa's tourism sector battered by pandemic, riots **WORLD, PAGE 12**



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Experimental space plane aces test flight

By ZHAO LEI
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China's reusable aerospace plane, which was tested on Friday, offers great potential in a wide range of businesses, according to industry observers.

"It will be able to do many different things: space tourism, transporting astronauts, satellite deployment, cargo transportation and emergency rescues," said Wang Yanan, editor-in-chief of Aerospace Knowledge magazine.

"Compared to rockets and space shuttles, this new vehicle is lower cost, requires less preparation and is more flexible. It will also permit ordinary people to take short trips into space or make ultrafast intercontinental journeys at an affordable price."

Wang said that once the new craft enters service, it will greatly reduce the complexity and cost of space missions, likely making space tourism as easy and convenient as flying.

Wu Peixin, an aerospace industry analyst in Beijing, said that commercial space enterprises will welcome a reusable aerospace plane because it will be technically and economically suited to placing small satellites in low orbit, an expensive process using rockets.

It could also help in space station operations by transporting crew members and material between the station and Earth.

"However, developing this kind of vehicle is never easy as it will have to fly in the atmosphere and outer space, which requires an aerodynamic design and propulsion system capable of adapting to different operational environments and modes," Wu added.

China Aerospace Science and Technology Corp, the country's major space contractor, said the maiden flight of a reusable suborbital prototype took place in North China's Inner Mongolia autonomous region on Friday.

Developed by the China Academy of Launch Vehicle Technology, a CASC subsidiary, the unnamed prototype was carried into space by a rocket launched from the Jiuquan Satellite Launch Center and flew for a while on its own before making a conventional landing at the Alshaa Right Banner Badajilin Airport in southwest Inner Mongolia. The test flight was successful, the State-owned conglomerate said in a statement, adding that the cutting-edge vehicle incorporates aviation and space technologies.

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The test laid a solid foundation for China to develop a reusable space transportation system, the statement said. It did not give details of the event.

It was the second time CASC, a leading domestic supplier of rockets and ballistic missiles, has announced developments in its reusable space vehicle project.

In September, it tested an experimental reusable craft at Jiuquan. It did not publish detailed information, photos or videos of the test.

China Aerospace Science and Technology Corp, another space contractor, is also working on a reusable space plane, which it plans to put into commercial use by 2030. The company said that it conducted a key test of a conceptual demonstration prototype to verify the propulsion shift mechanism between its ramjet and rocket engines.

In June 2018, the China Academy of Launch Vehicle Technology announced that its engineers were "designing a new spacecraft to send anyone able to pay \$200,000 to \$250,000 on a suborbital journey to enjoy a magnificent view of the stars, and experience weightlessness."

It said the reusable spacecraft is expected to enter service around 2028 and will look like a fixed-wing aircraft without a vertical stabilizer — upright tail fin — and will be propelled by a rocket engine. It will take off vertically like a rocket but make horizontal landing on a runway like a plane.

With a floor area of 10 square meters, the spacecraft will be able to carry a maximum of 20 travelers to an altitude of more than 100 kilometers, about 10 times the cruising altitude of a commercial jetliner, designers said. That would take future passengers to the Karman Line, the globally recognized boundary between the Earth's atmosphere and the edge of space.

China's five-star red flag flies proudly on red planet

By CHEN MEILING in Beijing
and MA JINGNA in Lanzhou

Four photos of Mars taken by the Tianwen 1 probe were unveiled in China last month, but the excitement generated by humanity's next great step in space exploration was shared around the world.

Just as eye-catching as images of the Martian surface itself was the Chinese national flag on the Zhurong rover's landing platform.

After the historic landing on May 15, the flag was slowly unrolled. Its red color stands out in the photo, marking China's pride in becoming the second country after the United States to successfully land on the red

planet. The earliest attempts at a landing, made by the Russians in 1971, ended in failure.

Few people are likely aware that state-of-the-art technology was needed to make unrolling the flag possible.

According to He Yanchun, deputy general manager of the Surface Engineering Department of the Lanzhou Institute of Physics in Lanzhou, Gansu province, a subsidiary of the China Aerospace Science and Technology Corp and producer of the flag device, due to the location and limitations of space, the 360 millimeter long and 240 mm wide flag was made out of shape memory composite to be

able to take the form of a scroll during the travel period to Mars before being unrolled.

When the probe landed, the flag gradually unfolded after being lightly heated. "Unlike folding or sticking up the flag, the device was a modern adaptation of traditional Chinese scroll paintings, and it created a good effect," He said.

Shape memory material is able to "memorize" its original shape and automatically recover that shape once prompted. The material also functions in extreme conditions such as low temperatures and high radiation, experts said.

With no previous examples to

learn from, the research team conducted hundreds of trials to overcome significant challenges. One was ensuring the flag remained tightly rolled up during the month-long flight to Mars, despite exposure to the harsh environment of space and drastic changes of temperature. To do that, the research team used extra materials to tighten the locking force, said Zhao Yunzhong, a designer of the department.

Electric heating bands were installed in both ends of the scroll. Once heated, the shape memory composite material straightened, allowing the flag to fall under the force of gravity.

"The heating and unrolling process was complicated and required precise design. For one thing, it was affected by the extreme and variable Martian environment, characterized by temperature differences, low air pressure and microgravity. For another, the weight and power consumption of the flag device needed to be adapted to the overall design of the probe, which posed a great challenge in terms of design and production," Zhao said.

"Our team conducted hundreds of experiments covering all possible conditions and collected a great deal of data before finally figuring out the perfect working and heating time. People working in the aerospace science and technology sector must be able to 'crack hard nuts' despite difficulties."

According to the institute, the flag device weighed less than 200 grams in order not to add too much weight to the probe. The unrolling of the flag barely resulted in any vibration or shock to other components.

Another national flag was pasted on the rover itself, with a length of 96 mm and width of 64 mm, using the same technology used on the Chang'e 3 and Chang'e 4 lunar probes.

As Zhurong continues to explore key scientific questions, such as potential locations of water and ice and volcanic activity on Mars, the flag will "wait" for good news of potentially historic findings, at the landing platform.

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