

# ***Zhurong* Touches down on Mars for *in situ* Scientific Investigations**



*Zhurong* (left), the Chinese Mars rover, poses together with the lander on the Red Planet (Image: CNSA/MARS)

After orbiting the red planet for over three months, on May 15, the lander of *Tianwen-1*, the first Mars Probe of China, softly touches down on the *Utopia Planitia*, its preset landing site on the Martian surface. Later, on May 22, it released *Zhurong*, the 240 kg rover named after the Chinese God of Fire, to conduct *in situ* investigations across the dusty, rugged Martian terrains.

Launched on July 23, 2020, *Tianwen-1* mission are designed to investigate the Red Planet's morphology and geological structure, its surface soil characteristics as well as water-ice distribution, its surface material composition, atmospheric ionized layer, climate and environment, and its physical fields and inner structures. In the process of the probe's Earth-Mars transfer and orbiting around the destined planet, the seven scientific devices onboard its orbiter, including a moderate-resolution camera, a high-resolution camera, the Mars-Orbiting Subsurface Exploration Radar, the Mars Mineralogy Spectrometer, the Mars Magnetometer, the Mars Ion and Neutral Particle Analyzer, and the Mars Energetic Particle Analyzer, were successively put into operation. Now it is time for the six devices installed on the rover *Zhurong*, namely the Multispectral Camera, the Terrain Camera, the Mars-Rover Subsurface Exploration Radar, the Mars Surface Composition Detector, the Mars Magnetic Field Detector, and the Mars Meteorology Monitor, to get to work.

As scheduled, the rover will work on the complicated terrains for 90 Martian days (one Martian day lasting for 24 hours and 39 minutes), at a peak speed of 200 meters an hour, despite the gravel-covered deserts and a temperature variation up to

120°C (-90°C~30°C). The structure of the rover has to endure the harsh environments and to provide stable and reliable support for the scientific devices aboard; not to mention that the components of onboard devices also need to stay in good condition. Such demanding requirements would be a nightmare for ordinary metal materials.

To help the Mars rover deal with the tough situations, scientists at the Chinese Academy of Sciences (CAS) developed a family of novel aluminum-ceramic complex materials. These materials are as light as aluminum to reduce the weight of the payloads; on the other hand, they are as powerful and wear-resisting as iron and steel, hence can help the rover maintain stable and reliable performance even after roving over the Martian surface for a long time. To overcome the large temperature variation, and to deal with potential unknown situations, the materials are highly isotropic with excellent strength and malleability, to help the rover survive unpredictable crashes, and collisions.

Since May 25, a payload developed by CAS scientists, the high-resolution subsurface radar, has been working smoothly to probe the Mars subsurface structure, to understand the thickness of the surface soil layer, the structure of the ice layer, and other subsurface structural details. Another payload developed by CAS scientists, a multispectral camera, is also in good working condition.

As of the morning of June 27, the orbiter of *Tianwen-1* had been working in orbit for 338 days, and the rover *Zhurong* had been working for 42 Martian days, covering a distance of 236 meters, according to the China National Space Administration.

## Reference

W. X. Wan, C. Wang, C. L. Li and Y. Wei. China's First Mission to Mars. *Nature Astronomy* **4**, 721. (2020)