Ground scientific verification test for High Resolution Imaging Camera of China’s First Mars Mission

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Mars is a planet in the solar system that is closer to the Earth and has the most similar natural environment to the Earth. It has always been the first choice for humans to go out of the Earth and Moon system for deep space exploration.

China’s First Mars Mission (HX-1) will be launched in 2020 with an orbiter and a lander rover. One of the scientific goals of our mission is to study the morphology and geologic structure of the Mars. In order to achieve this purpose, the orbiter is equipped with a High Resolution Imaging Camera (HiRIC) to obtain the high-resolution morphology data of typical regions and to study the formation and evolution of geologic structure. HiRIC consists of three TDI CCD line-scan detectors and two COMS area-array detectors. Each TDI CCD detector covers 5 spectral bands. Its main working mode is the panchromatic TDI CCD push-scan imaging with a maximum spatial resolution of 0.5m.

Ground scientific verification test is an effective way to comprehensively evaluate the performance, data quality of HiRIC, and to fully verify its on-orbit detection process and data processing methods. In this study, contents and results of ground scientific verification test for HiRIC is introduced. The engineering model is used here for image motion compensation effect evaluation test, focusing effect evaluation test, and outdoor field imaging test. The results show that, 1) HiRIC can calculate the image motion compensation parameters and control the camera imaging correctly according to the platform parameters of orbiter; 2) Focus processing is effective, and HiRIC can adapt to the high-resolution imaging needs of different orbit altitudes; 3) Clear image data can be obtained according to the on-orbit detection process in the outdoor field imaging test, and image data processing was correct. Image data quality, compression quality, and TDI CCD stitching accuracy all meet the requirements of the verification test. This test fully evaluated HiRIC’s ability to obtain high-resolution image data of the surface of Mars.