SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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TECHNOLOGY DEVELOPMENT FOR LUNAR SURFACE EXPLORATION

Abstract

The Japan Aerospace Exploration Agency (JAXA) endeavors to develop advanced technologies that will enable lunar surface activities. In addition, advanced test facilities to simulate lunar environments have been developed for technology verification, because surrounding environments of a spacecraft on the lunar surface are very different from those of a satellite in low Earth orbit. Among enabling technologies for lunar exploration, night survival is the key to carrying out long-term activities on the lunar surface. The spacecraft and instruments must survive the cold temperatures of the long lunar night. The instruments are expected to work on the surface of the moon for a longer time. In designing thermal models of spacecraft and mission instruments, the lunar surface has to be taken into account. Therefore, space chambers that simulate the existence of the surface of the moon is needed for thermal vacuum tests. One of the chambers can simulate a solar ray and thermal properties of the lunar regolith using glass beads. For example, a power supply system and thermal insulation technology that are necessary for long-term activity have been investigated using the test facility. The landing and mobility systems are also very important. For example, landing legs are an important subsystem for realizing safe landing, and a rover is supposed to play a major role in lunar exploration. Common to both systems is the interaction with the lunar regolith. The characteristics and properties of the lunar regolith differ from those of sand on the Earth. Therefore, to verify the performance of the mechanisms that interact with the lunar regolith, tests on the simulated conditions of the lunar soil are required. Therefore, a test facility consisting of a flat plane and a slope with variable inclination covered with the lunar regolith simulant has been constructed. Using the facility, it is possible to conduct various performance tests of surface exploration systems. In this paper, details of our technology developments and advance test facilities for lunar surface exploration are described.