

Rover Mission and Technology for Lunar or Planetary Surface Exploration

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JAXA is promoting lunar or planetary exploration missions. Japanese lunar or planetary exploration missions including landers and rovers are also earnestly under studying. The missions will follow up SELENE (SELenological Engineering Explorer, KAGUYA), a lunar global remote sensing mission. Post SELENE series missions will cover geological observation, investigation of surface or subsurface material, interior structure examination using a seismometer, potential resource investigation (ice, volatile), environment research (radiation, dust, etc), safe and precise autonomous landing demonstration, surface mobility demonstration, power generation with fuel-cell demonstration etc. The robotics technologies are expected to perform those missions.

The rover R&D group has been conducting the feasibility study of advanced technologies for lunar or planetary robotics exploration. Unmanned mobile robots are expected for the detailed surface exploration of the moon or planets, because rovers can travel safely over a long distance and observe what to see by some scientific instruments. Therefore the rover R&D group has developed an innovative test-bed rover with a new mobility system, lightweight manipulators, and advanced guidance and navigation functions. Smart manipulators with a new end-effector are also developed to perform the in-situ analysis or direct observation on the surface. The developed end-effector has two kinds of functions, gripping and scooping. The experimental results for sample collection show the effectiveness of the developed end-effector. The test-bed rover installed a single camera system, a stereo vision system, an inertial measurement system, a scan typed laser range finder etc. The rover R&D group developed advanced navigation schemes including terrain recognition, a path planning algorithm, a self-positioning method, an intelligent tele-driving system.

At this workshop, I introduce JAXA exploration roadmap on robotic missions. I also talk about a lunar robotics exploration by the lander and rover cooperation. Then I present the system configuration of the developed test-bed rover for long traverses and rover-based scientific observation. I also present the detailed functions and show the performance of the developed rover test-bed.