IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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CURRENT STATUS OF JAPANESE LUNAR POLAR EXPLORATION MISSION

Abstract

Recently, several polar explorations of the Moon are planned, because it has been suggested that water ice might be present in the lunar polar region based on remote sensing observation of the lunar surface using a neutron spectrometer and visible to infrared spectrometer. However, the precise amount and state of the water ice are still unknown.

At the Japan Aerospace Exploration Agency (JAXA), we are also studying on exploration to the lunar polar regions for resources, especially cold-trapped volatiles such as water ice using a rover. Volatile materials are expected to be useful for future human activity on the Moon and there is strong interest in the origin and concentration mechanism of the water ice from the viewpoint of science. Additionally, the polar regions are among the best candidates for long-term activity because of their long sunlight duration.

JAXA has studied lunar missions with landers and rovers for several years. Based on the latest study, the spacecraft system comprises a lander system and a rover system. The minimum target for the landing payload mass is several-hundred kilograms. After the spacecraft reaches the Moon it is inserted into a circular orbit having a 100km altitude via a few orbital changes. During powered-descent phase, the position of the lander is estimated by landmark navigation using shadows created by the terrain. After landing, the rover is deployed on the lunar surface using ramps. The rover then prospects water ice with its observation instruments.

Though the main purpose of the mission is resource prospecting for future lunar exploitation, we also expect it to perform in-situ scientific investigations and technology demonstrations. The composition of the volatiles and isotope ratio of water will reveal more of the history of the Solar System. We therefore plan to investigate not only water ice but also other volatiles in the polar regions. From a technological viewpoint, the Moon is the best place for demonstrating new technologies of planetary exploration. In general, water ice exists in dark and cold areas. Therefore, energy sources such as lithium-ion batteries with ultra-high energy density and sophisticated thermal insulation technologies such as a heat switch might be needed, for example.

To realize the mission, we are currently developing various technologies peculiar to exploration of lunar polar regions. This paper details the present status of the Japanese Lunar Polar Exploration Mission.