

Mission Objectives and Observational Requirements of the Planned Lunar Polar Mission

*大竹 真紀子¹、星野 健¹、唐牛 讓¹、白石 浩章¹、JAXA 月極域探査検討チーム¹

*Makiko Ohtake¹, Takeshi Hoshino¹, Yuzuru Karouji¹, Hiroaki Shiraishi¹, JAXA lunar polar mission study team¹

1. 宇宙航空研究開発機構

1. Japan Aerospace Exploration Agency

Currently, the International Space Exploration Coordination Group, organized by the space agencies of 15 countries and regions, is discussing future space exploration plans that will be based on international collaboration. A lunar polar mission has been studied by the Japan Aerospace Exploration Agency (JAXA) as a first step. Results derived by recent lunar exploration missions suggest that water ice might be present in the lunar polar region based on remote-sensing observations. In addition to the scientific interest about the origin and concentration mechanism of the water ice, there is strong interest in using water ice (if present) as an in-situ resource. Specifically, using water ice as a propellant will significantly affect future exploration scenarios and activities because the propellant generated from the water can be used in future lunar landing missions. However, it is currently unclear if water ice is really present in the polar region because of the limited available data. Therefore, mission objectives of the lunar polar mission are to obtain information about the quantity (how much), quality (is it pure water or does it contain other phases such as CO₂ and CH₄), and condensation/transportation mechanism of the water ice by carrying out in-situ measurements for assessing if we can use it as a resource in future space exploration activities. To obtain such information, we identified the following observation requirements.

-To measure water content directly with 0.1 wt% accuracy.

-To identify chemical species (H₂O, OH, H, CH₄, etc.) and measure their abundance.

-To measure temperature at the lunar surface, underground (up to 1.5m), and the water ice itself.

-To measure the partial pressure of water during day and night time.

-To measure the chemical composition of mineral phases, modal abundance, and space weathering degree

In the presentation, we discuss recent remote-sensing results of possible water ice in the lunar polar region, mission objectives of the lunar polar mission, its mission requirements, and instrument candidates.

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