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Author: Dr. John Walker
ispace Technologies, Inc., Japan, j-walker@ispace-inc.com

LUNAR SKYLIGHT EXPLORATION ROVER SYSTEM

Abstract

ispace has a history of developing lunar rovers for the Google Lunar XPRIZE (GLXP). Since 2010, it has iterated the design of four and two-wheeled rovers, including a dual rover system comprising a four-wheeled rover and two-wheeled rover connected by a tether. This system was designed to explore skylights on the lunar surface safely. The final configuration for ispace's GLXP mission, called "Hakuto", was one four-wheeled rover called "Sorato", with a mass of under four kilograms. In 2017, Sorato successfully passed a flight qualification campaign. Although the GLXP was concluded without a winner, the results of development were invaluable as a starting point for ispace's commercial missions. This paper describes the result of qualification of Sorato and the new rover system design for ispace's first mission using its own lander and rover.

ispace plans to explore a lunar skylight in this mission. In order to do this, it will update its dual rover system. Using Sorato as a starting point, we have improved the design of our four-wheeled rover in terms of mobility, payload capacity and reliability. Using our previous design of a two-wheeled rover, we have improved the design of our two-wheeled rover in terms of mobility and flight-readiness. Both rovers have been updated to tolerate the extreme temperature differences found outside and inside skylights.

In order to use a skylight exploration mission as a milestone for our ultimate goal of using resources from the lunar surface, we are integrating sensors designed to detect water into the rovers. Preliminary selection of sensors is included in this paper.

In order to support its payload business, we have developed a new standard payload interface based on ethernet. We are targeting entities from outside the space industry to become payload partners, and we are also targeting to travel to the moon at an unprecedented rate of once per month. This rate implies that we must make a simple, easy-to-develop-for interface. Therefore we have decided to implement a standard interface that any corporate or academic customer can meet, without specialized engineers. We have conducted qualification testing of this interface, especially for the radiation environment. We have also conducted qualification of the next generation of automotive ethernet solutions to develop an active tether system. The active tether transmits both power and data from the four-wheel rover to the two-wheel rover, with minimum mass and number of conductors.