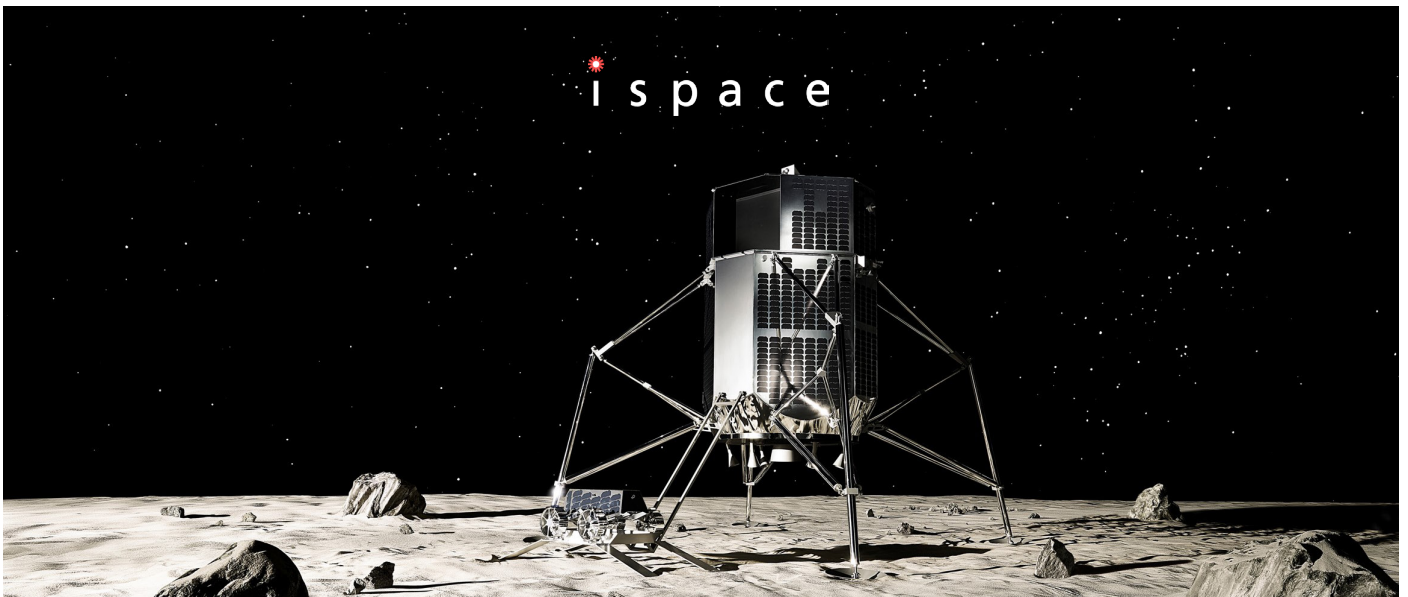


INVOLVING NEW COMPANIES IN OUR JOURNEY TO THE MOON



ispace is looking for partners for the world's first private commercial lunar exploration program HAKUTO-R.

Partnerships take the form of joint-technology development, space business entry and corporate branding.

Here are a few examples of ispace's collaboration with 3 new corporate partners recently announced in the frame of the HAKUTO-R program.

JAPAN AIRLINES

JAL was a Corporate Partner of Team HAKUTO, the sole Japanese competitor and one of the 5 finalists in the Google Lunar XPRIZE Competition, which ended in March 2018. In alignment with the "Challenge JAL" platform, in which JAL encourages the constant pursuit of pushing boundaries of what humans can achieve, the company continues to support ispace's challenge to reach the Moon, participating as a Corporate Partner to HAKUTO-R ("HAKUTO-Reboot").

Last October, the two organizations announced that JAL Engineering Company (JALEC) will provide a facility near Narita International Airport for the assembly, integration and testing of HAKUTO-R's lunar landers, as well as technical support, such as welding. Following the completion of the flight models, JAL will support the transportation of the landers to the launch site.

JAL's dedication to ispace's vision is also founded on the company's aspiration to create its own space business. Leveraging the learnings gained from the HAKUTO-R mission, JAL will pursue the creation of a space business as one of their frontier business development efforts. Through its support of HAKUTO-R, the world's first commercial lunar exploration program, JAL is helping to open up the new lunar frontier and contribute to the expansion of human activity in space.

NGK SPARK PLUG

NGK SPARK PLUG and HAKUTO-R have agreed to transport a trial design of NGK SPARK PLUG's solid-state battery technology to the Moon in 2021. Through this technological cooperation, the two organizations will conduct the world's first test of solid-state battery technology on the Moon.

Testing solid-state battery technology on the Moon is aimed at supplying the burgeoning lunar industry with a stable energy storage solution. However, in order to conduct sustained lunar exploration, energy storage technology must be capable of withstanding extremely cold temperatures on the Moon, such as during the lunar night and in the permanently shadowed regions at the Moon's poles.

Today's lithium-ion batteries consist of liquid electrolytes, which are not suitable for lunar conditions. As the Moon's poles can reach -150 °C (approx. -240 °F) in temperature, the liquid would freeze, which would cause the expansion of volume and risk of damaging the internal structure of the battery. Therefore, a stable power supply in space and on the Moon is critical for exploration and further development.

The current solution to keep electrolyte batteries above freezing temperatures has been to attach an electrical generator which generates heat using sources such as radioactive isotope which can be hazardous.

In comparison, solid-state battery technology uses a solid material as an electrolyte, such as ceramic, and avoids the issue of freezing liquid. Further, the technology is expected to produce safer, more compact batteries compared with conventional lithium ion batteries.

Currently, solid-state battery technology is still an emerging technology, not yet on the market for practical use, and there are several types under development. NGK SPARK PLUG has been pursuing research and development on "oxide-based ceramic electrolyte" battery technology with a focus on providing a wider operating temperature range and higher safety than other types. The choice of oxide eliminates the risk of combustion or hazardous gas leakage, and the company leverages its ceramics expertise in material and processing to improve the performance of its solid-state battery material.

NGK SPARK PLUG's specialty in making their batteries small and compact is a key feature for future spacecraft to install the technology in a limited space. At the same time, NGK SPARK PLUG has developed a unique capability of non-sintering the oxide-based electrolytes, instead of the common practice of sintering (densification of oxide electrolyte using a high temperature treatment). This means NGK SPARK PLUG will be able to eventually make the batteries larger for multiple applications.



MITSUI SUMITOMO INSURANCE

As part of the partnership, Mitsui Sumitomo Insurance Co., Ltd (MSI) and ispace announced plans to cooperate on the development of a lunar insurance service. The lunar surface is a region with many factors still unknown to humanity; as such, many new risks are to be expected. In order to overcome such risks and to progress toward future missions, MSI and ispace will work together to create a coverage for companies and individuals that will mitigate the risks of lunar exploration and support the sustainable development of a lunar economy.

MSI's announcement of a new lunar business is among the first commercial applications geared to supply the growing demand from the burgeoning lunar exploration industry. Aligned with ispace's vision to expand Earth's economy to the Moon, MSI recognizes the Moon as a viable expansion of its operations on Earth. Insurance is one of several industries on Earth which will expand to the Moon, enabling the development of a lunar economy.

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