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JAXA 宇宙探査イノベーションハブの紹介

Introduction of JAXA's Space Exploration Innovation Hub Center initiative

坂下 哲也¹

Tetsuya Sakashita¹

¹所属, 国立研究開発法人宇宙航空研究開発機構宇宙探査イノベーションハブ

1. Overview

Japan Aerospace Exploration Agency (JAXA) plans to proceed towards lunar and Martian exploration under the framework of international space exploration. The Moon and other planets have significant gravity fields, which means they have high affinity to ground technology, i.e. open innovation. Meanwhile, “Comprehensive Strategy on Science, Technology, and Innovation 2014 – A Challenge for Creating Japan in a New Dimension” had published by the Japanese government, which requires public research institutions and agencies to strongly contribute to innovation.

With those back ground, JAXA formed the Space Exploration Innovation Hub Center (TansaX) on April 1st, 2015. This paper shows activities of TansaX and relationship between exploration R&D and experiment on ISS.

2. Concept and initiative of TansaX

2.1. Concept

Lunar and planetary exploration is actively planned and carried out, with coordination and corroboration, in many countries around the world. In particular, exploration and investigation of the Moon and Mars, as well as manned exploration, are being vigorously considered within the framework of international cooperation. This is truly the dawn of “age of space exploration”. On the other hand, the increasing size of spacecraft, the prolonged development period, and the increase in costs have become major issues.

In order to realize efficient and challenging space exploration in a short period of time, it seems important to change the design concept and the exit strategy of technological development (simultaneously aiming at the acquisition of space exploration technology and its spread to the ground-based industry). In addition, it is important to aim for technological innovation in space exploration 20 years into the future by envisioning the participation of a wide variety of players, including private companies, in lunar utilization. Therefore, TansaX is conducting research and development with the main goal of simultaneously developing both terrestrial and space technologies into a new development group. Until now, there have been spin-in methods in which terrestrial technology is applied to space exploration and spin-out methods in which space exploration

technology is applied to terrestrial technology, but these methods have not led to new developments.

TansaX has therefore developed a new concept, as shown in Figure 1, in which terrestrial and space technologies are developed in two ways. In order to achieve this, it is important to find common issues between ground and space. JAXA has identified research issues that match the ground business issues of private companies and the space exploration issues of JAXA, and clarified the roles of both parties: JAXA is responsible for space exploration and private companies are responsible for ground applications. What is different from the conventional approach is that JAXA does not place development orders with

external parties based on the research agenda set by JAXA, but rather involves private companies and universities from the research agenda setting stage to conduct joint development. In addition, with an eye on the future development of space exploration and utilization, JAXA is aiming for the participation of a wide variety of players, including private companies, in the future. This is an attempt to lower the barrier to space exploration for “non-space” entities.

2.2. Open R&D frame work

In order to realize open innovation-type R&D, TansaX uses a two-step method for setting up joint research projects: a Request for Information (RFI) and a Request for Proposal (RFI). The RFI is a request for information on what kind of technologies private companies and universities have or what kind of technologies are needed to solve their problems. RFI is accepted at any time. JAXA selects the technologies that match JAXA's needs from the information provided in the RFI and solicits research proposals.

A cross-appointment system has been established for joint research. JAXA has introduced this system to facilitate the participation of private companies and universities by making it easier for researchers to play an active role without being restricted by the organization to which they belong.

New systems have also been introduced for the handling of intellectual property. Under JAXA's previous intellectual property system, when a private company or university conducted research and development under JAXA's sponsorship, the intellectual property generated belonged to JAXA. The TansaX collaboration is based on the premise that the intellectual property is shared with JAXA. In addition, JAXA and the private companies and universities are mutually exempted from paying licensing fees for the use of the intellectual property obtained through the joint research.

Participants are from all over Japan, and forming an all-Japan collaboration. 139 projects and 212 organizations, based on 959 RFI information, have been participating since 2015 as of 2021.

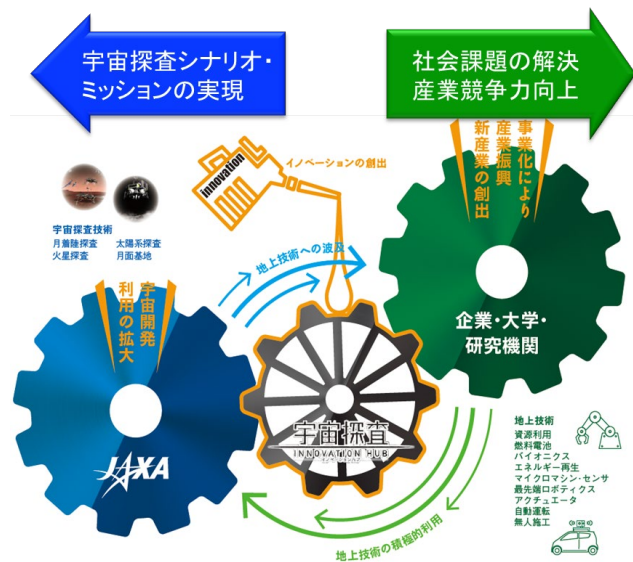
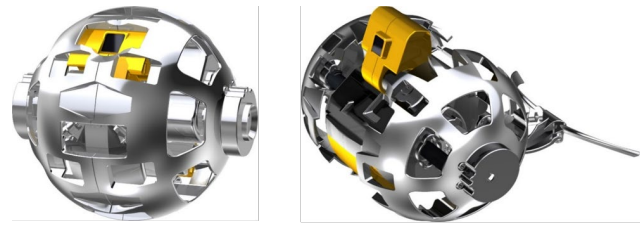


Figure 1. Concept of TansaX

3. Recent achievement

The results of TansaX's collaborative research over the past eight years have led to actual space exploration and technology demonstrations. One such case is the transformable small lunar robot SORA-Q, as shown in fig.2. SORA-Q was submitted to the first RFP in 2015 by TOMY COMPANY,LTD. and the joint research started in 2016 under the research theme "Small Robot Technology- Control Technology". Sony Group Corporation joined in 2019, and Doshisha University joined in 2021, and the four parties began joint development toward the implementation of a Smart Lander for Investigating Moon (SLIM). Subsequently, SORA-Q was decided to be used for data acquisition on the Moon by JAXA utilizing the lunar landing mission to be conducted by ispace, inc.. One SORA-Q will be headed to the Moon's surface by each of them.



クレジット：JAXA/タカラトミー/ソニー/同志社大学

Figure 2. SORA-Q

The Lunar Polar Exploration Mission (LUPEX) has adopted an imaging camera for water ice detection and a gas trace water meter based on joint research on TansaX. These are also joint research projects adopted in the first RFP, and preparations are underway for their installation in LUPEX. The drilling technology for LUPEX sample collection is also based on the joint research adopted in the 1st and 3rd RFPs.

In addition to the area such as the exploration rover, sensor, and human habitation technologies that we have been promoting, TansaX is about to start collaborative research aimed at future space experiments. The 8th RFP, which is under selection as of August 2022, called for joint research proposals on the themes of "Development of an ultra-compact 3D fluorescence microscope device" and "Development of an ultra-compact implantable biological control system for automated small animal experiments". Proposals were also invited for "Efficient and Automated Material Management Technology for Manned Space Station" as a technology to support space experiments from the side. TansaX will continue to work on technologies related to space experiments that are in line with the TansaX open innovation concept.