



## OS5-1

# 宇宙探査イノベーションハブの研究開発活動と国際宇宙ステーションの実証実験

## R&D activities on Space Exploration Innovation Hub Center and Demonstration Experiments on ISS

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### 1. Overview

Japan Aerospace Exploration Agency (JAXA) formed the Space Exploration Innovation Hub Center (TansaX) on April 1st, 2015. This new center was established to fulfill the 2014 policy entitled “Comprehensive Strategy on Science, Technology, and Innovation 2014 – A Challenge for Creating Japan in a New Dimension.” Consequently, public research institutions and agencies have had to perform strongly and contribute to innovation. Through the Innovation Hub Center, research projects will be developed and established within JAXA in an unprecedented way. Knowledge and specialists from various fields have been sourced to form a new research team. This paper shows activities of TansaX and relationship between exploration R&D and experiment on ISS.

### 2. Open innovation using dual-use approach for Space and on the Earth

#### 2.1 Concept

The advancement of space exploration and resulting expansion of potential habitats to support human life and activity can potentially create new value for space development and use. Over the next 10–20 years we expect space exploration to gather support from various players, including private companies, primarily advancing lunar and Mars exploration through international collaboration and competition. By the 2020s, we expect major countries will have developed plans to expand activity on the moon and Mars, intensifying international competition for outer space use. To lead and cooperate efforts in space exploration, it is important to modify our design philosophy and development objectives and establish innovative technology through a consolidated national effort. Furthermore, to clarify R&D goals that can contribute to the national economy, we are incorporating private company requests when selecting research topics. Fig.1 shows image of function of TansaX aiming for space exploration and terrestrial technologies.

#### 2.2 Key Research Areas

Exploration in a wide range of unexplored areas : Actualize wide-ranging yet in-depth exploration of unexplored areas by distributing functions through multiple small spacecraft.

Automatic and autonomous exploration technology : Development of the construction technology for space bases to be constructed on the Moon and Mars in the future.

In-Situ Resource utilization (ISRU) technology : A paradigm shift from “shipping all necessities from Earth” to “procuring necessities on site”

### 3. Open innovation R&D projects

#### 3.1 Collaboration with partners

Working to build a foundation for open innovation by encouraging the participation of players in a variety of fields, from large companies leading the industry to venture companies, mainly in non-space institutions.

Participated from companies and universities all over Japan, and establishing an all-Japan cooperation system. We have 128 projects and 201 organizations which have been participating since 2015 as of 2021.

### **3.2 Scheme**

In order to understand the needs of the non-space industry and determine joint research project themes, a new two-stage system, as RFI (Request for Information) and RFP (Request for Proposal) have been set up from the stage of setting the research topics. RFI : 565 (From 2015 to 2020), Joint research projects :128 (From 2015 to 2020).

In selecting and promoting research topics, reflecting the opinions of advisory committee members and outside experts such as private sector consultants in their activities.

## **4. Micro gravity experiments for space exploration R&D**

### **4.1 Purpose**

As already mentioned, we have 128 R&D projects for future space exploration on Moon and Mars until 2021. Before realizing these technologies for exploration missions in space, it is necessary to demonstrate them in space to prove technology maturity. But there are 2 major problems to demonstrate technologies for space exploration. One is partial gravity. Moon has 1/6G and Mars has 1/3G gravity and it is very difficult to produce these gravity condition. Another problem is limited chances for technologies for human space flight such as an environment control and health care etc. Mechanical and electrical technologies can be tested on satellites and other ways on orbit. But there is an only one field for human space flight technologies to demonstrate them on ISS now.

We have promoted these kinds of R&D projects and eager to use the field on ISS before realizing them on the moon. Especially we have been tacked on R&D projects for space farming. We built a lunar farming concept working group with the aid of agriculture professionals in Japan and promoted R&D projects for future agriculture systems which is useful for food production on the moon.

### **4.2 Lunar farming concept study and R&D projects**

Our aim of the working group is building a concept for self-sufficiency of food production system in space, which is necessary to realize a long-term stay of human beings as an ISRU technology. To establish a system for self-sufficiency of food for manned activities in space, searching for R&D themes which have common technical subjects with ground plant factories, and construct a system that can efficiently produce the necessary supplies compared to the transport cost from the earth. You can see all of the paper of the concept in HP of TansaX 1). Furthermore, we have been worked R&D projects based on the discussion in the working group and have already undertaken 13 projects and some has started technology demonstration activities on space using ISS.

### **4.3 Technology Demonstration on ISS**

Since the elemental technologies carried out in the joint research of the exploration hub were aimed at establishing POC on the ground, it is important to demonstrate the technologies before applying them to space missions. In addition, some of the technologies aim to be used in pressurized environments in which astronauts stay, and technical demonstration on the International Space Station is a valuable opportunity. For this reason, the Exploration Hub is studying a mechanism to accompany the theme that has completed elemental technology research in order to aim for space demonstration, and aims to increase the theme that will lead to space demonstration in the future.

## **References**

1) Report of Lunar Farming Concept Study Working Group 1st (summary) :  
[http://www.ihub-tansa.jaxa.jp/english/Lunarfarming\\_en.html](http://www.ihub-tansa.jaxa.jp/english/Lunarfarming_en.html)



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