Kibo Utilization Strategy

- Agenda 2020 toward maximizing “Kibo” utilization outcomes

(2nd Edition)

August 2017

JEM Utilization Center
Human Spaceflight Technology Directorate
Japan Aerospace Exploration Agency (JAXA)

Kibo Utilization Strategy

The circumstances surrounding “Kibo” have changed dramatically as reflected by recent changes in Japan’s space policy and Japan’s determination to continue participating in the ISS program until 2024.

In response to such changes, JAXA has developed the Kibo Utilization Strategy as a guideline to promote “Kibo” utilization strategically toward maximizing outcomes.

Kibo Utilization Strategy is for;

- Expanding and promoting “Kibo” utilization
- Covering the priority of research areas
- Promotion activities
- Requests for hardware development
- Research solicitation

Goals of Kibo Utilization (by 2024)

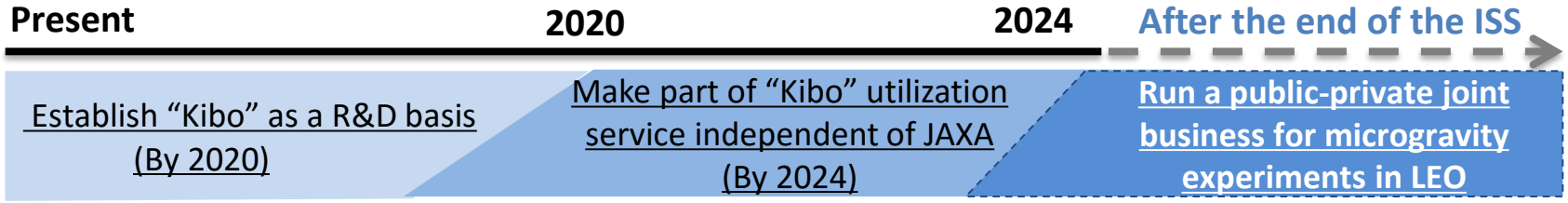
- **To establish "Kibo" as a valuable R&D basis for science & technology innovation by 2020, and make part of "Kibo" utilization service using the platforms independent of JAXA by 2024.**
- **After the end of the ISS, to run a public-private joint business for microgravity experiments in LEO (in accordance with JAXA Management & Business Policy 2017).**

1. Establish "Kibo" as a R&D basis (by 2020)

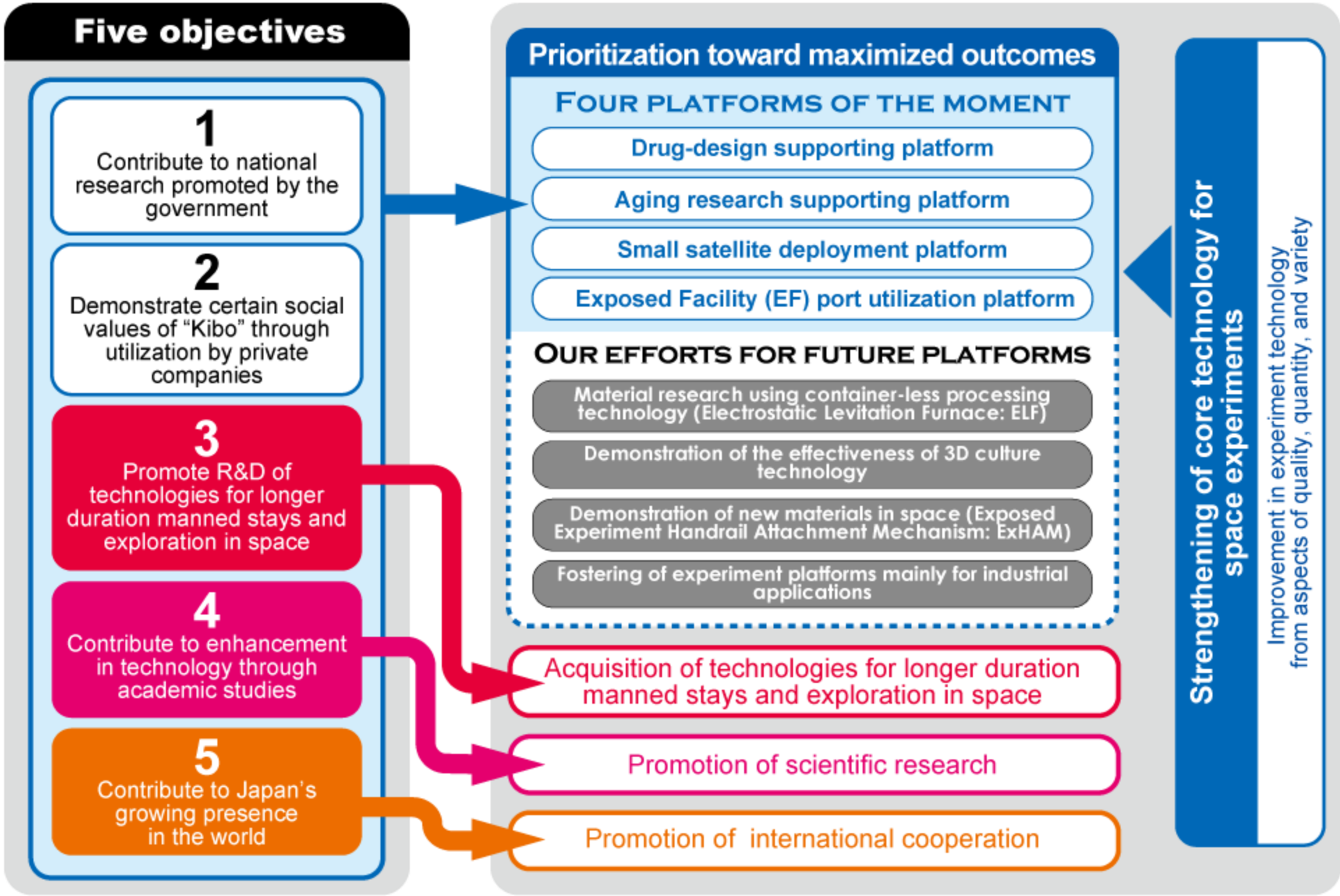
- By 2020, "Kibo" utilization service that brings forth new notions or values will be established by clarifying through space experiments what cannot be verified or phenomena that cannot be observed on the ground, and then "Kibo" utilization platforms will be used by various users of industry, government, and academia. It will yield significant research outcomes that cannot be achieved by JAXA alone.
- The role-sharing between JAXA and user service providers will be defined, and the know-how will be passed down to user service providers by 2020.

2. Make part of "Kibo" utilization service using the platforms independent of JAXA (by 2024)

- Generate consistent demand that will meet one-third to one-half of utilization service using the platforms by 2024.
- External organizations and groups will independently and constantly provide end users with utilization service, and thus a new market is expected to be formed.



Five objectives to be achieved by 2020



Drug-design supporting platform

Objective

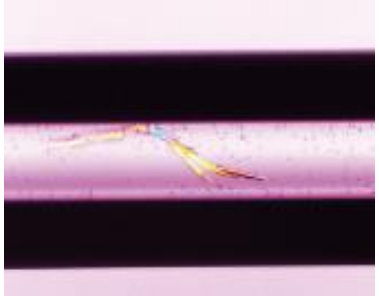
- Establish and promote a platform providing structural data useful for new drug design by multiplying experiment opportunities (4-6 times/year) and shortening the duration of experimental cycles (decrease by 40%).
- Newly develop a method of growing large-protein crystals for neutron diffraction and cooperate with the Japan Proton Accelerator Research Complex (J-PARC).

Required experimental technology

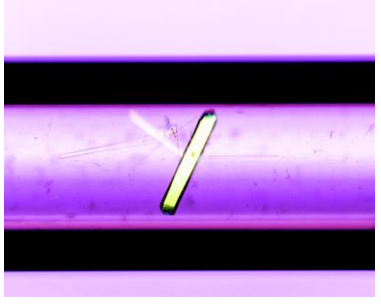
- In addition to 20˚C crystallization experiments, opportunities for 4˚C crystallization experiments are provided (2017~).
- Large-protein crystallization technology for neutron diffraction is now under development. The in-space applicability of membrane protein crystallization technology will be tested.
- A crystallization method is developed that allows the crystallization conditions of the vaper diffusion method to be applied in space without the effect of Marangoni convection on orbit.

Measures for promoting utilization

- Foster strategic cooperation with bio-ventures, pharmaceutical manufacturers, and enzyme manufacturers.



Crystal grown on Earth



Crystal grown in space

Aging research supporting platform

Objective

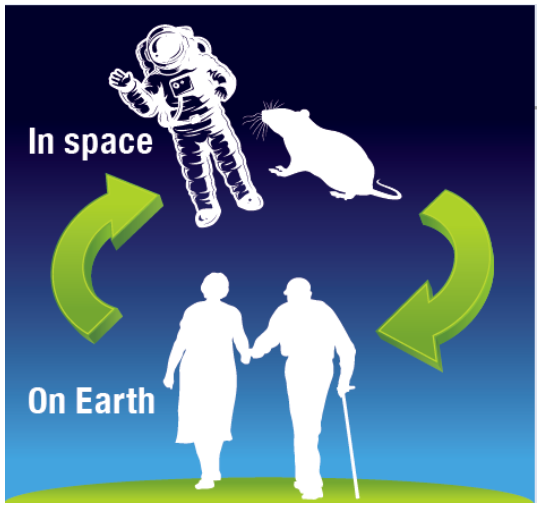
- Aim to contribute to elucidating the mechanism of biotransformation associated with human aging and developing related-disease control by using a centrifuge, which allows comparisons to be made in investigating gravitational effects on mice.

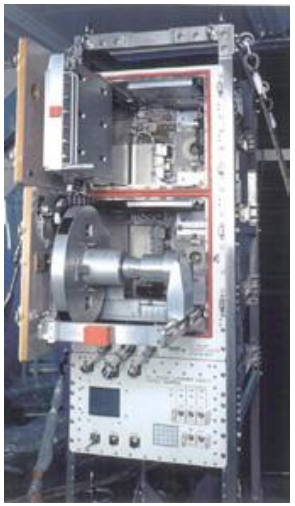
Required experimental technology

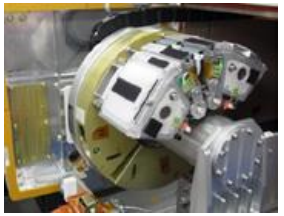
- A larger centrifuge for the Mouse Habitat Unit must be developed to increase the number of mice onboard (by FY2018).
- Sophisticated experimental technologies must be developed.

Measures for promoting utilization

- Research solicitation to invite experiments contributing to the world's cutting-edge medical care and surviving incurable diseases.







Microgravity section

Artificial gravity section

Small Satellite deployment platform

Objective

- Establish Japan's original service (business model) and promote utilization of the platform to meet demands from the world.
- Select user service providers for overseas users to provide appropriate service (in FY2017).

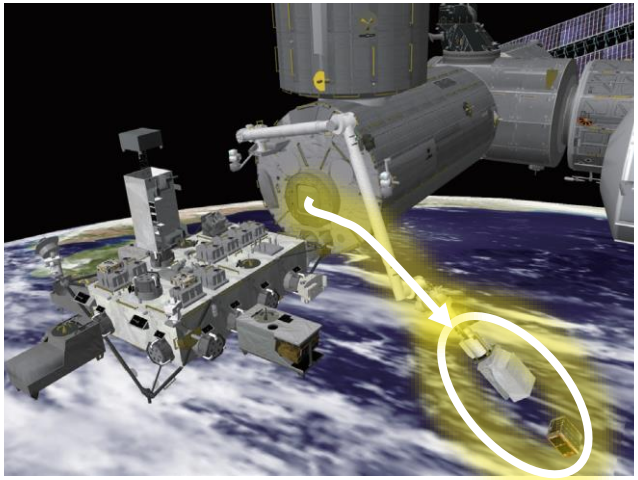
Required experimental technology

- The stages of functions of the JEM Small Satellite Orbital Deployer (J-SSOD) must be enhanced to increase its satellite deployment capability for allowing a maximum of 48-U satellites (by FY2020).

Measures for promoting utilization

- Promote cooperation with candidates for user service providers, including universities, consortiums, and dealers selling satellite kits.

Exposed Facility (EF)



JEM Small Satellite Orbital Deployer (J-SSOD)

Exposed Facility (EF) port utilization platform

Objective

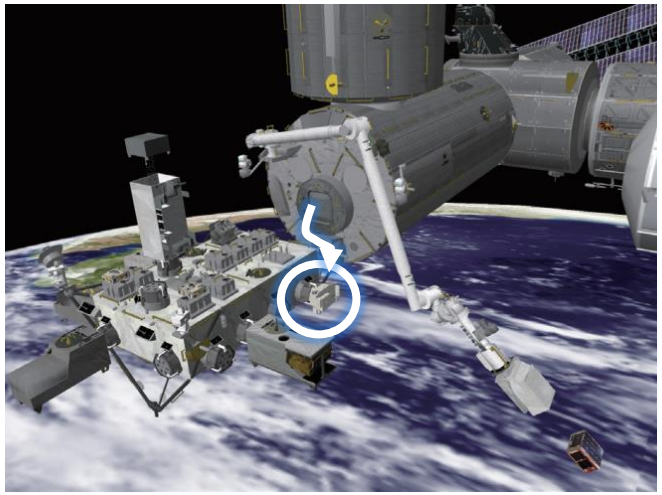
- Contribute to Japan's future space technology development by frequently demonstrating future innovative space technology, including the Earth observation sensor.

Required experimental technology

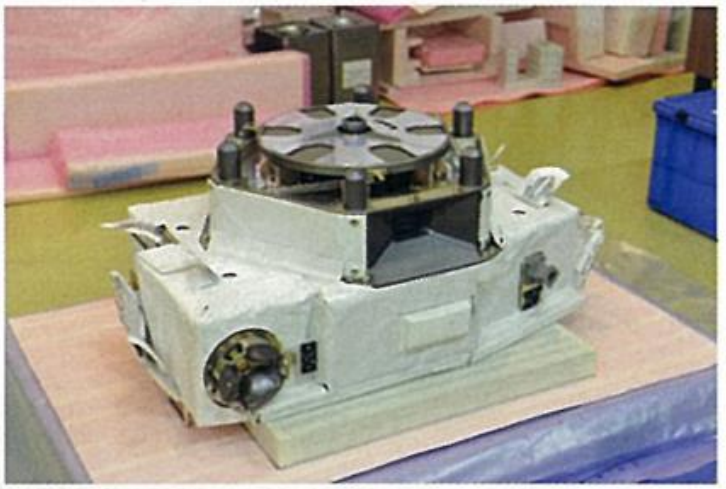
- The functions of the IVA-replaceable Small Exposed Experiment Platform (i-SEEP) must be enhanced in terms of quantity and quality.

Measures for promoting utilization

- Focus on demonstrating the space technology from JAXA projects while promoting fee-based utilization by the private sectors (e.g. sensor development, provision of images), universities, and overseas space agencies (FY2016- 2017).



Exposed Facility (EF)



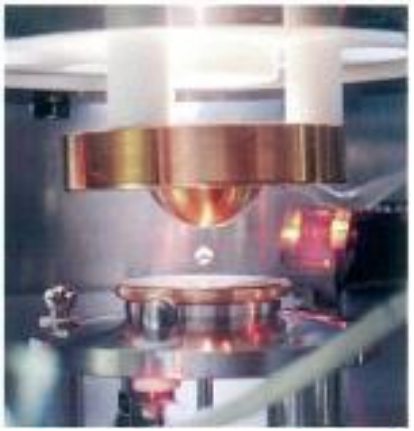
IVA-replaceable Small Exposed Experiment Platform (i-SEEP)

Our efforts for future platforms

Material research using container-less processing technology (Electrostatic Levitation Furnace: ELF)

- Obtain thermophyisical property data on high-melting point materials with strong commercial needs, including oxides and ceramics, and explore advanced functional materials.
- Build a strategic partnership with public research institutions in charge of material research, and strengthen the relationship.

Floating without a container



The ground-based electrostatic levitator

Demonstration of new materials in space (Exposed Experiment Handrail Attachment Mechanism: ExHAM)

- Contribute to the improved quality and reliability of space materials at companies, universities, and JAXA.
- Examine the development of devices enabling exposed experiments with a power supply, communication resources, and expanded functions, including multiplied experiment opportunities.

ExHAM

Demonstration of the effectiveness of 3D culture technology

- Develop 3D culture technology under the microgravity environment and demonstrate the effectiveness of that environment for 3D culture.

Fostering of experiment platforms mainly for industrial applications

- New research solicitation for experiments focused on the views of commercialization and industrialization proposed by an industry-academia joint team.
- Create new experiments leading to expanded commercial applications in cooperation with industry-academia-government projects or consortiums.

Acquisition of technologies for longer duration manned stays and exploration in space

- Promote research and development of robot application technology, automation/autonomy technology for space experiments, and robot utilization technology to support or replace astronauts' activities.
- Develop technologies for complete recycling environmental control, life support, and radiation measurement and protection.
- Develop health management technology for astronauts.

"Int-Ball" is a camera drone which can record video while moving in space under remote control from the ground.

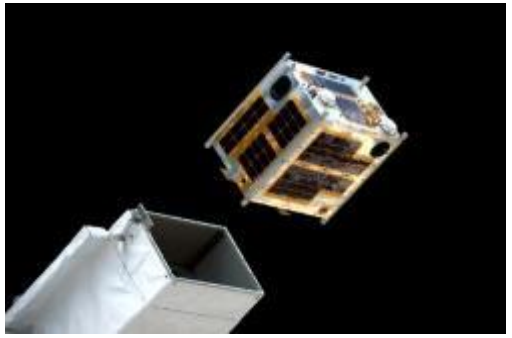
JAXA is aiming for a size reduction to one quarter of the system currently used on the ISS. The photo shows the prototype model.

Promotion of scientific research

- Invite research themes regularly. Select scientific themes with prospects and visions of creating and applying results.

Promotion of international cooperation

- Expand areas of NASA-JAXA cooperation under the Japan-US Open Platform Partnership Program.
- Prioritize “Kibo” utilization that has been valued and promoted by Asian countries. Contribute to Japan’s growing global presence through cooperation with other governments and the UN.
- Devise a utilization tactical plan for Asian countries soon (in FY2017).



Deployment of the Philippines' first microsatellite "DIWATA-1“

Collaboration with the UNITED NATIONS Office for Outer Space Affairs (UNOOSA) for CubeSat deployment

Strengthening of core technology for space experiments

- Promote the development of support equipment such as microscopes, an automatic analysis system, and an imaging system for samples. Realize cutting-edge research on Earth in space.
- Automate experimental facilities by examining the use of artificial intelligence (AI) and other tools with an eye toward future LEO platforms.