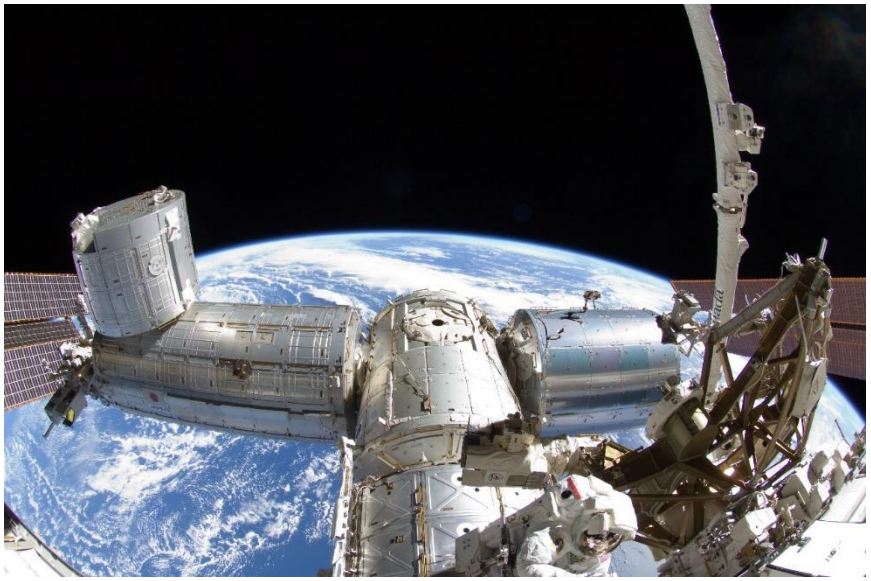
64th Committee on the Peaceful Uses of Outer Space August 31, 2021

Kibo-ABC activities on the ISS “Kibo” for STEM education and SDGs contribution in the Asia-Pacific region



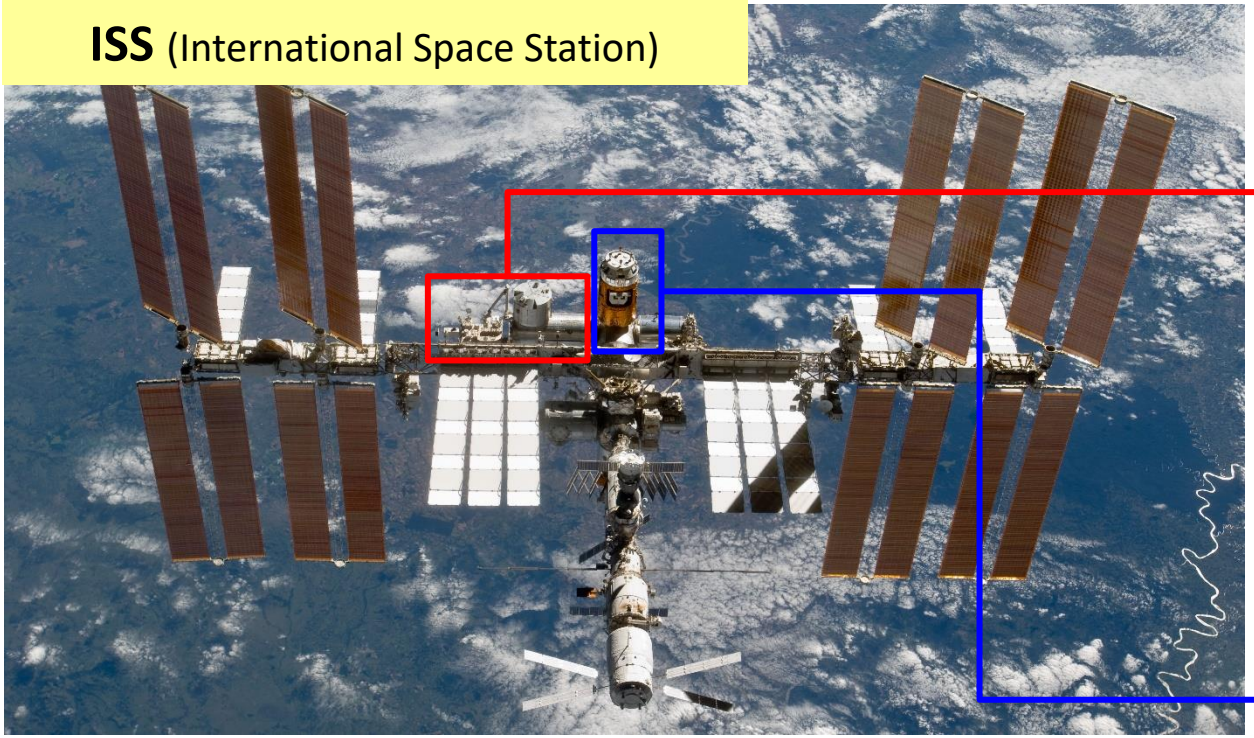
Fumiaki TANIGAKI

Kibo Utilization Center, Japan Aerospace Exploration Agency

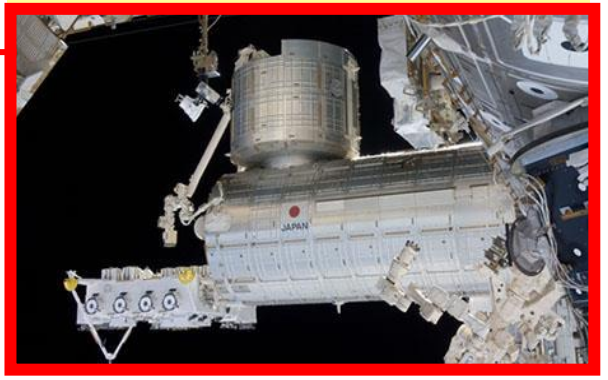
International Space Station/Kibo

Credit : JAXA/NASA

ISS (International Space Station)



Kibo
(Japanese Experiment Module)



HTV
(H-II Transfer Vehicle)

H-IIB
Japanese
Launch Vehicle

- The ISS is a huge manned construction located about 400km above the Earth.
- JAXA has contributed to the ISS program through the development and operation of the Kibo module and HTV.
- Japan is only country in the Asia-Pacific region to participate in the ISS program.
  JAXA has collaborated with many countries in the region.

What is Kibo-ABC ?

APRSAF
ASIA-PACIFIC REGIONAL SPACE AGENCY FORUM

APRSAF was established in 1993 to enhance space activities in the Asia-Pacific region.
APRSAF is the largest space-related conference in the Asia-Pacific region with participation of over 40 countries.
It currently consists of five working groups:

Space Frontier WG	Satellite Applications for Societal Benefit WG	Enhancement of Space Capability WG	Space Education for All WG	Space Policy and Law WG

Under the Space Frontier Working Group, the Kibo-ABC collaborative initiative was established in 2012 to promote "Kibo" utilization in the Asia-Pacific region and to share and build on the outcomes of "Kibo" utilization.

Kibo-ABC: Asian Beneficial Collaboration through Kibo Utilization

Kibo-ABC Members

14 countries and region,
18 organizations

As of Aug. 2021

New Zealand
*NZSA
*NZAN

Philippines
*DOST-SEI

Nepal
*NESARC

Rep.of Korea
*KARI

Malaysia
*MYSA

Singapore
*SSTL

Japan
*JAXA

Taiwan
*NSPO

Indonesia
*LAPAN

Thailand
*GISTDA
*NSTDA

Bangladesh
*NMST

Australia
*ASA
*ANU

Vietnam
*VAST-STI

UAE
*UAESA
*MBRSC

KIBO-ABC
Asian Beneficial Collaboration through Kibo Utilization

joined 2019
joined 2020

Goal and Activity of Kibo-ABC

Goal — **Sharing the Benefits of ISS/Kibo**

Step 1

Multilateral programs among member agencies

- Education and capacity building (for space agencies and students)
- Understanding of space environment utilization

Step 2

Bilateral missions between JAXA and a member agency

- Bringing innovative ideas
- Creation of bilateral missions (new space experiment missions)

SUSTAINABLE DEVELOPMENT GOALS

Education Innovation

Good health Education Economic growth Innovation

Kibo-ABC Multilateral Education Programs

Space Seeds for Asian Future program

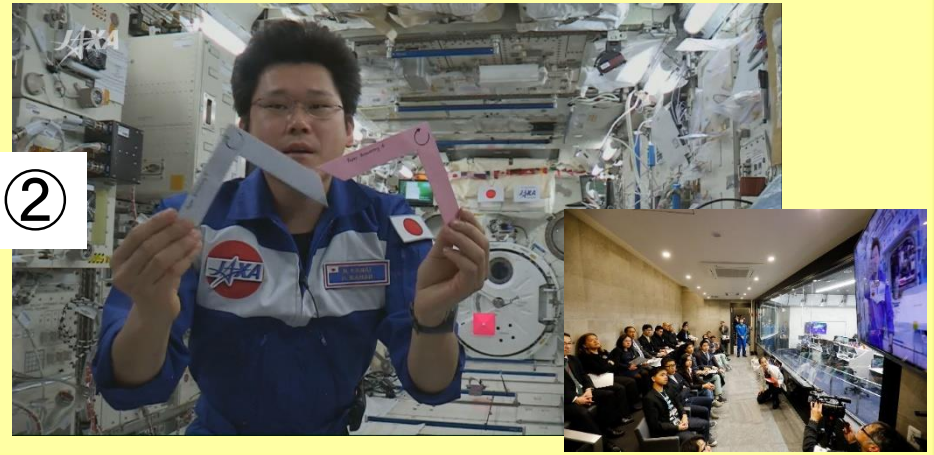
■Small plant experiment on Kibo

①

Asian Try Zero-G program

■ Scientific experiment ideas is proposed from Asian youth. ISS crew performs the selected ideas.

②



Kibo Robot Programming Challenge program

■ Programming competition for students to have interest in future space technology development

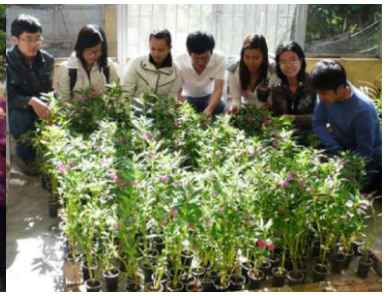
③

- *These programs are igniting the passion of the next generation in the Asia-Pacific region.*
- *They also engage and influence students to pursue careers in scientific and technology fields.*

① Space Seeds for Asian Future

(1) Space Seeds for Asian Future 2010-2011

- The first Asian countries' collaborative mission was successfully performed with Indonesia, Japan, Malaysia, Thailand, and Vietnam.
- Asian seeds were launched to the ISS and returned to each country in 2011. These seeds were used for education and research purposes in each country.
- Well over one thousand students and educators enthusiastically nurtured the plants and learned about the ISS and the research conducted there.



(2) Space Seeds for Asian Future 2013

- About 40,000 peoples in seven countries (Australia, Indonesia, Japan, Malaysia, New Zealand, Thailand, and Vietnam) joined in this program.
- Students and teachers observed the growth of AZUKI beans (*Vigna angularis*) to see if there was any difference between the ground and space seedlings.
- They learned how to conduct a real scientific investigation in space.

① Space Seeds for Asian Future

(3) Space Seeds for Asian Future 2021 (Asian Herb in Space: AHiS)

- The purpose of AHiS is to provide students and young researchers in the Asia-Pacific region with an opportunity to learn about space biology.
- 12 countries/region (Australia, Bangladesh, Indonesia, Japan, Malaysia, Nepal, New Zealand, Singapore, Taiwan, Thailand, UAE, and Vietnam) take part in AHiS.

March 2021

June 2021

- Mission-1: Japanese and Malaysian researchers analyze the basil grown in the Kibo module. Students learn the experiment results and also conduct the ground control experiment.
- Mission-2: Each agency plans and conducts an education project using space flight seeds.

- *Basil samples and the seeds were returned to the Earth in July 2021. Each participating agency will begin the project !*

② Asian Try Zero-G

- Asian Try Zero-G (ATZG) features the implementation of student-proposed physics experiments performed by Japanese astronauts in Kibo.
- ATZG has been conducted 6 times, and 11 countries have joined in ATZG.
- Each agency in the Asia-Pacific region was invited to submit experiment proposals and worked on the screening of proposals according to the agreed selection criteria.

Joining in space experiment at JAXA Mission Control Room

Results discussion at web-meeting

- Students excitedly observed and took part in the operation of their own experiments at JAXA Tsukuba Space Center.

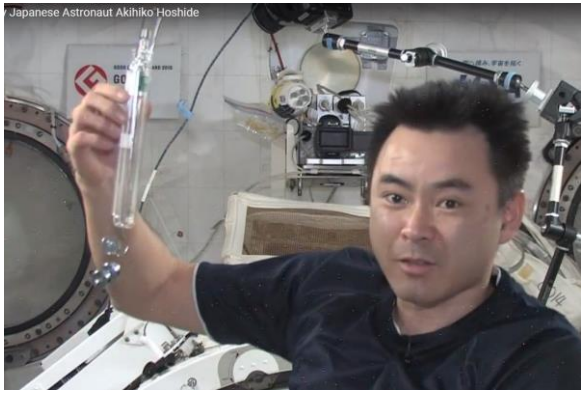
  They said, "We learned many things through the activities with friends from Asian countries who share a mutual interest in space. We were so inspired!"

Press conference at JAXA

② Asian Try Zero-G

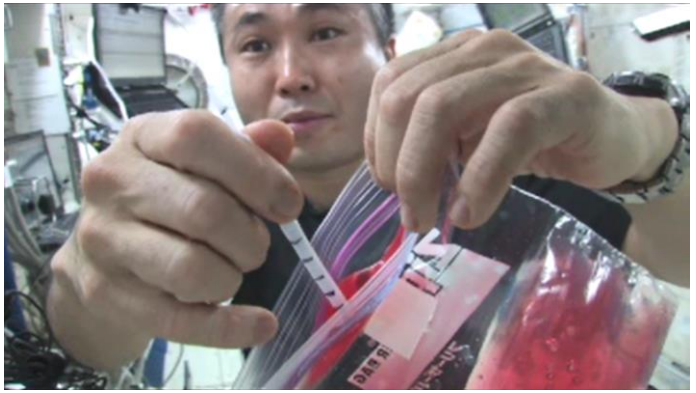
Astronaut Furukawa

Formation of soap bubble



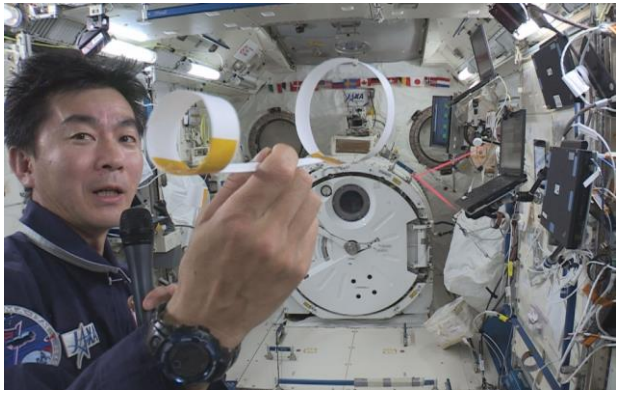
Astronaut Hoshide

Hook's law & Mass/Weight



Astronaut Wakata

Capillary action



Astronaut Yui

Movement of hoop glider

Astronaut Ohnishi

Liquid Density Action

Astronaut Kanai

Trajectory of boomerang

② Independent Activity in Each Country

Selection Committee in Malaysia

Prize award ceremony

Meeting with JAXA specialists

Prize award ceremony

② Independent Activity in Each Country

Preparation for experiment

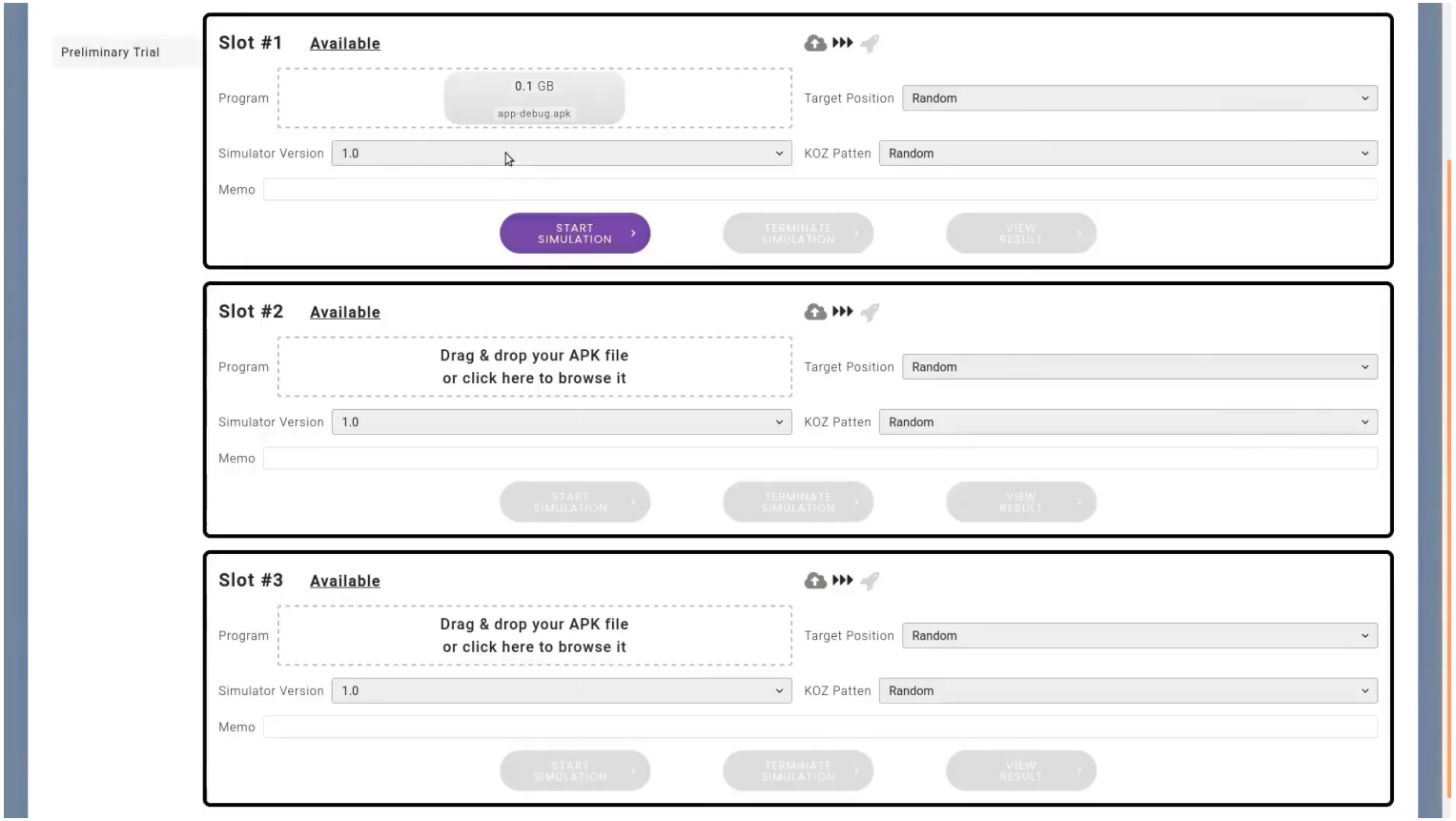
The selected proposers

Plan for future

Results discussion at web-meeting

③ Kibo Robot Programming Challenge

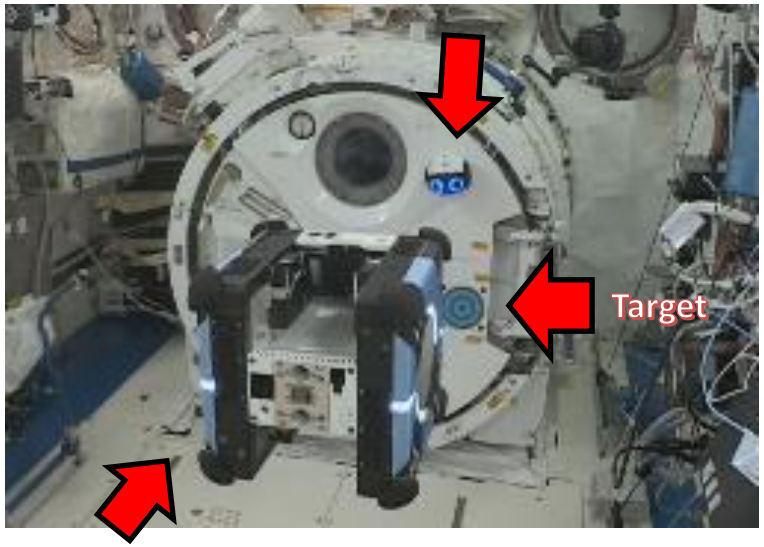
- **JAXA** and **NASA** have presented a robot programming competition on Kibo under the **Japan-US Open Platform Partnership Program (JP-US OP3)**.
- **Kibo Robot Programming Challenge (Kibo-RPC) is a new educational program** to allow the next generation of scientists and engineers to access space related activities and to gain knowledge of STEM.
- Students solve various given problems and compete in accuracy and time to the target.
  They learn cutting-edge methodology and team work.
  Kibo-RPC expands international exchange by interacting with participants internationally.



③ Kibo Robot Programming Challenge

- The 1st Kibo-RPC was successfully finished in 2020 under global pandemic of COVID19. 1168 students of 313 teams participated from Australia, Indonesia, Japan, Singapore, Taiwan, Thailand, and the UAE.

JAXA's Int-Ball



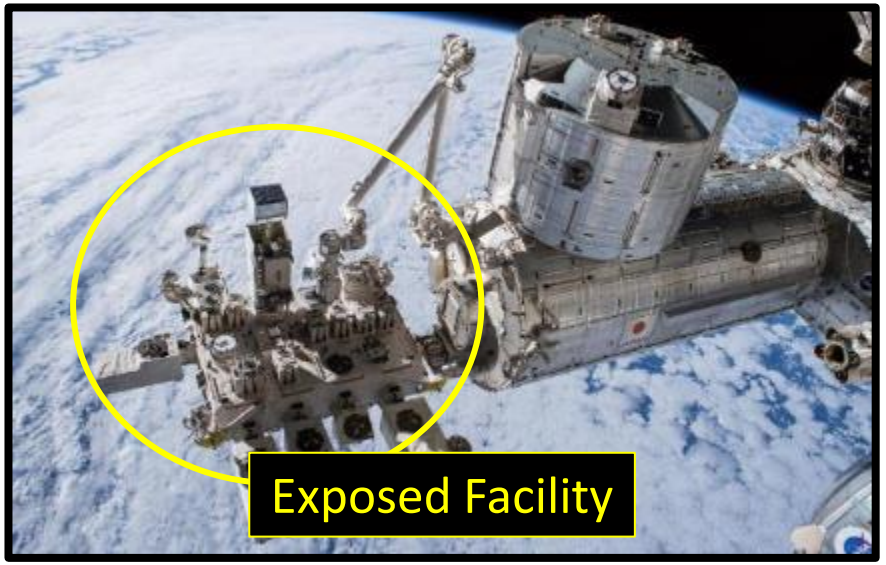
NASA's Astrobee

- The 2nd Kibo-RPC is ongoing with participants in 286 teams from 11 countries/region (Australia, Bangladesh, Indonesia, Japan, Malaysia, Nepal, New Zealand, Singapore, Taiwan, Thailand, and Vietnam).
- *The final round of the 2nd Kibo-RPC will be conducted on Kibo in September, 2021.*

Japanese Experiment Module “Kibo”

A broad range of research, experiments, and observations has been conducted in numerous fields, such as life science, space medicine, material science, fluid science, the Earth and planetary science, as well as the cultivation of human resources.

- Life science for supporting a long-lived healthy society
- Material science for improving technologies for manufacturing
- Technology development for a prosperous, safe, and secure life



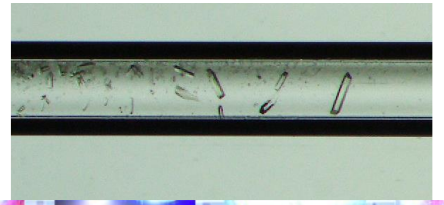
- Small satellite deployment through the airlock
- New material exposure experiment
- Space technology development such as the Earth observation sensor
- Astronomical X-ray observations

Bilateral Projects under Agreement with JAXA

(1) Protein crystal growth experiment for anti-malaria drug design

The first Thai experiments in Kibo were conducted twice in 2019 and 2020.

Protein crystal



GISTDA/NSTDA

(2) New radiation dosimeters experiment

New dosimeters were exposed inside and outside Kibo to measure the radiation in 2019-2021. The data analysis is ongoing in Malaysia.

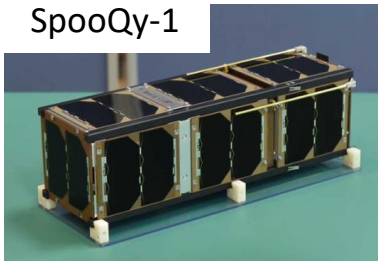
MYSA/UPM

Bilateral Projects under Agreement with JAXA

(3) CubeSat development and deployment from Kibo

Singaporean CubeSat was deployed from Kibo for the future satellite communication technology innovation in 2019.

SpooQy-1



SSTL/NUS

(4) Robot education mission

Emirati astronaut performed the camera robot education mission in Kibo in 2019.
Students studied how to control a robot and the attitude control of spacecraft.

MBRSC

Live viewing in UAE

Students talked to Astronaut at JAXA.

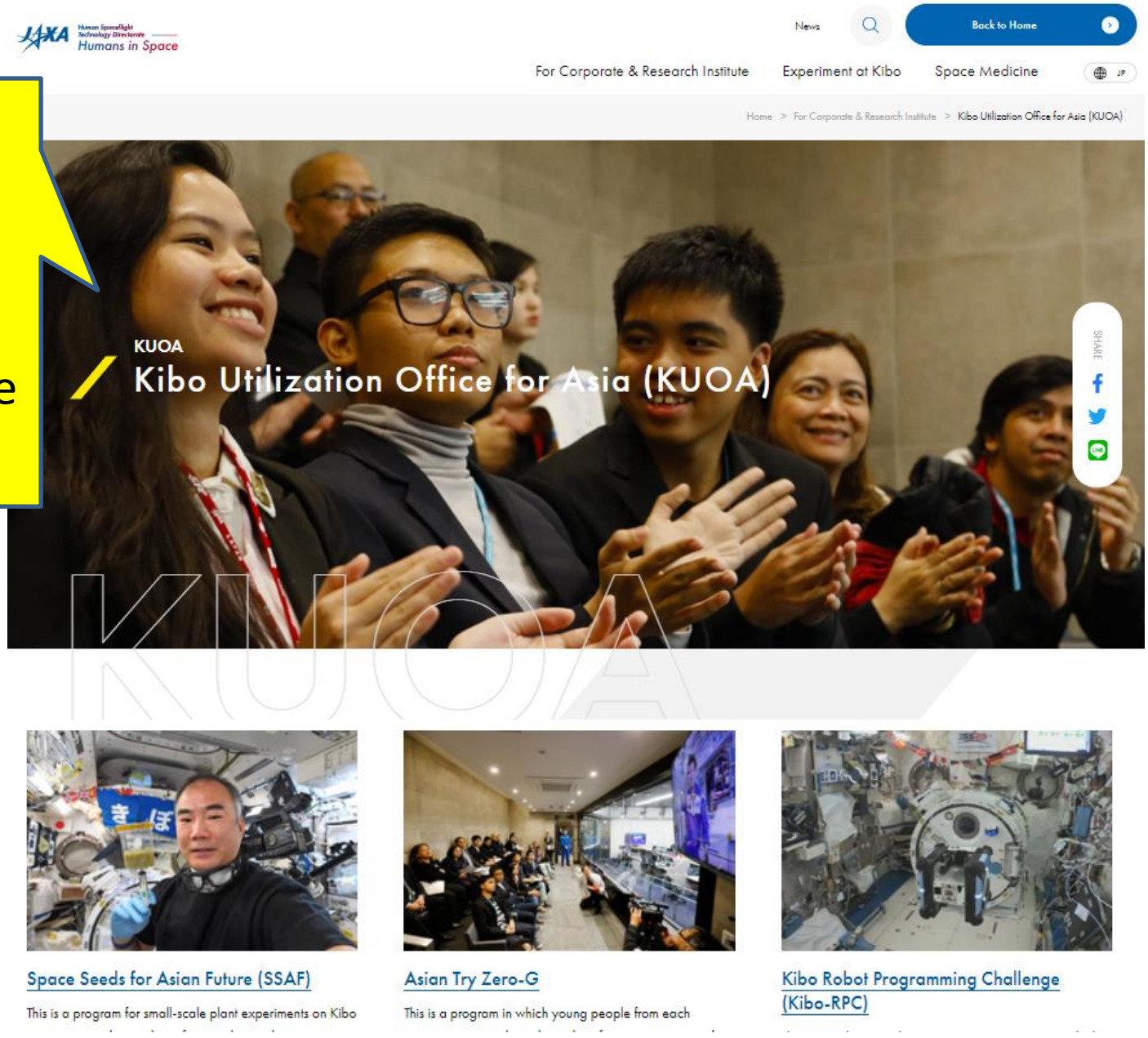
(5) Researchers in other countries are studying promising experiment ideas.

For More Information (1)

You can get more information about Kibo utilization activity in the Asia-Pacific region on the website.

Portal site:
https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/

Search
"KUOA JAXA" !



For More Information (2)

Website

1. Portal site: https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/
2. Kibo-ABC: https://www.aprsaf.org/initiatives/kibo_abc/
3. Space Seeds for Asian Future:
   https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/ssaf/
4. Asian Try Zero-G:
   https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/tryzerog/
5. Kibo Robot Programming Challenge:
   https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/kibo-rpc/
6. Protein crystal growth experiment (Thailand):
   http://iss.jaxa.jp/en/kuoa/news/190618_pcg.html
7. New radiation dosimeters experiment (Malaysia):
   http://iss.jaxa.jp/en/kuoa/news/190614_sofpads.html
8. CubeSat deployment from Kibo (Singapore):
   https://iss.jaxa.jp/en/kuoa/news/190618_SpooQy.html
9. Robot education mission (UAE):
   https://youtu.be/L05wA9ots5g
   https://iss.jaxa.jp/en/kuoa/news/191007.html

Summary

- Each Kibo-ABC participating agency in the Asia-Pacific region has planned and conducted each project on their own.
- Kibo-ABC programs contribute to sustainable development of space-related activities and human resource development in the region.
- Kibo-ABC programs expand the boundary of ISS/Kibo utilization both geographically and multi-generationally. The subsequent programs are expected to inspire the next young generation further.
- Moreover, space environment utilization aboard ISS/Kibo has been recently increasing in the Asia-Pacific region in order to solve social problems.

Thank you for your attention!