

66th Committee on the Peaceful Uses of Outer Space June 1, 2023



Kibo Robot Programming Challenge, KiboCUBE, and More

- UNOOSA/JAXA Education Programs on the ISS “Kibo” -



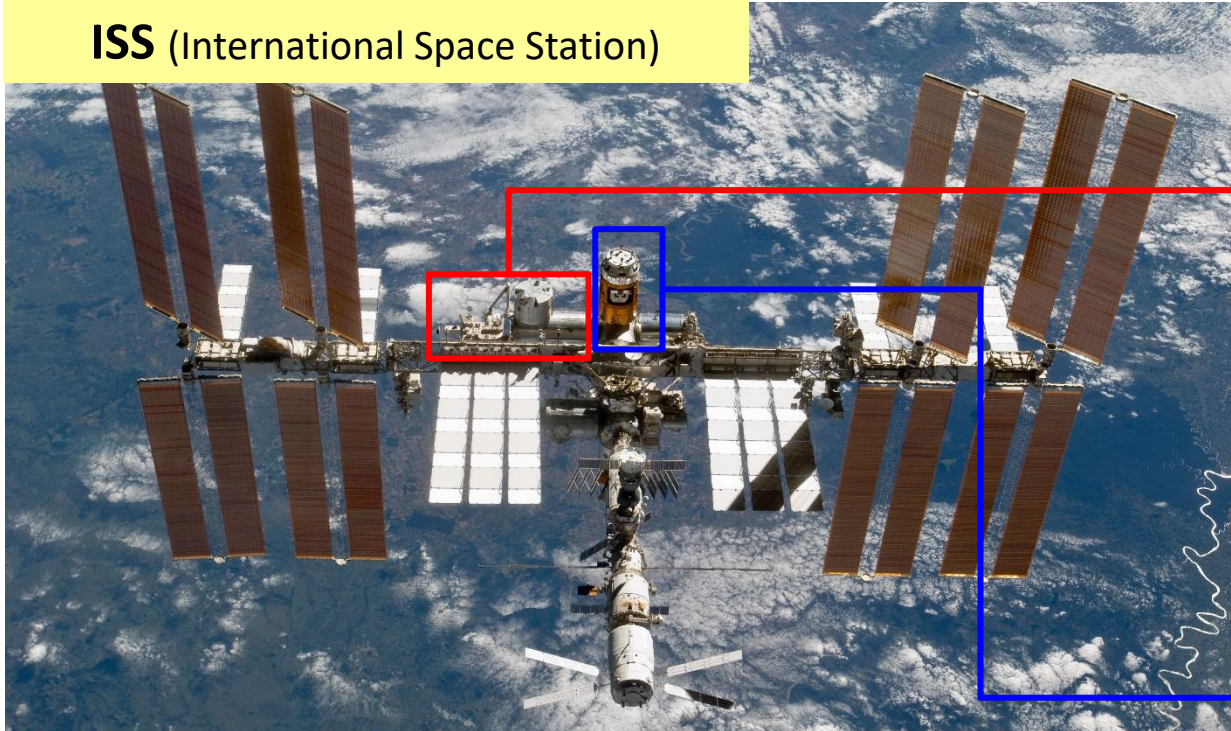
Fumiaki TANIGAKI

Kibo Utilization Center
Japan Aerospace Exploration Agency



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 by developing and operating the Kibo module and HTV.
 - Japan is the only country participating in the ISS program in the Asia-Pacific region.
- JAXA has collaborated with many countries in the region.



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.

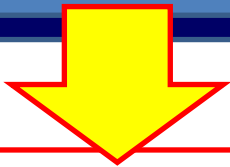
Space
Frontier
WG

Satellite
Applications for
Societal Benefit
WG

Enhancement
of Space
Capability WG

Space
Education
for All WG

Space
Policy and
Law WG



Kibo-ABC: Asian Beneficial Collaboration through Kibo Utilization



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. 19 organizations from 14 countries and regions are implementing several programs as members of Kibo-ABC.

Goal

Sharing the Benefits of ISS/Kibo

Step 1

Multilateral education 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)



Education



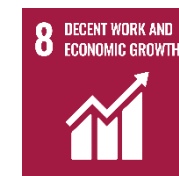
Innovation



Good health



Education



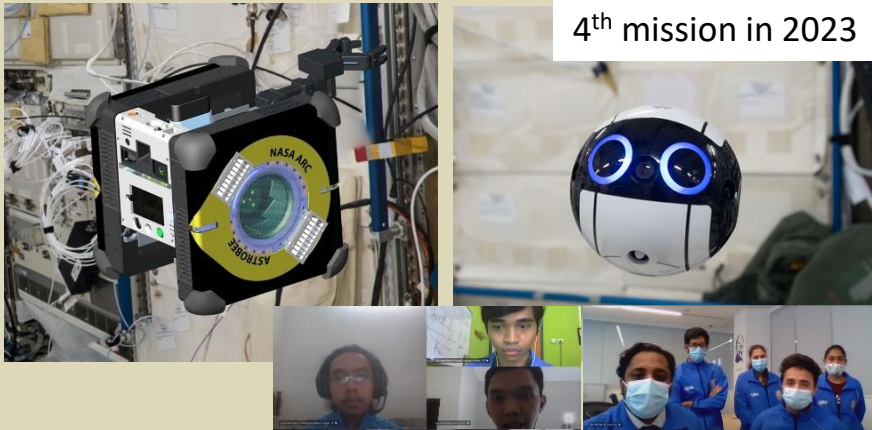
Economic growth



Innovation

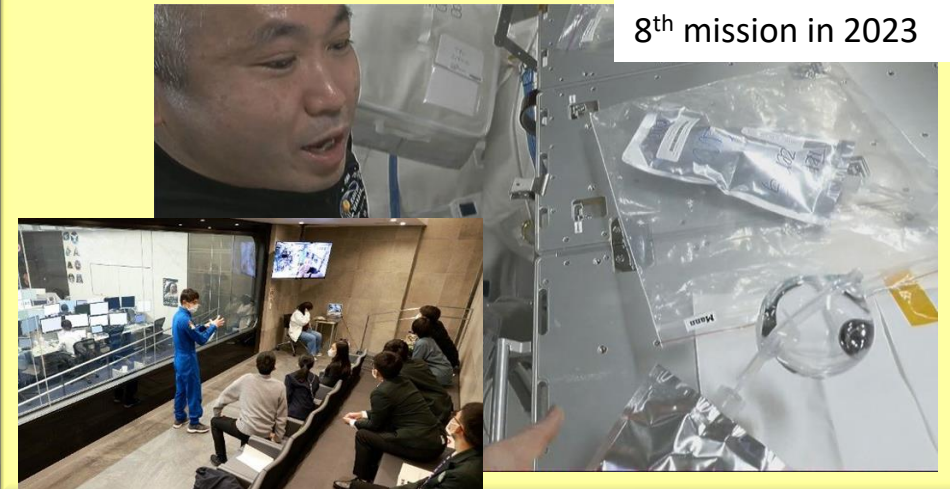
Kibo Robot Programming Challenge program

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



Asian Try Zero-G program

- Scientific experiment ideas is proposed by Asian youth. The ISS crew executes selected ideas.



Space Seeds for Asian Future program

- Small plant experiments on Kibo



- 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 science and technology.

- ❑ The Kibo-RPC is an educational program. **Students solve various problems by programming free-flying robots (Astrobee and Int-Ball) in the ISS.**
- ❑ Participants will have the chance **to learn cutting-edge methodologies and hone their science, technology, engineering, and mathematics (STEM) skills.**
- ❑ The Kibo-RPC expands international exchange by encouraging students to interact with other participants from around the world.
- ❑ The program also expands Kibo utilization in the Asia-Pacific region and the world.
- ❑ The Kibo-RPC has been conducted every year since 2020.

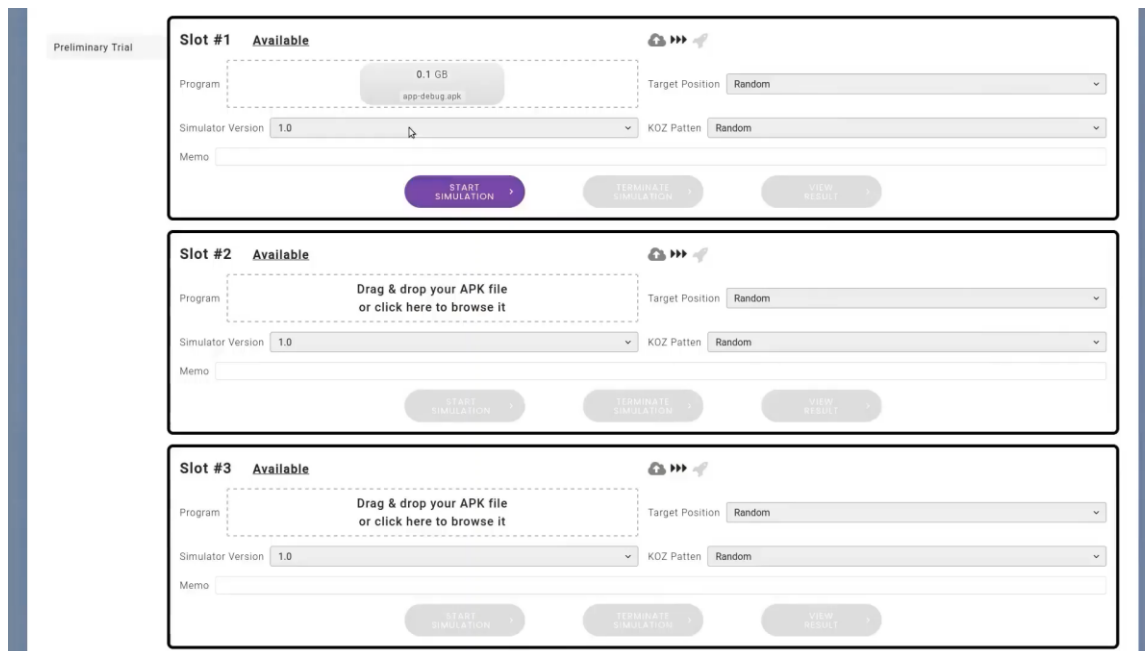


©NASA
NASA's Astrobee



JAXA's Int-Ball

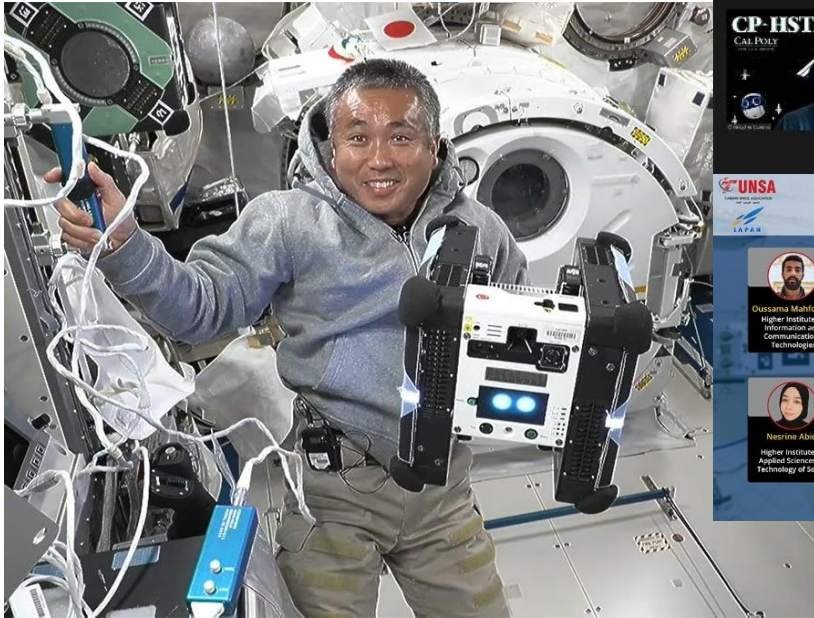
©JAXA/NASA



The screenshot displays a web interface for the Kibo-RPC simulation. It features three distinct simulation slots, each with a 'Preliminary Trial' label. Each slot contains a 'Program' field (with a file size indicator of 0.1 GB and 'app-debug apk'), a 'Target Position' dropdown menu set to 'Random', a 'Simulator Version' dropdown menu set to '1.0', and a 'KOZ Patten' dropdown menu set to 'Random'. Below these fields are three buttons: 'START SIMULATION', 'TERMINATE SIMULATION', and 'VIEW RESULT'. The interface is clean and user-friendly, designed for easy navigation and control of the simulation environment.

The 3rd Kibo-RPC in 2022

1,431 students on 351 teams from 17 countries and regions joined the 3rd Kibo-RPC.

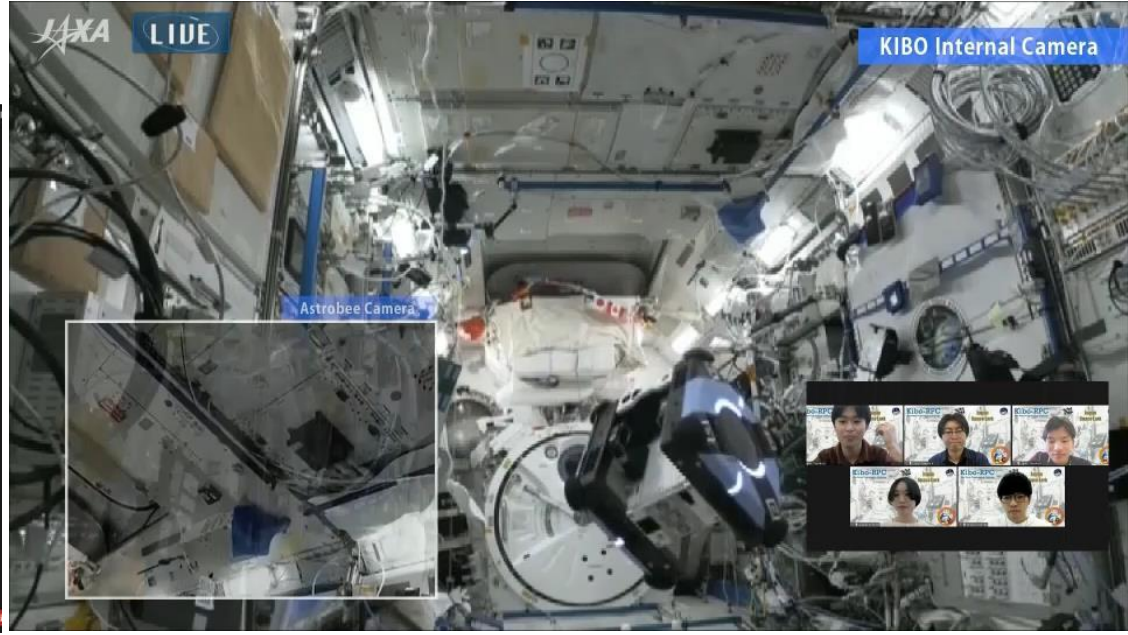



Kibo RPC Bondowoso3/Prime Team

CP-HSTAR CAL POLY NASA

UNSA LAFAB JAXA

 Oussama Mahfoudhi Higher Institute of Information and Communications Technologies	 Faishal Aziz Rahmat Yogyakarta State University	 Chaima Jabri National Institute of Applied Science and Technology
 Nesrine Abidi Higher Institute of Applied Sciences and Technology of Douze	 Karomatun Nissa Yogyakarta State University	 Farid Adwani National Institute of Applied Science and Technology



Schedule of the 4th Kibo-RPC

2023

February

April

July

September

Call for Participation until 5/28

Program Development

Preliminary Round
using simulator

Program Refine

Final Round
in ISS using real robot



Preliminary round is held by participating agencies.

Kibo-ABC members
since 2020

NASA (USA)
since 2022

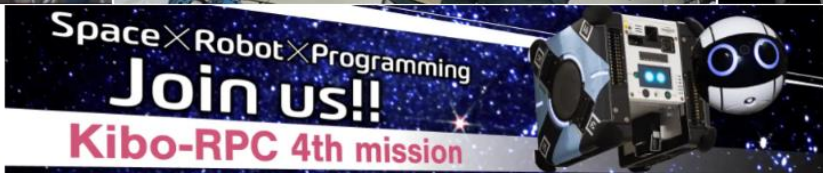
UNOOSA
(developing economies)
since 2023

Cooperation framework :
APRSAF/Kibo-ABC

Japan-U.S. Open Platform Partnership Programs (JP-US OP3)

UNOOSA – JAXA Cooperation

Kibo Robot Programming Challenge



<https://jaxa.krpc.jp/>

Students have already started developing their programs for the Preliminary Round !



UNITED NATIONS
Office for Outer Space Affairs



About us ▾ Our Work ▾ Space4SDGs ▾ Information for... ▾ Events ▾ Space Object Register ▾ Document

Our Work > Access to Space for All > Opportunities > Hypergravity/Microgravity Track

Kibo Robot Programming Challenge (Kibo-RPC) Rounds

CLOSED FOR REGISTRATION

updated on 9 May 2023

The United Nations Office for Outer Space Affairs and the Japan Aerospace Exploration Agency (JAXA) have agreed to join forces to expand the existing [Kibo Robot Programming Challenge \(Kibo-RPC\)](#) that JAXA has been conducting from 2020. The Kibo-RPC is a programme organized under the "Asian Beneficial Collaboration through Kibo Utilization" (Kibo-ABC) initiative of the Asia-Pacific Regional Space Agency Forum (APRSAP) organized by JAXA, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, and space agency partners in the Asia-Pacific regions.

The Kibo Robot Programming Challenge (Kibo-RPC) is an educational programme where students will obtain and test programming skills to solve various problems by moving free-flying robots (Astrobee and Int-Ball) in a simulation environment. Preliminary rounds will be held and the selected teams will run their programs on the free-flying robots in the final round at the Japanese Experiment Module (Kibo) aboard the International Space Station (ISS). Through this experience, students will learn the techniques and methods involved in programming and robotics, while boosting their interest in STEM (science, technology, engineering and mathematics) by moving actual robots on the ISS. Students will also learn about the importance of bridging the gap between simulation and reality.

Up until the 3rd mission of Kibo-RPC, Kibo-RPC was only open to students in Asia-Pacific countries that are part of the Kibo-RPC participating countries and regions. However, by collaborating with UNOOSA, the 4th mission of Kibo-RPC is open to teams from developing economies and economies in transition that are Member States of the United Nations. **Students in developing economies and economies in transition that are NOT Kibo-RPC participating countries and regions can register using the UNOOSA international slot.** Please see the [JAXA Kibo-RPC 4th mission website](#) and Guidebook for more information. Due to the large interest that is expected, for this first year, **UNOOSA will limit the registration to 50 teams. In case there is a large number of registrations, UNOOSA reserves the right to close the registration before the deadline.**

Applications for the UNOOSA international slot for the 4th mission of Kibo-RPC will be accepted until **14 May 2023 (Sunday, 16:59 CEST)**.

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



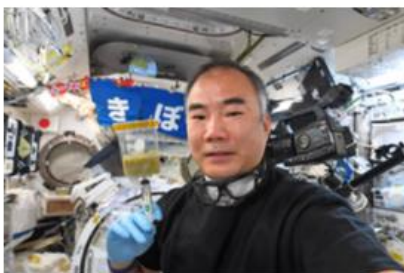
Portal site:



<https://humans-in-space.jaxa.jp/en/biz-lab/kuoa/>

Search

“KUOA JAXA” !



[Space Seeds for Asian Future \(SSAF\)](#)

This is a program for small-scale plant experiments on Kibo



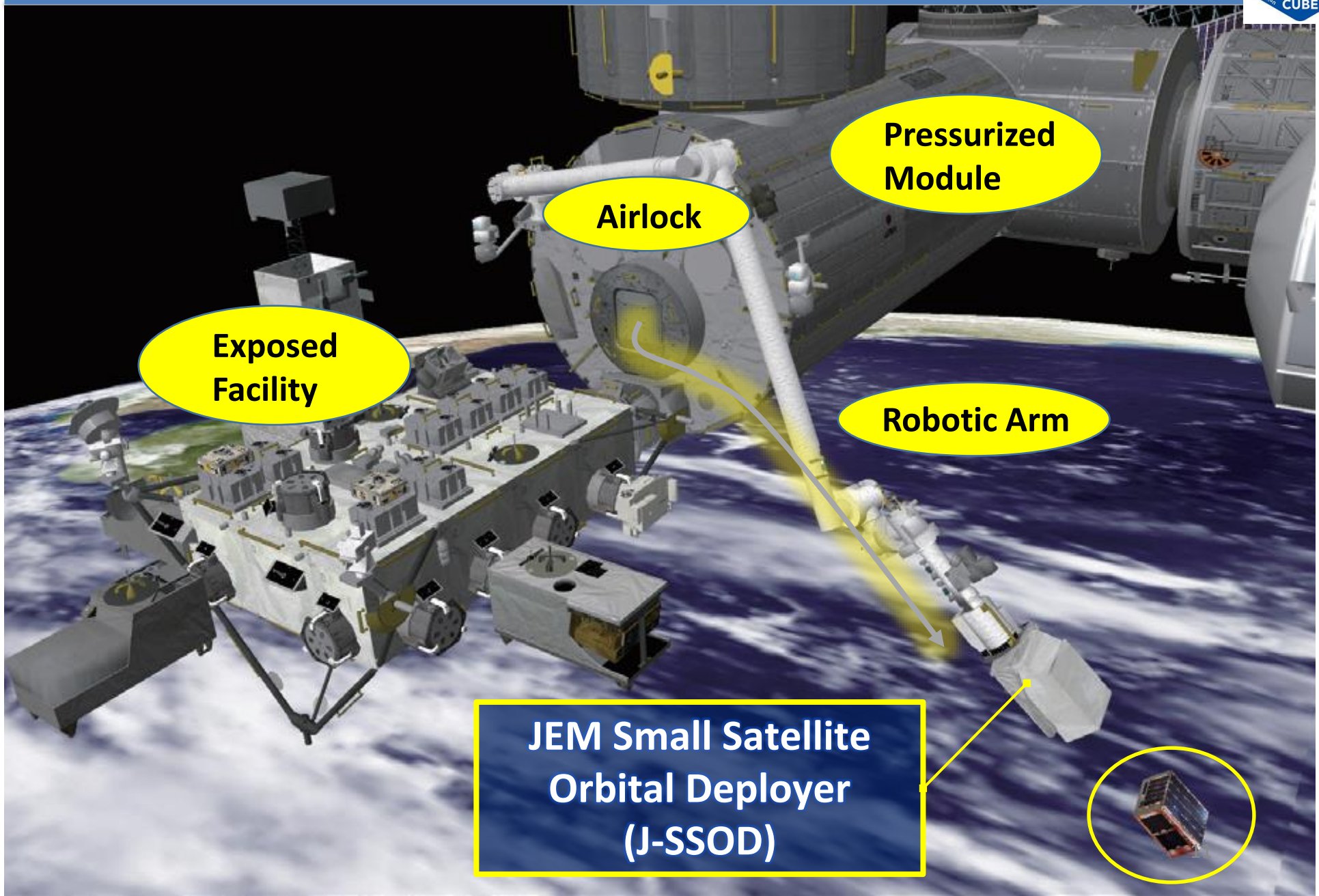
[Asian Try Zero-G](#)

This is a program in which young people from each



[Kibo Robot Programming Challenge \(Kibo-RPC\)](#)

J-SSOD to deploy CubeSats from “Kibo”



JAXA launched comprehensive capacity-building measures to provide educational programs and sustainable satellite deployment opportunities, which contribute to the SDGs Goal 4, 8 and 9.

Partner: UNOOSA

Kibo CUBE

- Program in collaboration with UNOOSA
- To provide 1U size CubeSat deployment opportunities for Access to Space for All

Partner: UNISEC (University Space Engineering Consortium)

J-CUBE (Fee-Based)

- To provide more challenging satellite deployment opportunities for various countries in collaboration with Japanese universities

Kibo CUBE Academy (Online education program)

- To provide opportunities for educational aspects through satellite lifecycle
- Sustained international contribution by construction of relation in various countries and university in Japan

Partner: UNOOSA , Cooperation: UNISEC

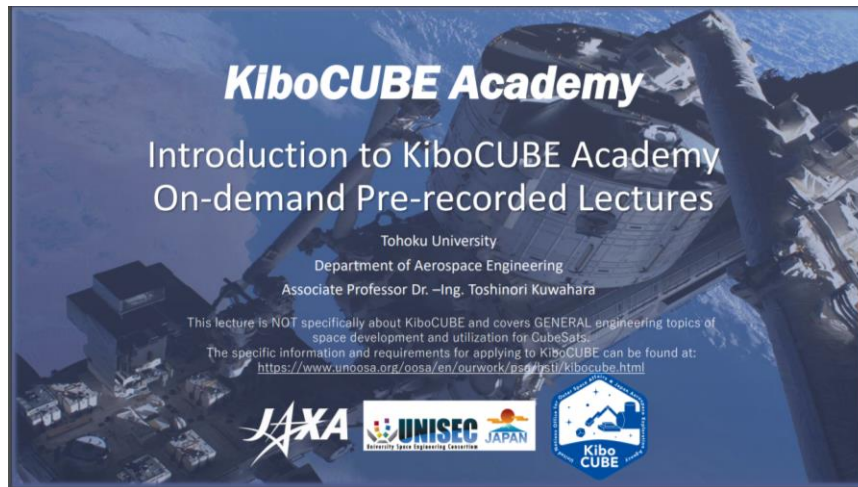
Free lectures are posted here !



https://www.unoosa.org/oosa/en/ourwork/access2space4all/SatDevTrack_Webinars.html#Tag1






Live sessions are also held a few times a year.




- Lecture 0 Introduction to KiboCUBE Academy ([pdf](#) and [video](#)) *up
- Lecture 1 Introduction to Small Satellite Mission and Utilization ([pdf](#) and [video](#))
- Lecture 2 CubeSats for Capacity Building ([pdf](#) and [video](#))
- Lecture 3 Overview of Project Management of Satellite Development
- Lecture 4 Systems Engineering for Micro/nano/pico-satellites ([pdf](#) and [video](#))
- Lecture 5 Introduction of Safety Review Process ([pdf](#) and [video](#))
- Lecture 6 CubeSat Design for Safety Requirements ([pdf](#) and [video](#))
- Lecture 7 Introduction to CubeSat Technologies ([pdf](#) and [video](#))
- Lecture 8 Subsystem Lecture for CubeSat: Power Control System
- Lecture 9 Subsystem Lecture for CubeSat: Communication System
- Lecture 10 Subsystem Lecture for CubeSat: Command and Data Handling System
- Lecture 11 Subsystem Lecture for CubeSat: Structure System ([pdf](#) and [video](#))
- Lecture 12 Subsystem Lecture for CubeSat: Mechanism System ([pdf](#) and [video](#))
- Lecture 13 Subsystem Lecture for CubeSat: Thermal Control System
- Lecture 14 Subsystem Lecture for CubeSat: Attitude Control System
- Lecture 15 Introduction to CubeSat Environmental Testing ([pdf](#) and [video](#))
- Lecture 16: Introduction to Orbital Mechanics for Microsatellites ([pdf](#) and [video](#))
- Lecture 17: Introduction to CubeSat Operation and Ground System
- Lecture 18: Introduction to CubeSat Payload Systems ([pdf](#) and [video](#))
- Lecture 19: CubeSat System Integration and Electrical Testing ([pdf](#) and [video](#))
- Lecture 20: Space Debris Problems and Countermeasures ([pdf](#) and [video](#))
- Lecture 21: Lessons Learned of CubeSat Missions ([pdf](#) and [video](#))



1. Free of charge
2. A learner can get technical support from experts (UNISEC, JAXA, Service provider)
3. Launch opportunities: 3-4 times a year (even if you miss a certain flight, you don't have to wait for a long time for the next chance)
4. Low vibration conditions during the launch compared to rocket rides
5. You can see the deployment in real time!



Round / Winner		Objective / Status
1 st 	KENYA : "1KUNS-PF" University of Nairobi	To monitor agriculture and coastal areas Deployed : May 11, 2018
2 nd 	GUATEMALA : "Quetzal-1" Universidad de Valle De Guatemala	To acquire remote sensing data for natural resource management Deployed : Apr. 29, 2020
3 rd 	MAURITIUS : "MIR-SAT 1" Mauritius Research and Innovation Council	To collect images and to test onboard communication Deployed : Jun. 22, 2021
3 rd 	INDONESIA : "SS-1" Surya University	To demonstrate remote communication Deployed : Jan.6, 2023
4 th 	MOLDOVA : "TUMnanoSAT" Technical University of Moldova	To demonstrate technology and test various components Deployed : Aug. 12, 2022

Round / Winner		Objective / Status
5 th 	SISTEMA DE LA INTEGRACIÓN CENTROAMERICANA (SICA) : "MORAZAN-SAT"	To monitor weather variables in remote areas providing early warning during extreme weather events Under development
6 th 	MEXICO : "Gxiba-1" The Universidad Popular Autónoma del Estado de Puebla	To observe active volcanoes in Mexico and analyze the ash dispersion Under development
6 th 	TUNISIA : "TUNSAT-1" Ecole Supérieure Privée d'Ingénierie et de Technologie Appliquée	To validate the technology which is the focus on the reliability of 1U CubeSat Under development
7 th	No awardee	N/A

- JAXA is eager to support capacity-building and technology development in collaboration with UNOOSA.
- Kibo-ABC programs (such as Kibo-RPC) and the KiboCUBE program contribute to the sustainable development of space-related activities and human resource development worldwide.
- The 4th Kibo-RPC is conducted in 2023, and the next Round of KiboCUBE is coming soon !