

Deployment Service for CubeSat from ISS

KiboCUBE Academy in Tunisia

25th August 2022

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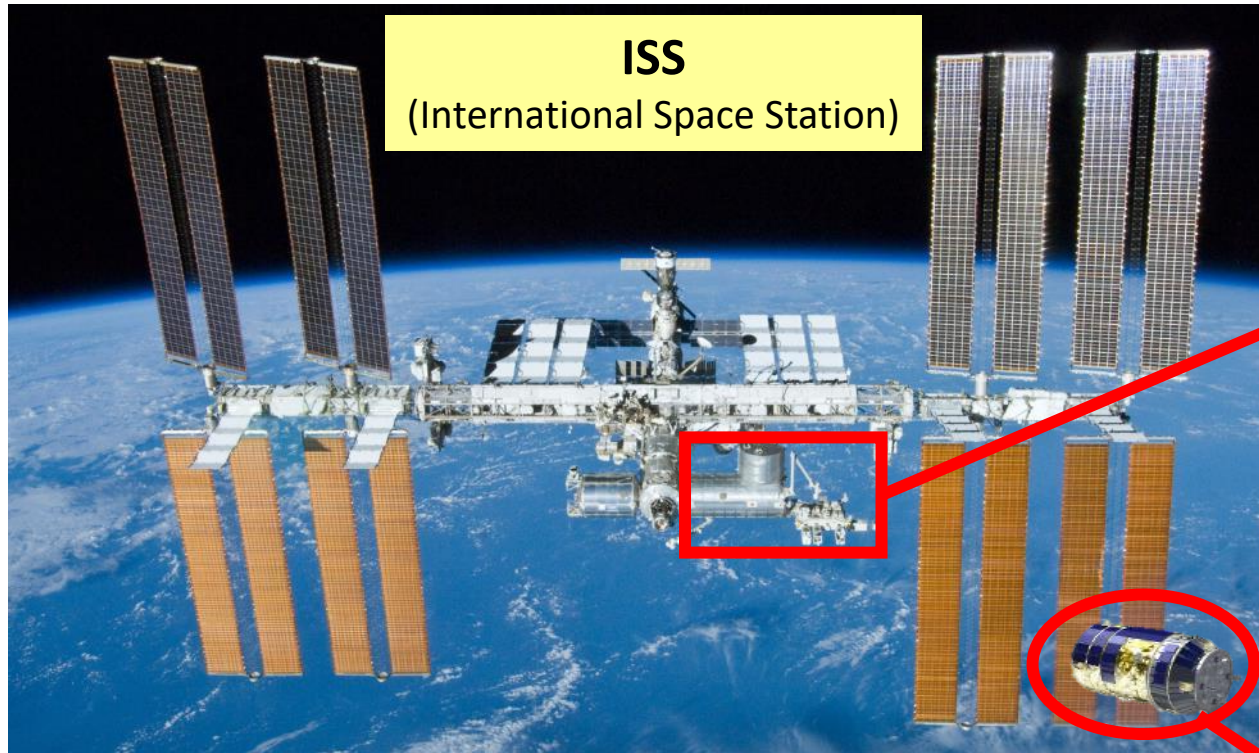
Human Space Technology Directorate

Japan Aerospace Exploration Agency

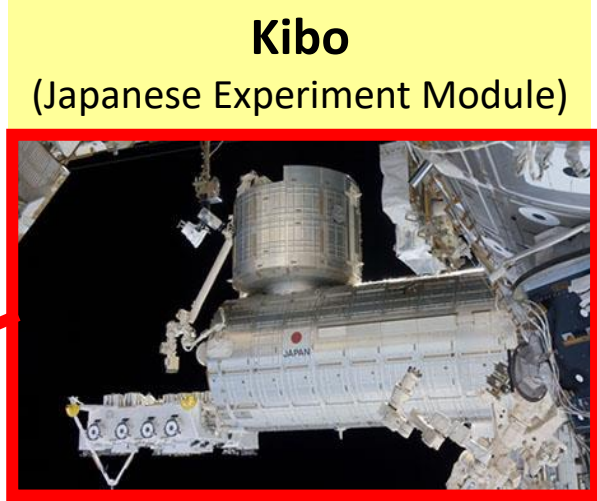
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ISS: Japan's Capabilities and Contributions



ISS
(International Space Station)



Kibo
(Japanese Experiment Module)

HTV
(H-II Transfer Vehicle)

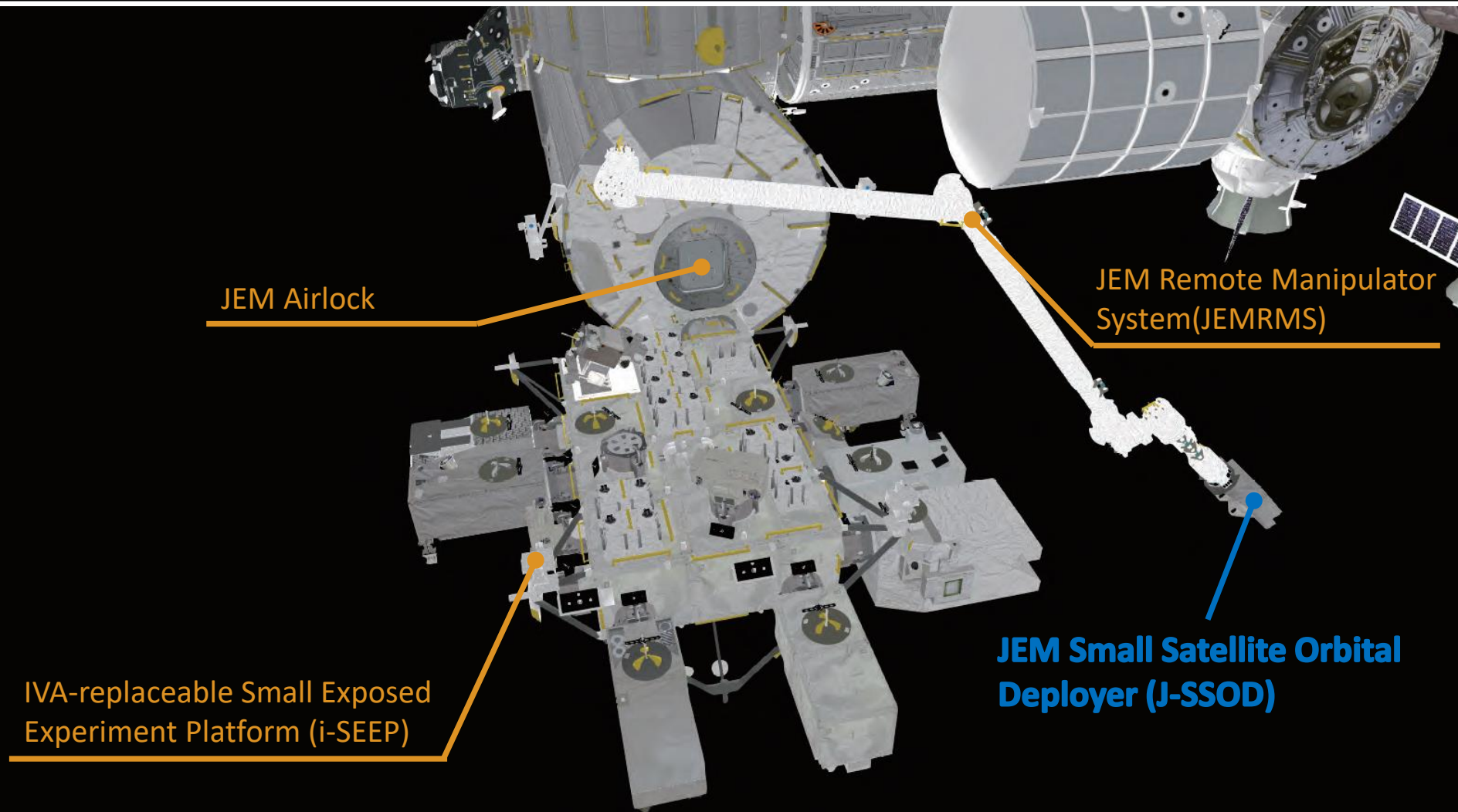


H-IIB

- ISS is a huge manned construction located about 400km above the Earth.
- 15 countries participate in the ISS program
- Japan strives to make concrete international contributions through extensive utilization of Kibo and HTV.

ISS: Japan's Capabilities and Contributions

"Kibo" is Unique! – Exposed Facility



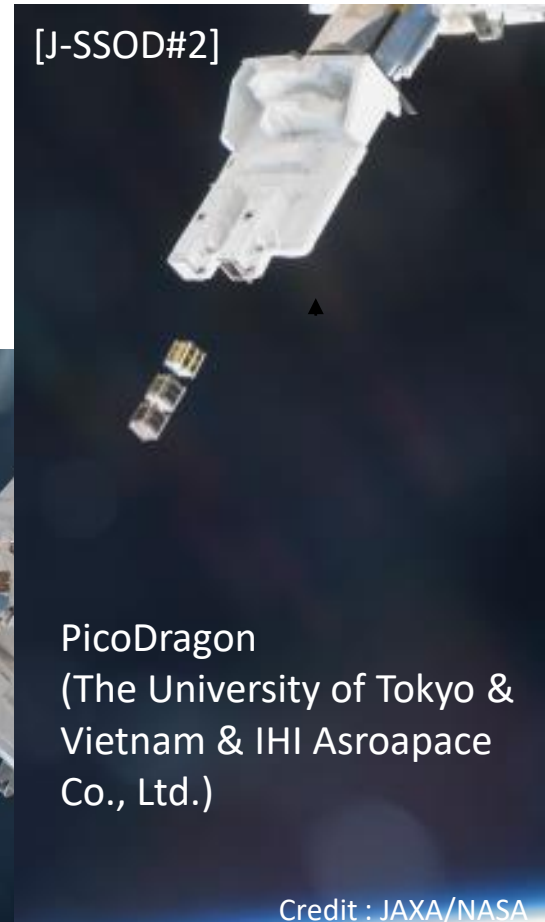
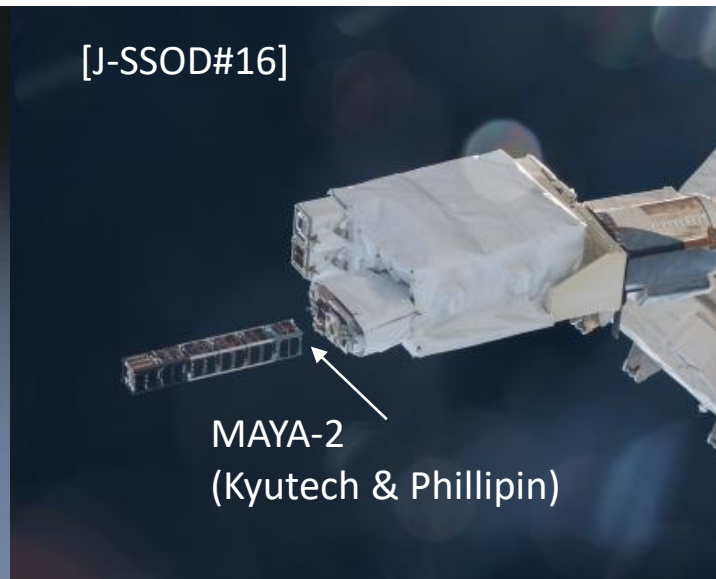
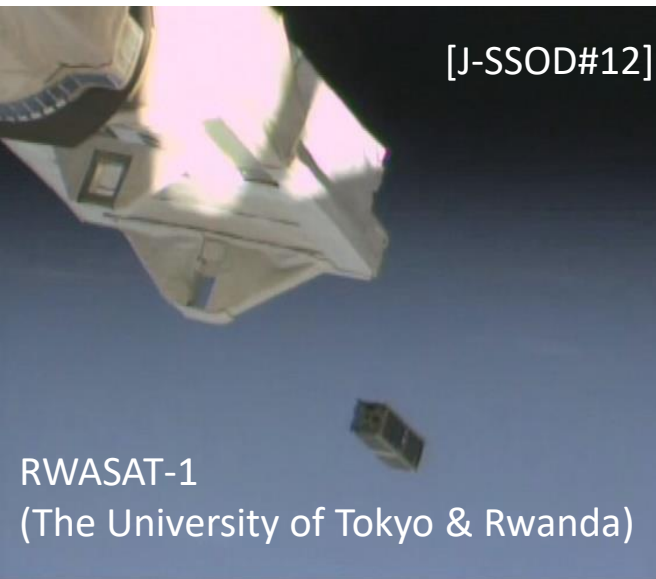
Japanese Experiment Module (Kibo) has unique capabilities to conduct various space experiments in Exposed Facility. JEM Small Satellite Orbital Deployer (J-SSOD) can deploy small satellites into the orbit from Kibo.

Credit : JAXA

“Kibo” is Unique! – Exposed Facility

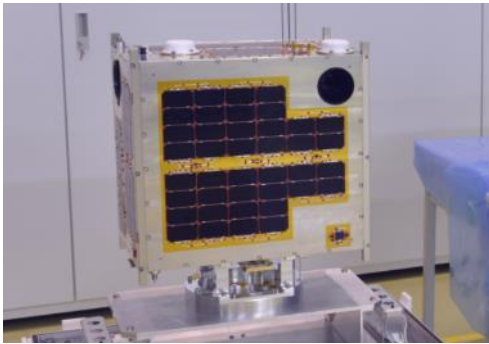
Small satellite deployment mission (J-SSOD)

- JAXA can operate the satellite deployment missions from Kibo from 2012.
- By August 2022, **65** satellites have been successfully deployed from J-SSOD.
- JAXA has selected Space BD Inc. and Mitsui Bussan Aerospace Co.Ltd. as the service providers



“Kibo” is Unique! – Exposed Facility

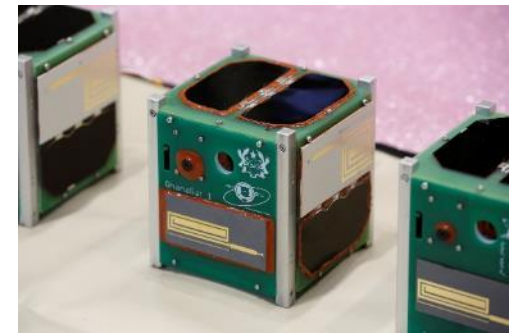
Small satellite deployment mission (J-SSOD)



MicroSat (20~100kg)



NanoSat (1kg~20kg)



PicoSat (less than 1kg)

Credit : JAXA

Extremely Low-cost

- New players are welcome to join (enterprises, local governments, developing countries etc.)
- Great opportunity for education tools and challenging missions

Ref: Prof. Nakasuka, Tokyo Univ. (2017.6.12) (modified by JAXA)

Short Turn Around Life Cycle

(more than 5 years → less than 1-2 years)

- College students can experience whole development cycle
- Curriculum can be standardized as sustainable program
- Quick return on your business investments, technology demonstration

Cost-Effective Method for Various Missions

- Practical remote sensing data can be obtained from small satellites



Snapshot of Banana farm, Mindanao, the Philippines
(provided by PHL-MICROSAT, DIWATA-1)

“Kibo” is Unique! – Exposed Facility

Small satellite deployment mission (J-SSOD)

Specification for J-SSOD platform

Item	Specification
Satellite Size	CubeSat : 1U, 2U, 3U or 6U (*1) 50 kg class satellite: 55×35×55 cm
Satellite mass	CubeSat : 1.33 kg or less per 1U 50 kg class satellite: 50kg or less
Orbital altitude	approximately 380 - 420 km (*2)
Inclination	51.6°
Deployment direction	Nadir-aft 45° from the ISS nadir side
Deployment velocity	CubeSat : 1.1 - 1.7 m/sec 50 kg Microsat : 0.4 m/sec
Ballistic coefficient	100kg/m ² or less (*3)

*1) CubeSat specification:

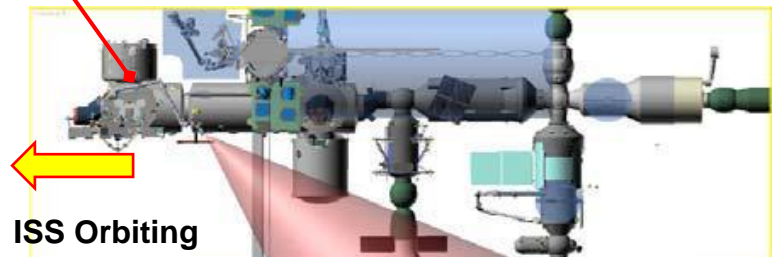
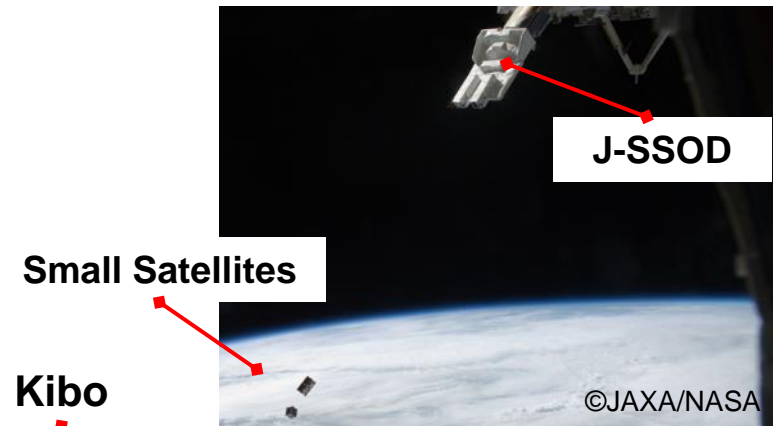
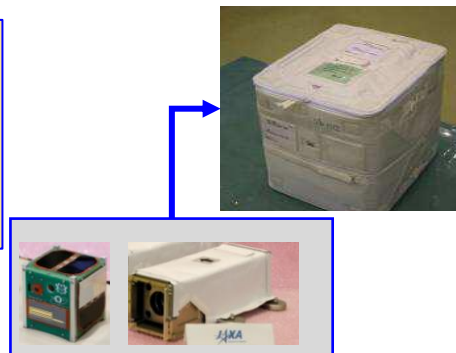
For 1U,2U and 3U: 10cm(W) × 10cm(D) Height: 1U: 10cm, 2U: 20cm, 3U: 30cm

For 6U: 10cm(W) × 20cm(D) × 30cm(H)

*2) Depends on ISS altitude.

*3) Depends on ballistic coefficient, altitude at release, solar activity, etc.

Lower vibration environment are provided since Small Satellites are stowed in a soft bag and carried to the ISS together with other cargo.



ISS Orbiting Direction

Deployment Direction(Cone)
Nadir-aft 45° from the ISS nadir side

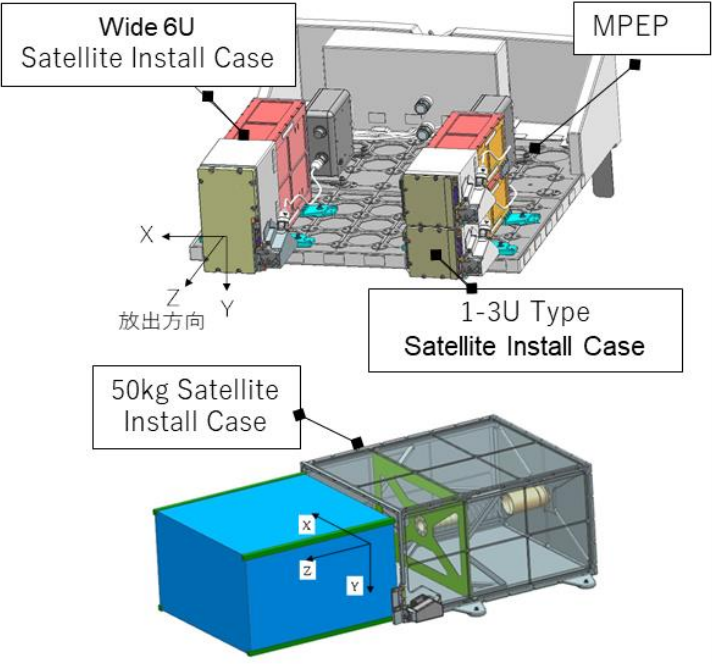
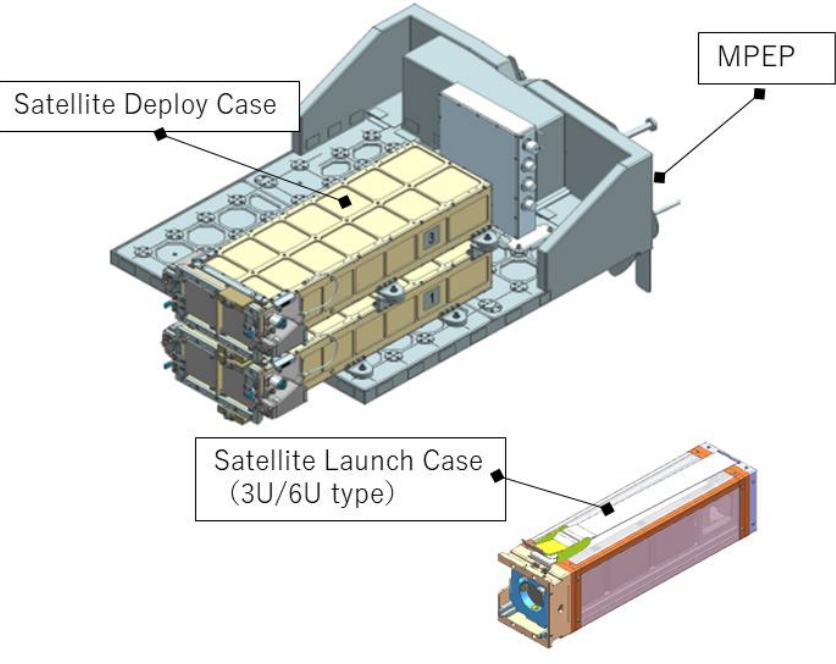


Credit : JAXA/NASA

“Kibo” is Unique! – Exposed Facility

Small satellite deployment mission (J-SSOD)

- JAXA can provide two type of J-SSOD case.
- J-SSOD-R which has been operated since J-SSOD#16 can be used repeatedly and can release 6U satellites in a slot.

① J-SSOD Satellite Install Case	② J-SSOD-R Satellite Deploy Case
 <p>The diagram shows a 3D cutaway view of the J-SSOD Satellite Install Case. It features a central 'Wide 6U Satellite Install Case' (red) and two '1-3U Type Satellite Install Case' (yellow) units. A '50kg Satellite Install Case' (blue) is shown in a separate view below. The entire assembly is mounted on the 'MPEP' (Main Payload Exposed Facility). A coordinate system with X, Y, and Z axes is shown, with 'Z' labeled as '放出方向' (release direction).</p>	 <p>The diagram shows a 3D cutaway view of the J-SSOD-R Satellite Deploy Case. It features a 'Satellite Deploy Case' (blue) and a 'Satellite Launch Case (3U/6U type)' (orange). The entire assembly is mounted on the 'MPEP'.</p>
<ul style="list-style-type: none">• Satellites of 1~3U, W6U and 50kg class can be deployed.• Satellites can be installed in satellite install case on the ground and launched.• Crew mounts satellites install case on MPEP inside Kibo .	<ul style="list-style-type: none">• Satellites of 1~6U can be deployed.• Satellites can be installed in satellite launch case on the ground and launched.• Crew installs satellites in satellite deploy case and mounts satellite deploy case on MPEP inside Kibo .• Satellite install case can be kept in Kibo and reuse again.

“Kibo” is Unique! – Exposed Facility

Small satellite deployment mission (J-SSOD)

- 40 Cubesats from 27 countries (other than Japan) were deployed using J-SSOD.
- Zimbabwe (BIRDS-5), Uganda (BIRDS-5) and Indonesian (SS-1) satellite will be launched and deployed this year.



2012, 2013 : USA, Vietnam

2014, 2015 : Brazil

2016 : Singapore, Philippines, Italy

2017 : Bangladesh, Ghana, Mongolia, Nigeria

2018 : Bhutan, Costa Rica, Kenya, Philippines, Malaysia, Singapore, Turkey

2019 : Nepal, Rwanda, Sri Lanka, Egypt, Singapore

2020 : Philippines, Guatemala, Paraguay, Myanmar, Israel

2021 : Mauritius, UAE, Australia

2022 : Moldova

JEM Small Satellite Orbital Deployer (J-SSOD)

Capacity building through J-SSOD

- JAXA has provided the opportunities of satellite deployment to various countries as a gateway for sharing the values of ISS/Kibo for the purpose of enhancing satellite development and operation technology.
- JAXA launched new comprehensive capacity building measures to provide the educational programs and sustainable satellite deployment opportunities, which finally contribute the SDGs Goal 4, 8 and 9.

Kibo CUBE

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

J-CUBE (Fee-Based)

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

Kibo CUBE Academy

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

JEM Small Satellite Orbital Deployer (J-SSOD)

Capacity building through J-SSOD

J-CUBE (New Satellite Deployment Opportunity)

- JAXA launched the new fee-based satellite deployment initiative which is called “J-CUBE” from 2021.
- In this J-CUBE, JAXA allocates up to 6 satellite deployment opportunities for 1U to 3U satellite a year.
- JAXA provides the two set of frame works, international collaborative frame work and the Japanese domestic challenging frame work.
- For the international collaborative frame work, satellite deployment opportunities for the space emerging countries are provided for more challenging and advanced missions with the collaboration with Japanese universities.
- JAXA signed an agreement of J-CUBE with UNISEC-Japan in April 2021.
- You can find the outline of J-CUBE of the following website;
<http://unisec.jp/serviceen/j-cube>
- 3 satellites was selected in the international collaborative frame work and 2 satellites was selected in the collaboration with Japanese universities last year.

Thank you for your attention !!

**Innovative launch opportunity for Micro/Nano-satellite
by using one and only function on Kibo/ISS**



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Human Space Technology Directorate
Japan Aerospace Exploration Agency
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Credit : JAXA/NASA

