



JEM Small Satellite Orbital Deployer

J-SSOD



CubeSats deployed from "Kibo"

14th October, 2012, JAXA deployed the first CubeSat from ISS using the Japanese Experiment Module (JEM) "Kibo" robotic arm. Since then, a new history of space development began.

A variety of uses are currently developing CubeSats, which are deployed using the Small Satellite Orbital Deployer "J-SSOD".

J-SSOD expands opportunities to launch CubeSats.

The world's first CubeSat orbital deployer, JEM Small Satellite Orbital Deployer (J-SSOD) was developed in Japan to deploy CubeSats from Japanese Experiment Module "Kibo" on International Space Station (ISS) into orbit.

Recently CubeSats are rapidly being developed by domestic and foreign universities and private companies, and various missions such as technology demonstrations are carried out.

Japan Aerospace Exploration Agency (JAXA) developed and operates the J-SSOD service to expand CubeSat utilization. J-SSOD deploys CubeSats from "Kibo" on ISS, orbiting at an altitude of about 400 km above the earth.

J-SSOD service aims to expand the use of space, such as promoting space development and creating new space industry, as well as fostering human resources to support space development and expanding the application and demand for space technologies in space developing countries.

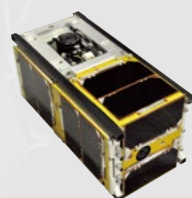
Various kinds of CubeSats have been deployed.

2012

J-SSOD#1

RAIKO

Technology validation mission



- Investigator: Wakayama University/ Tohoku University
- Size: 2U

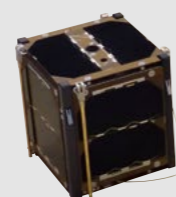
- It has taken 63 images during 10 months of operation and successfully completed an experiment of high-speed transmission of 100kbps.

2018

J-SSOD#8

1KUNS-PF

Kenya's first satellite/
Selected as the first KiboCUBE program



- The University of Nairobi (Kenya)
- Size: 1U

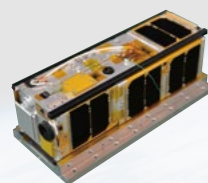
- To develop and educate space engineers
- To technologically verify commercial products

2015

J-SSOD#4

S-CUBE

Satellite for observation of meteor's ultraviolet rays



- Investigator: Chiba Institute of Technology / Tohoku University
- Size: 3U

- The world's first "Meteor Observation Project from Space"
- The first 3U CubeSat in Japan

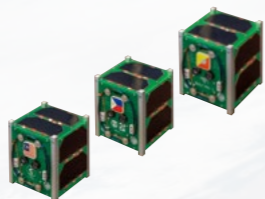
Image by JAXA/Chiba Institute of Technology

2020

J-SSOD#9

BHUTAN-1, MAYA-1, UiTMSAT-1

Joint Global Multi Nation BIRDS-2



- Kyushu Institute of Technology
- Royal University of Bhutan
- University of the Philippines
- MARA University of Technology of Malaysia
- Size: 1Ux3

- Earth photography with onboard cameras, Technology demonstration of data relay techniques, Message exchange over amateur radio
- Detection of abnormalities caused by space radiation, Technology demonstration of GPS for consumer use, Observation of the Earth magnetic field, Verification of ground station networks on amateur radio frequency bands

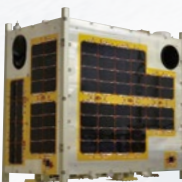
(Note.) Bhutan's first satellite

2017

J-SSOD#5

DIWATA-1 (PHL-MICROSAT)

First microsatellite in the Philippines



- Investigator: Tohoku University/ Hokkaido University/ University of the Philippines/ Republic of the Philippines, Department of Science and Technology
- Size: 50kg class

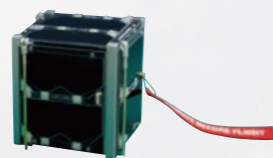
- Demonstrates natural resources and disaster monitoring in the Philippines with the first microsatellite in the country.

2020

J-SSOD#13

Quetzal-1

Guatemala's first satellite/
Selected as the 2nd KiboCUBE program



- Universidad del Valle de Guatemala
- Size: 1U

- Technology demonstration of phytoplankton concentration (chlorophyll a) detection

Unique and New Space Environment Utilization with J-SSOD

The CubeSats are stored in the J-SSOD satellite install case and launched as a vehicle cargo to the ISS. After being transferred to the Japanese Experiment Module "Kibo", the satellite install case will be set up to be grabbed by the robotic arm. The crew member takes care of the set up, and the ground controller will send the deployment command. J-SSOD can deploy several CubeSats at a time, so that more missions can be carried out.

1 More Opportunities for Launch

The satellite install case can be transferred to the ISS by any transfer vehicle to the ISS.

2 Mitigation for Mechanical Environment at Launch

The satellite install case is stowed in CTB (Cargo Transfer Bag), which is a soft-cushion bag filled with cushion foam during launch. Therefore, the actual mechanical environment such as random vibration and quasi-static acceleration during the rocket launch are mitigated. Shock testing with a payload attach fitting (PAF), usually required for a piggyback payload rocket, is not needed.

Opportunities for deploying CubeSats from "Kibo"

In May 2018, as a new step to enhance the commercial utilization of Kibo, JAXA selected two J-SSOD service providers. Not only those who deploy satellites for R&D or human resource development, but also those who want to use satellites for commercial use can join the opportunity. The Service providers are responsible for developing users in Japan and overseas.

JAXA continues to make international contributions with UNOOSA through the KiboCUBE initiative. KiboCUBE aims to provide educational or research institutions from space developing countries of United Nations membership with opportunities to deploy, from the ISS Kibo, cube satellites (CubeSats) which they develop and manufacture.

2021

J-SSOD#17

MIR-SAT1

Mauritius's first satellite/
Selected as the 3rd KiboCUBE program



- Mauritius Research and Innovation Council
- Size: 1U

- Demonstration the primary operating systems of the bus, which are power, attitude determination and control, communication and flight planning.
- Demonstration of the camera for use in star tracking.

2022

J-SSOD#22

TUMnanoSAT

Moldova's first satellite/
Selected as the 4th KiboCUBE program



- Technical University of Moldova (TUM)
- Size: 1U

- Capacity building
- Technology demonstration of nano/micro wire sensor, magnetometer, micro-gyroscope, sun sensor, communication protocol, and power source

2022

J-SSOD#20

Light-1

UAE Space Agency/ National Space Science Agency (Bahrain)/ Khalifa University (UAE)/ New York University - Abu Dhabi



- Size: 3U

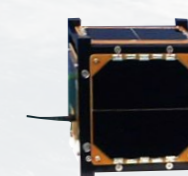
- Study Terrestrial Gamma-ray Flashes (TGFs)
- Compare the performance of two different light-sensing technologies and two different scintillation crystals.

2023

J-SSOD#24

Surya Satellite-1 (SS-1)

Selected as the 3rd KiboCUBE program



- Surya University (Indonesia)
- Size: 1U

- Demonstration of amateur radio communication system and APRS (Automatic Packet Reporting System) communication platform.
- Capacity building

2022

J-SSOD#21

KITSUNE

The first Wide 6U (W6U) CubeSat deployment for J-SSOD



- HAK Consortium (Haradaseiki Co., Addnics Co., Kyushu Institute of Technology)
- Service provider: Mitsui Bussan Aerospace Co., Ltd.
- Size: W6U

- Earth observation with 5-m class resolution color images by COTS camera
- Demonstration of 2U size Kyutech standard bus system

Image by HAK Consortium

2023

J-SSOD#24

OPTIMAL-1

- ArkEdgeSpace Inc., University of Fukui
- Service provider: Space BD Inc.
- Size: 3U

- Demonstration of a micro-propellant using water as propellant
- Demonstration of an ultra-compact hyperspectral camera
- Demonstration of low-power transmission and receiver (Store and Forward)

Image by Space BD Inc.

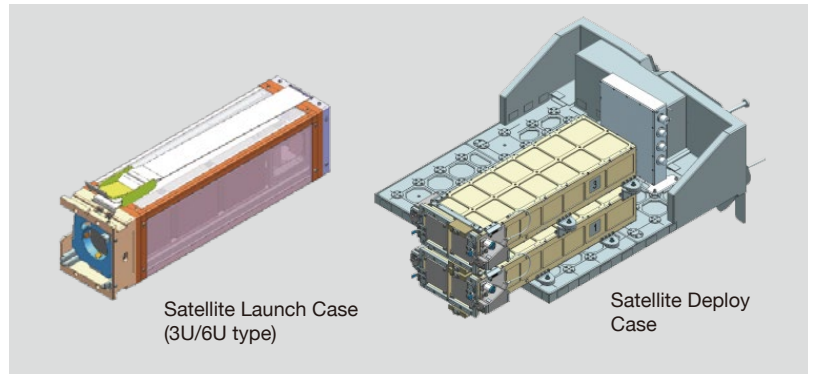
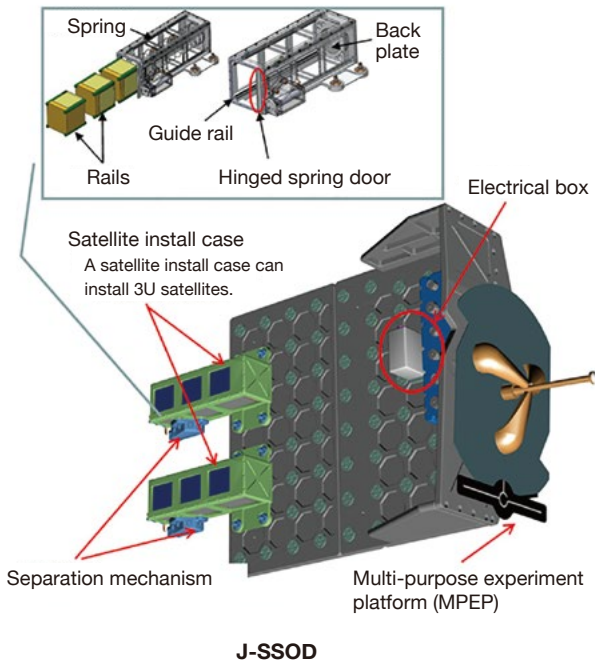


J-SSOD's Specifications

J-SSOD has a satellite install case which can install CubeSats from 1U (10 x 10 x 10cm) to 6U. 50 kg class satellite is also applicable. J-SSOD is released by the elastic force of the spring inside the satellite install case. With increased demand, the repeatedly usable deployer J-SSOD-R (JEM Small Satellite Orbital Deployer Resuppliable) was introduced in 2020. Satellites are loaded in a satellite launch case and transported to the ISS, where it is transferred to a satellite release case by a crew member.

ITEM	SPECIFICATIONS
INSTALLABLE SATELLITE SIZE	CubeSat: 1U, 2U, 3U, 4U, 5U, 6U, W6U* 50kg class satellite: 55×35×55cm
INSTALLABLE SATELLITE MASS	CubeSat: 1.33 kg or less per 1U, W6U size satellite is 6.8kg or less 50kg class satellite: Less than 50kg
INSERTION ORBIT	Elliptical orbit with altitude of 380 km - 420 km (depends on ISS altitude) Inclination: 51.6°
BALLISTIC COEFFICIENT	CubeSat: 120kg/m ² or less 50kg class satellite: 100kg/m ² or less (To prevent collisions between the satellites and the ISS, it makes satellites drop faster than ISS after its deployment.)
INSERTION DIRECTION	Nadir-aft 45° from the ISS nadir side, in terms of ISS body coordinate system
INSERTION VELOCITY	CubeSat: 0.77~1.7m/sec 50kg class satellite: 0.4m/sec (Depends on satellite mass)
LIFE EXPECTANCY ON ORBIT	About half or one year (depends on ballistic coefficient, released altitude, or solar activity, etc.)

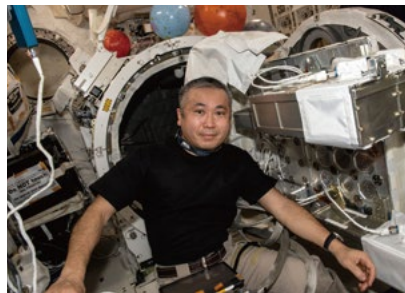
* 1U~6U : 10cm(W)×10cm(D), Height: 1U: 10cm, 2U: 20cm, 3U: 30cm, 4U: 40cm, 5U: 50cm, 6U: 60cm, W6U: 10cm(W)×20cm(D)×30cm(H)



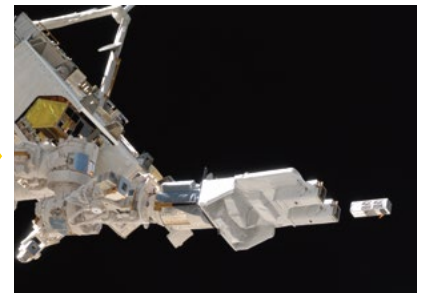
CubeSat deployment mission using J-SSOD



1 The satellite install case which installs CubeSats is stowed in a soft-cushion bag for shipping. The satellite install case is launched by a cargo transfer vehicle to ISS.



2 The satellite install case is installed on the MPEP by the crew member in Japanese Experiment Module "Kibo", and then transferred from the airlock to the outside.



3 The robotic arm of "Kibo" holds the MPEP to transfer it to the release point. The satellites are deployed by a command signal sent from ground.

