

# **PNST 2024 round webinar**

## **Kyushu Institute of Technology**



**Tetsuhito Fuse**

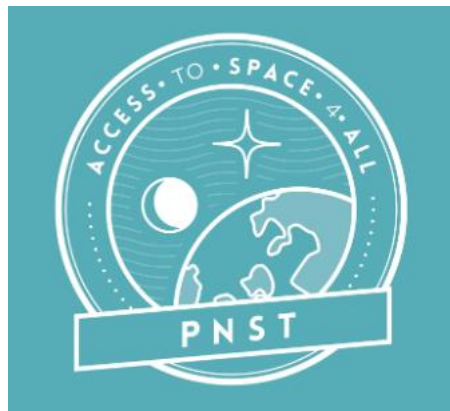
Laboratory of Lean Satellite Enterprises and In-Orbit Experiments

Kyushu Institute of Technology

Kitakyushu, Japan

11 December 2023

**Kyutech offers full-scholarship program named PNST which is operated under Space Engineering International Course (SEIC), by Kyutech Collaboration with UNOOSA and Japanese Government.**



# Kyushu Institute of Technology (Kyutech)



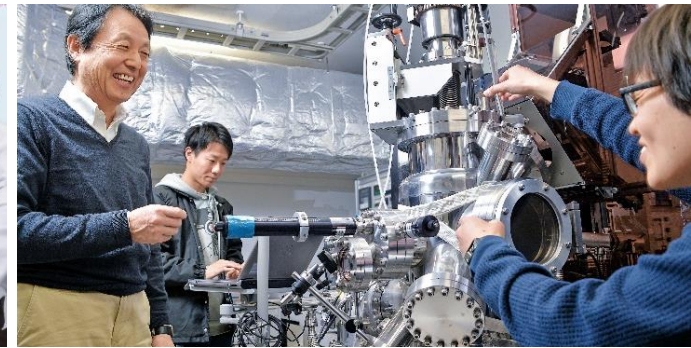
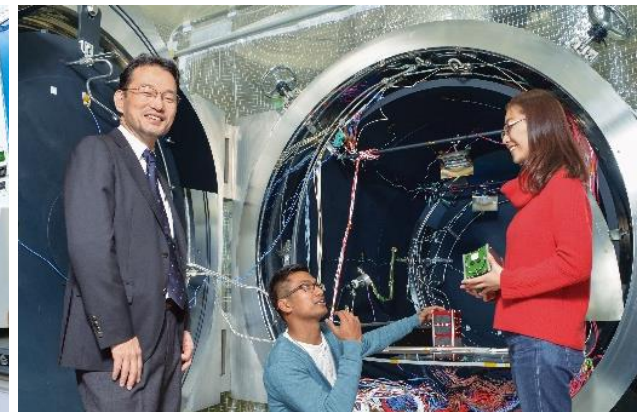
- A national university founded in 1909
  - 4,200 Undergraduate students
  - 1,300 Graduate students
  - 360 Faculty members
  - Engineering, Computer science, Life-science
- Located in the Kitakyushu region
  - Population of more than 1million



# Hands-on and Practical Education

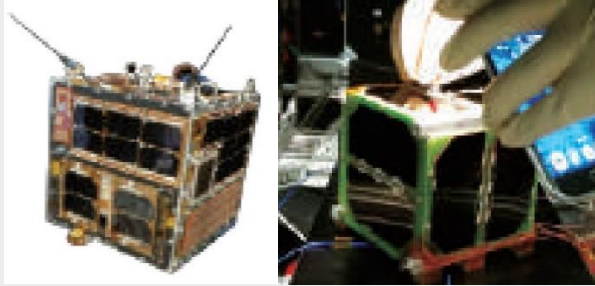
## Lab-Based Final Year of All Undergraduate Program

Final-year undergraduate students become laboratory members for research work and thesis



# Research Centers & Units

## Center of Excellence for Advanced Research



*Laboratory of Lean Satellite Enterprises  
and In-Orbit Experiments*



*Integrated Research Center for  
Energy and Environment*



*Next Generation Power Electronics  
Research Center*



*Research Center for  
Neuromorphic AI Hardware*

# International trend of Nano/Small Sat

## □ Space business and Tech demo

- Mainly LEO mission
- Lower prices of components, etc.
  - Ideas for space applications are important
  - Interdisciplinary research on multiple disciplines

## □ Advanced research on Nanosatellites

- Challenging programs of science missions (Moon, deep space missions)
- Huge amount of technical challenges
  - Research topic of cutting-edge is crucial
  - Advanced Research Initiatives and Technology Demonstrations in LEO



SpaceX Satrlink program

(<https://ja.wikipedia.org/wiki/%E3%82%B9%E3%82%BF%E3%83%BC%E3%83%AA%E3%83%B3%E3%82%AF>)



JAXA/ISAS Deep Space Fleet

([https://app.journal.ieice.org/trial/103\\_2/k103\\_2\\_212/index.html#u\\_2e0000\\_2efig-1](https://app.journal.ieice.org/trial/103_2/k103_2_212/index.html#u_2e0000_2efig-1))

# Mission of LaSEINE

Bringing diversity to the space sector and  
contributing to space activities through  
CubeSats



# Space Engineering International Course



# Introduction

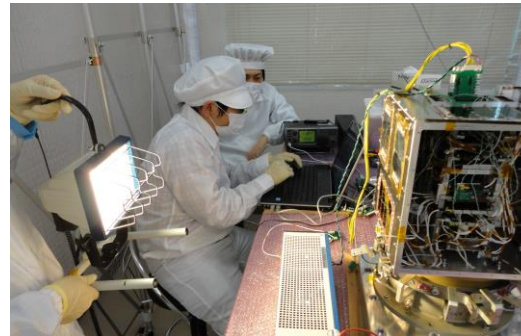
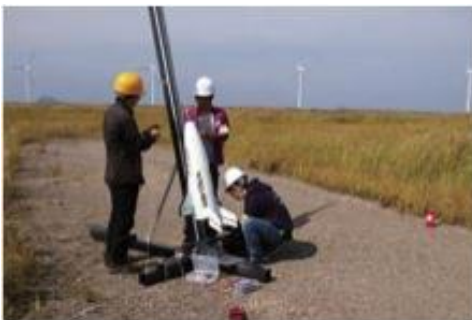
Overview comments by Associate Prof. T. Fuse



# Space Engineering International Course (SEIC)



- Started in April 2013 at Graduate School of Engineering, Kyutech to support PNST
  1. Research toward a Master or Doctoral degree
  2. On-the-job training such as space environment testing workshop
  3. Project Based Learning (PBL) through space projects
  4. Space-related lectures in English
    - Not only engineering, but also space policy and others



There is a scholarship opportunity. “PNST”

# Space Projects at Kyutech



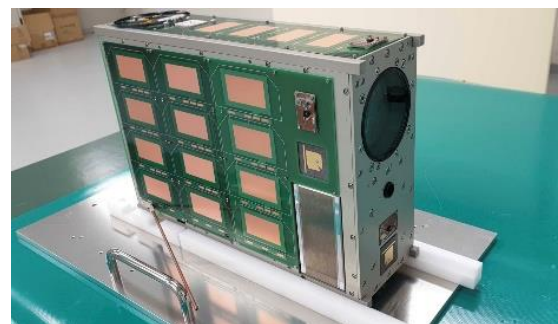
**BIRDS-1 CubeSats**

Kyutech has numerous world-class space facilities and space projects, including:

1. Electrostatic discharge testing in space plasma environment
2. Space-use material degradation testing under UV and atomic oxygen flux
3. Nano-satellite environment testing (vibration, shock, thermal vacuum, thermal cycling, outgassing, EMC & antenna compatibility, etc.)
4. Hypervelocity impact testing using two-stage light gas guns (up to 6.2 km/s)
5. BIRDS nano-satellite series
6. HORYU nano-satellite series
7. SPATIUM nano-satellite series
8. Aoba-Velox nano-satellite series
9. KITSUNE 6U satellite



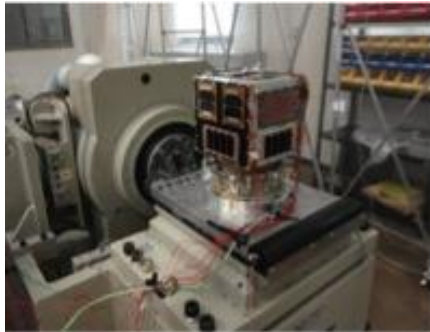
**Thermal vacuum chamber at CeNT**



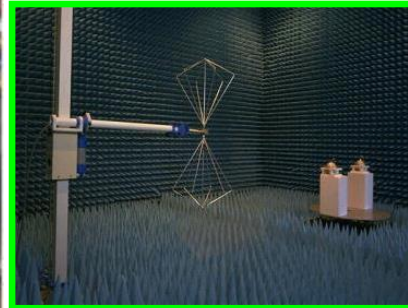
**KITSUNE tech demonstration satellite**

# Center for Nanosatellite Testing

To be capable of doing all the tests for a satellite up to 50cm, 50kg



Vibration



EMC & Antenna pattern



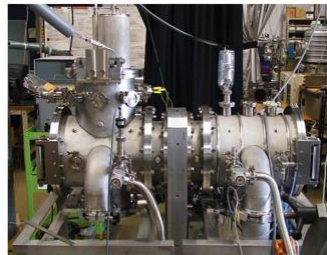
Pressure & Leak



Thermal vacuum



Assembly & Integration



Thermal vacuum



Thermal cycle



Shock



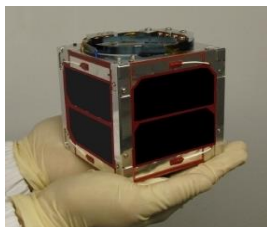
Outgas  
(ASTM E595)



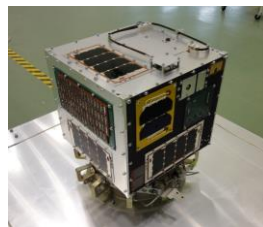
$\alpha$ & $\epsilon$  measurement

Conducted more than 400 tests for external users since 2010

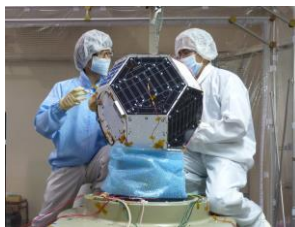
# Kyutech Satellite Heritage



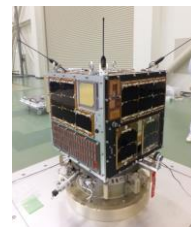
**HORYU-1 (1U)**  
2006-2010  
Not launched



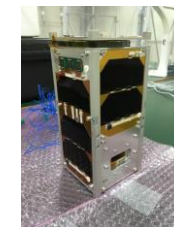
**HORYU-II**  
2010-2012  
Launch 2012/5/18



**Shinen-2**  
2013-2014  
Launch 2014/12/03



**HORYU-IV**  
2013-2016  
Launch 2016/02/17



**AOBA VELOX-III**  
2014-2016  
ISS Release 2017/01/19



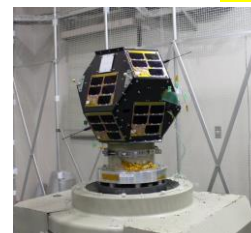
**BIRDS-I constellation**  
2015-2017  
ISS release 2017/07/07



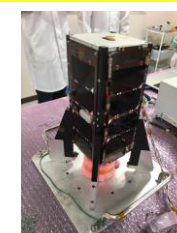
**BIRDS-II constellation**  
2016-2018  
ISS release 2018/08/10



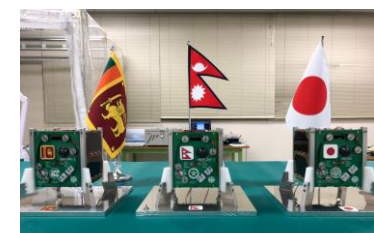
**SPATIUM-I**  
2016-2018  
ISS release 2018/10/06



**Ten-Koh**  
2016-2018  
Launched 2018/10/29



**AOBA VELOX-IV**  
2016-2018  
Launched 2019/01/18



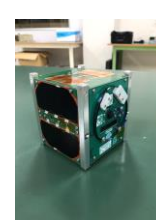
**BIRDS-III constellation**  
2017-2019  
Launched 2019/04/18



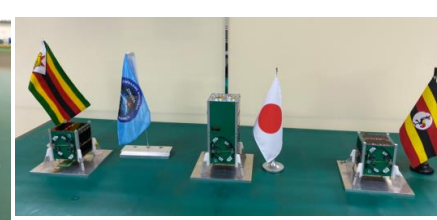
**BIRDS-IV constellation**  
2018-2020  
Launched 2021/03/14



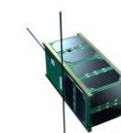
**KITSUNE**  
2019-2021  
Launched 2022/03/24



**FUTABA**  
2018~2021  
Launch, 2021



**BIRDS-5J, -5Z, -5U**  
2022年

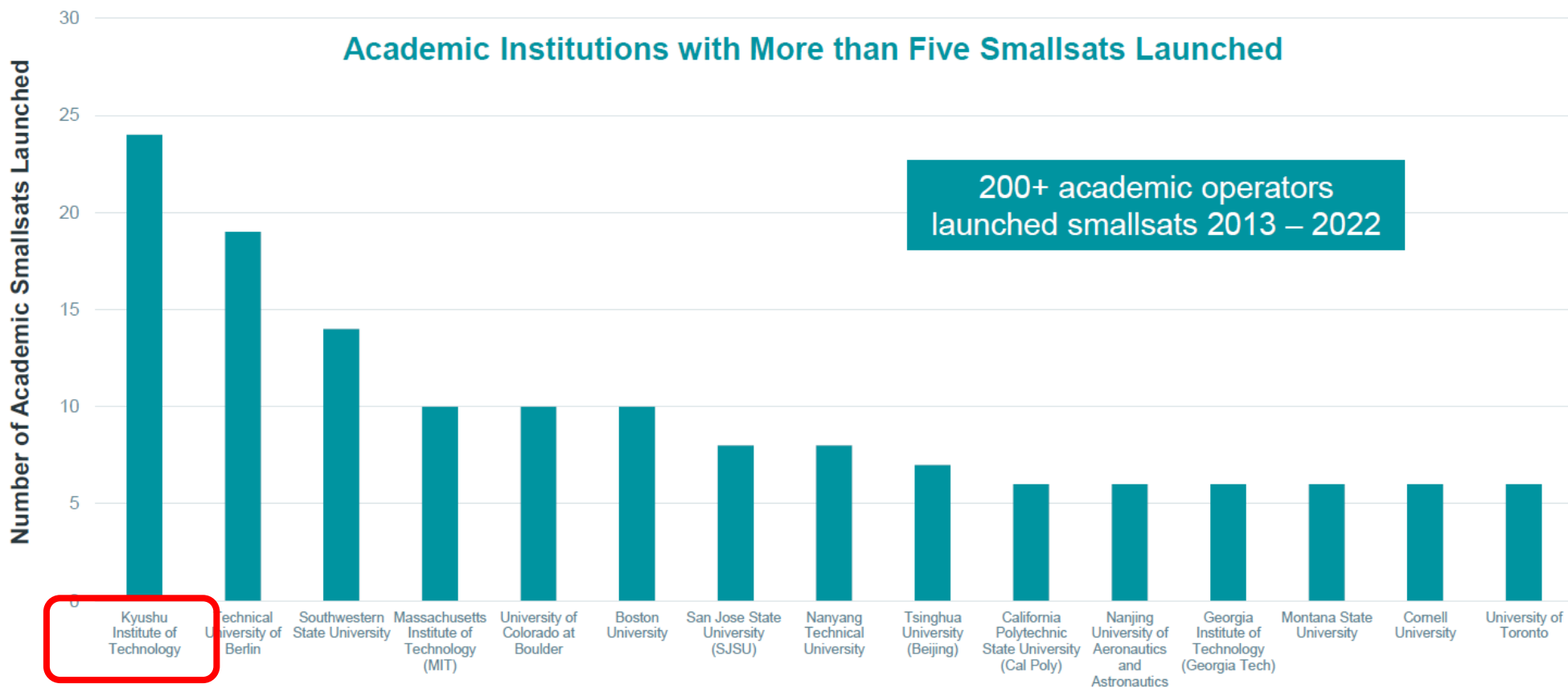


**MITSUBA**  
2022年

Satellite name  
Satellite development period  
Launch/ISS release date

## Operator and Mission Type Trends

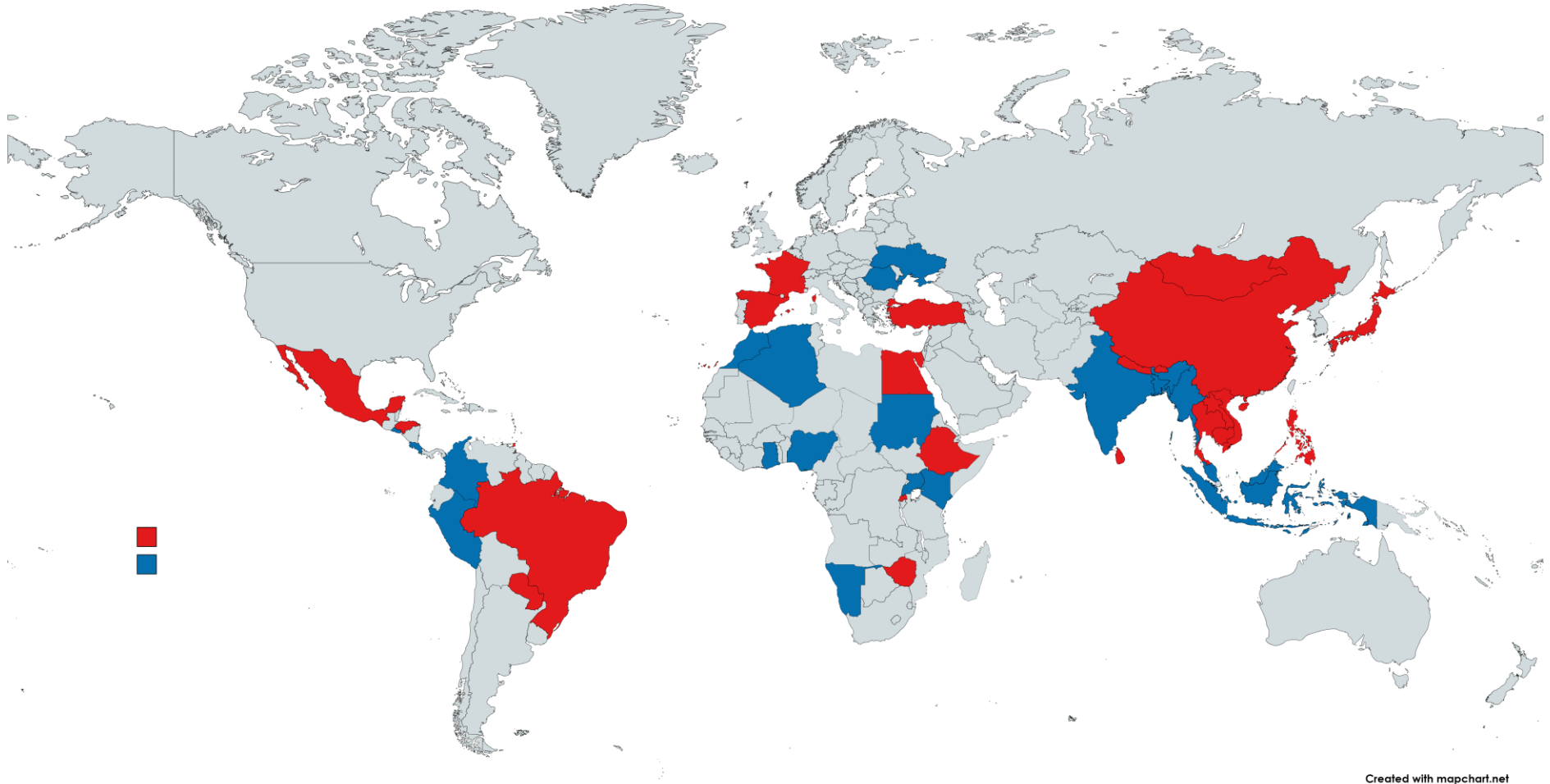
Number of Academic Smallsats 2013 – 2022, by Institution



## Where SEIC students come from (as of April 2022)

Number of Students (67 in total)	Nationality (26 countries)
25	Japan
4	France, Philippines, Zimbabwe
3	Paraguay, Thailand, Uganda
2	Bhutan, Spain
1	Brazil, Cambodia, China, El Salvador, Ethiopia, Honduras, India, Indonesia, Laos, Malaysia, Mexico, Myanmar, Nepal, Rwanda, Sri Lanka, Trinidad and Tobago, Vietnam

# SEIC Student Composition



Graduated

Current (as of April 2023)

More than 159 foreign students from 46 countries enrolled in 11 years

# International Awards and Recognition

Bringing diversity to engineering education



## *GEDC Airbus Diversity Award (2017)*

The BIRDS Project





# BIRDS Program

Satellite program for non-space faring countries

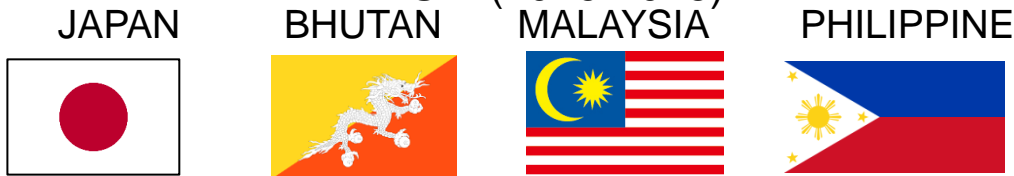
## Mission Statement

By successfully building and operating the first national satellite, make the foremost step toward indigenous space program at each nation.

### BIRDS-I (2015-2017)



### BIRDS-II (2016-2018)



### BIRDS-III (2017-2019)



### BIRDS-IV (2018-2020)

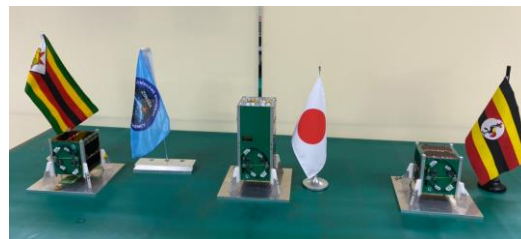


### BIRDS-V (2020-2022)



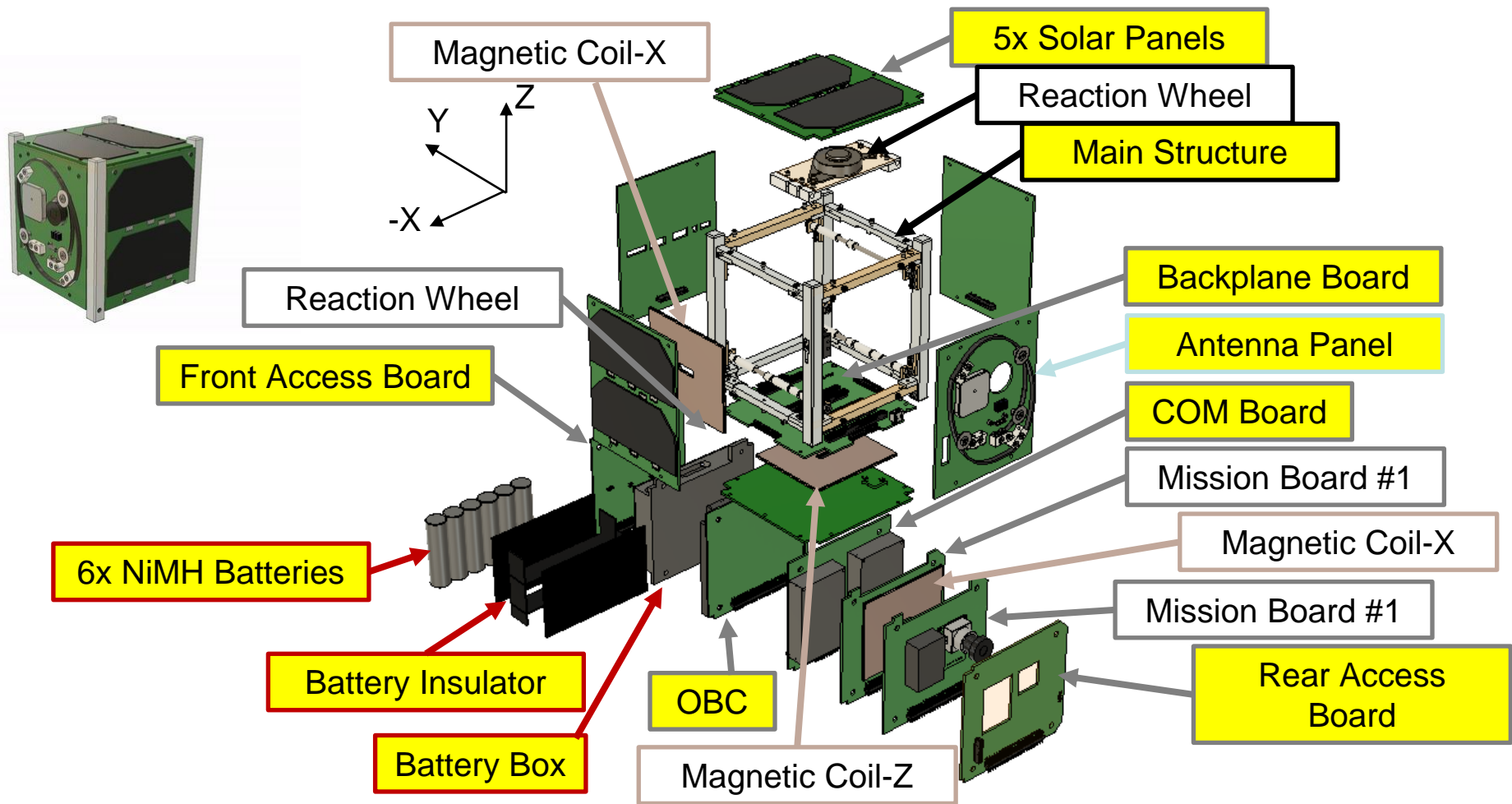
# Program features

- 1U CubeSat constellation of
    - BIRDS-I: 5 satellites by **Bangladesh\***, **Ghana\***, Japan, **Mongolia\***, and Nigeria
    - BIRDS-II: 3 satellites by **Bhutan\***, Malaysia and Philippine
    - BIRDS-III: 3 satellites by Japan, **Sri Lanka\*** and **Nepal\***
    - BIRDS-IV: 3 satellites by Japan, **Paraguay\*** and Philippine
    - BRIDS-V: 3 satellites by Japan, **Zimbabwe\*** and **Uganda\***
  - Made by students at Kyutech
  - 2 years from concept design to disposal
  - Released from ISS
  - Network operation by multiple ground stations
- \* First satellite for the country*



Group photos of BIRDS-I, -II, -III, -IV and -V teams

# BIRDS-BUS Opensource



To promote international cooperation and proliferation of CubeSat technology, all the technical information will be put in the public domain very soon.

# What you can acquire in SEIC



- Hands-on training
- Diversity environment
- Space engineering professionalism and research
- Project management and system engineering skills through space projects
- Be professional of space engineering

The Access to Space for All x SDGs Interview Series #2 on PNST is released in the UNOOSA website.



Access to Space for All initiative for Sustainability: Interview Series Article #2 July 2022

## How Education Through PNST Contributes to the SDGs

Interviewee: Prof. Mengu Cho, Director of the Space Engineering International Course, Kyutshu Institute of Technology (Kyutech)

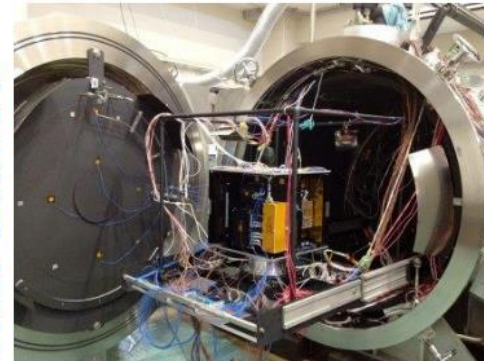


Abhas Maskey, 2020 graduate of the PNST fellowship, Founder of Antarikchya Pratisthan Nepal

Date: Interview conducted with Kyutech on 28 June 2022 and with Abhas Maskey on 13 July 2022

### Background:

The [United Nations/Japan Long-term Fellowship Programme: Post-graduate study on Nano-Satellite Technologies \(PNST\)](#) is offered by the [United Nations Office for Outer Space Affairs \(UNOOSA\)](#) and the Government of Japan, through the support of the [Ministry of Education, Culture, Sports, Science and Technology \(MEXT\)](#), in cooperation with the [Kyushu Institute of Technology \(Kyutech\)](#). The Fellowship programme provides extensive hands-on



[https://www.unoosa.org/documents/pdf/Access2Space4All/AccSpace4AllxSDGsInterview/AccSpace4All\\_x\\_SDGs\\_Interview\\_PNST.pdf](https://www.unoosa.org/documents/pdf/Access2Space4All/AccSpace4AllxSDGsInterview/AccSpace4All_x_SDGs_Interview_PNST.pdf)

# FAQ

Q: What kind of academic background is needed to be selected for PNST candidates?

A: Any engineering background are possible. But especially, mechanical, electrical, computer science and related science background is preferable.

Q: What feature does Kyutech look for in an applicant other than an academic background?

A: Motivation and energy to change your home country and world using space technology

Note: GPA score is required to be qualified.

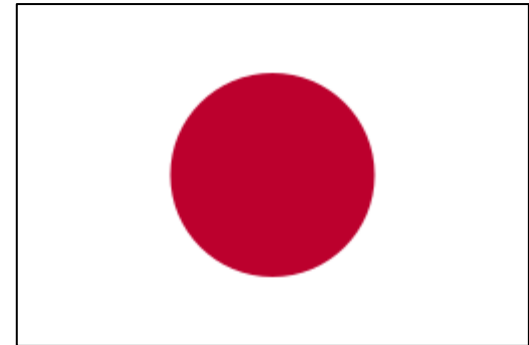
Must have earned Grade Point Average(GPA) of 2.3/3.0

APPLICATION GUIDELINES

JAPANESE GOVERNMENT (MEXT) SCHOLARSHIP FOR 2024  
RESEARCH STUDENTS / UNDERGRADUATE STUDENTS (UNIVERSITY  
RECOMMENDATION) [SPECIAL SELECTION]

\*4 Regarding the above k), if a GPA cannot be calculated from the transcript, only in case that the above k) clearly states that his/her grade ranking at the university/faculty or graduate school is within the top 30%, MEXT deems that the applicant's academic achievement is equivalent to a GPA of 2.30 or above. If the university recommends such student, a copy of the above k) must be submitted to MEXT (See also 4. (4)③ of the appendix "Notes of Recommendation").

**Come to Japan for  
a great learning  
and cultural  
experience ...**



**... it will change  
your life**



**SEIC students celebrating spring under cherry blossoms**



# The End

This pdf is available to  
you at UNOOSA website



**Kyutech**  
Kyushu Institute of Technology

