

Post-graduate Study on Nano-Satellite Technologies (PNST) Fellowship Kyushu Institute of Technology (Kyutech)



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Laboratory of Lean Satellite Enterprises and In-Orbit Experiments

Kyushu Institute of Technology (Kyutech)

Kitakyushu, Japan

16 May 2023



PNST in partnership with the Government of Japan in cooperation with the Kyushu Institute of Technology (Kyutech) provides nationals of developing countries or non-space-faring nations extensive research opportunities in nano-satellite systems through the use of the nano-satellite development and testing facilities available at Kyutech.

PNST program is full-scholarship program operated under Space Engineering International Course (SEIC), by Kyutech



Introduction

Where We Are



Kyushu Institute of Technology (Kyutech)



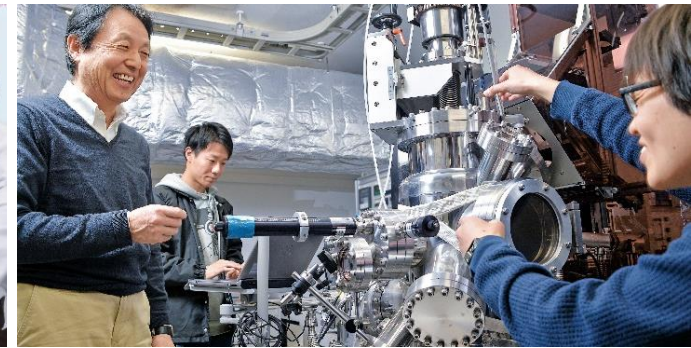
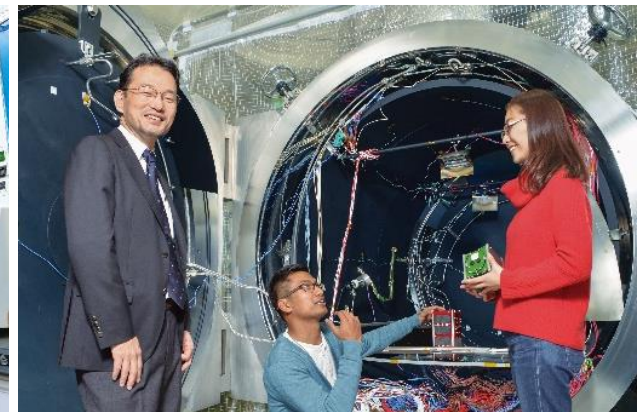
- A national university founded in 1909
 - 4,200 Undergraduate students
 - 1,300 Graduate students
 - 360 Faculty members
 - Engineering, Computer science, Life-science
- Located in the Kitakyushu region
 - Population of more than 1million



Hands-on and Practical Education

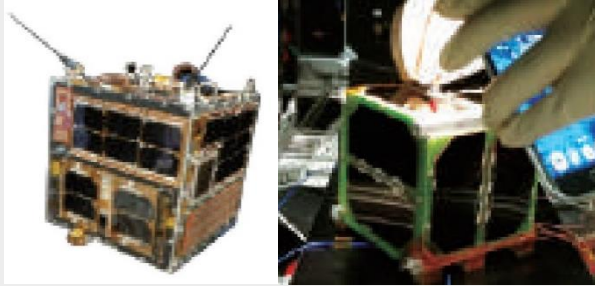
Lab-Based Final Year of All Undergraduate Program

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*



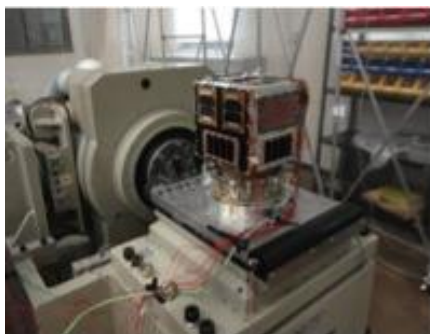
*Next Generation Power Electronics
Research Center*



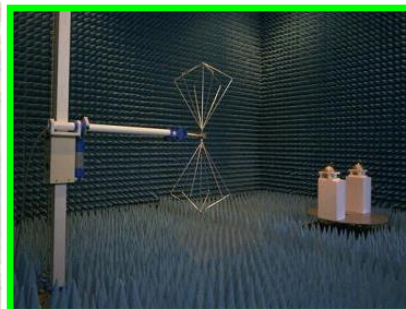
*Research Center for
Neuromorphic AI Hardware*

Center for Nanosatellite Testing

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



Vibration



EMC & Antenna pattern



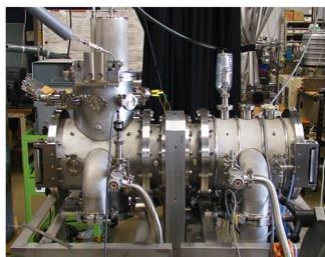
Pressure & Leak



Thermal vacuum



Assembly & Integration



Thermal vacuum



Thermal cycle



Shock



Outgas
(ASTM E595)



α & ϵ measurement

Conducted more than 400 tests for external users since 2010

Space Development and Utilization Award (JAXA president award), 2022

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

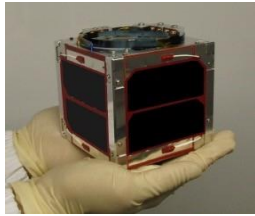


Thermal vacuum chamber at CeNT

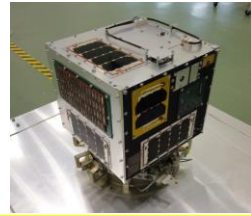


KITSUNE tech demonstration satellite

Kyutech Satellite Heritage



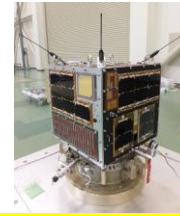
HORYU-1 (1U)
2006-2010
Not launched



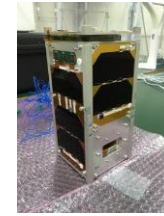
HORYU-II
2010-2012
Launch 2012/5/18



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



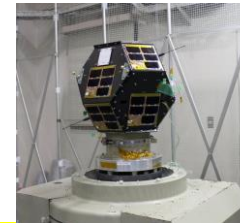
BIRDS-I constellation
2015-2017
ISS release 2017/07/07



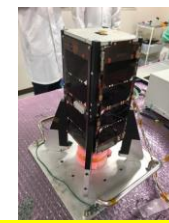
BIRDS-II constellation
2016-2018
ISS release 2018/08/10



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



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



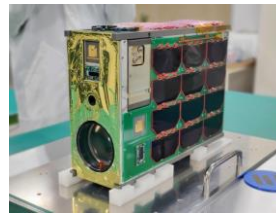
AOBA VELOX-IV
2016-2018
Launched 2019/01/18



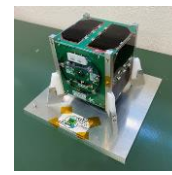
BIRDS-III constellation
2017-2019
ISS release 2019/06/17



BIRDS-IV constellation
2018-2020
ISS release 2021/03/14



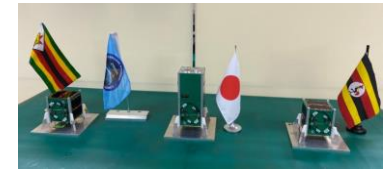
KITSUNE
2019-2021
ISS release 2022/03/24



FUTABA
2018~2021
ISS release 2022/08/12



MITSUBA
Launch failure
2022/10/12

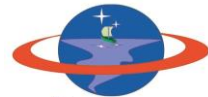


BIRDS-5J, -5Z, -5U
Launch 2022/11/7

27 satellites launched since 2012

World No.1 academic satellite operator*

*Bryce Space and Technology

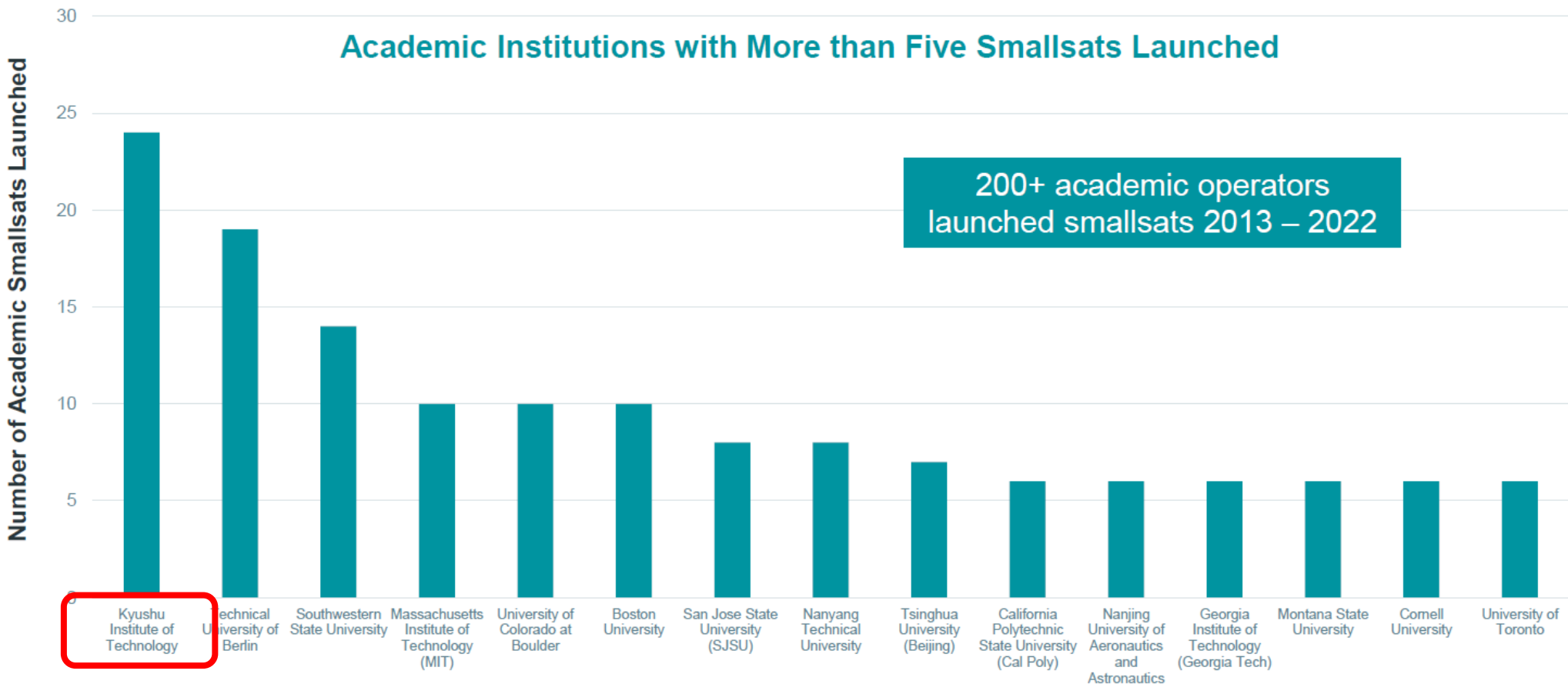


La SEINE



Operator and Mission Type Trends

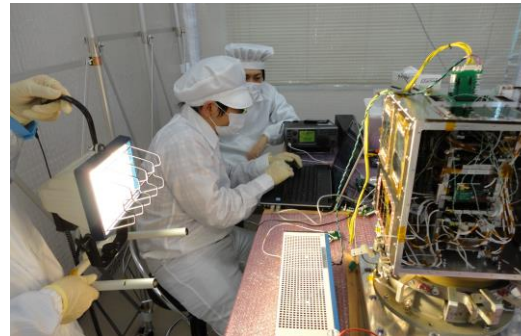
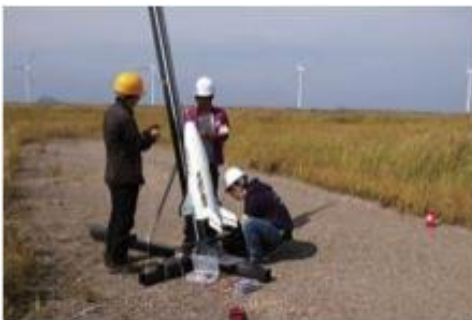
Number of Academic Smallsats 2013 – 2022, by Institution



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

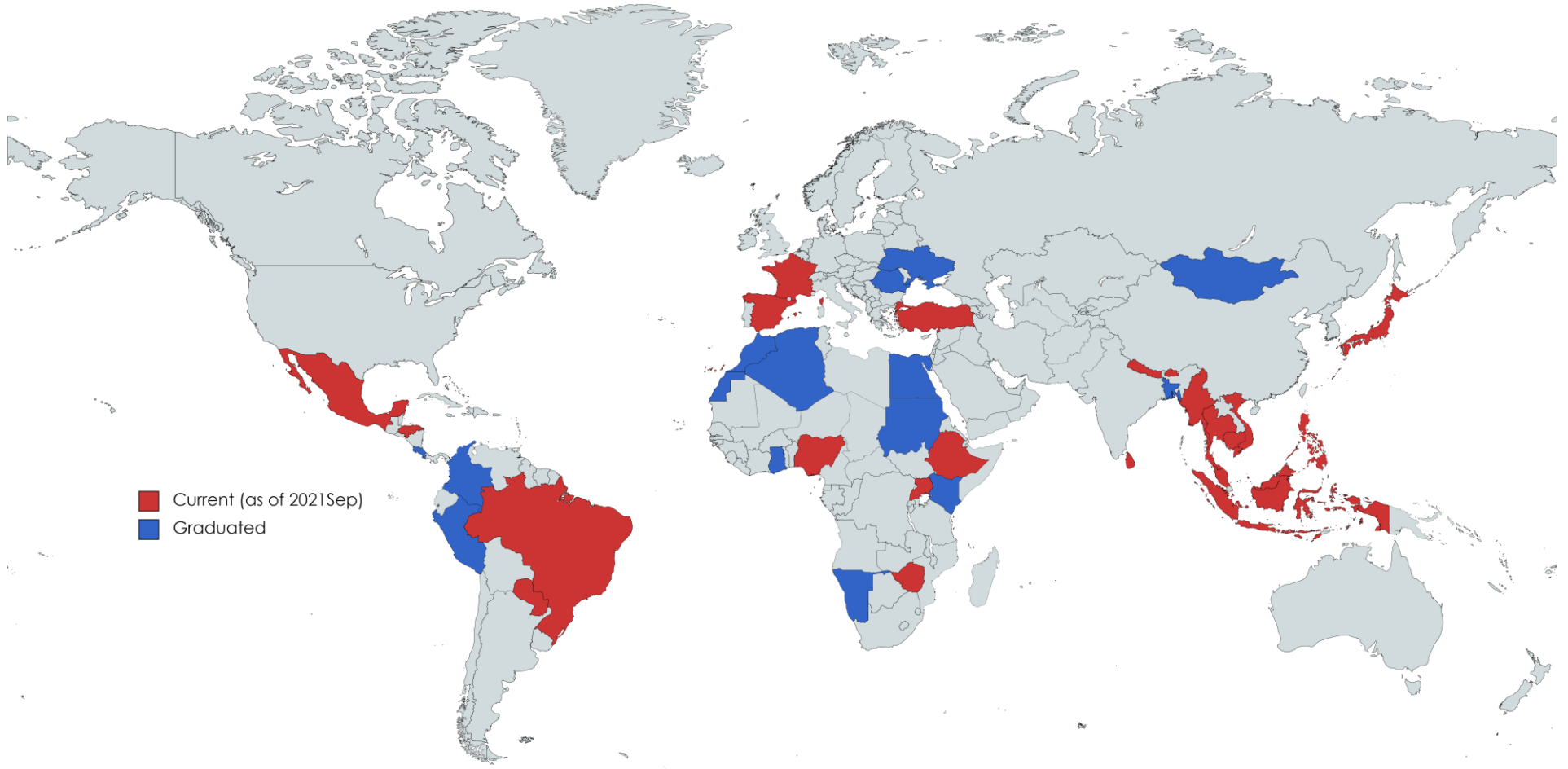


There is a scholarship opportunity. “PNST”

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



Created with mapchart.net

Graduated

Current (as of October 2021)

More than 120 foreign students from 41 countries enrolled in 9 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

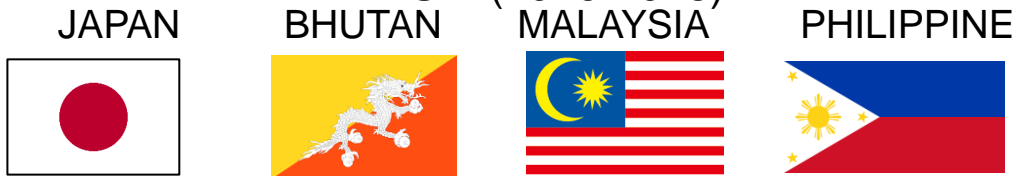
Mission Statement

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)

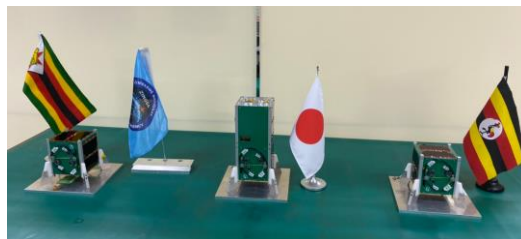


BIRDS-V (2020-2022)



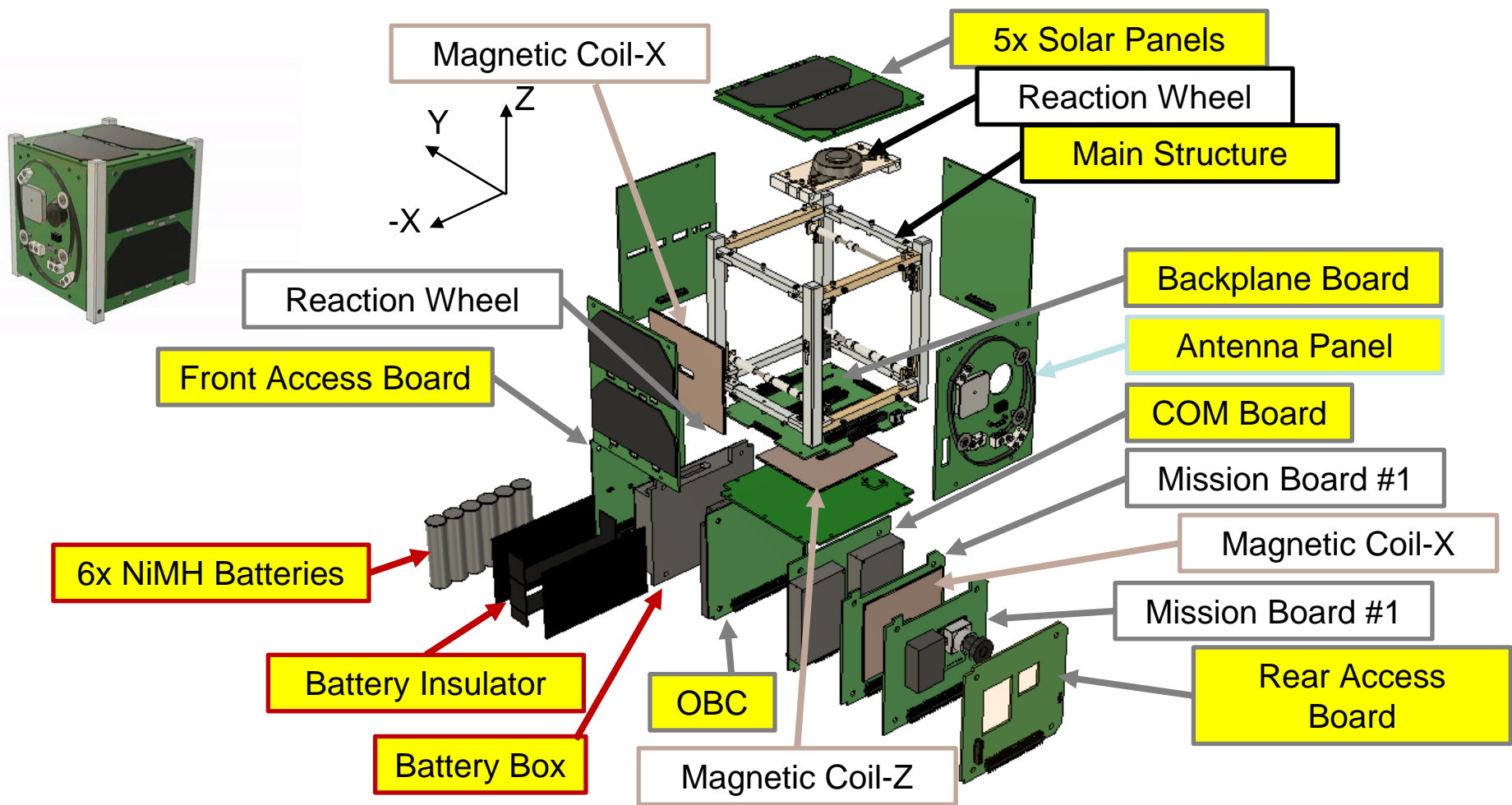
Program features

- 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

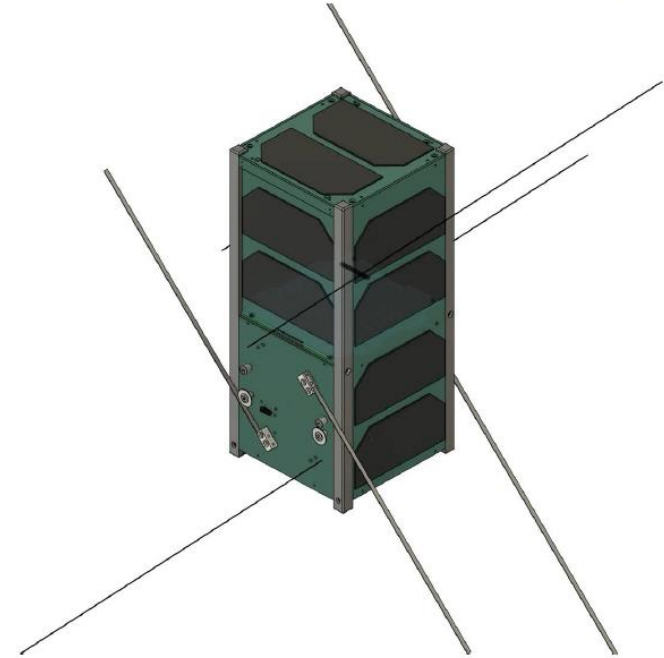
BIRDS-BUS Opensource



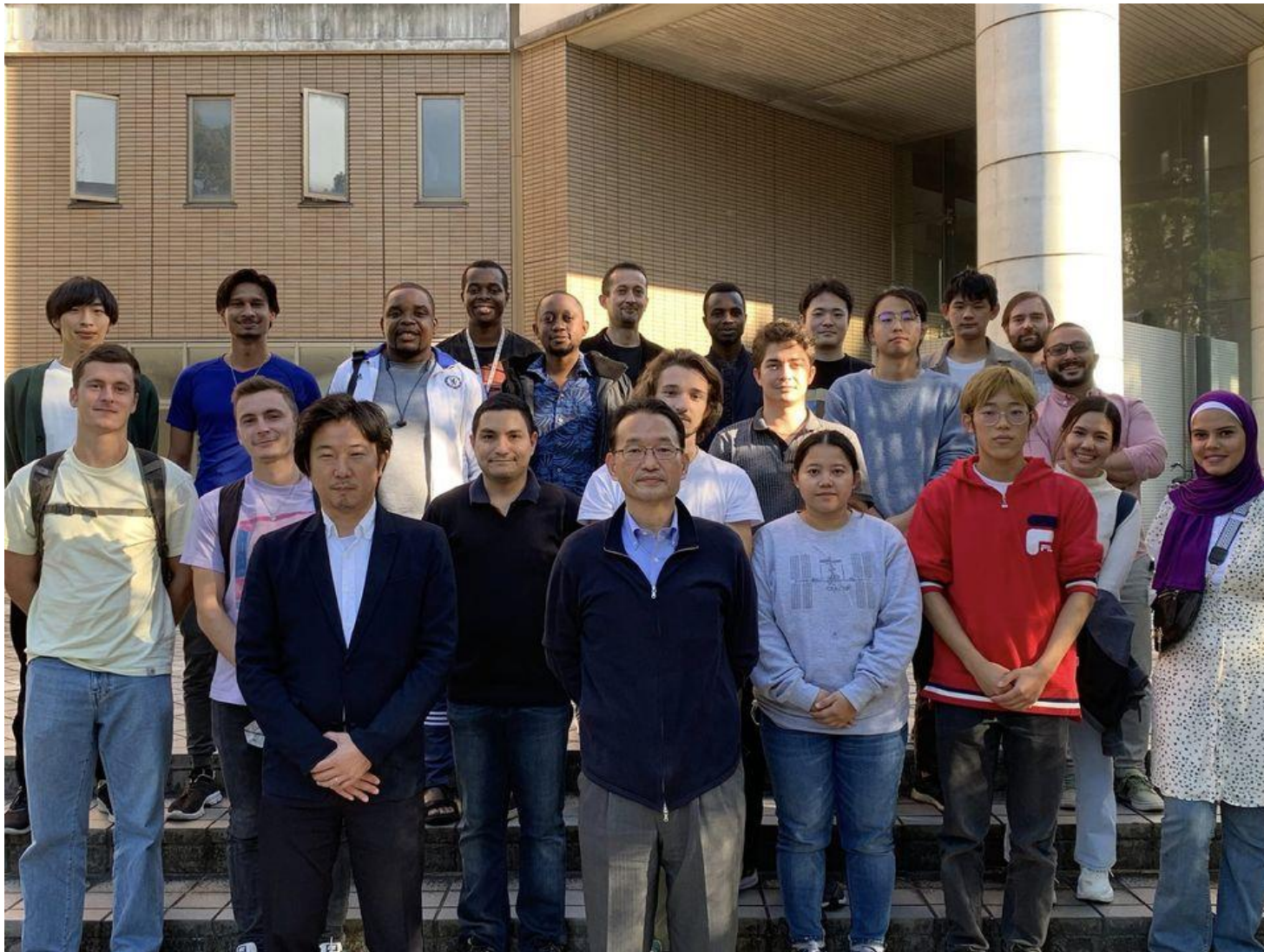
To promote international cooperation and proliferation of CubeSat technology, all the technical information will be put in the public domain very soon. 18

BIRDS-X Mission

- The goal
 - Bring diversity to the space sector and democratize the usage of space
- Missions
 - Using a 2U CubeSat, BIRDS-X, we Provide an opportunity to do hands-on work on satellite communication using an APRS payload onboard
 - Two competitions
 - APRS mission payload competition
 - APRS ground terminal competition
 - Demonstrate a new low-cost UHF transceiver in orbit

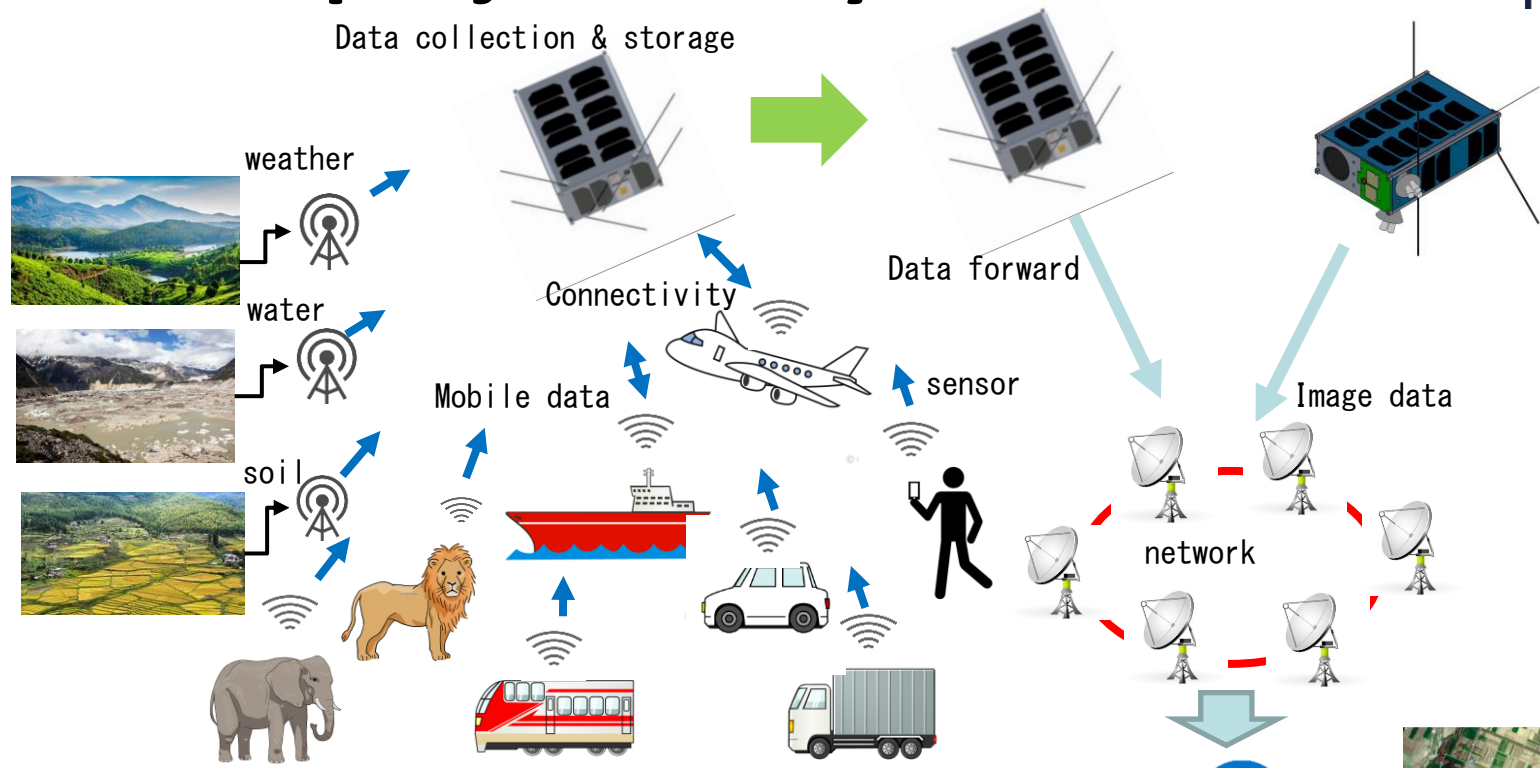


BIRDS-X project



BIRDS-X satellite is developing to be launched in next year!

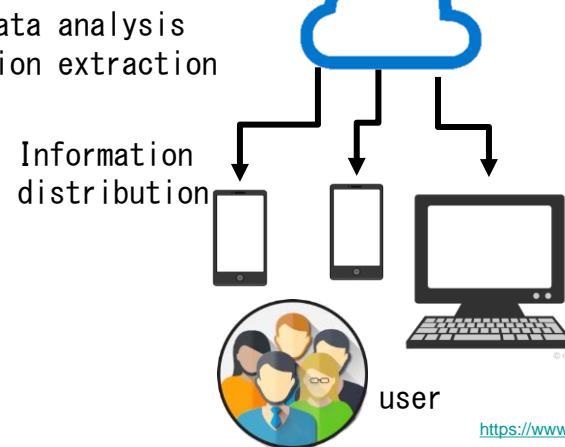
Next project at Kyutech



KITSUNE (6U)
Launched March 24, 2022

Earth observation
(5m GSD)

S&F mission done by
BIRDS countries



<https://www.toshinikueisha-mito.com/>

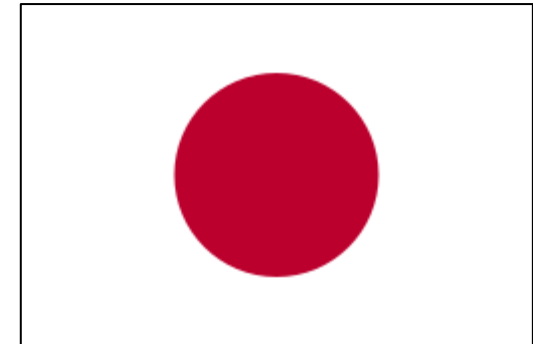
http://www.shikoku-np.co.jp/national/%5Clife_topic/photo.aspx?id=20120516000644&no=1

<https://agrijournal.jp/renewableenergy/11918/>

What students can acquire in SEIC through PNST (Post-graduate Study on Nano-Satellite Technologies)

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

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



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



SEIC students celebrating spring under cherry blossoms

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)

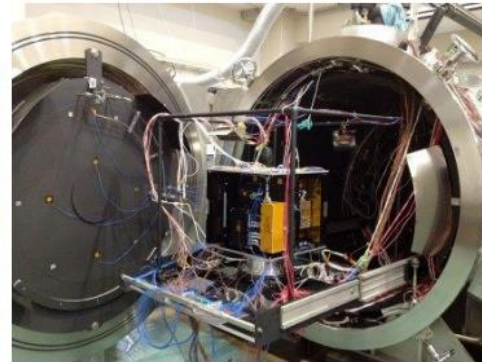


Abhas Maskey, 2020 graduate of the PNST fellowship, Founder of Antarikchya Pratisthan Nepal

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 ²⁴

The End

This pdf is available to
you at UNOOSA website



Kyutech
Kyushu Institute of Technology

