Expansion of the United Nations/Japan Long-term Fellowship Programme on Nano-Satellite Technologies Hosted by the Kyushu Institute of Technology (Kyutech), Japan

~Post-graduate study on Nano-Satellite Technologies (PNST)~

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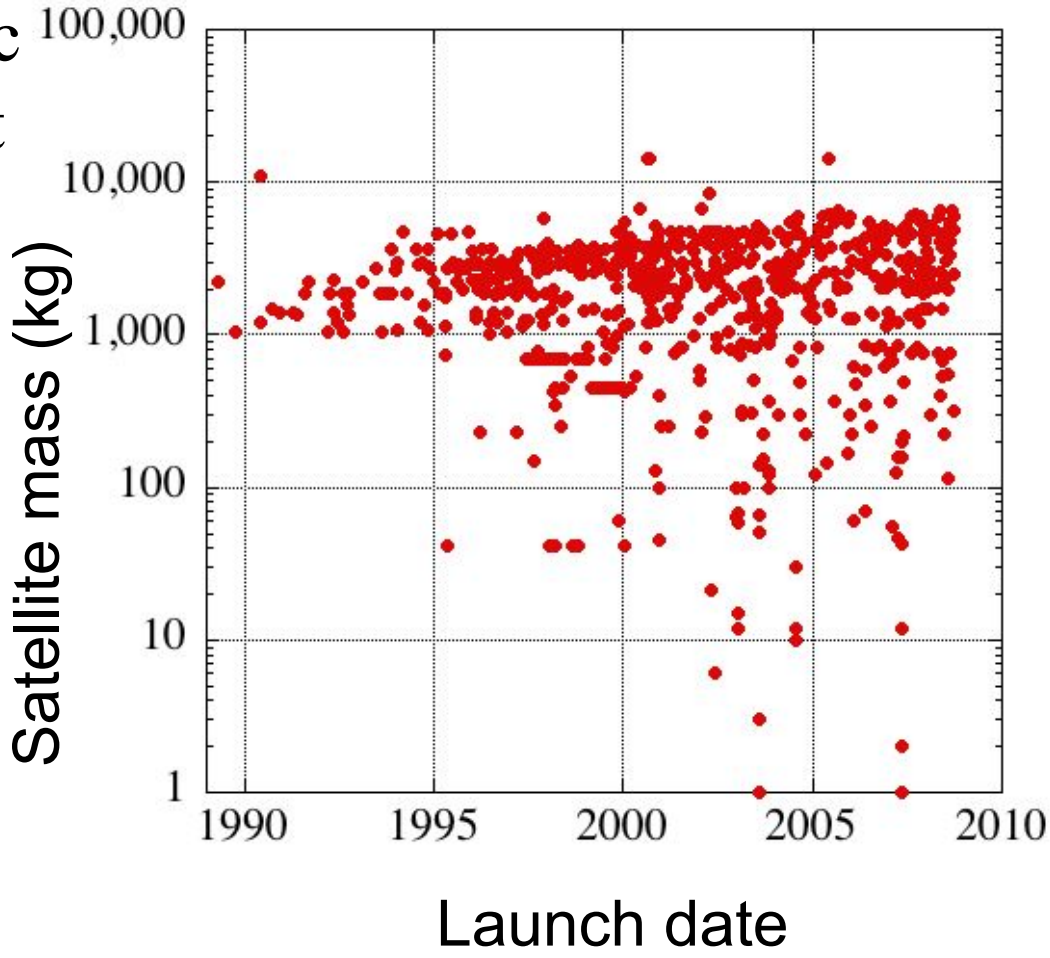
Background

Background

- Interest in capabilities for basic space technology development
- Satellites affordable even to universities and smaller institutions
- Small space enterprises from university-based satellite projects



Background

- Presentation of UN Basic Space Technology Initiative (BSTI) at 27th International Symposium on Space Technology and Sciences, Tsukuba, Japan in 2009
- **Mission**
  - To enhance access to space application tools for sustainable development through building capacity in basic space technology
- **Objectives**
  - Respond to the growing **interest in many countries to establish indigenous capacities in basic space technology**
  - Promote **international cooperation and information exchange** in capacity building in basic space technology
  - Others

Kyutech answered the call for collaborations made by UN

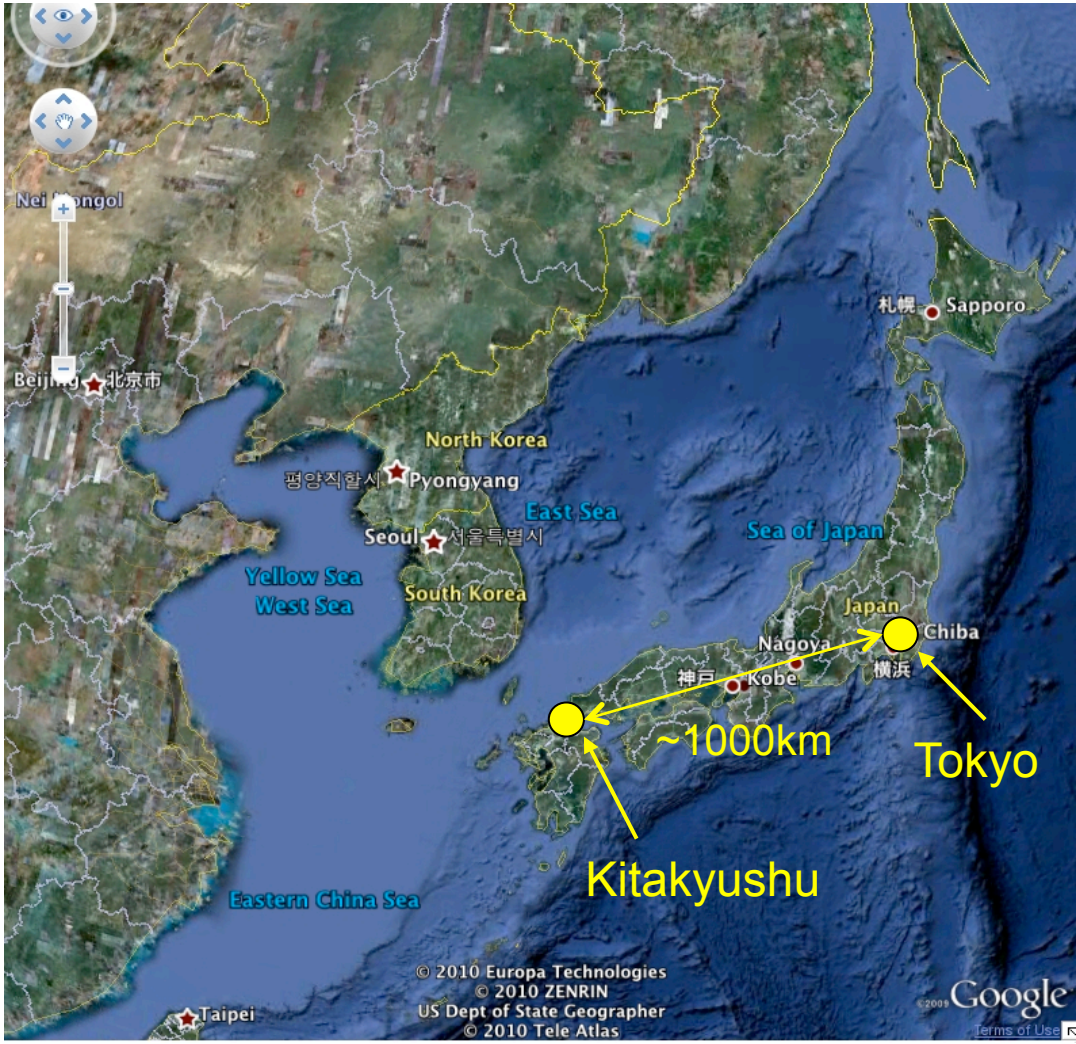
Needs of Long-term Fellowship for Capacity Building

- Reading books or attending lectures can not make a satellite
- Experience the complete cycle of designing, building and testing
  - Even better with launching and operating
  - Learn through the failures during the tests and the efforts necessary to correct the defects
- Long-term fellowship to support students studying abroad and gaining experience through *on-the-job training (OJT)*
- Learn to *think and be innovative*
  - Participate in a satellite project *as a team member not as a guest*
  - Experience necessary to *build a facility from scratch* in home country
  - University-like environment is more suitable than well-prepared comfortable institutions, such as space agencies or industries

Introduction to Kyutech

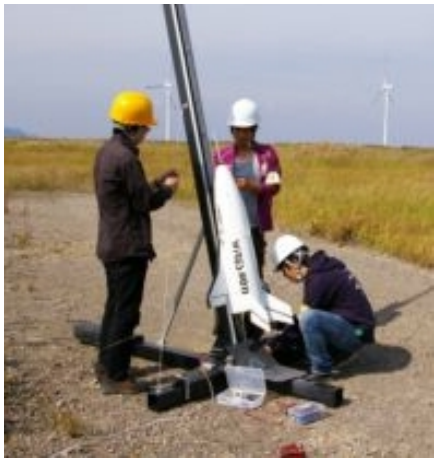
Kyushu Institute of Technology (Kyutech)

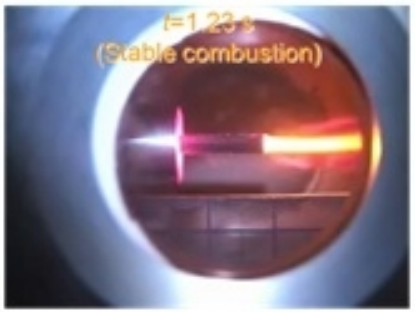
- Founded in 1909
  - 4,400 Undergraduate students
  - 1,700 Graduate students
  - 370 Academic staff
  - Engineering, Computer science, Life-science
- Located in the Kitakyushu region
  - Population of more than 1million



Space Engineering Research and Educations at Kyutech

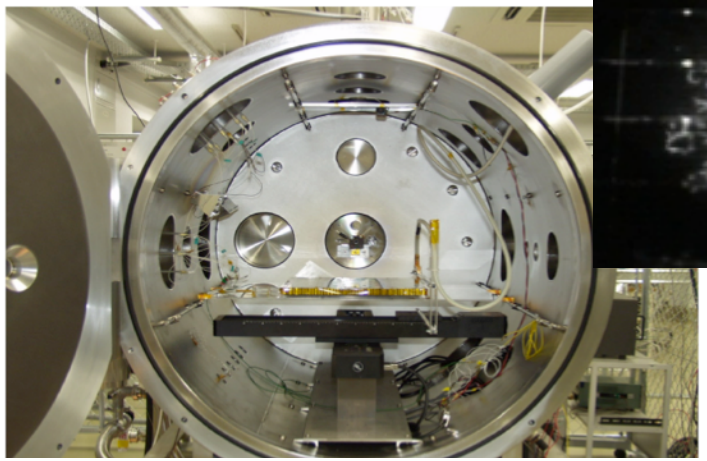
- Space Engineering Education at Tobata Campus since 1993
  - Undergraduate (30 students/class) and graduate levels
- Laboratory of Spacecraft Environmental Interaction Engineering
  - Established in 2004
- Center for Nanosatellite Testing
  - Established in 2010
- Member of International Astronautical Federation (IAF) since 2011



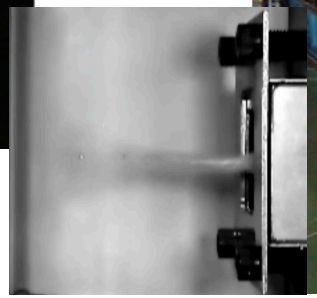


Laboratory of Spacecraft Environment Interaction Engineering

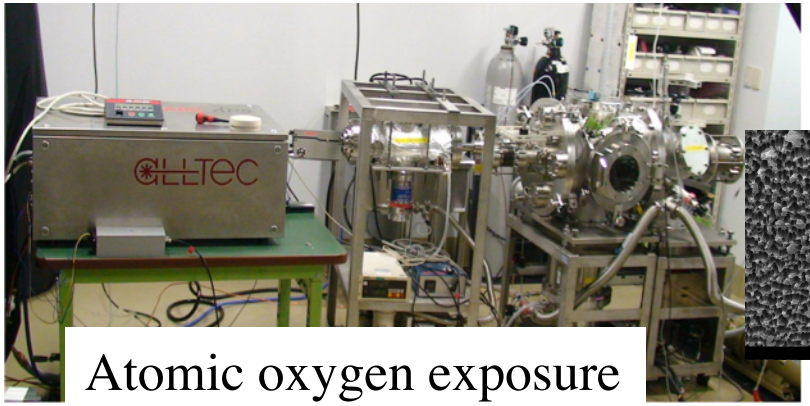
- Capability for various spacecraft environment tests
- Various joint researches with domestic/international industry and agencies
- Leading multiple international standardization (ISO) efforts

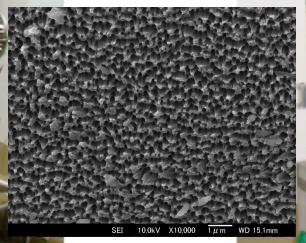


Spacecraft Charging and electrostatic discharge

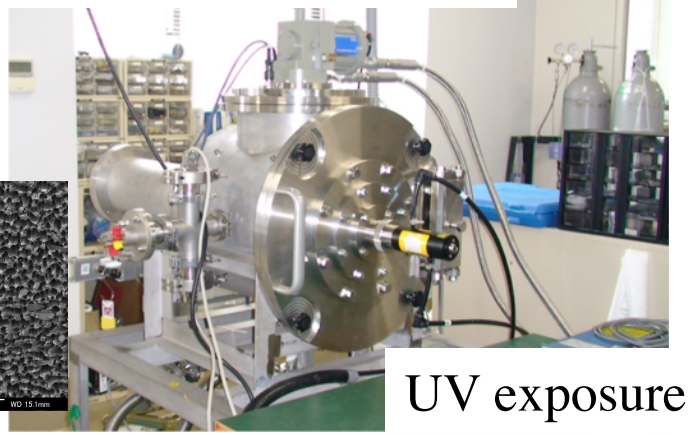


Hypervelocity Impact





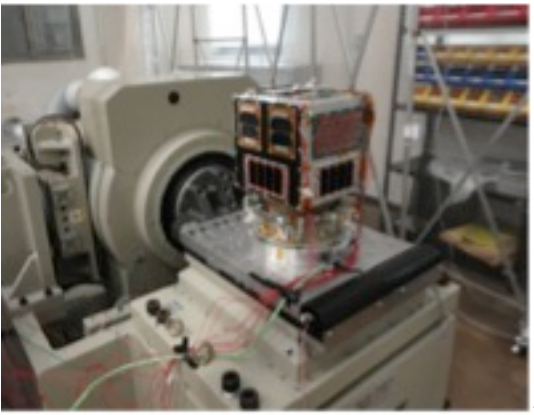
Atomic oxygen exposure



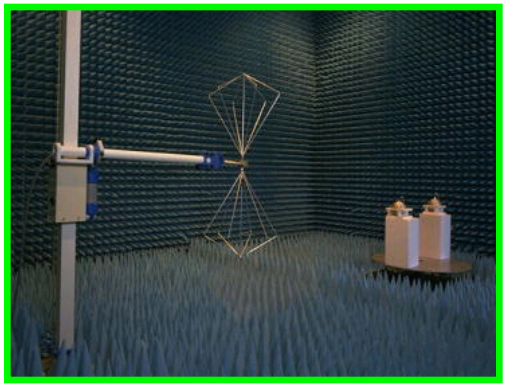
UV exposure

Nano-satellite environment tests

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



Vibration

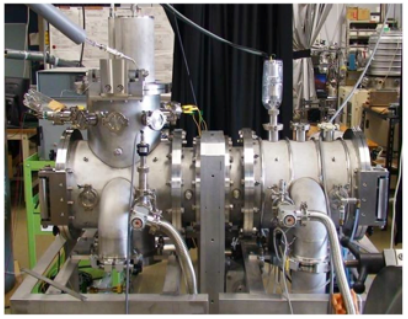


EMC & Antenna pattern

Pressure & Leak

Thermal vacuum

Assembly & Integration



Vacuum thermal shock

Thermal cycle

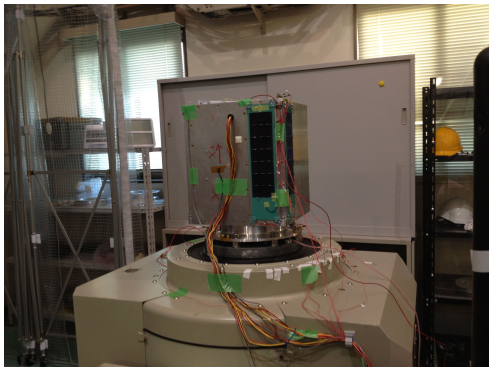
Shock

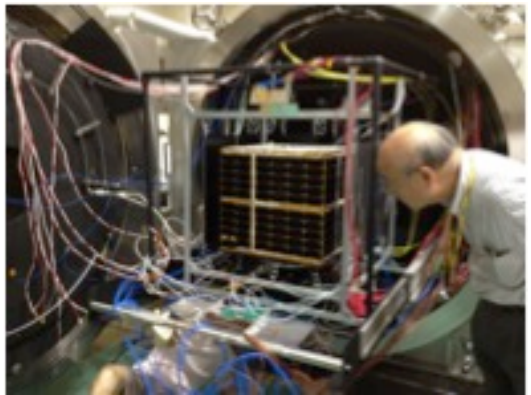
Outgas (ASTM E595)

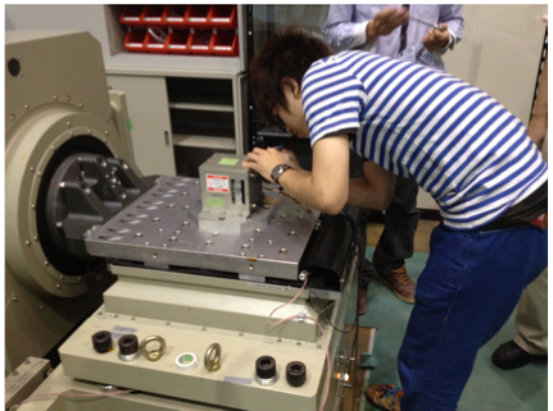
α&ε measurement

Center for Nanosatellite Testing

- Established in 2010
- Provides all the environmental test services except radiation for :
  - Nanosatellites up to 50cmx50cmx50cm and 50kg
  - Equipment worth more than 2 million US$
- Tested or testing 15 nano-satellites for Japanese universities or industries

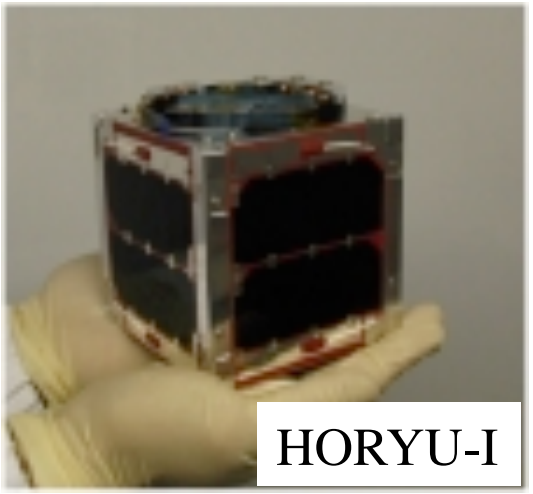




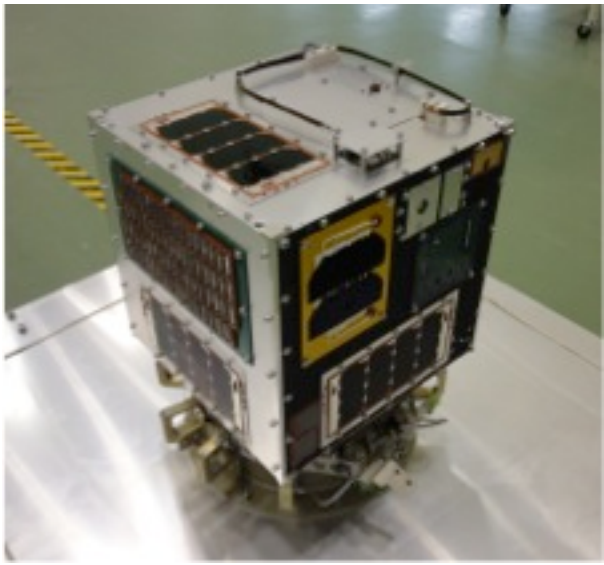


Kyutech satellite project

- Kyutech nanosatellite project
  - 25 graduate and undergraduate students working together
    - Responsible for all the processes
      - Conceptual study, design, fabrication, testing and operation
- Official educational program for graduate students
  - Learn systems engineering and project management
  - Writing a Ph.D thesis
    - Extract a state-of-the-art research element from the project work



HORYU-I



HORYU-II

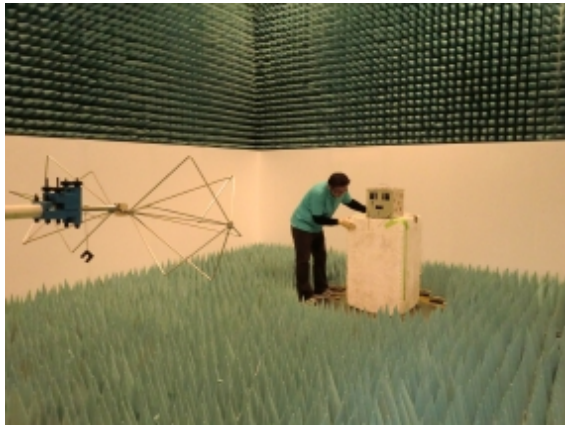
(Launched on May 18, 2012)

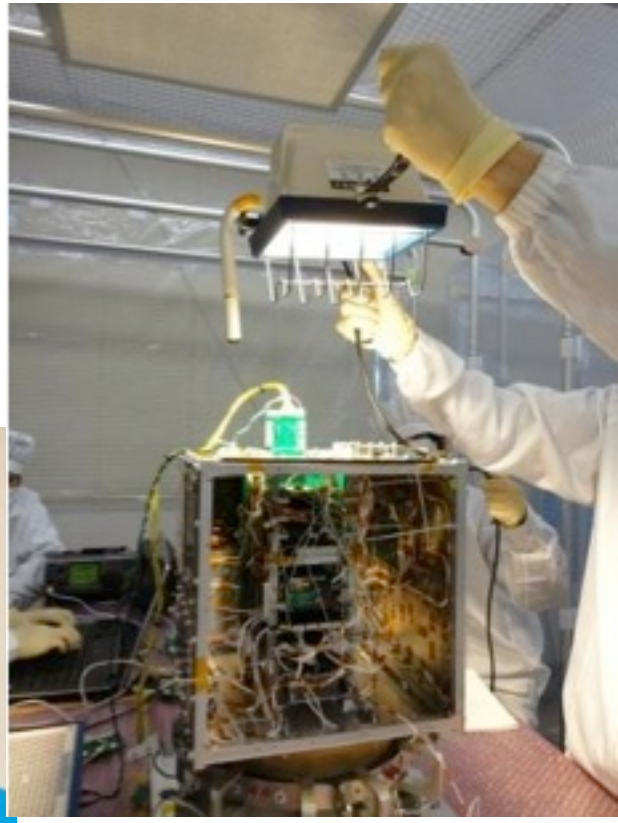
Motivation

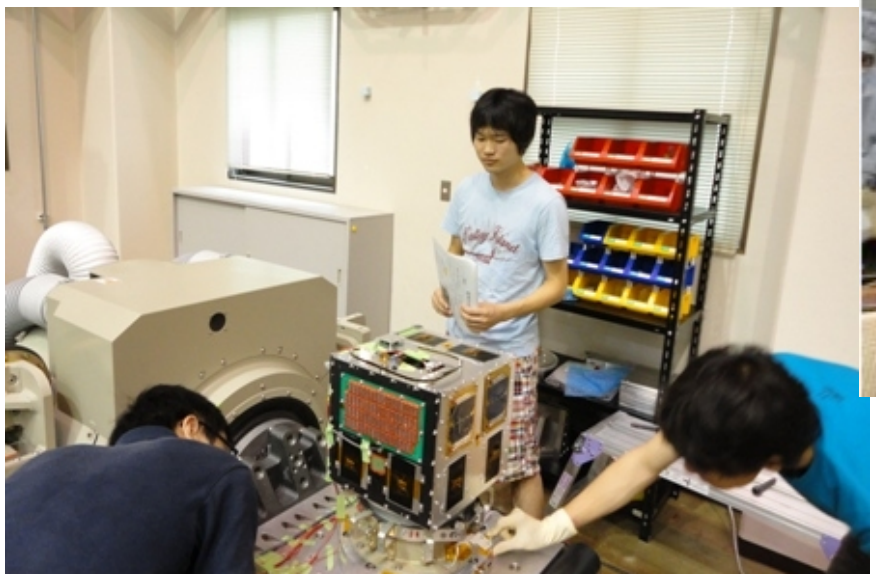
- Kyutech's motivation for UN/Japan Long Term Fellowship
  - Contributing to humanity through space engineering education for international students and promotion of peaceful use of outer space
  - Recruiting excellent students from all over the world
  - Providing a multicultural learning environment to Japanese students
  - Strengthening Space Engineering research

On-the-Job Training

Kyutech can offer on-the-job training opportunities to those who want to start their own space program in their home country







Introduction of Post-graduate study on Nano-Satellite Technologies (PNST) program

DNST Fellowship(2011, 2012)

- United Nations/Japan Long-term Fellowship Programme on nano-satellite technologies
  - Doctorate in Nano-satellite Technologies (DNST)
- **2 students** accepted every year since October 2011
- Kyutech provides financial support to students entering Doctorate programme (3 years)
  - Living expense 80,000 yen/month
  - Exemption from the tuition and entrance fees
- Extensive research opportunities in core technologies for nanosatellite system development
    - **Especially infrastructure, such as testing**

DNST fellowship (2011, 2012)

- September, 2010
  - Exchange of diplomatic documents between Japan and UN
- Selection for the class of 2011
  - **36 applications from 18 countries**
    - Mongolia (Vibration Testing)
    - Egypt (Onboard Computer)
- Selection for the class of 2012
  - **39 applications from 25 countries**
    - Nigeria (Power System)
    - Thailand (Orbital Dynamics)
- DNST students are engaged in Ph.D. research and the satellite project

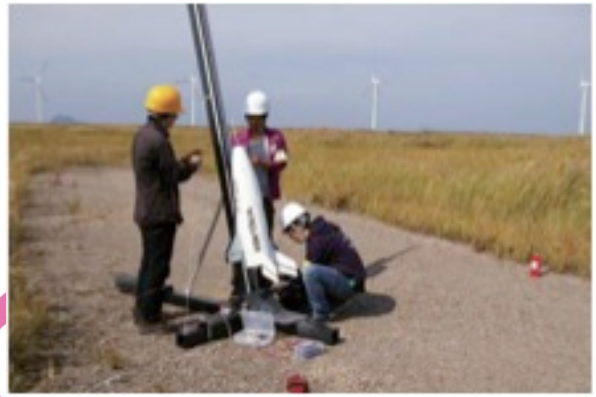
Program Expansion (2013~)

- **Post-graduate study on Nano-satellite Technologies (PNST)**
- Number of fellowships
  - 2 → 6 (2 for Master and 4 for Doctor course)
- MEXT (Japanese government) fellowship
  - Support of living expense
    - 80,000yen/month → approx. 145,000 yen/month
- Exemption from the tuition and entrance fees by Kyutech
- Space Engineering International Course (SEIC)
  - Post-graduate curriculum in English
  - Master (2 years) and Doctorate (3 years)

These changes apply from the class of 2013 (starting Oct. 2013)

Space Engineering International Course (SEIC)

- To be started in April 2013 at Graduate School of Engineering, Kyutech
- Research toward a Master or Doctoral degree
- On-the-job training such as space environment testing workshop
- Project Based Learning (PBL) through a space project
- Lectures in English
  - Space Systems Engineering, Satellite Engineering, Space Environment, Environment Testing, Power System, Structure and Material, Dynamics, Propulsion, Plasma, Semi-conductor, and more



How to apply?

Application package:
http://www.unoosa.org/oosa/en/SAP/bsti/fellowship.html

or google “BSTI fellowship”

The application deadline is February 28, 2013

For further details, please contact

cho@ele.kyutech.ac.jp (Kyutech)

werner.balogh@unoosa.org (UN)

Conclusions

- United Nations/Japan Long-term Fellowship Programme on nano-satellite technologies
  - Provides hands-on experience necessary to build capabilities in basic space technology, especially infrastructure building through testing of nano-satellites
  - Furthers worldwide nano-satellite development efforts
- The classes of 2011 and 2012 have been quite successful
  - Strong worldwide interests proven (nearly 40 applications)
  - The programmes will be expanded from the class of 2013
  - **The application is due February 28, 2013**

Goal

Promote the peaceful and innovative use of outer space with the participation of a larger number of countries for the benefit of humanity