UNITED NATIONS
Office for Outer Space Affairs

Being at Kyutech is like having the entire world in our lab

Interview conducted on 19 October 2020

Institution:

Kyutech
Kyushu Institute of Technology

Interviewee: Pooja Lepcha, PhD Student at Kyushu Institute of Technology from the Bhutan

Background:
In past decades, developing countries have been able to leverage space technologies mostly by relying on rich countries sharing data from their space agencies and satellites. In recent years, however, interest by developing countries in building their own capacity to develop space technology has grown enormously.

The fellowship, launched by the Kyushu Institute of Technology (Kyutech) in Japan and the United Nations Office for Outer Space Affairs (UNOOSA), addresses this need by offering study programmes on nanosatellite technologies for post-graduate students from developing countries or nations that do not yet have space-faring capabilities.

Nanosatellite development is an ideal first-step to build space technology know-how, as nanosatellites offer access to space at reduced cost, compared to traditional satellites.

Each year, six masters and doctoral students are selected for the fellowship and enrol in the Space Engineering International Course at the Graduate School of Engineering within Kyutech. The chosen candidates receive a grant from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan for the duration of their fellowship, covering housing, food, local transportation, and other expenses.

The students work in the Centre for Nanosatellite Testing, where they get to experience the full cycle of designing, building and testing a satellite.

Information on the fellowship programme is available here:

http://www.unoosa.org/oosa/en/ourwork/psa/bsti/fellowships.html

In the interview below, we spoke with Pooja Lepcha, a recipient of the fellowship, about her experience.

I am Pooja Lepcha from Bhutan. I am currently doing my PhD in electrical and space systems engineering at Kyutech. Until I started my masters' degree in Applied Science for Integrated Systems Engineering, also at Kyutech, I spent most of my life in Bhutan, where I did my bachelor in Electrical Engineering. While being a student, I am also employed by the Bhutan government in the Ministry of Information and Communication, which hosts the division working on space in our country.

1. **How did you learn about the Kyutech fellowship and where were you at the time in your studies and career?**

I learnt about the fellowship by following developments in the space sector in Bhutan: in 2016, Bhutan, who did not, at the time, have any satellites in space, expressed its interest in accessing the sector. The country started a project to build Bhutan's first satellite at Kyutech, involving three young Bhutanese engineers, whose studies at Kyutech were sponsored by Bhutan and whom I was later to meet at the university.

Typically, Kyutech approaches countries without space capabilities who may be interested in developing a satellite, offering their expertise to help them build it. Bhutan was an exception to this process, as they themselves approached Kyutech seeking out their help to develop the satellite. This initiative was envisioned by His Majesty the fifth King of Bhutan to raise awareness and interest towards space technology in Bhutan.

The project of Bhutan's first satellite gathered huge attention in the country. By doing some research online, I found out about the fellowship programme to study nanosatellite technology at Kyutech, saw that I met all the requirements to apply and sought my government's (as they are my employer) approval to apply, which they granted.

Knowing I would be competing for the fellowship with qualified applicants from all over the world, I initially felt I did not have much hope of being selected. Then I was invited to the two rounds of selection interviews, which felt surreal. I was delighted when I learnt I had passed the selection and obtained the fellowship!

2. **How did the fellowship change your path? What opportunities did it unlock for you?**

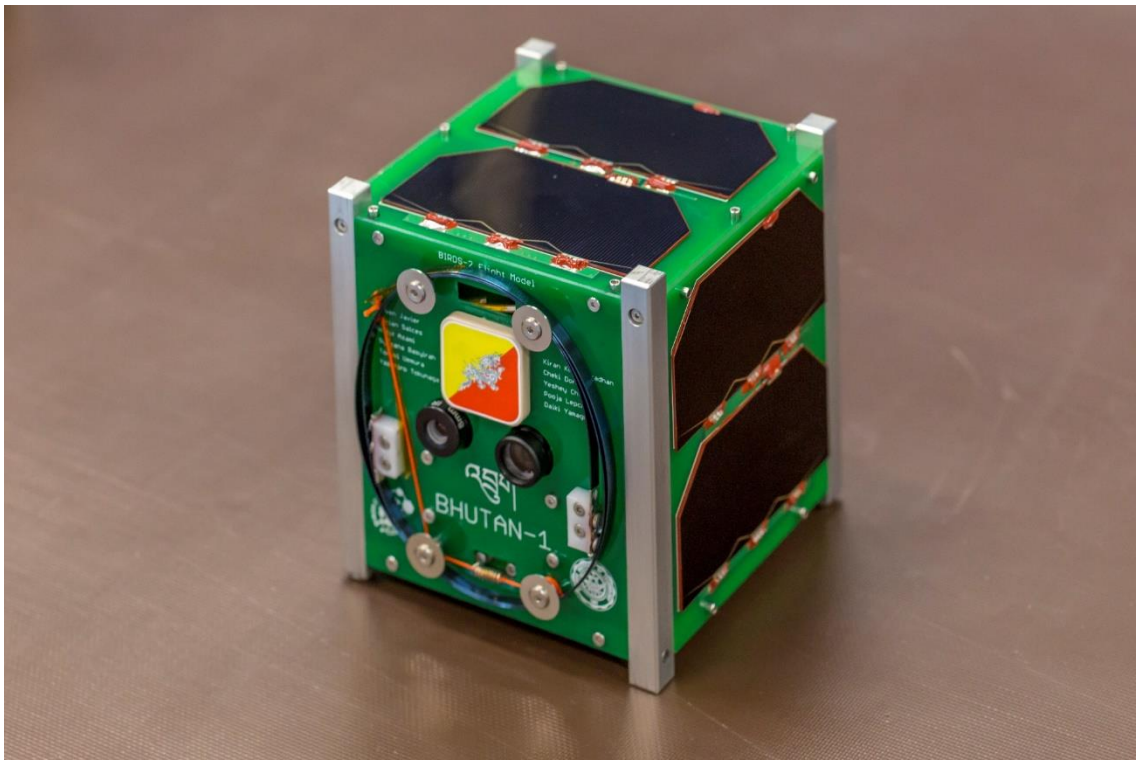
Through the fellowship, I changed my career path from being an electrical engineer to a space engineer!

Work on the first Bhutanese satellite kicked off in October 2016 as a part of BIRDS-2 Satellite Project, along with satellites from Malaysia and the Philippines. The BIRDS Satellite project series is an international collaboration that Kyutech and the Japanese Aerospace Exploration Agency (JAXA) are part of to help countries build and deploy their first satellites.

The long-term goal of the BIRDS Project is to train students in developing countries to help launch and steer their nations' space programmes. Through BIRDS, over two years, students design, develop and operate identical 1U CubeSats (1kg, 10cm cubic). Several young people who studied nanosatellite technologies at Kyutech have worked on the BIRDS projects, helping countries such as Bangladesh, Bhutan, Ghana, Mongolia, Nepal and Sri Lanka launch their first satellites.

The BIRDS-2 team just before their satellites were delivered to JAXA

When I arrived at Kyutech in October 2017, the Bhutanese satellite was transitioning from engineering to flight model: when a satellite is in flight model, it means it is almost ready to be flown into space. I was so inspired by this project that I asked to join the team, becoming its fourth member from Bhutan. At the time they were doing the final testing and assembly and I was privileged to contribute to those tests and also to work on the ground sensors of the satellite, that enabled remote data collection after the launch. The satellite is a 1 unit cube satellite, with dimensions of 10x10x10 cm, and weighs just around 1kg.



The flight model of Bhutan's first satellite, BHUTAN-1

My background was in electrical engineering, and, before Kyutech, I had only dealt with high voltages and electrical design for buildings and street lightings. So, for me, working on the small electronic devices that go inside of a satellite was something new. Moreover, having no background on satellites and space technologies, there was a lot of space related jargon I did not understand. So, I attended as many seminars as I could and asked questions to my seniors in the lab whenever any terms or algorithms escaped me.

The main objective for Bhutan in pursuing this satellite was to build capacity in space technologies: the team working on the project learnt how to design, build, test and operate a satellite, skills that are going to be precious for any future space endeavours.

The satellite, BHUTAN-1, was launched in June 2018 and then, thanks to the support of JAXA, which brought the satellite in space, it was deployed from the Japanese Experiment Module Kibo of the International Space Station (ISS) in August 2018.

We have now been operating BHUTAN-1 for over two years and have learnt a lot through this project, for example which maximum and minimum temperature the satellite can stand, what temperature variations to consider when modelling the space environment and how the modules inside the satellite work.

After completing their studies at Kyutech, the team who built the satellite went back to Bhutan. They are now working in the same government agency as me and, together, we will develop future satellite projects and contribute to the growth of the space sector in our country.

Before 2016, Bhutan did not have any space presence. Not many people talked about space in Bhutan: there was almost no university level programme on space in the country, not much research was being conducted in this field, and little information was available on scholarships or opportunities related to space. As Bhutan is a developing country, and as there were no role models working in space in the country, when I started my studies it felt almost impossible to pursue a career in the sector.

Being part of the Kyutech fellowship allowed me to discover a network of people with similar interests, and to connect with mentors and friends whom I can learn about the space sector with. Without this fellowship, I would not have had the opportunity to build this incredible network in the space sector.

In turn, this fellowship allowed me and my colleagues to become a point of reference for students in our own countries, someone they can turn to to discuss their dreams of working in the space sector. I did not have access to a mentor when I started, but I am happy to fulfil this role for the next generation interested in space in Bhutan.

3. What are you focusing on in your current studies at Kyutech?

At Kyutech, I took the Space Engineering International Course, which is offered to both masters and PhD students. This course is particularly helpful for people like me, from a developing country and initially with no background knowledge on space technologies, because it provides a comprehensive background on mission design and development, including how to think about requirements and limitations for space missions.

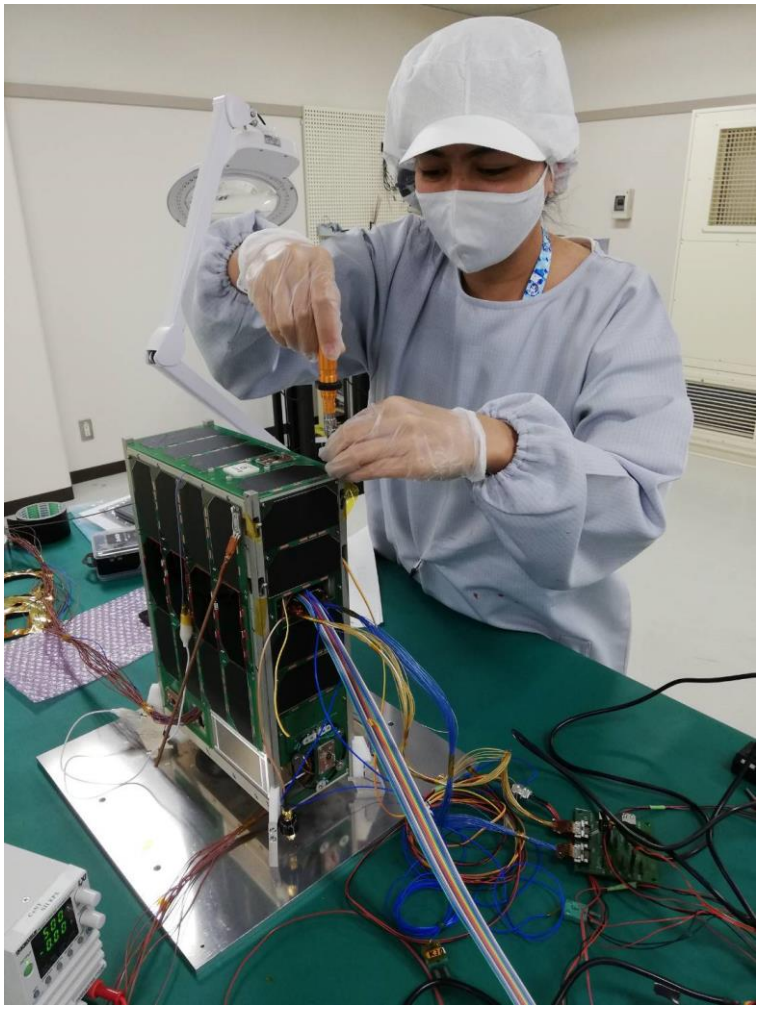
While taking the course, students are encouraged to get involved in hands-on satellite projects. I had joined the Bhutan satellite project too late to be part of the design stage, so, after this project was over, I sought out other projects where I could be involved in all phases of building a satellite. Next, I joined the BIRDS-3 project, that included the first satellites of Nepal and Sri Lanka. Here I was responsible for handling the power system, which is the very heart of a satellite and ensures uninterrupted power supply to the satellite from the beginning to the end of its life. My fellow participants in the project were from Sri Lanka, Nepal and Japan. The constellation of satellites was launched on April 17th 2019 and deployed from the ISS on June 17th 2019. The satellites have been operating flawlessly in space for more than a year now. Through the satellites, we have been taking pictures of different parts of the world and posting them on our official website (https://birds3.birds-project.com/). We also obtained significant amount of in-orbit data that will be used to model the space environment for future satellite projects.

The BIRDS-3 team with the flight models

Being able to take part in hands-on projects on satellites is a key advantage of Kyutech: students here have incredible opportunities to work on space technologies first-hand, outside the classroom.

For my master's thesis, I focused on the ground station part of a satellite mission, developing a way to collect remote sensing data using small satellites. Small satellites are a great solution for developing countries like Bhutan, who typically do not have many automatic remote sensing stations. Small satellites are also cheaper to build and more accessible for universities to work on and test the technology than large conventional satellites. At the same time, small satellites are able to fulfil similar missions as larger ones.

I then continued this research into my PhD: I still have two years to go to complete it and I am working on how to collect satellite data, for example on water levels and weather monitoring parameters, through sensing stations in developing countries. I am currently working with 11 countries to build the sensing stations. These remote data will be collected by the KITSUNE satellite, funded by the Japanese government. This is my third involvement in a satellite project through Kyutech. Each has been a unique experience and I have acquired so much knowledge and interpersonal skills through this journey. I am striving to be part of as many projects as I can while I am here, because such opportunities will be rarer once I leave Kyutech.



Pooja at work on her latest satellite project, the 6U KITSUNE.

4. What do you think is the distinctive feature of the Kyutech fellowship?

At Kyutech, it feels like the entire world is in our lab. We have students from all over the globe, each with a different set of skills and background. Working in this environment is incredibly interesting and we end up learning not just about technical things but also about different cultures.

Kyutech invites many professionals from the space sector (at least before COVID-19, now we are doing it via Zoom), such as professors from top universities and even astronauts who have led expeditions in space, to talk to students. Hearing such speakers is a great experience: they make me feel space is not as far as it seems and inspire me to raise my ambitions.

The students currently at Kyutech could be the next space leaders in their countries. The network and friendships we built here will be important for the future, when we will be working on space technologies in our respective countries and hopefully on joint space endeavours.

My fellow students talk about the challenges they face in the space sector in their own country, and how they are planning to address them: we exchange lessons that are useful for all of us. And, beyond the work aspect, I built life-long friendships here. Even if we come from different countries, I relate to my colleagues very closely and I will for sure keep in touch with them after we leave Kyutech.

The place where I live, in Kyushu, is quiet and convenient for students to live and work, with a lot of surrounding nature. Living in Japan is an interesting experience in itself. We have several Japanese students in the lab and they introduced us to some of the unique features of their culture. I have come to appreciate the honesty, commitment and precision of my Japanese colleagues: they never give up, they take great care of running the project on schedule and they ask others for help only when they have given their best. They are also very respectful of others, both at work and outside the office. I would like to keep some elements of the Japanese etiquette when I go back to Bhutan.

One small difficulty for me as a Bhutanese was to adapt to Japanese food, as we in Bhutan like spicy food, while the Japanese really don’t.. Despite this, I really like Japan.

Pooja bonding with her Kyutech lab mates, who come from all over the world, while celebrating Hanami, the cherry blossom festival in Japan

5. What do you think are the next steps in your education/career?

Once I have completed my PhD, I want to go back to Bhutan and help develop the space sector in my country. I will continue working for the government while sharing my knowledge and skills with students in Bhutan, raising awareness about space applications and encouraging them to build a path in the space field. Attention to the sector is growing in Bhutan and the country is already working on its next satellite project.

Mine and my colleagues' experiences at Kyutech were pivotal for the development of the space sector in Bhutan. We now have a working group focused on satellites and their applications within the government department we work in, bringing together people from different backgrounds, such as hydrology, weather monitoring, academia and also public policy. There are not yet plans to form a separate space agency in Bhutan, but there could be possibilities for this in the future.

6. **Would you recommend the fellowship to other people? If so, what would be your advice to them?**

I would definitely recommend this experience to others. It taught me that some things I thought were impossible were in fact possible.

My advice to future students at Kyutech is to be open about learning all sort of skills and different cultures and take advantage of being in a community with people from all over the world. Each one of them has so much to offer. Use your time at Kyutech wisely and productively, taking advantage as much as possible of all the lessons and opportunities, as these can be really important for the future.

Kyutech strives to have at least one woman in each fellowship intake. In the picture below, you can see fellow female students from Thailand, Malaysia, Egypt and Sri Lanka. In the BIRDS-2 and BIRDS-3 projects, we had three women in the team, and, out of the four team members who developed Bhutan's first satellite, two of us were women. I particularly encourage all fellow women aspiring to be space scientists and engineers to apply!

Pooja wearing Yukata with fellow students and friends.