



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

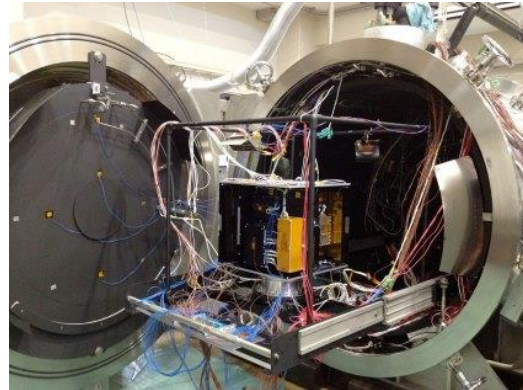
Date: Interview conducted with Kyutech on 28 June 2022 and with Abhas Maskey on 13 July 2022

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 opportunities in nano-satellite systems through the use of the nano-satellite development and testing facilities available at Kyutech. Every year PNST accepts up to three students in the Master's Program (2 years duration) and up to three students in the Doctoral Program (3 years duration). The selected students will enroll in the Space Engineering International Course (SEIC). The fellowship is open to nationals of developing or non-space faring countries.

Thanks to the generous contributions from MEXT, transportation to and from Japan and a monthly grant to cover living costs are provided to the selected students, along with the tuition fee being borne by Kyutech. Through the collaboration that started in 2012, UNOOSA and Kyutech have selected more than 50 students from various developing countries. Many have returned to their countries to promote and develop space activities locally within their countries/regions.

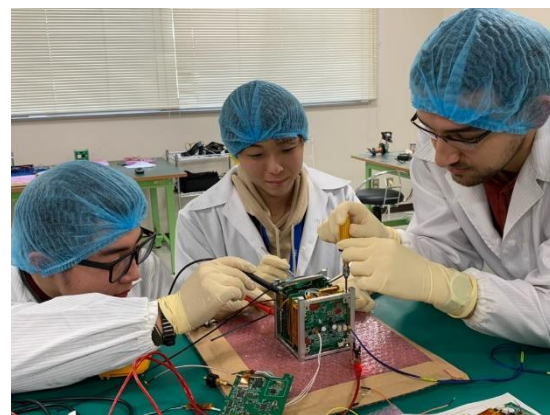
This PNST fellowship has been awarded the Japanese Ministry of Foreign Affairs Award in 2017 for its contribution to human resource development in the global space sector



The thermal vacuum chamber ©Kyutech

Year	Selected Student's Countries of Origin
2022	Egypt, Mexico, Mongolia, South Africa, Turkey, Thailand
2021	Bhutan, Cambodia, Ethiopia, Laos, Trinidad and Tobago, Zimbabwe
2020	Brazil, El Salvador, Indonesia, Nepal, Paraguay, Vietnam
2019	Bhutan, Ethiopia, Laos, Malaysia, Sri Lanka, Trinidad and Tobago
2018	Algeria, Egypt, Nepal, Sudan, Turkey,

PNST Past 5 Year Beneficiaries Data ©UNOOSA



Students from different countries working together ©Kyutech



Interview: First, we talked with Prof. Cho from Kyutech.



Prof. Cho has been working on the PNST programme from the beginning ©Kyutech

Q: What is the objective of the PNST fellowship and why has your organization decided to work on it?

The main goal of PNST is to provide long-term educational opportunities in space engineering, especially to students coming from developing and non-space faring countries. The uniqueness of PNST is that it offers a degree and allows students to absorb various aspects of aerospace engineering through the experience of going through the whole life-cycle of satellite development. The students also have the opportunity to take part in multiple projects and network with fellow students and university staff through these active hands-on projects over a longer period of time.

Capacity-building needs are constantly evolving and the “hands-on” approach at the heart of the PNST has proven to be the most efficient way to combine theoretical knowledge with practical experience. This is done by maximizing exposure to the various testing facilities and tools that the university has on offer. The students are encouraged to learn through trial and error.

Q: Why did Kyutech choose to provide opportunities under the PNST programme?

“We need to bring diversity into the space sector and lower the barrier for entry to space by assisting developing countries through effective capacity-building.”

Our mission is to bring diversity to the space sector. Most people in the space industry are graduate students from engineering-related backgrounds from specific universities that have aerospace engineering courses or prominent professors that are strong in the field. This is making the space sector a homogenous society where it is hard to have innovations bursting since everyone thinks the same way. We must promote the notion that space is for everyone, otherwise the evolution and advancement in space activities will nor reach their true potential. We need to bring diversity into the space sector and lower the barrier for entry to space by assisting developing countries through effective capacity-building. The more diverse the sector is, the more ideas and progress we will achieve.

Therefore, through PNST, we strive to bring in students from all regions with different backgrounds and cultures to come together and work on a satellite project. Since we offer an engineering course, mathematics and physics are at the core. However, the key is the passion about space. Everything else is a very welcome add-on, especially to make life on Earth better.



Group photo of the students of SEIC with the HORYU4 satellite ©Kyutech



Q: How does PNST contribute to capacity-building in developing countries and achieving the SDGs?

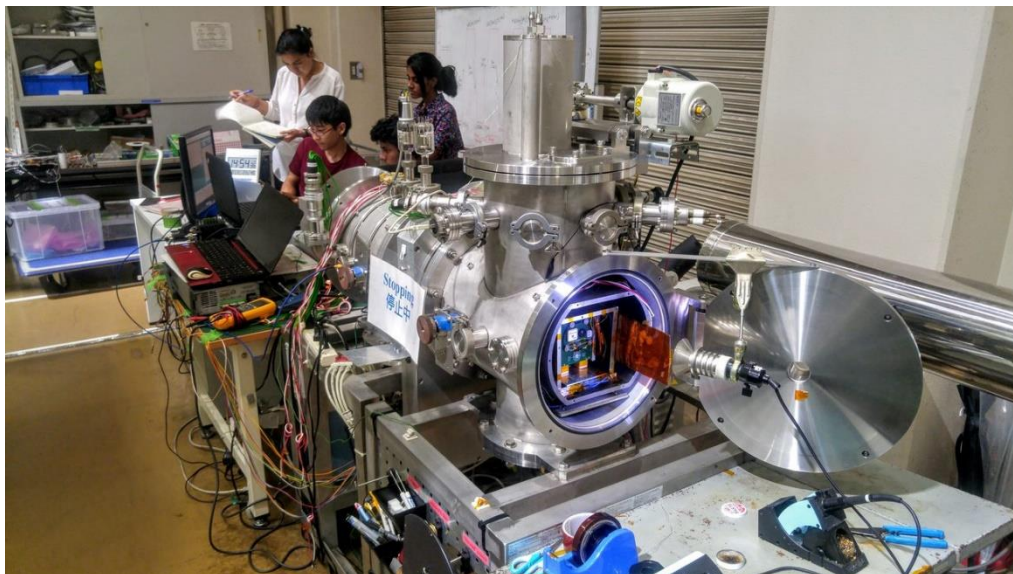
For a country to develop a sustainable space programme, many variables must come together. In the first place, you need to have good infrastructure and technology. However, the most important variable is human capital. A well-educated and trained workforce will turn dreams into reality. Therefore, through PNST, we put a strong emphasis on supporting SDG4 Quality Education and SDG 8 Decent Work and Economic Growth. The people who are needed in the space sector now are those who understand the needs of the country/region and how to use space technology to contribute to solving them. This allows them to address local issues and make well-informed decisions. At Kyutech, we try to foster this skill through hands-on satellite projects. By going through the whole life cycle of proposing a satellite mission, designing, developing, testing, launching, operating, and utilizing the data that comes out of it, the students learn what a satellite can do (and not do), how much it costs, how long it takes, and how to overcome the multiple challenges that arise during the process. It gives them a holistic experience and teaches them what is really important. This understanding only comes through experiencing the whole process of satellite development.



“Going through a whole life cycle of a satellite gives students a holistic experience and teaches them what is really important.”

The SDG5 Gender Equality is also in our scope. As mentioned earlier, the goal of PNST is to bring diversity to the space sector to encourage more innovation. Even if the space sector has a majority of men, with PNST we are striving to change the status quo. Fortunately, we are seeing more women coming in and we were very pleased that we achieved 50-50 gender ratio for the selection of PNST students in the 2022 round. We encourage more females to apply, to revert the space gender unbalance.

Finally, through different applications that the satellites we develop through the course provide, we can address many SDGs. For example, through the BIRDS project, we developed satellites that monitor water quality and land use by multi-spectral cameras and collect ground sensor data such as soil moisture, landslide precursor, etc.



The students conducting tests at the smaller thermal vacuum chamber ©Kyutech



Q: Explain in detail about the current status about PNST.

As of April 2022, it has been 10 years since we started the PNST programme with UNOOSA. Every year we welcome 6 students to the programme and in total, we have brought in more than 50 students to the Space Engineering International Course at Kyutech. Over the 10 years, Kyutech has launched 12 satellite projects and more than half of them are done through the contribution of PNST students.



Vibration test facility ©Kyutech

Furthermore, we have also made our satellite bus information free and accessible to all by providing them on an open-source platform. This has proved to be beneficial for us as well, since the users will revise and maintain the information to be useable to all and students can continue their space activities when they return to their countries, using technology that they are already familiar with. We want to truly make space accessible to everyone.

Q: What are the lessons learned from your long engagement in capacity-building activities through PNST?

The major lessons learned through PNST are the positive effects of cultural exchange and the significance of the human relations and networks built through this experience. By having students from different backgrounds and cultures work on joint projects, they absorb the positive aspects of each other's cultures and work ethics. International students get to know about the good side of Japanese culture from the Japanese students and from living in the country. And vice versa, the Japanese students learn the mentality from the various international students. It is great to see the synergy.

Thanks to the pandemic, we have started a regular monthly online meeting between students and alumni, to connect them and share the latest activities that are happening all around the world. It is fantastic to see alumni all over the world, participating in many space-related activities and to see the community helping each other when someone is in need. The oldest of the alumni are around 40 years old and they are now getting promoted to management levels within their respective organizations and having an impact to young engineers in their countries. In relation, in recent years we've seen second-generation applicants - these are students who are applying to PNST because of the recommendations of the first-generation alumni. We are building an ecosystem of PNST students, and we will do our best to maintain and support this growing effort.

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Group photo of the students with the BIRDS-1 flight models ©Kyutech

Q: How has Access to Space for All and the cooperation with UNOOSA helped your organization?

The success of PNST is owing to the cooperation with UNOOSA. The network that UNOOSA has to offer is extremely vast and this is one of the reasons why we get so many applications from around the world. This has also helped elevate the reputation of our university as a “capacity-builder”. PNST is part of UNOOSA’s Access to Space for All initiative which is a great amplifier and catalyzer, and we are pleased to have the programme promoted more and be part of a set of activities to support capacity-building through a well-structured pathway. We would like to nurture this cooperation and good relationship with UNOOSA. When you look at the regions/countries that have a satellite, we believe there are still many regions/countries that are missing from the map or not well presented. At Kyutech, we see this as an opportunity. Through this collaboration with UNOOSA, we hope to be able to provide support to all the countries in the world.

Next, we talked with an alumnus of PNST, Dr. Abhas Maskey of Nepal.

Q: Why did you pursue your career in space?

I became deeply interested in space by studying aerospace engineering at the Seoul National University (SNU). I earned my bachelor’s and Master’s degrees at SNU, and was involved in small satellite development projects of increasing complexity. Through this experience, I learned that space technology, especially satellite data and applications can support sustainable socio-economic development in various ways. Space activities in Nepal have been limited, hence I knew working in the space field would be something new, unique, and niche in the country and there is a lot of work to be done. These aspects led me to realize that using space technology to contribute to life here on Earth, especially in my home country Nepal, is the career I wanted to pursue.



PNST alumnus ©Abhas Maskey

Q: Why did you choose to apply to the PNST programme and how was your experience?



Flight model integration of NepaliSat-1 at Kyutech ©Abhas Maskey

I had the opportunity to go to Kyutech during my time in Korea to conduct qualification tests for the engineering and flight models of the small satellites that we were developing. This was my first time to witness the infrastructure Kyutech has to offer and get in touch with the international team that was working on multiple satellite projects involving students from different countries. I was intrigued by how Professor Cho was mentoring and bringing together people from different backgrounds. I was also very interested in learning how to build useful and strong connections in the space community and felt that there were many things that I could learn from him and the community

that he had built. Therefore, it was a no-brainer. After I returned from this trip to Japan, I applied as soon as the opportunity came.

As I had hoped, I was able to gain amazing hands-on experience through the PNST fellowship. At Kyutech, I managed the team that was developing the first satellite of Nepal “NepaliSat-1”, the first satellite of Sri Lanka “Raavana-1”, and also contributed to the 6U CubeSat project “KITSUNE”. For the NepaliSat-1 project, the experience was not only

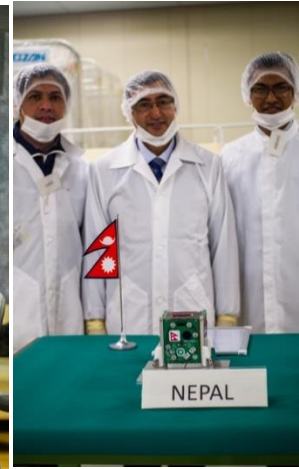


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about the technical aspects of satellite development. I was actively taking part in conversations between the Government of Nepal and the Nepal Academy of Science and Technology (NAST) to fund and realize this project. It truly gave me a holistic overview of how to initiate discussions, secure the necessary resources, and manage a space project from start to finish. Not only has it helped my career personally, but it has boosted the interest of space in Nepal. The development and launch of NepaliSat-1 made the government and population of Nepal realize the potential of space and actually put space on the discussion table.



(Left) Press release of BIRDS-3 project ©Abhas Maskey



(Right) Nepali team with NAST VC Dr. Shrestha ©Abhas Maskey

Q: What are you doing now back in your country after the PNST experience? What are your future plans?



Satellite training at remote Khotang, Nepal ©Abhas Maskey

After returning to Nepal, I created a non-profit organization called Antarikchya Pratisthan Nepal, the translation to English would be “Space Foundation Nepal”. We are involved in many activities such as satellite projects with university students, satellite constellation projects with Thailand for high school students, and CanSat training programmes. Through these projects, we are trying involve people who have never had access to basic education and infrastructure. Our focus rests also on bringing as many female students as possible, supporting SDG4 Quality Education and SDG5 Gender Equality. In order to generate funds to conduct further activities, we are pursuing public-private partnerships, which are linked to SDG17 Partnerships for the Goals.

The outcomes of these activities have been very positive. They truly are a game-changer. People who have never used laptops are now able to design satellites and build their own circuit boards. They are learning complicated skills through hands-on experiences, by taking part in each step of the implementation of these space projects. We believe that building a satellite is for everyone now and it is becoming a basic tool for people to acquire



skillsets and knowledge. With the experience of building a satellite, they are able to build many more things that can enhance the quality of their lives.

“We believe that building a satellite is for everyone and it is becoming a basic tool for people to acquire skillsets and knowledge.”



Engineering model environment testing in Bangalore, India ©Abhas Maskey

Antarikhya Pratisthan Nepal is making use of UNOOSA’s Access to Space for All and we applied to the Payload Hosting Opportunity, offered by UNOOSA and Mohammed Bin Rashid Space Center. Hopefully we can get awarded this opportunity and continue growing connections.

This is important because, currently, there are exciting discussions for a framework for a space agency in Nepal. Our organization is responsible for getting all the national stakeholders in one place to conduct discussions on the realization of this endeavour. We have succeeded in collecting government representatives from the ministries in charge of telecommunication, education, science, technology, and related industry actors. For the creation of a space agency, we look at how it has been done in similar neighbouring countries. Thanks to the network I became part of at Kyutech, I have access to information about what other countries, such as Malaysia, the Philippines, and Bhutan, have done and are currently working on. This information is extremely helpful as a sample, but we need to localize the solutions to meet the needs of Nepal. Our next steps will be to further strengthen our involvement with the government to set the priorities of the country and train human resources that can support the action.

Q: How does PNST help contribute to capacity-building in developing countries and solving the SDGs? How has it helped you and your country?



Nepal has recorded 26 glacial lake outburst floods that have caused significant losses and damages since 1977. ©MattW/flickr

With infrastructure such as satellites, in case of events such as floods, we are able to monitor the water level and forward the information to ground stations to provide early warnings to the population. In case of earthquakes, we can use space-derived data to support the recovery phase and reconstruction of the damaged areas.

The experience I gained and knowledge that I acquired through the PNST programme has allowed me to build the foundation of building an infrastructure for space activities in Nepal, linking to SDG9 Industry, Innovation, and Infrastructure. Nepal is a mountainous country affected by climate change, especially with the outburst of floods due to the warming of temperatures at the glacier lakes. There are other natural disasters such as earthquakes that have an impact on the region as well.





These are good demonstrations of how space-related infrastructure can effectively be used to adapt and mitigate the effects of natural disasters and climate change, also in connection with SDG13 Climate Action. In addition, PNST creates a strong human capital and gives them opportunities for better employment. I see many of my fellow colleagues at Kyutech returning to their countries and contributing to space activities there. Also, there are a lot of partnerships and cooperation among the alumni. These aspects can be linked to SDG8 Decent Work and Economic Growth and SDG17 Partnerships for the Goals.

Q: Do you recommend PNST to other people?

PNST has given me the opportunity to study under one of the world's most prominent professors in the field and build a precious network. You will be able to find creative and motivated students around you, who are determined to make a change in their own countries through space technology. With this common goal, they will always be available to help you when you need them. This fellowship is designed to help people in countries who need to start everything from scratch and support activities ground-up. Personally, being part of the whole effort in Nepal, I know first-hand that it is not an easy path to return to your country and be part of the heavy lifting for space activities in a place where there is none. Nevertheless, I am grateful for this opportunity. I am lucky to be here at this moment in time where I can make an impact, and this is all thanks to my experience at Kyutech through the PNST programme. I highly recommend students who want to make a change apply to the fellowship.



BIRDS-3 team had members form Bhutan, Sri Lanka, Nepal, and Japan ©Abhas Maskey