UNISEC-Global The 35th Virtual Meeting

July 15, 2023, 22:00-24:00
(Standard Japan time GMT +9)

The following report was prepared by UNISEC-Global Secretariat
July 15, 2023
Japan

Table of Content

1. Opening Remarks 3

Sudip Bhattarai, Tribhuvan University 3

2. Presentation on "Satellite Projects by Antarikchya Pratisthan Nepal (Space Foundation Nepal)" 4

Eliza Sapkota, Antarikchya Pratisthan Nepal 4

3. Presentation on "Earth Observation for Disaster Risk Reduction in HKH Region" 6

Mandira Singh Shrestha, ICIMOD 6

4. Presentation on "Space Camp India: My Experience and Plans" 9

Ira Sharma, UNISEC-Nepal 9

5. Announcement and Acknowledgement 10

Haruka Yasuda, UNISEC-Global 10

6. Participant Statistics 11

1. Opening Remarks

Sudip Bhattarai, Tribhuvan University

Dr. Sudip Bhattrai is the Head of Department of Mechanical and Aerospace Engineering, Pulchowk Engineering Campus at Tribhuvan University. He has been a faculty there since 2014. He completed his BE and MSc in Aerospace Engineering from Nangjin University of Aeronautics and Astronautics in 2011 and 2014 respectively. He completed his Ph.D. in Aerospace Engineering from University of South Wales at the Australian Defense Force Academy in 2021. He is also a visiting academic at the same university. Sudip's research is primarily focused on hypersonic airbreathing vehicles and propulsion systems. He uses experimental and numerical techniques to investigate problems in hypersonic/supersonic and subsonic aerodynamics, detonation phenomena, reactive flows, and aircraft flight performance and operations.

Pictured: Dr. Bhattarai giving the opening remarks

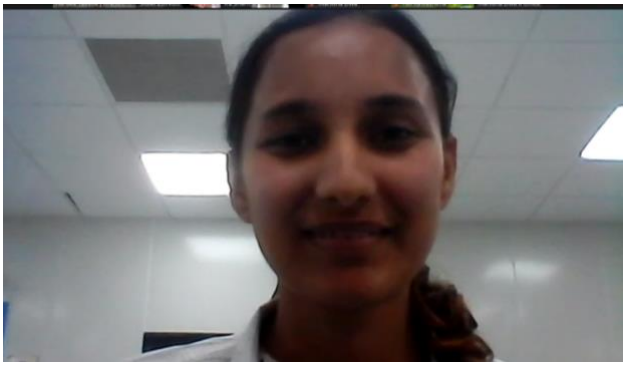
Highlights:

- Directly involved in the academia of Nepalese engineering sector
- Discussed some history and present engineering education situation of Nepal
- Tribhuvan University is the oldest university in Nepal (and biggest), founded about 70-80 years
- Expanded campuses all over Nepal, upwards of 1000 campuses all over Nepal
- Head of Department, firstly of Aerospace faculty but now looks after all Mechanical and Aerospace
- Aerospace in general has been about aviation in Nepal and is still struggling sector
- Early engineers studied abroad and came back with expertise 30-40 years ago
- Recently again, organically, the engineering sector has been again receiving "brain-gain" (people returning)
- The space sector in Nepal is a testament to that
- Question is how do we re-develop the sector that was developed 50 years ago
- In academia, the Aerospace engineering sector is based on the foundation of mechanical engineering
- BE in Mechanical, BE in Aerospace
- MSc in Mechanical Systems Design with 3 other programs
- PhD programs launched as well
- Engulfed the aviation sector and branching towards true space sector
- International relations and networks to bring in international grants that supports research
- Participated in the CLTP11 training program, was a unique program as an outsider to space sector
- Undergraduate students participating in the MIC8, abstract has been submitted, waiting for results
- Improvement in diversity, quotas from different backgrounds as mandated by the government
- Latest batch has 25% women in Mechanical and Aerospace Engineering, which is a new record
- Keen to improve on that record of having a more inclusive education system

2. Presentation on "Satellite Projects by Antarikchya Pratisthan Nepal (Space Foundation Nepal)"

Eliza Sapkota, Antarikchya Pratisthan Nepal

Eliza Sapkota completed here BE in Mechanical Engineering from Kathmandu University in 2022 and since then, has been involved in Danfe, Munal and PHI-1 satellite project as a Satellite Research Fellow at Antarikchya Pratisthan Nepal (Trans. Space Foundation Nepal). She mentors nine high school students who are building Nepal's first high school satellite as part of Project Munal. She also fulfills the role of Project Manager for Nepal's PHI-1 satellite project. She was recently awarded 2023 Emerging Space Leader Award (ESL) by International Astronautical Congress (IAC) for her contributions and continued work on developing space sector in Nepal.



Pictured: Eliza highlights some of the work that Antarikchya Pratisthan Nepal is doing in Nepal

<u>Highlights:</u>

- Antarikchya Pratisthan Nepal is a non-profit organization training next generation of space leaders
- The organization is moving towards Vision 2050, a vision to launch the first astronaut by 2050
- Focus on training space engineers and conducting R&D in space technology
- The prime tool for teaching space is satellites
- Inspired by NepaliSat-1, Nepal's first satellite
- PaperSat programs for Grade 3-7, TinkerLab Electronics program for Grade 6-10
- SastoCube/E-Cube Program Grade 7-12 and High School Satellite Program for Grade 11-12
- Working directly with the government entities including Ministries and Nepal Academy of Science and Tech.
- Provide facilities that allows training
    - Khwopa Engineering Campus' Antenna Design Laboratory (Collaboration)
    - Nepal Academy of Science and Technology's MakerSpace and Ground Station (Collaboration)
- Three satellite projects are underway; Danfe, Munal and Danfe-2 (PHI-1)
- Danfe is in collaboration with Thailand and is mission payload designed for 3U CubeSat
    - Part of MPCP (Multi-Payload CubeSat Platform) by KMUTNB/INSTED, Bangkok
    - Uses PX4 Drone Operating System to check if it can be used as a CubeSat OS
- Munal is a 1U CubeSat being built by 4 community high school involving 9 students
    - Planned to be launched in August 2023
    - Currently in-Flight Model stage and the final testing is going on at Ananth Tech., India
    - Planned to handover ISRO and the launch is through PSLV rocket
    - Missions include Store & Forward and Imaging
    - Completely in-house BUS design including OBC/EPS and COM
    - Camera mission has AI algorithm that improves on-board image selection
    - Using STM32WL chip to see if that can be used as a System-on-chip system
    - Unique Art and Culture mission, sending Nepal's music, language, recordings, arts to space
- Danfe-2 which is the local name of Payload Hosting Initiative (PHI-1) project by MBRSC/UNOOSA
    - Is part of UNOOSA's Access to Space Program

    - Mohammad Bin Rashid Space Center (MBRSC) is the space agency of Dubai
    - 12U CubeSat, currently MDR, PDR is completed and EM is being developed
    - Project Manager from Nepali side, MBRSC is leading PHI-1
    - Similar to Danfe-1, PX4 improved implementation
- Educational programs include PaperSat (paper satellite), E-Cube (educational cube) and SastoCube
    - PaperSat is a satellite that is Lego like, form factor of 1U made of paper and plastic
    - Satellite Bootcamp teaches necessary skills such as CAD, PCB design, soldering and programming
    - Satellite Bootcamp used SastoCube before and now has evolved to E-Cube
    - E-Cube is a low-cost educational satellite that is inspired by the UNISEC's CLTP
    - Currently training being conducted at all provinces in Nepal
- Ground Sensor Terminal (GST) in-house design to get ground data and send it using LoRa
- Kyutech's KITSUNE was used to check if data could be uplinked, successful
- Ananth Techology in India is supporting environmental testing for satellites
- Women are getting the opportunity but we want more women to get into STEM and space
- All details on programs: https://www.antarikchya.org.np/

Pictured: Antarikchya Pratisthan Nepal's flagship project called Munal which is a 1U High School Satellite

Q&A:

Q: I was looking for such kits but they are really expensive. Is it possible to share some of the documentation? I am really touched that you have been doing that in Nepal.
Eliza: We are building both PaperSat and E-Cube. It is commercially available through Antarikchya Pratisthan Nepal. I will be glad to give you some references and some links so that you can follow up later.

Q: How often are the bootcamps (satellite bootcamps) conducted?
Eliza: Actually, now we are targeting to work on E-Cube. E-Cube bootcamps are being conducted every month in different schools in all provinces of Nepal. For the bootcamp, we call for applications to see the interest of students. That was for 2-3 months ago. Now we are focusing on E-Cube but if there are enough students willing to learn, we can conduct the bootcamps immediately as well.

Q: How are you able to get over 33% participation of young women. Has there been any special efforts to participate them? The participation levels are much lower here in Canada.
Eliza: Thank you for the question. It looks difficult but while calling for applications of Munal satellite, many girls were interested. We were targeting four schools and we had mentioned that we would be open to considering as many girls as possible because Nepal needs young space enthusiasts to work on space projects. Girls here in Nepal are interested, they are learning about STEM, it takes time but they are getting slowly involved.

Q: How long does it take to build a CubeSat in Nepal?
Eliza: Being a non-space fairing country and a developing country, it takes more than 2 years to build a complete 1U system even though we had BIRDS open-source reference.

3. Presentation on "Earth Observation for Disaster Risk Reduction in HKH Region"

Mandira Singh Shrestha, ICIMOD

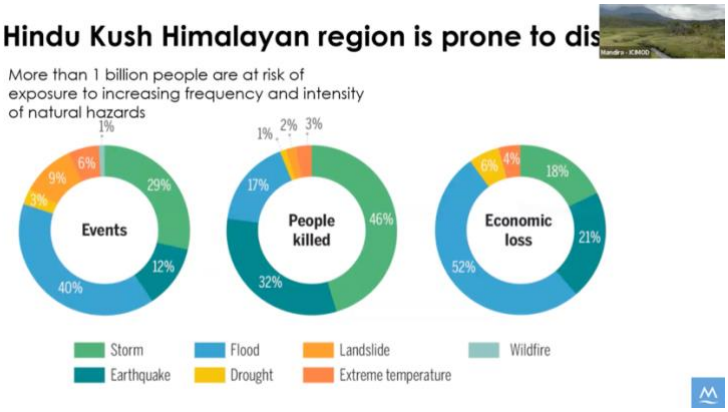
Dr. Mandira Singh Shrestha did her PhD from Kyoto University in Japan. She leads the Climate Services Initiative at International Center for Integrated Mountain Development (ICIMOD). ICIMOD is a multinational organization that aims to protect the sensitive Hindu-Kush Himalayan (HKH) Region. She also leads the transboundary flood risk reduction work, promotes dialogue and strengthens capacity in the region. Dr. Shrestha's research interests center on transboundary flood forecasting, monitoring and end user engagement. She has coordinated the development of a web based regional flood information system in the Himalayan region where the countries are sharing real-time data and information for flood risk reduction.

Pictured: Dr. Shrestha's provides insight into how satellites are being used in Nepal for disasters

Highlights:

- Presentation focuses on use of satellite technology instead of discussing the engineering aspect
- ICIMOD stands for International Center for Integrated Mountain Development
- ICIMOD works towards a regional mountain knowledge and learning
- Working towards sustainable development of the mountain of eight countries
    - Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan
- Regional inter-governmental international organization, unique
- Hindu Kush Himalayan (HKH) Region extends 3500km from east to west covering all eight countries
- Global asset for food, energy, water, carbon, cultural and bio diversity
- 10 major rivers originate including Ganges, Indus that feed over 1 billion people
- Downstream there are about 1.9 billion people affected
- ICIMOD aims to link policies to science and practice
- Sharing knowledge to influence policies and to make changes in the ground
- The HKH region is extremely prone to disasters
- Floods alone include majority (40%) of said disasters
- More than 1 billion people are at the risk of exposure to increasing frequency and intensity
- Transboundary risks and vulnerabilities are increasing, early warning and sharing necessary
- In 2021 March, India's Chamoli disaster triggered an avalanche
    - The incident killed over 150 people; hydro station damaged
    - Difficult to reach areas, used satellite data to assess the damage
- In 2021 June, Nepal's Melamchi watershed triggered by Glacier Lake Outburst Flood (GLOF)
    - Evacuation possible but huge infrastructure damaged
    - Remote sensing images used again to do rapid assessment
    - Natural formed lake upstream shown to have completely drained in before/after imagery
- These disasters affect women disproportionally, mainly because of lack of information
- Very few climate observing networks, limited simulations and limited quality data
- The amount of in-situ data (observed data on the ground) are limited, limited sharing of data
- Important to use available, credible data to create actionable services that saves lives

- Application of satellite technology has a range of applications that ICIMOD needs
    - Food security and agriculture
    - Weather and climate security
    - Land use and land cover, water and related disasters
    - Air quality is becoming more important
- Opportunities include
    - Harmonization of climate data and information
    - Increase in demand in climate services so that people can adapt to climate change
- ICIMOD's mandate is to host mountain specific climate data and information
- ICIMOD aims to provide state-of-art climate services that combines in-situ and ex-situ (satellites) data
- What do we need to do in order to mitigate the risk for disasters?
    - Develop partnerships to increase knowledge base
    - Use better gender mainstreaming and governance
    - Use better technologies like space technology to enhance monitoring
    - Build better early warning systems
    - Bring better financing and insurance schemes to protect the most vulnerable
- ICIMOD actively tracks and monitors cryosphere region by checking on glacial lakes and outbursts
- Cryosphere is strongly affected by climate change
- End-to-End Early Warning Systems' first point of entry will be real-time data collection
    - Sensors and satellite data
- GPRS/GSM and satellite iridium for data transmission
- Satellites have also allowed ICIMOD to create mathematical models for flood routing
- 3-day advanced forecast of floods using Hindcast through JAXA/NASA data
- Using IMERGE Dataset from NASA being used
    - Integrated Multi-satellitE Retrievals for GPM
    - 30 min temporal resolution with 10km x 10km spatial resolution
    - Website: http://gpm.nasa.gov/data/imerg
- Precipitation map by JAXA Global Rainfall Watch
    - https://sharaku.eorc.jaxa.jp/GSMaP/
- Satellite based precipitation mapping is because of the density of rain gauges we have spread out
- High spatial map data instead of point data
- ICIMOD has developed web-based GIS that allows anyone to open
- Rainfall estimates compared to data ground-truth data that allows better modeling
- HIWAT (National **H**igh **I**mpact **W**eather **A**ssessment **T**ool) for disaster early warning
    - 54 hrs forecast, temperature, rainfall lightning, hail, wind, floods, super storms
- Streamflow Prediction Tools used in Bangladesh/Nepal
    - Collaboration with NASA's SERVIR Program
    - 10 days lead time, designed for larger rivers
    - https://servir.icimod.org/science-applications/streamflow-prediction-tool-nepal/
- Key takeaways
    - Technology and innovation have increased accessibility and allowed analysis of remote areas
    - In-situ and satellite-based merged products improve accuracy and reliability of data
    - There is a greater demand for climate information services
    - Regional collaboration and partnership are key for sustainable planet



Pictured: Hindu Kush Himalayan Region is extremely prone to disaster

Q&A:

Rei: I have two questions, the first question is that you mentioned that compared to men and women, the women will die more in case of floods or inundation? The rate is higher than men, is that true? How much?
Dr. Shrestha: That is very true. During any kind of disaster, especially in under developed or developing countries, we find that women and children are marginalized groups are extremely vulnerable. One example is the 2015 earthquake where 56% of those that were killed were women, 6% more. These are for different reasons. For floods for instance, the information that is reaching women about early warning is either late or does not reach on time. They are not well prepared in terms of evacuation. The other is also culture differences also makes them very vulnerable. There are a lot of social economic factors also that contribute to women and children marginalized to be more vulnerable in disasters. There are many evidences that indicate women and children are vulnerable. There should be a lot of concerted efforts so that such vulnerabilities are minimized and ensuring that information, early warning and other means of information are reaching that people that needs to be evacuated.

Rei: You mentioned early warning systems. Education will make the situation better?
Dr. Shrestha: Yes, that is one part. There are many parts that can contribute to early warning systems. We talk about early warning systems, it's not only about systems. The United Nationals Disaster Risk Reduction Agency (UNDRR) defines early warning systems in four elements. First is risk knowledge, the second one is monitoring of what is happening, the hazards and observations. The third pillar is looking at the community and dissemination of the warning. And the fourth pillar is more of the response of the warnings and the evacuations. For people to be ready for evacuation, they need to be made aware. The warning, how the warning goes, where they have to go, without making them aware, no action is going take place. And you can provide the best warnings, but if it is not actionable, there is no point. The information and knowledge have to imparted together. They need to be co-designed with the people and community on the ground because they know what is happening and what the hazards are.

So, it is a co-development process, both in the terms of engaging and educating is necessary. We call it communication continuum where first the early warning needs to be available, then it needs to be understandable. After it is understandable, it also needs to be such that people are there taking action. It has to also be believable. There has to be behavior change and action takes place. Right now, the World Metrological Organization (WMO) WMO is the UNDRR, they have announced an entire initiative called the "Early Warning 4 All). That means by 2027, early warning has to reach every person. That is quite an ambitious target but that is what we are working towards at all fronts. Improving the observations, improving the monitoring, improving information coming from satellites, the technology itself that needs to be improved. Making the risk maps and risk assessments, improvements in communication as well as dissemination and the response. Then only, we will have actionable response and save lives and livelihoods.

Rei: In Nepal, there are a few natural hazards, natural disasters, as you had mentioned. Do you have any early warning or prediction systems for earthquakes?
Dr. Shrestha: Yes that is a good question because when we talk about hazards, it is multi hazards. Nepal is one of the multi hazard area. We live in a multi-hazard environment. The once that I described earlier such as floods, landslides those are more towards hydro-meteorological disasters, right? But now what you are talking about is floods and landslides. Yes, we do have early warning systems for floods. Over the last few decades, the number of people who die of floods have reduced dramatically because of the effectiveness of early warning systems. But now when it comes to landslides, slowly being developed. The landslide detection system is in the developing phase. There are a lot of people of who still die of landslides.

In case of earthquakes, they are very difficult to predict. Early warning for that is also difficult. People are working on it. A few months ago, there was a presentation regarding application of earth observation using satellites. There was a very good presentation from Japan regarding early warning for earthquakes. It was interesting to hear that, so something similar maybe from different technologies but very short lead time. That area is still not yet developed for Nepal. As you may remember, we had a big one in 2015, so we are still very vulnerable. We cannot say that another one cannot happen soon. We have to be prepared and you are right. Awareness of earthquake, stronger buildings, infrastructure and codes, that's also important. At one time, I was in Japan during an earthquake and I didn't run because I felt safe within the building also.

We have the department of geology and mines have installed many different sensors across the country to monitor the movements. **(*Rei comments about how Japan is working towards developing such technology and that is hopeful that earthquake prediction technology can mature)*** We look forward to learning more from Japan because a lot of knowledge transfer can happen and that can be used for saving lives.

4. Presentation on "Space Camp India: My Experience and Plans"

Ira Sharma, UNISEC-Nepal

Ira Sharma is a Junior Satellite Research Fellow at Antarikchya Pratisthan Nepal. At Antarikchya, she looks after media relations, fund planning and program handling. She is also trained to conduct educational satellite bootcamps to school students. In her spare time, she oversees UNISEC-Nepal's activities as well.

Pictured: Ira shares her experience of Space Camp India

<u>Highlights:</u>

- Only international participant of Space Camp India in 2022 (around June/July)
- Space Camp originated in the US, slowly the concept spread all over the world
- Conducted originally by Alabama Space Science Exhibit Commission
- Kids of 8-16 years old, young minds can be curated and molded
- A window into space and science
- Three factors that was important:
    - Passion: the camp instilled the passion for science, technology and space
    - Exposure: provided tools that allowed hands-on experience
    - Empower: competitions, medals and encouragement
- Activities included visits, workshops, astronomy
- Competitions included space quizzes, prep wings, space warriors
- Won trophy and competitions, encouraged to continue learning
- Occurred in Lovely Professional University
- Workshops that participants got to explore:
    - Can-in-Space: learned about satellites
    - Aeromodelling: crafted small model planes
    - "Dronification": built drones
    - Model Rocketry: launched small rockets
    - Pathway to Stars: learned about stars
    - Space Robotics: learned about rovers
- Fun learning experience
- Space Camp India gave me idea to experience what space is, plan to pursue a career in space
- Building robots, CanSats, over all a very good exposure
- Realized what science and STEM can do, hands-on experience is critical life-skill
- In conclusion
    - Beautiful experience overall
    - Meeting and connecting with new people
    - Scared before but because of indulging activities, was at ease
- Want to empower young people (girls specifically) and conduct similar program in Nepal

5. Announcement and Acknowledgement

Haruka Yasuda, UNISEC-Global

Pictured: Yasuda-san announcing the latest updates from UNISEC

- **New Point-of-Contact Announcement**
  - Dr. Sidiki Zongo from Burkina Faso
    - Works at Ministry of High Education, Research and Innovation
    - Completed PhD from South Africa in 2017
    - Research interest include NLO-Photonics and renewable energy
    - Space science programs include telecom, weather and security
    - RASCOM: Regional African Satellite Communication Organization

- **New University Members for UNISEC Local Chapters**
  - UNISEC-Colombia: University of Cauca
  - UNISEC-Egypt: Beni-Suef University
  - UNISEC-India: Cambridge Institute of Technology
  - UNISEC-Philippines: Ateneo de Davao University
    - Ateneo de Davo University was established in 1948
    - Department of Aerospace Engineering has number of programs implemented
    - BS in Aerospace began in 2018
    - AD ASTRA Laboratory and is involved in the SPACERIDE Program by PhilSA
    - Research and development in Unmanned Aerial Systems and Flight Simulations
    - CanSat programs, drone programs and CFD programs
    - Uses space technology for disaster response operations

- **CLTP 12 (Cansat Leadership Training Program)**
  - Program Date: August 21, 2023 - September 1, 2023
  - Venue: Nihon University, Chiba, Japan
  - 18 trainees from 14 countries
  - Website: http://cltp.info/index.html, contact info: secretariat@cltp.info

- **Mission Idea Contest (MIC8)**
  - 23 abstracts from 17 countries
  - Notification to all on August 8, 2023
  - Full paper submissions will be October 3, 2023
  - Final presentation will be November 29, 2023, will be broadcasted online
  - Register here: http://www.spacemic.net/application.html, contact info: info@spacemic.net

- **9th UNISEC-Global Meeting**
    - Venue: Tokyo, Japan, in-person event
    - November 27 - December 1, 2023
    - Details: to be announced
    - J-Cube Workshop during the same time
    - 8th Mission Idea Contest on Nov 29, 2023

- **Launch Opportunity**
    - J Cube: Special discounted opportunity
    - Size to be 1U, 2U, 3U
    - Deployment from International Space Station
    - Technical Support will be provided, Collaboration with UNISEC-Japan's University
    - Full information: http://unisec.jp/services/j-cube
    - Contact: info-jcube@unisec.jp

- **35th UNIGLO Virtual Meeting**
    - Date: August 19, 2023 22:00 - 24:00 (JST)
    - Theme: Introduction to J-CUBE
    - Host: UNISEC- Japan
    - Moderator: Ira Sharma
    - Virtual UNISEC-Global Meetings takes place third Saturday of almost every month of 2023
    - Seeking local hosts for September 16, October 21, …

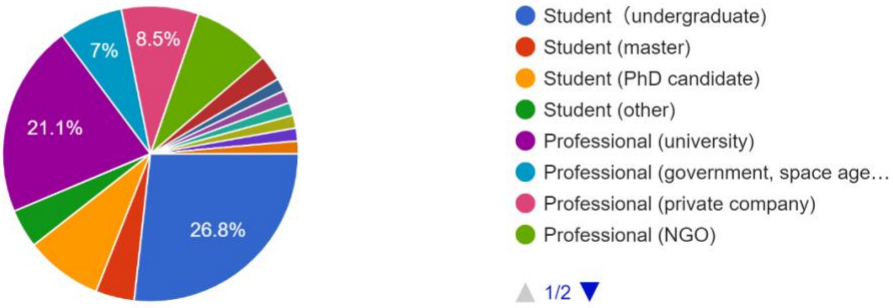
6. Participant Statistics

71 registered participants from **26** countries and regions for the 35th Virtual UNISEC-Global Meeting.

Country/Region	Number of registrations	Country/Region	Number of registrations
Australia	1	Pakistan	1
Bangladesh	7	Peru	3
Bhutan	1	Philippines	8
Bulgaria	1	South Korea	1
Burkina Faso	1	Taiwan	1
Canada	1	Tunisia	1
Dominican Republic	2	UK	1
Egypt	4	US	2
Ethiopia	1	Zimbabwe	1
India	2		
Indonesia	1		
Japan	10		
Kazakhstan	1		
Kenya	2		
Luxembourg	1		
Namibia	2		
Nepal	14		

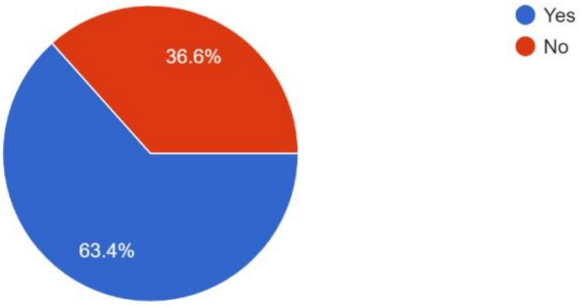
Student or professional?

71 responses



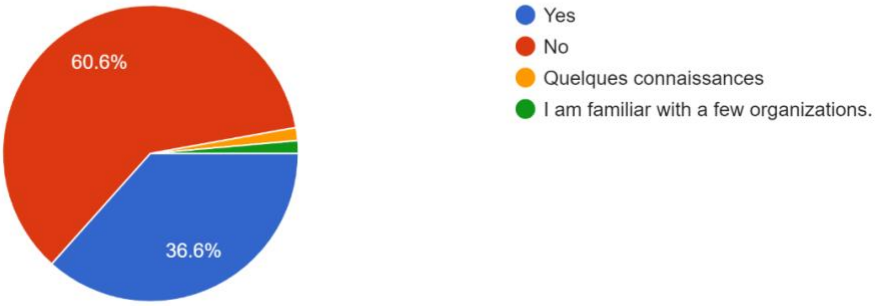
Have you participated in the UNISEC-Global Meeting previously?

71 responses



Are you familiar with Nepalese space projects?

71 responses

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6
UNISEC GLOBAL

Thank you