

PHI: The Platform to Realize Your Dreams



Interviewee:

Ms. Aysha Alharam
Engineering Specialist, National Space Science Agency of Bahrain (NSSA)
Ms. Eliza Sapkota
Project Manager, Antarikchya Pratisthan Nepal (APN)



Date: Interview conducted with NSSA on 8 March and with APN on 10 March 2023

Background:

The [Payload Hosting Initiative](#) (PHI) is offered by the [United Nations Office for Outer Space Affairs \(UNOOSA\)](#) in collaboration with the [Mohammed Bin Rashid Space Centre \(MBRSC\)](#). PHI is a hands-on opportunity under the Satellite Development Track of the [Access to Space for All initiative](#), which provides the launch payload hosting and access to ground stations for projects with a maximum volume of 5U on the PHI-1 mission, a 12U modular satellite platform developed by MBRSC. This collaboration was announced in October 2021, during the 72nd International Astronautical Congress (IAC) in Dubai. Through this opportunity, UNOOSA and MBRSC hope to contribute to broadening space activities and applications and to capacity-building in space science and technology, especially for developing countries.

The 1st round of applications opened in January 2022. After a competitive selection process, UNOOSA and MBRSC announced the 2 awardees of the 1st round at the 73rd International Astronautical Congress (IAC) in Paris in September 2022. Teams from the [National Space Science Agency of the Kingdom of Bahrain \(NSSA\)](#) and the [Antarikchya Pratisthan Nepal](#) were picked to deliver payloads to space.



Announcement of Awardee Event at the IAC 2022 in Paris ©MBRSC

Read more:

Press Release:

- [UNOOSA and MBRSC sign a Memorandum of Understanding for satellite payload hosting](#) (28 October 2021)
- [UNOOSA and Mohammed Bin Rashid Space Centre announce awardees of payload programme](#) (21 September 2022)

Awardee page:

- [National Space Science Agency of the Kingdom of Bahrain \(NSSA\)](#)
- [Antarikchya Pratisthan Nepal \(APN\)](#)

Interview: First, we talked with Aysha, who is the Project Leader of one of the teams selected as the awardee of the 1st round, the National Space Science Agency of Bahrain (NSSA)



Aysha has been working as a space engineering specialist at NSSA since 2018 ©NSSA

Q: Why did you decide to undertake this space project? What benefits do you see in the space environment?

Space is an environment that challenges us to work on pursuing technology, innovation, and further development of products and services on Earth. Space activities are a global effort, and we believe that by taking part in a space project, we will not only gain technical know-how and expertise but also experience in terms of international and regional collaboration.

We decided to work on cybersecurity for our project as we wanted to work on a technology that is critical and is a trending topic. There are thousands of satellites in space providing essential services that support daily life on Earth. However, if the communication between satellites or with the ground infrastructure is not secured, satellites can be easily hacked or misused. Depending on what kind of asset is violated, there can be serious consequences that can affect millions of people socioeconomically.

Q: How does your project contribute to capacity-building in your country and the achievement of the Sustainable Development Goals?

NSSA is a newly established space agency which started its activities in 2014. One of the fundamentals of the national space policy of Bahrain is capacity-building and it is one of the main goals included in the current strategic plan of the NSSA. Therefore, we look forward to building capacity through participation in the PHI programme and contribute to the United Nations Sustainable Development Goals in parallel.

NSSA was awarded the International Astronautical Federation Excellence in 3G (Geography, Generation, and Gender) Diversity Award” in 2022, which recognizes outstanding contributions regarding the promotion of 3G diversity. NSSA has a very high percentage of women working in the agency, which reaches 65%. On top of that, women occupy 67% of leadership roles at the agency NSSA is also a very young agency in terms of the average age, which is 31. For the PHI project, 3 of the 4 main team members are women and all team members are under 35. As you can tell from the numbers, we truly believe in promoting STEM education and careers, especially in space for women/girls and the young generation. With this vision, through our participation in PHI, we aim to provide access to women/girls and students from different age levels, irrespective of their backgrounds and religion, by conducting outreach education programmes like summer camps and events/workshops that would disseminate the technical knowledge we gain from the development of the payload, with the cooperation with the Ministry of Education. Accordingly, we will contribute to SDG #4 Quality Education and SDG #5 Gender Equality.

Furthermore, our project focuses on cybersecurity. It will assist in safeguarding critical infrastructure for sustainable cities and communities on Earth, by protecting assets in space, which is linked to SDG #11 Industry, Innovation, and Infrastructure. And we believe cybersecurity is also an important factor for SDG #16 Peace, Justice, and Strong Institutions, where adequate information technology may contribute to reducing violence and crime on the internet and raise transparency for institutions.



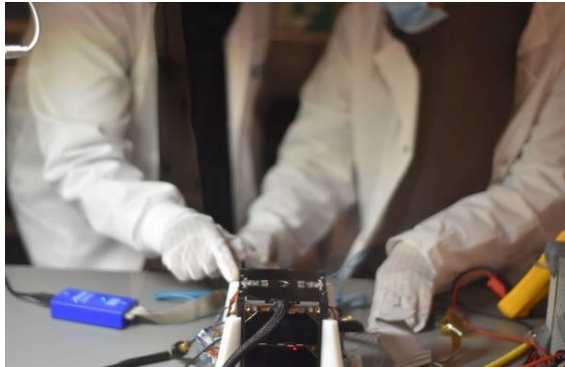
NSSA Winning the 3G award at IAC2022 in Paris ©NSSA

• 65% of the workforce in NSSA are women

• 67% of the leadership roles in NSSA are assumed by women.



Q: What is the objective of your project and what is the current status of the development?



(Top) Aman team ©NSSA

(Below) The team working on their payload ©NSSA

The mission of the proposed Aman payload is to test an optimized Advanced Encryption Standard (AES) implemented on Field Programmable Gate Arrays (FPGAs), which are integrated circuits that enable users to customize for their own use. Many small satellite developers avoid using encryption algorithms as it complicates the system and consumes a lot of power. We see this as a risk and that is why we are trying to optimize this technology, to enhance the security of the system, without having a negative effect on the performance of the satellite. We decided to utilise an FPGA as they can process in parallel to operate faster and more efficiently.

Along with this, the objective of the project is to generally gain practical hands-on experience for designing, developing, testing, and integrating a payload for future satellite missions. Obtaining this key technology and experience is a core focus of NSSA and we also plan to publish research papers and studies out of what we gain.

We were selected as one of the first round awardee teams in October 2022 and we have conducted the kick-off meeting and information exchanges with the team at MBRSC. We are reaching the Project Design Review (PDR) milestone in late spring, to finalize the design of our payload. The plan is to have the development and testing completed and the launch to space is scheduled to take place in 2024.

Q: What are your future plans?

NSSA will continue to build national capacity, as is clearly stated in our agency’s strategic objectives. In the short future, we aim to be able to work on larger satellite projects and on interplanetary space exploration missions. NSSA will also continue to develop and pursue innovation in many different types of technologies, including critical ones such as cybersecurity. Additionally, NSSA aims to promote and collaborate with the national space sector, in space technology, space applications, and ground infrastructure. Of course, in line with those developments, there will be research and analysis done and more research papers will be published.



Q: How has Access to Space for All helped your organization and do you recommend it to others?

Access to Space for All has supported our organization greatly, by providing a rare opportunity that would otherwise be inaccessible at this early stage of development of our agency. It will enhance our technical skills and expertise and build capacity in the Kingdom. We are also certain that this will boost confidence of our country in conducting space activities and attract more interest in STEM education and the space sector. Another great point is that this opportunity has enabled us to extend our relationship with various experts, regionally and internationally, which we hope will evolve to be a long-lasting and beneficial relationship.



Team at NSSA with the IAF 3G Award ©IAF



Example of NSSA public awareness initiatives ©NSSA

The various webinars organized under the initiative have also been beneficial for NSSA. We ourselves attend these educational webinars, but we also share the information and promote participation to the universities and organizations in Bahrain that are interested in space. We hope to promote the initiative further and have more institutes from Bahrain also apply to the various hands-on opportunities provided by UNOOSA and its partners.

“For a new space agency like us, access to human networks is valuable, as they have abundant know-how, experience, and advice to share.”

I recommend participation in the Access to Space for All initiative, especially in the PHI opportunity, for those who are interested in learning about how a space system works, how to host/be hosted, and the various processes that you need to go through to put something up into space. This project gives an opportunity of applying the theoretical knowledge you learn to an actual tangible project. Along with the great technical experience you will gain, the connections you make with people in the sector are precious. For a new space agency like us, or for any emerging country, such access to human networks is valuable, as they have abundant know-how, experience, and advice that can be helpful. Lastly, PHI provides a platform that can test many different technologies and you can utilize this to further develop and test whatever interests you. This programme can be the first step for your space activities to strengthen and grow.

Next, we talked with Eliza, who is the Project Leader of the other team selected as the awardee of the 1st round, Antarikhya Pratisthan Nepal (APN).

Q: Why did you decide to undertake this space project? What benefits do you see in the space environment?

Nepal is a country which is affected by natural disasters. From space, a natural phenomenon can be monitored, studied, and when we see a risk is closing in, we can warn the population. When a disaster occurs, space technology can help understand the situation, manage the risk, and support recovery efforts. Hence, we see that space technology and applications are something that is crucial for Nepal to be able to use. Antarikhya Pratisthan Nepal (APN) is a non-profit organization that aims to promote space education and create a space sector in Nepal. APN has “Vision 2050”, where the organization is working to place the first Nepalese astronaut in space by 2050, but to realize this, we are starting with the first steps which we believe is to focus on satellite systems. We decided to work on this project to develop Nepal’s capacity for a future workforce in space and to gain experience through international partnerships.

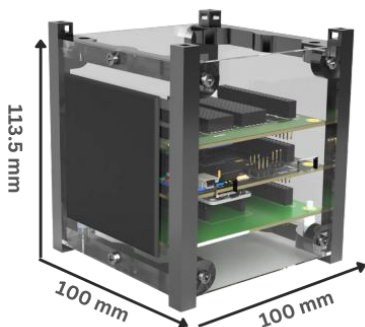


Eliza has been working as a Satellite Research Fellow at APN since 2022, Feb ©APN

Q: How does your project contribute to capacity-building in your country and supporting the Sustainable Development Goals?



At APN, we are involved in various capacity-building projects to help Nepal establish its own space agency. APN conducts outreach activities targeting the young generation, promoting space education in primary and secondary schools. We also conduct a series of hands-on workshops and training to high school students from ages 16-18 on the satellite development process. We teach the fundamentals such as what is a satellite, what kind of missions can be realized, what are the basic components, what does each of them do... etc. We also use a kit for students to actually touch and play around with the PCB, build their own systems and gain a deeper understanding. We also use CAD to design the 3D printed structures and go through the overall design process. The duration of this training is around a week, but we hope to be able to extend the duration and expand the types of activities that they can do. There are few organizations that do space-related activities in space, and therefore our range of activities is growing. We think this is helping to send out the message to the government and authorities that it is high time that we have our own space agency, dedicated to using space technology and applications to contribute to the SDGs within our country. For Nepal to be ready for this next step, we need more experience, which we hope to get through our participation in the PHI programme.



(Top) CubeSat Training for primary school students ©APN

(Bottom) CubeSat Training Kit: ECube ©APN

Through the APN LoRa Payload mission that we proposed for PHI, we will develop skills and obtain knowledge and expertise in space technologies. As explained earlier, developing human resources is a key objective and we believe that this boost in technological capabilities will not only benefit the space sector, but many other industrial sectors within the country. These aspects are linked to SDG #8 Decent Work and Economic Growth and #9 Industry, Innovation, and Infrastructure. I would also like to emphasize that half of the project members of the APN LoRa Payload mission are women, and we believe that we can be good examples and role models for women and girls who are interested in pursuing STEM education and careers. Furthermore, we anticipate more women and girls to be engaged in our project through the different outreach/educational activities we will conduct with the know-how that we will gain through PHI. Therefore, we see a strong connection with SDG #4 Quality Education and #5 Gender Equality.



The members of the APN LoRa Payload mission ©APN



Q: What is the objective of your project and what is the current status of the development?



APN LoRa Payload Layout Design ©APN

The APN LoRa Payload mission will study the on-orbit performance of the PX4 Middleware, which is an Operating System (OS) used in drones. This open-source PX4 autopilot drone software and flight proven PX4 compatible hardware combined with sensors has the potential to cut down software development time of CubeSats. Another aspect that we will be demonstrating is the use of novel STM32 system-on-chips for both on-board computing and communication by utilizing the Long Range (LoRa) technology. We are in the designing phase and will have a joint PDR with the team from Bahrain and MBRSC in spring.

Q: What are your future plans?

In the future, as explained earlier, APN would like to progress to realize the “Vision 2050”. Despite our high achieving goal of putting an astronaut up into space, we realize there are many different technological capacities we need to build, and satellite technology is one of our main focuses. When we have the essential technology, infrastructure, and human resources, we hope to be able to develop our own satellite missions that will focus on the specific needs of Nepal. For example, we would like to monitor glacier lakes in the country, since these lakes are the epicentre of floods resulting from melting ice due to climate change.

Nevertheless, at this stage, our focus remains on progressing step by step, starting with building capacity for space technology and applications. We want to nurture the space sector here so that aspiring space enthusiasts will have a job in Nepal and nurture space education so that the young generation can stay in Nepal and continue with their studies and careers. We want people from Nepal to be able to pursue their dreams in space-related fields without leaving the country. Individually, as there is no possibility of pursuing my studies yet here in Nepal, I plan to go study abroad, but of course to come back to Nepal with all the inspiration and knowledge I gain out of that experience and contribute to the development of space activities in my country.

“We want people in Nepal to be able to pursue their dreams in space-related fields without leaving the country.”



Photo of a Ground Sensor Terminal installed in Melamchi River for Flood Early Warning System ©APN

Q: How has Access to Space for All helped your organization and do you recommend it to other people?

Nepal is a non-spacefaring country and we are in the beginning of developing a space programme. Therefore, we are always looking for space projects that could potentially provide us with a more hands-on experience, as Nepal does not have the infrastructure and resources for that. Having access to an opportunity which literally provides us with “access to space”, where we can directly work on a payload that will be flown to space is just what we wanted. When we learned about the Access to Space for All initiative and that PHI was open for applications, we jumped on this chance. We look forward to the knowledge and experience that the Nepalese space researchers will gain from this project and we will definitely use this experience strategically to continue to train the human resources in Nepal.



Eliza and APN team with high school students preparing for CubeSat testing ©APN

“More people became aware and interested in our space-related activities and more entities are keen to form partnerships with us.”

Being selected for PHI was a big deal for us, as we gained a lot of media coverage within the country. More people became aware and interested in our space-related activities and more entities such as industry and other NPOs are keen to form partnerships with us. For example, the Nepal Academy of Science and Technology (NAST) is the government entity in charge of scientific and technological development and innovation in Nepal. By being selected as an awardee of an international collaboration like PHI, we see that the Academy is also more interested in our work, and we have succeeded in receiving some funding for our activities from them. Additionally, it is not only that our project is a space project, but the fact that we are trying to develop something that would support the country socioeconomically has had a great message.

I recommend taking part in Access to Space for All and PHI for those who are searching for hands-on opportunities that can help promote and grow your space sector nationally and internationally. The recognition it brings to the country and the organization’s activities has a huge impact. This allows you to be on the starting line and provides you with access to experts and professionals in the industry. It really accelerates the possibilities of international collaboration. This initiative is truly a wonderful platform for progressing space science and technology.



Media coverage in local newspaper ©APN

New round of PHI is planned to be opened during 2023. Stay tuned...