

Opportunities under the
United Nations
Access to Space for All initiative
APRSAF28 Space Education 4 All Working Group



UNITED NATIONS OFFICE
FOR OUTER SPACE AFFAIRS

16 November 2022

Hazuki Mori

Expert, Space Applications Section
United Nations Office for Outer Space Affairs



UNITED NATIONS
Office for Outer Space Affairs



UNOOSA and Space for Sustainable Development



Space for Women



Space Law for New Space Actors



UN-SPIDER



Access to Space for All



Space for Persons with Disabilities



Space Economy



Space for Climate Action



International Committee on GNSS



Space for Youth



Space Sustainability



Space for Water



UNITED NATIONS Office for Outer Space Affairs





Access to Space for All

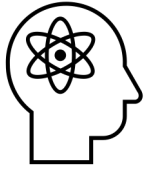
Space Technology Capacity Building



The goal of the Access to Space 4 All initiative is to provide research and orbital opportunities for UN Member States **to access space and to ensure that the benefits of space, in particular for sustainable development, are truly accessible to all**



Provides the possibility of developing hands-on capabilities from A-Z in to promote the safe and sustainable use of outer space



Provides cutting edge skills for jobs and other opportunities



Fosters international cooperation between the UN, space-faring partners, and applying developing nations



Has a strong social impact to the country, regions, and young generations

Access to Space for All in Numbers

- **9** Hands on Opportunities
- **1** Annual Fellowship
- **27** Awardees involving **42** Entities from **30** countries
- **4** CubeSats launched
- **7** Microgravity Experiments performed
- **16** projects in development
- **62** Scholarships granted
- **70+** Hours of educational content on YouTube



SPACE AGENCIES



RESEARCH INSTITUTIONS AND UNIVERSITIES



PRIVATE SECTOR





Access to Space for All

Impact of the initiative

HyperGES "Watermeal, the Future Food Source for Space Exploration"



HyperGES and community impacts

- Expand space-related knowledge and awareness in Thailand
- Flagship program in astroculture, produce intensive research environment
- Team up with other organization. Stepping out of their comfort zone encouragement

Ellas construyen el satélite guatemalteco

Conozca a las siete estudiantes que participan en el proyecto del CubeSat.

BUENA VISTA Guatemala/España

U No debemos envidiarle nada a los hombres. Este proyecto muestra que Guatemala, pese a ser un país en vías de desarrollo, está dando los pasos correctos para avanzar en el mundo de la tecnología y la innovación. Como ingenieras, tenemos un desafío tecnológico, pero que debemos demostrar que somos capaces de vencerlo. Este proyecto es un desafío para las mujeres guatemaltecas, pero, también, un reto para el mundo. Este proyecto es un desafío para las mujeres guatemaltecas, pero, también, un reto para el mundo. Este proyecto es un desafío para las mujeres guatemaltecas, pero, también, un reto para el mundo.

FIRST MAURITIAN SATELLITE – OPENING NEW OPPORTUNITIES

JOURNEY TO SPACE ALTHOUGH NOT EASY BUT EXTREMELY REWARDING AND OFFERS HIGHLY PROMISING FUTURE

MAURITIUS EMBARKS IN NEW SPACE ERA

- Geolocation interesting for future space related activities
- More advanced space nations interested to collaborate

ENTHUSIASTIC YOUNGSTERS

- The training program on antenna building gave us an insight of the high level of enthusiasm for this new field. There is hope to enhance this interest further to build new capacity.



BOOST TECHNICAL CAPACITY

- Building highly technical capacity
- Sophisticated ground station for future missions set up
- Training of younger generation

GOVERNMENT FULLY SUPPORTIVE

- This historical initiative for the Republic of Mauritius promises to unlock new opportunities for research, innovation and socio-economic development.

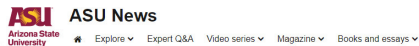
A POTENTIALLY NEW SOCIO-ECONOMIC PILLAR

opportunities for Mauritius. Data &D, business and technological collaborations.

Aerospace, AI and Digital Centre



ESPIITA was able to grow, to expand by inauguration **AEROSPACE, AI AND DIGITAL CENTER** on **July 2022**



Guatemalan team launches nation's 1st CubeSat, wins Interplanetary Initiative prize

International student team recognized for its success through adversity



June 6, 2022

When members of the team that built the Quetzal 1 CubeSat watched their satellite take off on a SpaceX Falcon 9 rocket in 2020, it was the culmination of six years of hard work, overcoming financial and personnel hurdles, and challenging cultural barriers.

That hard work and ingenuity has garnered the team the CubeSat Delivery Prize award through Arizona State University's [Interplanetary Initiative](#). The award is just the latest step in the team's remarkable journey.

Free and Forced Oscillations of Magnetic Liquids Under Low-Gravity Conditions

Authors: Roberto Cabas, Gabriel Cano Gómez, Elena Castro-Hernández, Filippo Maggi

Check for updates

Author and Article Information

Appl. Mech. Feb. 2020, 87(2): 821919 (9 pages)

Paper No. AM-19-1411

Published Online: December 19, 2019

Standard View PDF Share 66 Citations

187 International Journal of Numerical and Analytical Methods in Mechanics

LATERAL SLOSHING OF MAGNETIC LIQUIDS IN MICROGRAVITY

Authors: Roberto Cabas, A. J. García-Sánchez, F. Gómez, E. Castro-Hernández, M. A. Hernández Gutiérrez, F. Maggi

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Author and Article Information

Final results!! COSPAR 2021

Materials Sciences in Space (S2)

Drop Tower Demo (S2S2)

Consider for oral presentation.

AXISYMMETRIC AND LATERAL FREE SURFACE OSCILLATIONS OF FERROFLUIDS IN MICROGRAVITY

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3. How has participating in DropTES changed the environment around you?

CIDIMEC

Know our work and impact

Research Areas

Last Publications

MECHATRONICS DEPARTMENT

3. How has participating in DropTES changed the environment around you? Cont'd (3)

In Feb. 2017 I was elected to be the President of the American University of Madaba (AUM) in Jordan. That month AUM started the Innovation project for its students and for high school students in Jordan at large.





Access to Space for All

Structure of the initiative

HYPERGRAVITY AND MICROGRAVITY

Building capacity for conducting experiments in orbit



Hands-on opportunities in hypergravity and microgravity from ground to orbit



Open source tools bridging hands-on and education components



Educational material for building up experiments

SATELLITE DEVELOPMENT

Building capacity that enables the development, deployment, and operation of satellites



Hands-on opportunities for satellite deployment



Open source tools bridging hands-on and education components



Educational material supporting the whole life-cycle of satellites

SPACE EXPLORATION

Broadening the engagement in space exploration



Hands-on opportunities to engage in space exploration



Open source tools bridging hands-on and education components

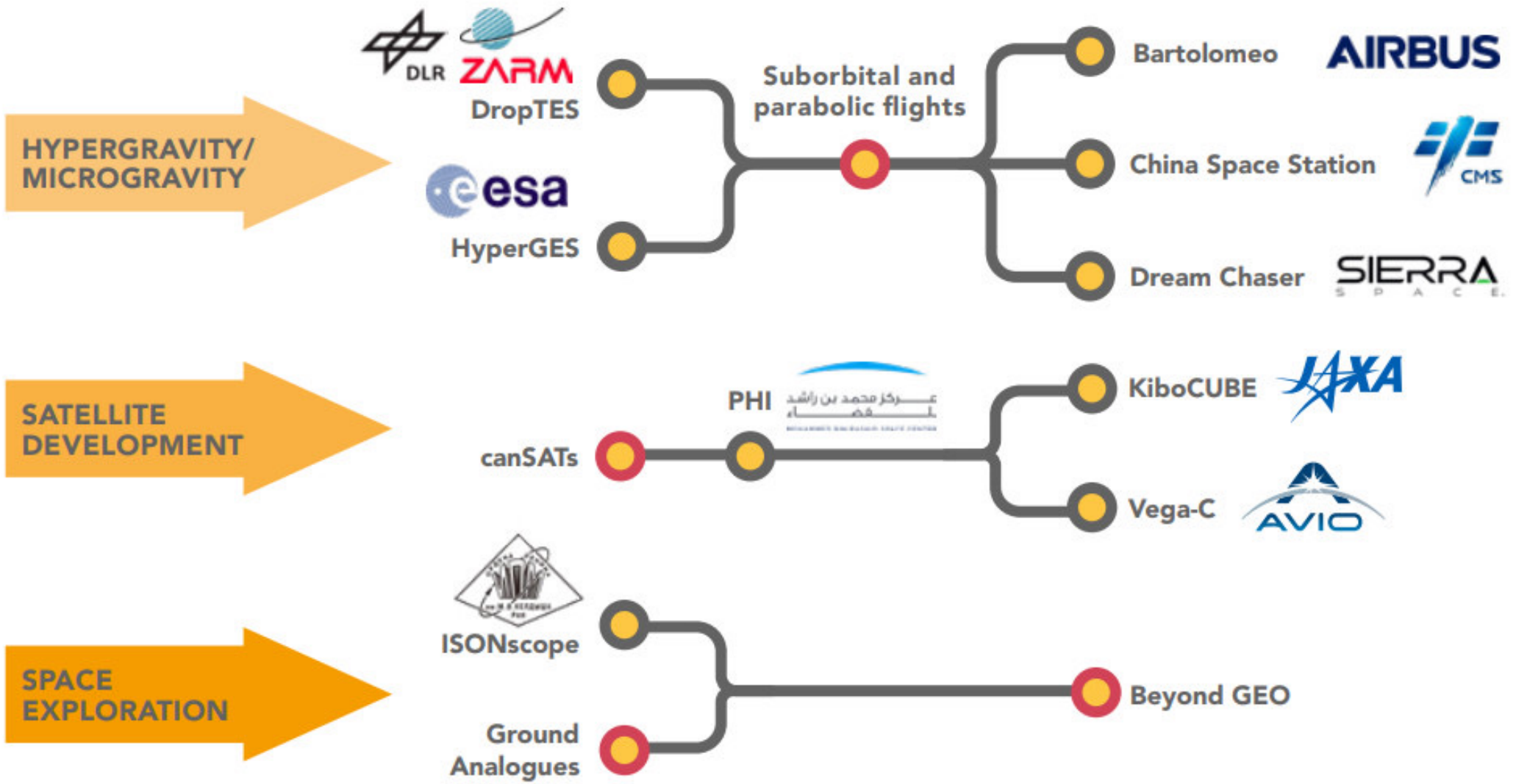


Educational material for space exploration




Access to Space for All

Hands-on Component



- 
- **Achievable entry point** to acquire knowledge and skills through conducting various experiments in many different scientific fields
 - **Beneficial first step to start capacity-building** for space activities

- 
- A satellite in space, viewed from a low angle. The satellite has a complex structure with various instruments and a robotic arm. Large solar panels are visible, extending from the main body of the satellite. The background is the blackness of space.
- CubeSats offer a **large variety of applications**
 - CubeSat development can be the first step for a country in **the acquisition of the skills and know-how needed to develop a space programme**
 - CubeSats are **affordable to develop and represent an achievable entry point** to space activities.

- 
- Increasing capability in astronomy/observation and space data analysis can **deepen scientific knowledge and support necessary technology for monitoring space debris, managing space traffic, and future exploration beyond GEO**
 - Space exploration can **motivate the young generation** who are the leaders of tomorrow
 - Space exploration is an international effort and it can **foster international cooperation**



Access to Space for All

Hypergravity/Microgravity Track



DropTES



Partners: ZARM (Center of Applied Space Technology and Microgravity) and DLR (German Aerospace Center)

- Established: 2014
- Aims to provide educational or research institutions with opportunities to conduct a series of **microgravity experiments** at the Bremen Drop Tower in Germany.
- The drop tower experiment series consists of **5 drops or catapult launches** to be conducted within one week. Each experiment series is accompanied by an on-site experiment integration taking place one week prior to the campaign.
- 7 experiments have successfully been conducted with the programme.
- Currently open for applications until 22 January 2023.**



2014 German Jordanian University



2015 & 2020 Universidad Católica Boliviana "San Pablo"



2016 Universidad de Costa Rica



2017 Warsaw University of Technology

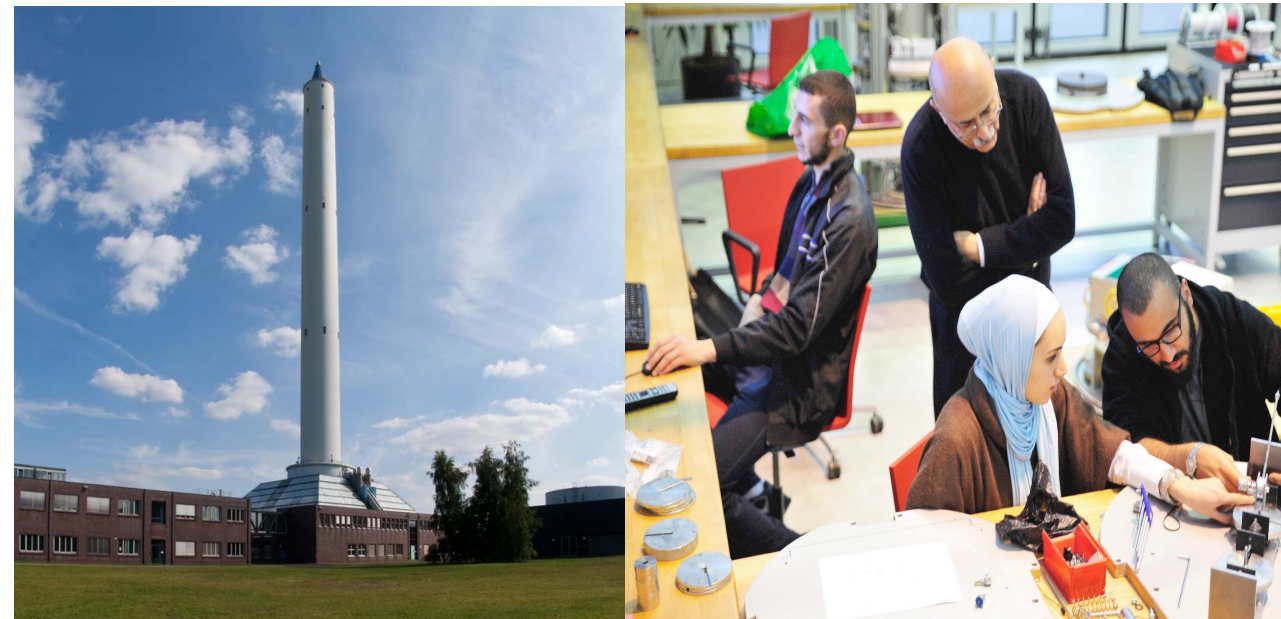


2018 University of Bucharest Politehnica



2019 Politecnico de Milano "Polimi"

Photo credit: ZARM





Access to Space for All

Hypergravity/Microgravity Track

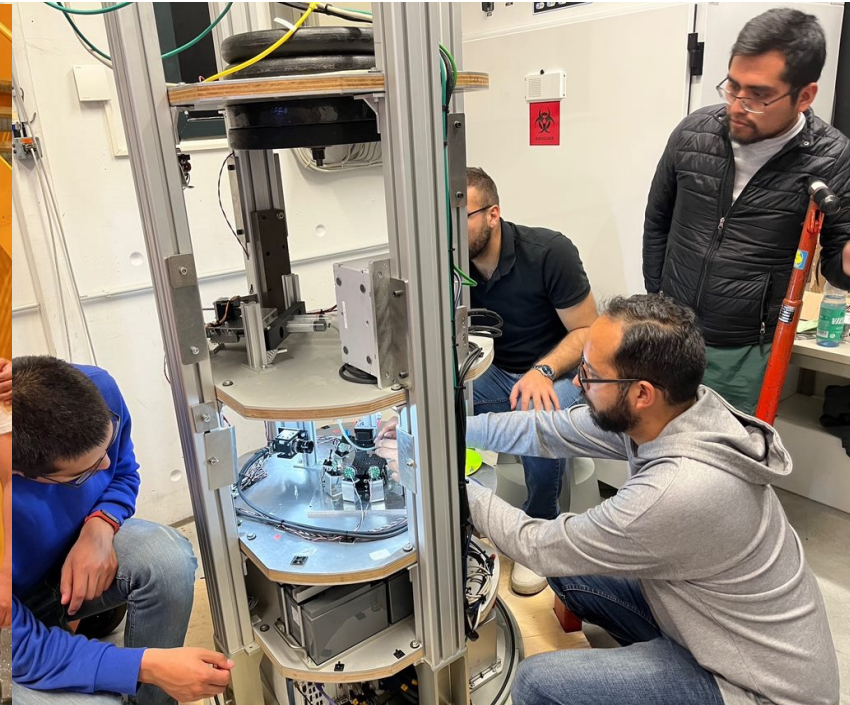
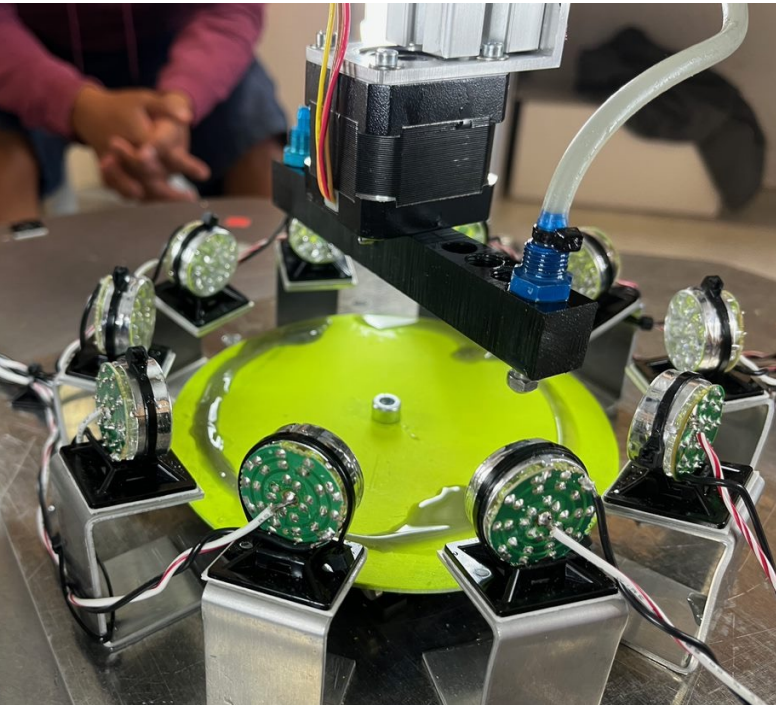


Universidad Católica Boliviana "San Pablo" awardee of DropTES 2nd & 7th round

- In 2015, the team **examined and evaluated the property of Nitinol**, which is a metal alloy often used in medical devices.
- In 2022, the team tested **3D printing techniques using liquid resin**, which could lead to new applications in various fields.



The **technical expertise and skills acquired through the experiments** helped develop ventilators during the COVID19 pandemic.





Access to Space for All

Hypergravity/Microgravity Track



HyperGES



- Partner: ESA (European Space Agency)
- Established: 2019
- Aims to provide educational or research institutions with opportunities to conduct a series of **hypergravity experiments** at the Large Diameter Centrifuge (LDC) facility at the European Space Research and Technology Centre (ESTEC) in the Netherlands.
- The LDC allows samples to be exposed to acceleration forces of 1-20 times Earth's gravity. The experiment series consists of 1-2 weeks for on-site experiment integration/preparation and actual experiment campaign.
- The first round awardee is a university in Thailand which will test the effect of hypergravity on watermeal, as a **possible food source for space exploration**.
- **Currently open for applications until 18 November 2022.**

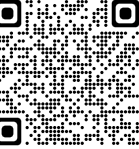
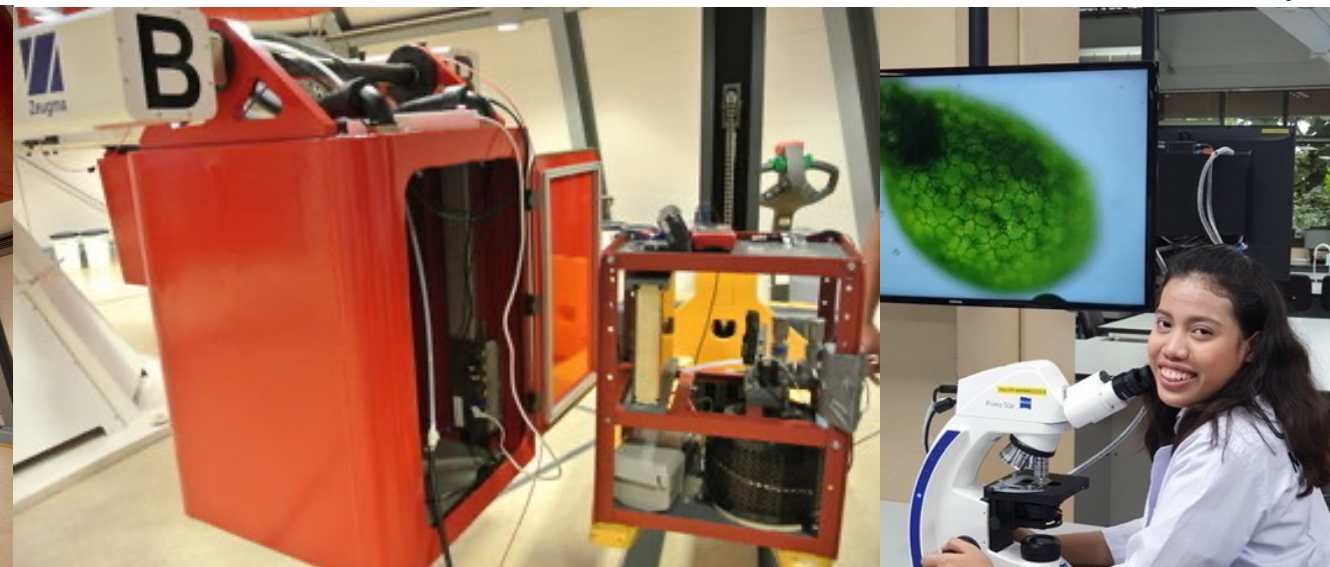


Photo credit: ESA



Photo credit: Mahidol University





Access to Space for All

Hypergravity/Microgravity Track



Bartolomeo



- Partner: Airbus Defence and Space
- Established: 2018
- Aims to provide institutions with opportunities to **accommodate a payload on the Airbus Bartolomeo external platform on the International Space Station.**
- The opportunity is for a **3U CubeSat payload** which will get an "All in One" Space mission service (integrated, launched, installed as a part of the Bartolomeo for a mission operation span of a year)
- The first round was awarded to a team formed by 3 African countries, Egypt, Kenya and Uganda which will develop an **imaging system to monitor climate change in East Africa**, to be launched in 2024.

AIRBUS



Photo credit: Airbus

Photo credit: IAF

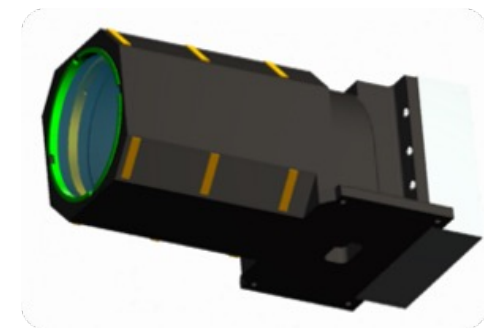
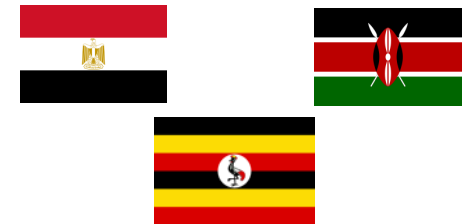


Photo credit: EgSA



Access to Space for All

Hypergravity/Microgravity Track



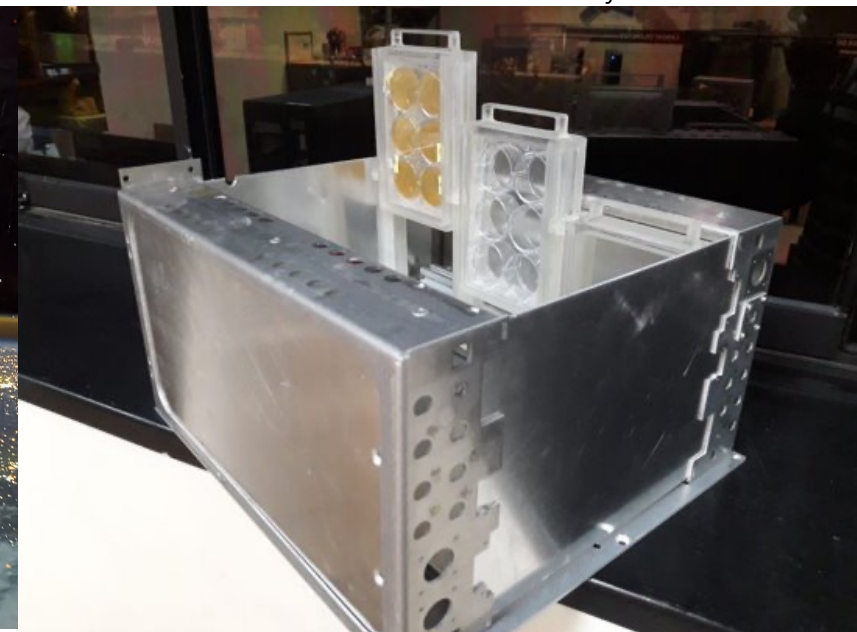
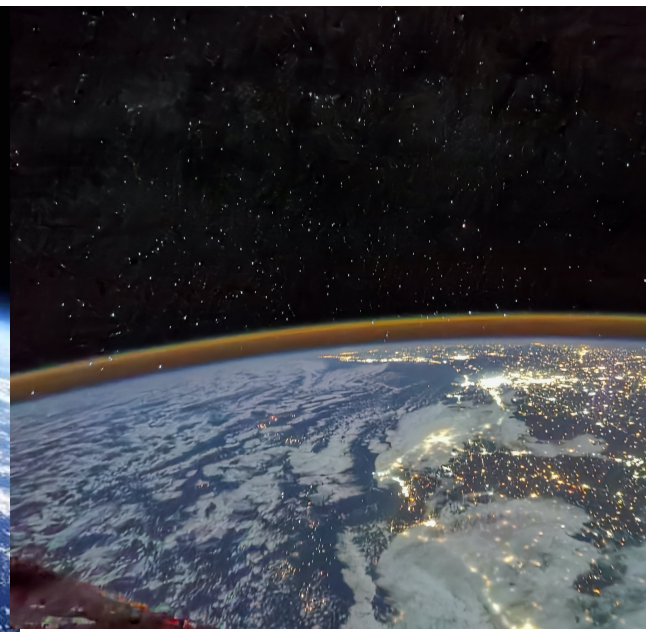
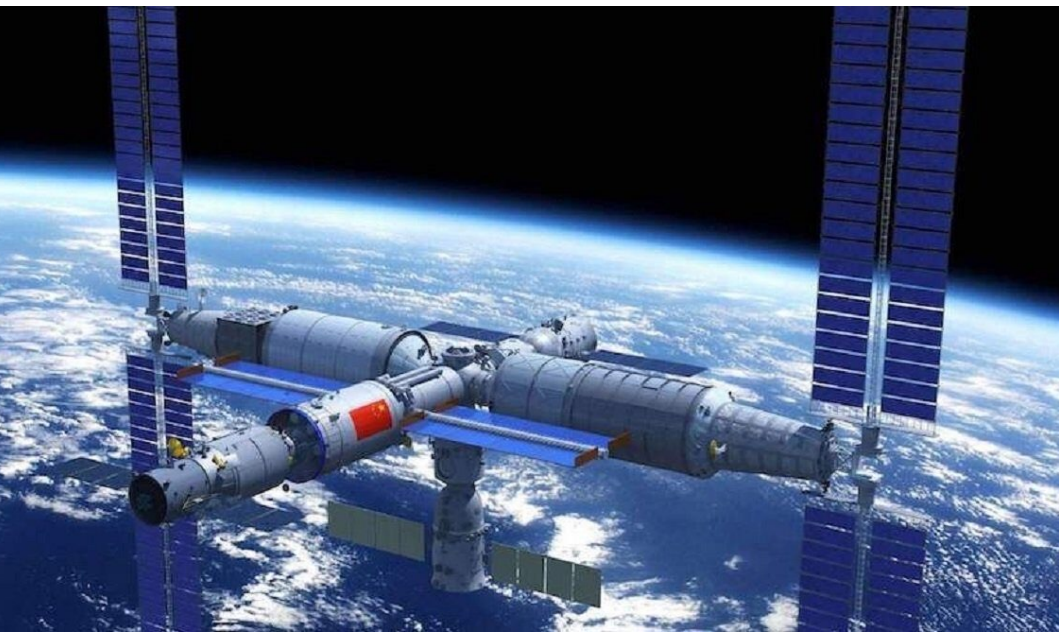
China Space Station



- Partner: CMSA (China Manned Space Agency)
- Established: 2018
- Aims to provide scientists from around the world with opportunities to **conduct their own experiments on board the China Space Station (CSS) either inside or outside the CSS.**
- **8 projects involving 22 institutions from 17 UN Member States** has been selected for the first round. The research areas vary from life science, biotechnology, fluid physics, combustion, astronomy to space technologies.
- Few of the projects are scheduled to be launched to the CSS in 2023 to start their on-orbit experiments.

Photo credit: CMSA

Photo credit: Mars Society Peru





Access to Space for All

Satellite Development Track

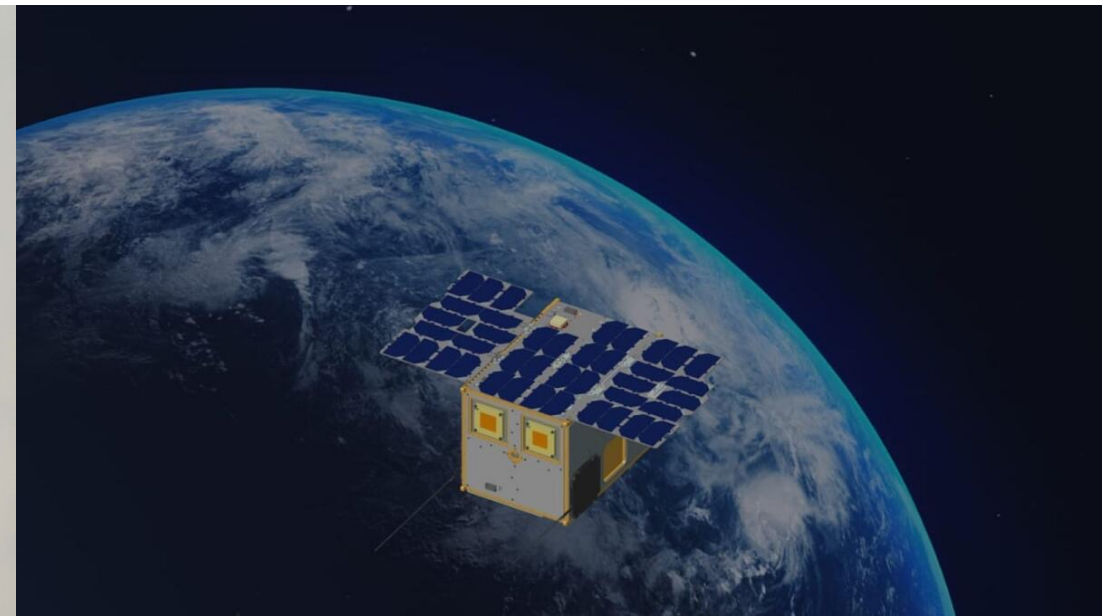


Payload Hosting Initiative (PHI)



- Partner: Mohammed Bin Rashid Space Centre
- Established: 2021
- Aims to provide opportunities for **hosting a payload (up to 5U) on a 12U PHI modular satellite platform** developed by MBRSC.
- The first round opened for applications in January and closed in April 2022. 2 teams from Bahrain and Nepal have been selected in October 2022. Bahrain will test communication between the satellite and the ground station/Internet of Things (IoT) terminals. Nepal will study the operation of middleware for drones in space.

Photo credit: MRBSC





Access to Space for All

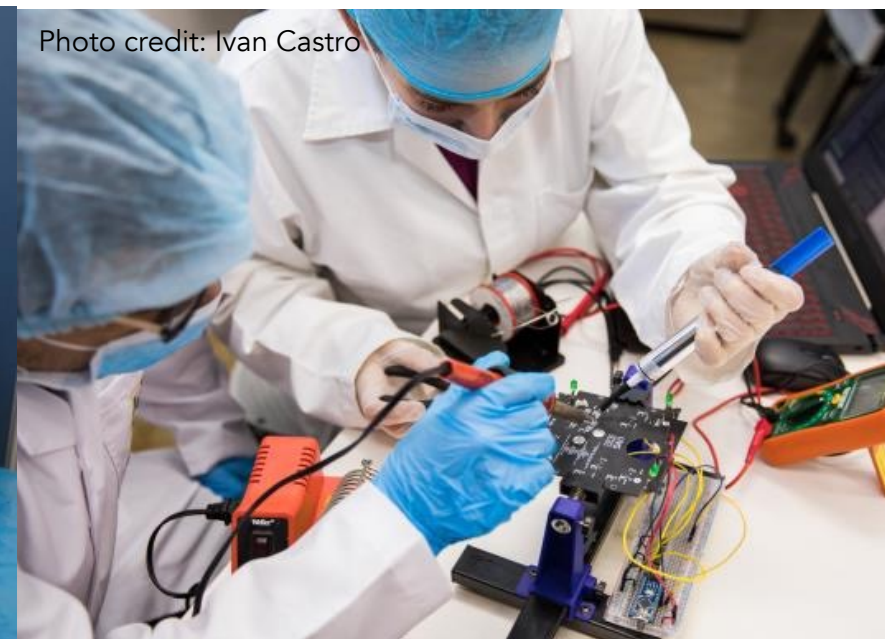
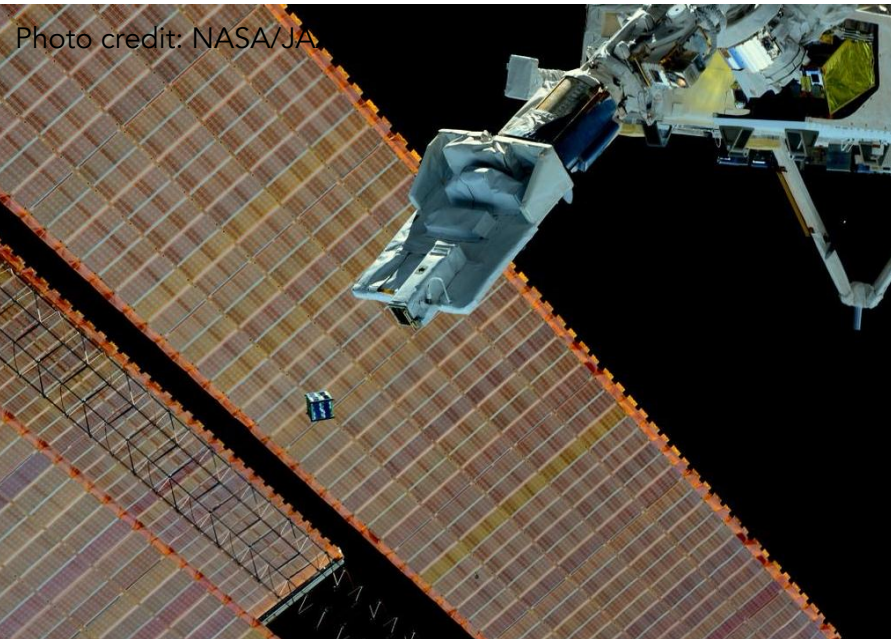
Satellite Development Track



KiboCUBE



- Partner: JAXA (Japan Aerospace Exploration Agency)
- Established: 2015
- Aims to provide educational or research institutions from developing countries with opportunities to **deploy 1U CubeSats from the Japanese Kibo module of the International Space Station**
- 4 CubeSats have been deployed; the first satellite of Kenya: "1KUNS-PF" in 2018, Guatemala: "Quetzal-1" in 2020, Mauritius: "MIR-SAT 1" in 2021, and Moldova: "TUMnanoSAT" in 2022.
- 4 CubeSats are under development in Indonesia, the Central America Integration System (SICA), Mexico, and Tunisia.





Access to Space for All

Satellite Development Track



Vega-C



- Partner: Avio S.p.A.
- Established: 2018
- Aims to provide educational and research institutions with opportunities to **deploy a CubeSat of maximum 3U size using the Vega-C launcher**
- The first round applications are currently under selection.



Photo credit: Avio





Access to Space for All

Space Exploration Track



ISONscope



- Partner: Keldysh Institute of Applied Mathematics, Russian Academy of Sciences
- Established: 2020
- Aims to **provide a small wide field-of-view telescope to educational or research institutions from developing countries**
- The cooperation is under the International Scientific Optical Network (ISON) and awarded teams are expected to contribute to the observation campaigns of ISON.
- The first round opened in 2021 and 2 African countries, Kenya and Nigeria have been selected.

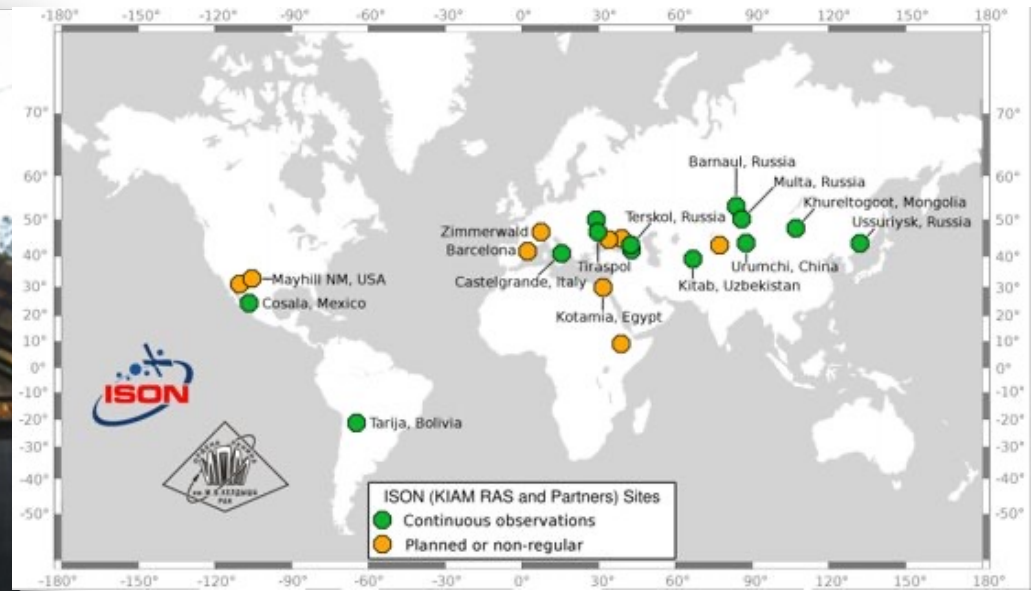
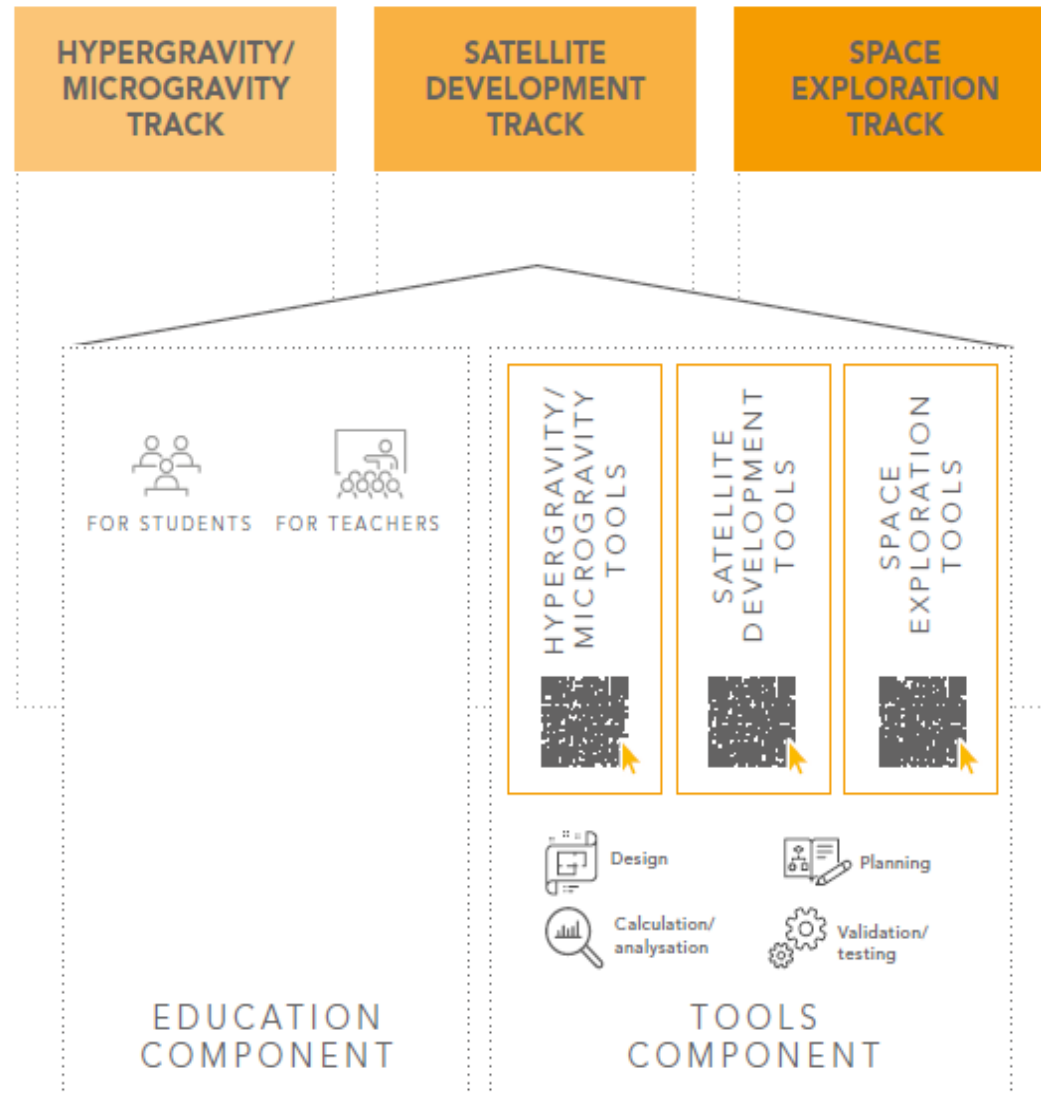


Photo credit: KIAM RAS



Access to Space for All

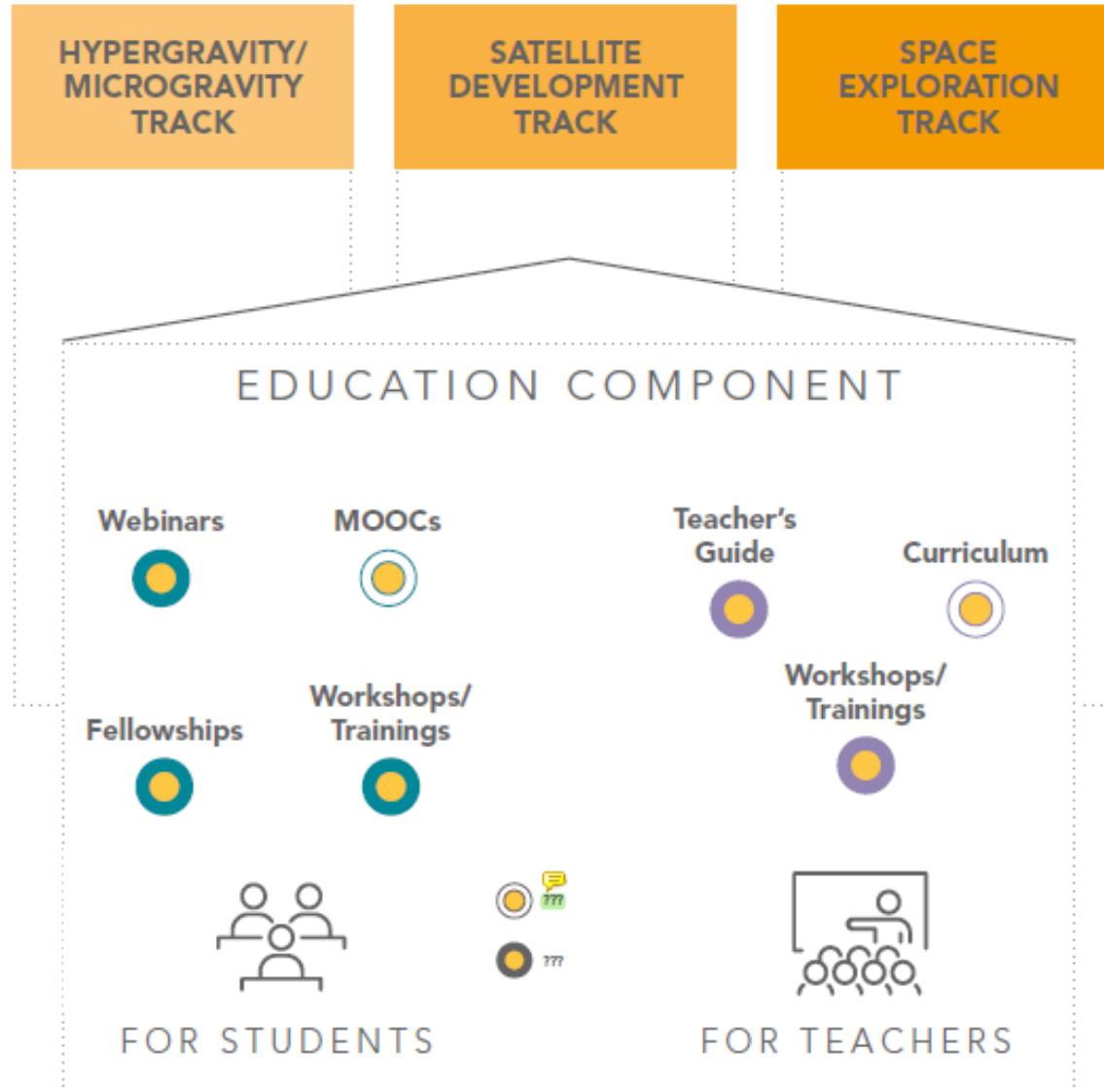
Tools Component





Access to Space for All

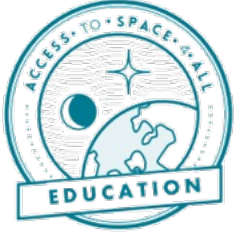
Education Component





Access to Space for All

Education Component



Conducting R&D in Hypergravity/Microgravity Webinar Series

9 webinars with 45 speakers from 40 entities in 13 nations

Covered technical and fundamental knowledge on:

- Benefits of conducting R&D in Hypergravity/Microgravity environment
- What type of R&D can be done (with examples from life science, physical science, and technology demonstration)
- Existing available platforms, opportunities, and networks

https://www.unoosa.org/oosa/en/ourwork/access2space4all/HMT_rack_Webinars.html#Tag6

No.	Contents
1	Introduction to Hypergravity/Microgravity
2	Life Science Part 1: Biology
3	Life Science Part 2: Physiology
4	Life Science Part 3: Pharmacology
5	Physical Science Part 1: Material Science
6	Physical Science Part 2: Fluid Dynamics
7	Technology Demonstration
8	UNOOSA Hypergravity/Microgravity Track Opportunities
9	Regional Hypergravity/Microgravity Activities

Space Biology and Altered Gravity

Why study biological effects of microgravity?

- All life on earth have evolved in the Earth's gravitational field. We have little knowledge of what happens to organisms in the apparent absence of this force.
 - Studies in microgravity will tell us how biological systems acclimate and adapt to this new environment.
 - Studies in microgravity will also reveal how gravity has driven evolution and continues to influence biological process on Earth.

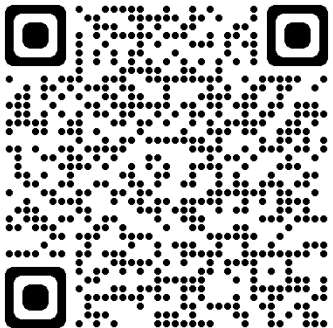
Why study biological effects of hypergravity?

- During space flight, living systems are not only exposed to microgravity, but also experience around 3 g during launch and 3+ g more landing.
- Chronic hypergravity models can be used complement and predict microgravity-associated changes (i.e., the shift from 2 g to 1 g may recapitulate aspects of the shift from 1 g or microgravity).

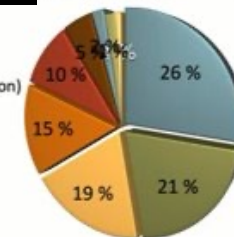
Gravity has (mainly) impact on:

- Weight
- Hydrostatic Pressure
- Convection
- Buoyancy
- Sedimentation

NB: Spaceflight holds more variables: e.g. isolation, radiation, (pressure, gas composition), stress, training,



- Combustion
 - Fundamental Physics
 - Fluid Dynamics
 - Astrophysics (Planet Formation)
 - Materials Sciences
 - Biology
 - Hardware Tests
 - Student Programs
 - Chemistry
- › fundamental research
› technology development (mission preparations)





Access to Space for All

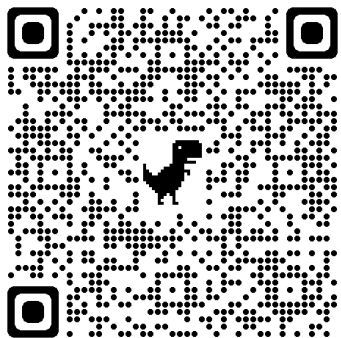
Satellite Development Track



KiboCUBE Academy

- KiboCUBE Academy aims to provide **theoretical knowledge to develop, operate and utilize small satellites.**
- Season 1 was conducted in January-February 2021 with 4 webinars and Season 2 between November-December 2021 with 3 live sessions, 21 pre-recorded videos, and technical consultation sessions.

https://www.unoosa.org/oosa/en/ourwork/access2space4all/SatDevTrack_Webinars.html#Tag1



No.	Contents of Pre-Recorded Lectures for Season 2
1	Introduction to Small satellite mission and Utilization
2	CubeSat for Capacity Building
3	Introduction to CubeSat Project Management
4	System Engineering for CubeSat
5	Introduction of J-SSOD and Safety Review process
6	CubeSat design for safety requirements
7	Introduction to CubeSat technologies
8	Subsystem Lecture for CubeSat (Power control system)
9	Subsystem Lecture for CubeSat (Communication system)
10	Subsystem Lecture for CubeSat (Command and Data Handling system)
11	Subsystem Lecture for CubeSat (Structure system)
12	Subsystem Lecture for CubeSat (Mechanism system)
13	Subsystem Lecture for CubeSat (Thermal control system)
14	Subsystem Lecture for CubeSat (Attitude Control System)
15	Introduction to CubeSat Environmental Testing
16	Orbit Dynamics of CubeSat
17	Introduction Operation technics and ground system
18	Introduction Payload for CubeSat
19	Satellite operation and Related Regulations (ITU etc.)
20	Space debris problem and Countermeasures
21	Lessons & Learned for CubeSat mission



Access to Space for All

Satellite Development Track

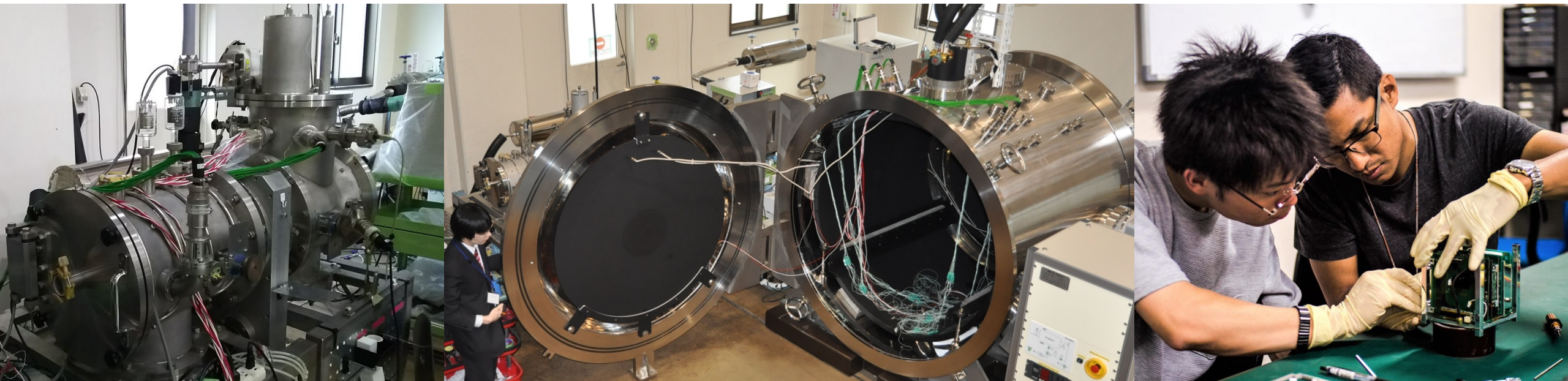


Post-graduate Study on Nano-Satellite Technology (PNST)



- Partner: Kyutech (Kyushu Institute of Technology) with the support of the Gov. of Japan (MEXT)
- Established: 2013
- Provides **3 students in the Master's Programme (2 years duration) and 3 students in the Doctoral Programme (3 years duration)** to enroll in Kyutech's **Space Engineering International Course (SEIC)** for a **hands-on, extensive research opportunity in nano-satellite systems through the use of the nano-satellite development and testing facilities** available at Kyutech.
- The selected fellows are expected to return to their home counties upon completion of their studies and contribute to their countries using the experience and knowledge gained from the programme.
- **Currently open for applications until 9 January 2023.**

Photo credit: Kyutech





Access to Space for All Satellite Development Track



Post-graduate Study on Nano-Satellite Technology (PNST)



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

United Nations Office for Outer Space Affairs
How satellite technology has opened new opportunities: From El Salvador to the world
 Interview conducted on 25 August 2021
 Institution: **Kyutech**
 Interviewee: Fatima Duran, Master's Student at Kyushu Institute of Technology from the Republic of El Salvador

Access to Space for All Initiative for Sustainability- Interview Series Article #2 July 2022
How Education Through PNST Contributes to the SDGs
 Interviewee: Prof. Meegu Cho, Director of the Space Engineering International Course, Kyushu Institute of Technology (Kyutech)
 Interviewee: Abhas Maskey, 2020 graduate of the PNST fellowship, Founder of Antarcitya Pratishthan Nepal
 Date: Interview conducted with Kyutech on 28 June 2022 and with Abhas Maskey on 13 July 2022

Background:
 The United Nations Office for Outer Space Affairs (UNOOSA), in partnership with the Government of Japan and the Kyushu Institute of Technology (Kyutech) through the UN/Japan Long-term Fellowship Programme Post-graduate study on Satellite Technologies (PNST).

The programme provides 3 masters and doctoral students from developing countries the opportunity to enroll in the Kyutech Space Engineering International Course (SEIC) to study nano-satellite systems. The chosen candidates receive a grant from the Ministry of Education, Culture, Sports, Science and Technology of Japan for the duration of their fellowship, covering housing, food, local transportation, and other expenses. In addition, each candidate is provided an economy class air ticket between an international airport in the country of his/her nationality and Narita or Fukuoka International Airport. Fees for matriculation, tuition and entrance examination are covered by Kyutech.

Fatima is a first-year master student in the programme since fall of the PNST fellowship, she obtained her bachelor's degree in aerosp Pusan University of South Korea and an associate degree in aerosp technician in Universidad Don Bosco, El Salvador. She is also a member of the Space Generation Advisory Council (SGAC) of El Salvador and the El Salvador Aerospace Institute.

In this interview, we spoke with her about her experience at I

Background:
 The United Nations/Japan Long-term 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 opportunities in nano-satellite development and the use of the nano-satellite systems through PNST facilities available at Kyutech and 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) and 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 is provided to the selected students, along with the collaboration that started in 2012. UNOOSA students from various developing countries, Many have returned to their countries to promote and develop space activities locally within their countries/regions.

The 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.

PNST Past 5 Year Beneficiaries Data UNOOSA

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

Students from different countries working together @Kyutech

www.unoosa.org





Access to Space for All Partnerships



SPACE AGENCIES



RESEARCH INSTITUTIONS AND UNIVERSITIES



PRIVATE SECTOR



17 PARTNERSHIPS FOR THE GOALS



UNOOSA and Space for Sustainable Development



Space for Women



Space Law for New Space Actors



UN-SPIDER



Access to Space for All



Space for Persons with Disabilities



Space Economy



Space for Climate Action



International Committee on GNSS



Space for Youth



Space Sustainability



Space for Water



UNITED NATIONS Office for Outer Space Affairs



**Any questions?
Interested in cooperation ?
Contact us**



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