Access to Space for All

Space Technology Capacity Building

UNITED NATIONS
Office for Outer Space Affairs

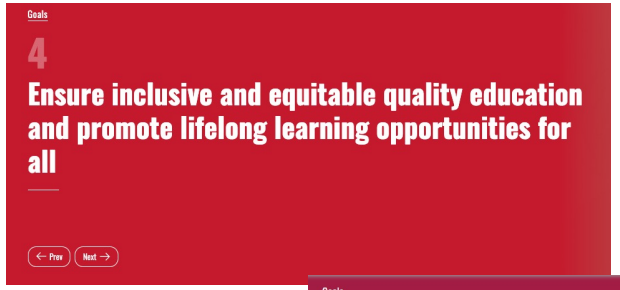
The goal of the Access to Space 4 All initiative is to provide research and orbital opportunities for UN Member States **to access space and to ensure that the benefits of space, in particular for sustainable development, are truly accessible to all**

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



SPACE4SDGS

Access to Space for All

Impact of the initiative

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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

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

BOOST TECHNICAL CAPACITY

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

A POTENTIALLY NEW SOCIO-ECONOMIC PILLAR

- Space offers numerous possibilities for Mauritius. Data analytics, opportunities for R&D, business opportunities, intergovernmental collaborations.

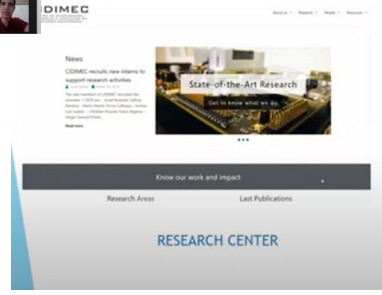
ENTHOUSIASTIC YOUNGSTERS

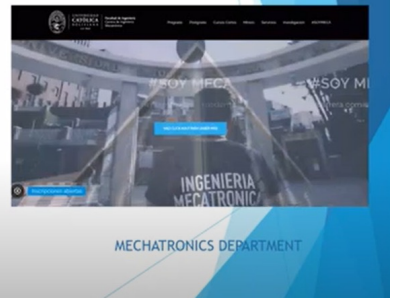
- The training program on antenna building gave us an insight of the high level of enthusiasm for this new field. There is hope to enhance this interest further to build new capacity.

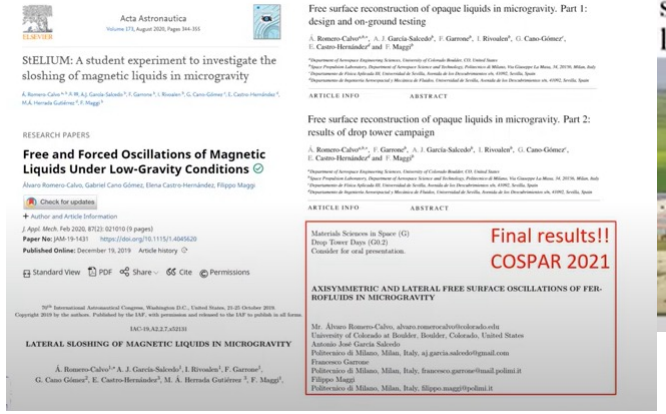
GOVERNMENT FULLY SUPPORTIVE

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

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







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

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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

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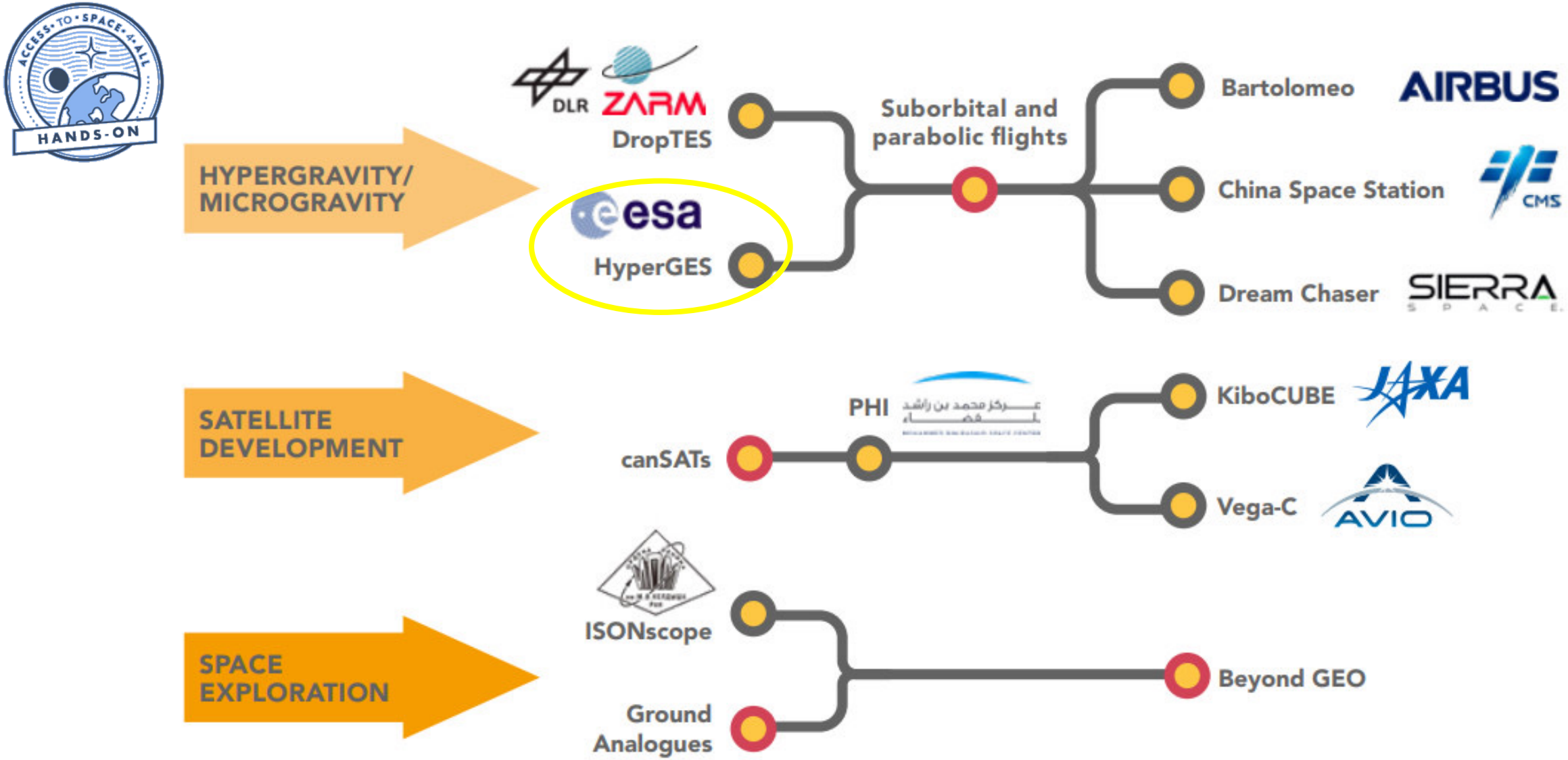
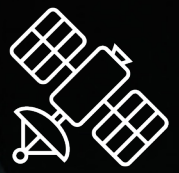


- CubeSats offer a **large variety of applications**
- CubeSat development can be the first step for a country in **the acquisition of the skills and know-how needed to develop a space programme**
- CubeSats are **affordable to develop and represent an achievable entry point** to space activities.

What is KiboCUBE?

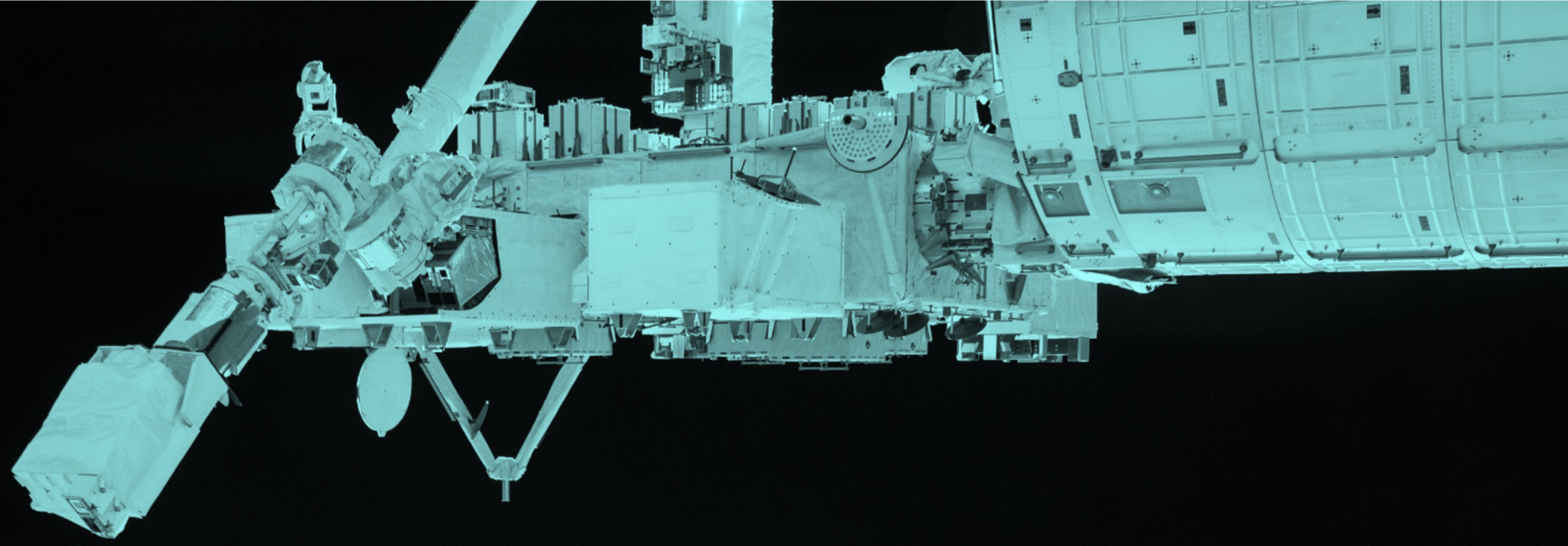
A cooperation programme between United Nations Office for Outer Space Affairs (UNOOSA) and Japan Aerospace Exploration Agency (JAXA) which started from 2015, implemented under the Access to Space for All Initiative.



Aims to provide educational or research institutions from **developing nations and economies in transition** with opportunities to deploy 1U cube satellites (CubeSats) which they develop and manufacture from the International Space Station (ISS) Japanese Experiment Module (Kibo)

Photo credit: JAXA

Why KiboCUBE?



Cost-efficient
JAXA will bear the cost of the launch of the CubeSat to the ISS and deployment from Kibo

Friendly environment for launch
Lower vibration since your CubeSat will be carried as cargo to the ISS

Support from OOSA/JAXA
Technical support from JAXA & other Japanese partners
Administrative support from OOSA

Photo credit: JAXA

Access to Space for All
Satellite Development Track

UNITED NATIONS
Office for Outer Space Affairs

KiboCUBE 1st Round Awardee: Kenya

- Institute: University of Nairobi
- Satellite: 1KUNS-PF
- Objective: To monitor agriculture and coastal areas
- Partnership: University of Rome (Italy)
- Deployed from ISS: 11 May 2018
- Re-entered atmosphere: June 2020

Achievements

- More than 300 images downloaded, surpassing initial expectations
- **Accelerated the creation of the Kenya Space Agency,** which led to more KSA participation in other Access to Space for All opportunities such as the Bartolomeo and ISONscope programme

Photo credit: JAXA

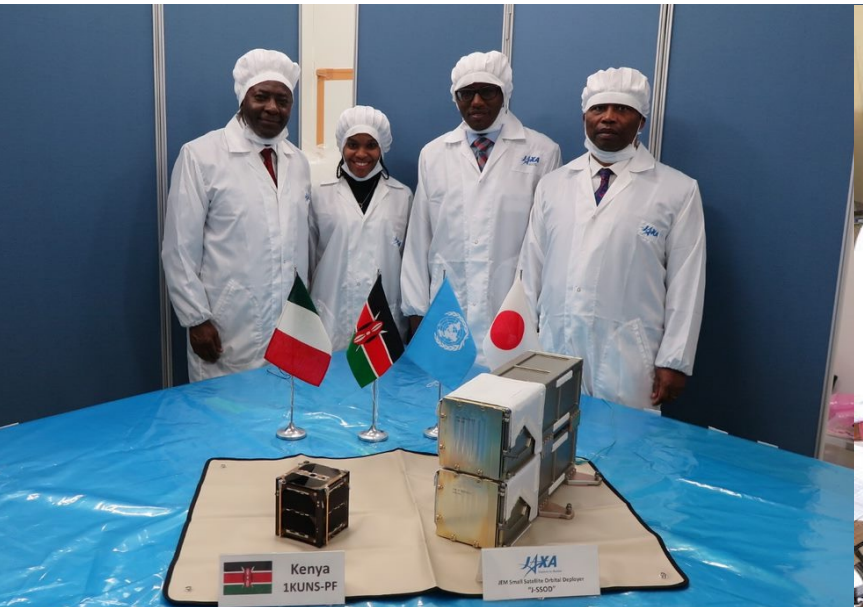


Photo credit: JAXA/NASA

Access to Space for All
Satellite Development Track

UNITED NATIONS
Office for Outer Space Affairs

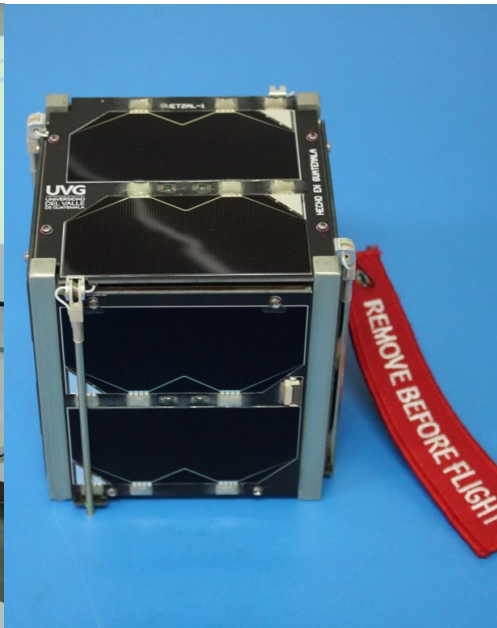
KiboCUBE 2nd Round Awardee: Guatemala

- Institute: Universidad del Valle de Guatemala
- Satellite: Quetzal-1
- Objective: To test the acquisition of EO data
- Partnership: Universitat Wurzburg, University of Alabama, University of Colorado Boulder, LASP, NASA, ESAC, UKSA, ASTROSAT, and more
- Deployed from ISS: 29 April 2020
- Re-entered atmosphere: August 2021

Achievements

- In operation for 211 days with 84,976 data packages received globally, **involved more than 100 students in the project, developed 70% of the CubeSat in-house.**
- **Conducted successful outreach activities** involving the media, workshops for young students (especially girls) & publishing books/documentaries

Photo credit: Ivan Castro



Access to Space for All
Satellite Development Track

UNITED NATIONS
Office for Outer Space Affairs

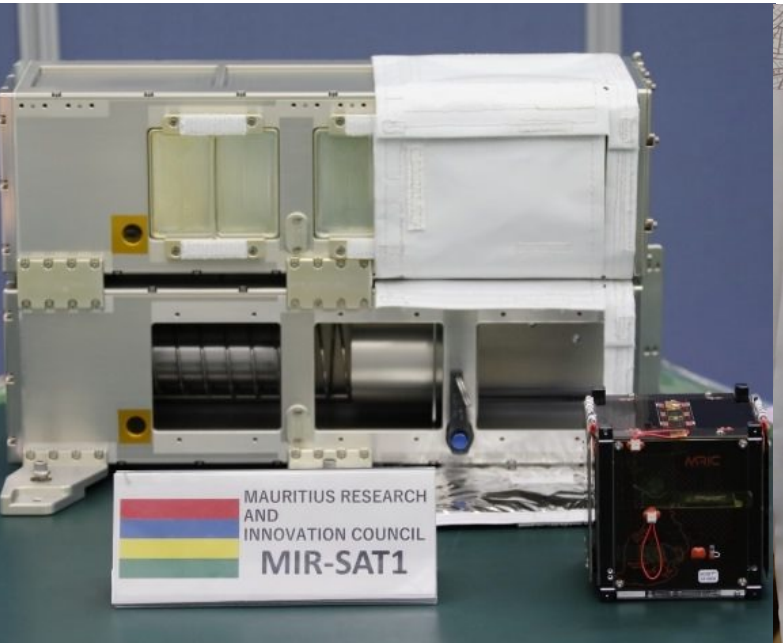
KiboCUBE 3rd Round Awardee: Mauritius

- Institute: Mauritius Research and Innovation Council
- Satellite: MIR-SAT 1
- Objective: To collect images and to test onboard communication
- Partnership: SSC Clyde Space
- Deployed from ISS: 22 June 2021
- Re-entered atmosphere: April 2022

Achievements

- One of the first Small Island Developing Nations (SIDs) to develop a satellite. Downloaded images of Mauritius and neighboring areas.
- **Conducted successful outreach activities** involving the amateur radio society and providing antenna workshops to over 100 students in 12 schools and 5 universities in the country.

Photo credit: JAXA




CLIN D'ŒIL

7 - 8 août 2021

SATELLITE MAURICIEN

Des collégiennes contactent MIR SAT 1

Elles sont comblées et fières de leur exploit. Le mois dernier, les élèves de la State Secondary School (SSS) Forest-Side Girls ont reçu des données de notre premier satellite mauricien, le MIR-SAT 1.

Les filles du collège SSS Forest-Side, avec leur enseignant, Vickram Mungul, et d'autres employés de l'établissement.

LE collège SSS Forest-Side collège est devenu le premier établissement scolaire de l'océan Indien à avoir communiqué avec notre vaisseau de l'espace.

L'idylle entre les collégiennes et la technologie des satellites s'est développée en 2019, lorsque le Mauritius Research Innovation Council (MRIC) a organisé un atelier sur le MIR-SAT 1.Vickram Mungul a monté l'équipe, constituée des filles de Grades 10 et 13. Il les a formées à la communication avec les satellites. Une première étape a été franchie lorsque les filles ont reçu avec succès leur première image du satellite américain NOAA, situé à quelque 860 km dans l'espace, et ont capturé les données du satellite russe Meteor-M N2.

Après le lancement du MIR-SAT 1, le 3 juin, les filles se sont mis en tête d'engager une communication avec le satellite. Leurs efforts ont payé lorsqu'elles ont effectivement reçu des données du MIR-SAT 1 et ont téléchargé la télémétrie sur SatNogs.db, ce qui a conduit à sa validation. «*Le représentant de la Mauritius Radio Amateur Society nous a annoncé, par téléphone, que la télémétrie est disponible sur le SAT NOG, une base de données grecque qui recueille des données satellitaires*», explique Vickram Mungul.

Cette annonce a créé l'euphorie chez les collégiennes. «*C'est une joie et une fierté immense de permettre à notre collège d'être la première école de l'océan Indien à avoir capté une communication avec notre satellite. Ce matin (NdlR, hier matin), j'ai appris que des élèves du Prof Hassam Raffia SSS ont également pu recevoir une communication*», se réjouit l'enseignant.

Chloé CHELVAN

LARM NWAR D'OSMOSIS PROJECT

Saluer la solidarité nationale

ASCENSIO

Deux ave

Photo credit: MRIC/MARS

Access to Space for All
Satellite Development Track

UNITED NATIONS
Office for Outer Space Affairs

KiboCUBE 4th Round Awardee: Moldova

- Institute: Technical University of Moldova
- Satellite: TUMnanoSAT
- Objective: Technology demonstration in various modules and subsystems of the CubeSat
- Partnership: Romanian Space Agency
- Deployed from ISS: **12 August 2022**

Achievements
Just deployed 2 weeks ago with live event in Moldova attended by the Prime Minister and other Ambassadors.

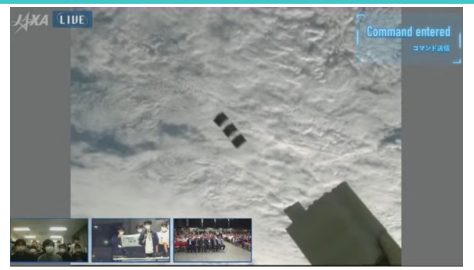


Photo credit: TUM

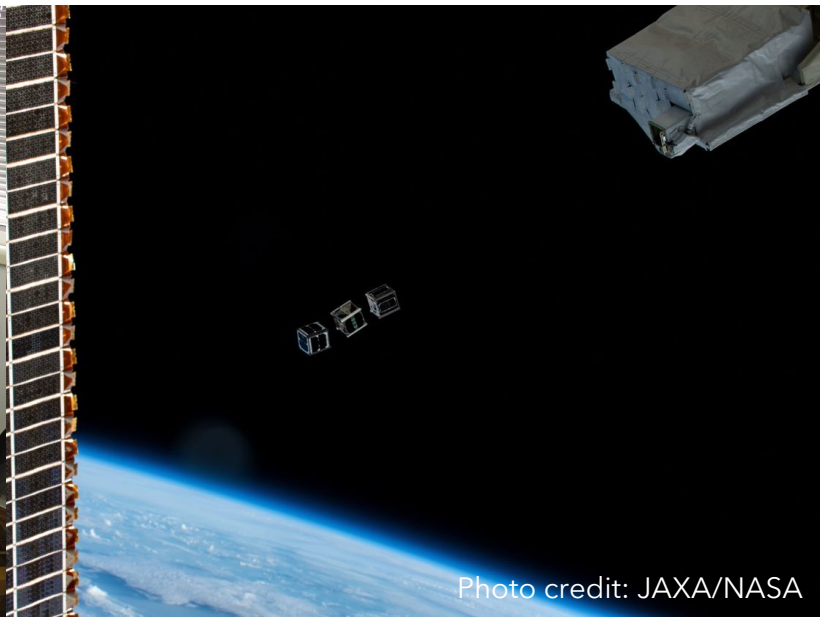


Photo credit: JAXA/NASA

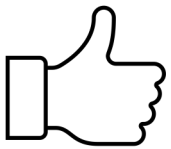
Access to Space for All
Satellite Development Track

UNITED NATIONS
Office for Outer Space Affairs

KiboCUBE Upcoming CubeSats

Round/Year	Winner	Objective	Status of Satellite
3rd round /Selected in 2018	**INDONESIA:** Surya University "SS-1"	To demonstrate remote communication	▪ Development completed and **waiting for launch in fall 2022**
5th round /Selected in 2020	**SISTEMA DE LA INTEGRACIÓN CENTROAMERICAN** "MORAZAN-SAT"	To monitor weather variables in remote areas providing early warning during extreme weather events	▪ Concluded CDR and currently under development
6th round /Selected in 2022	**MEXICO:** Universidad Popular Autónoma del Estado de Puebla "Gxiba-1"	To observe active volcanoes in Mexico and analyze the ash dispersion	▪ Currently under development
6th round /Selected in 2022	**TUNISIA:** Private Higher School of Engineering and Applied Technology of Tunisia "TUNSAT"	To demonstrate ground-space communication using self-build techologies	▪ Currently under development

… who is next?
It could be YOU



Access to Space for All
Tools Component

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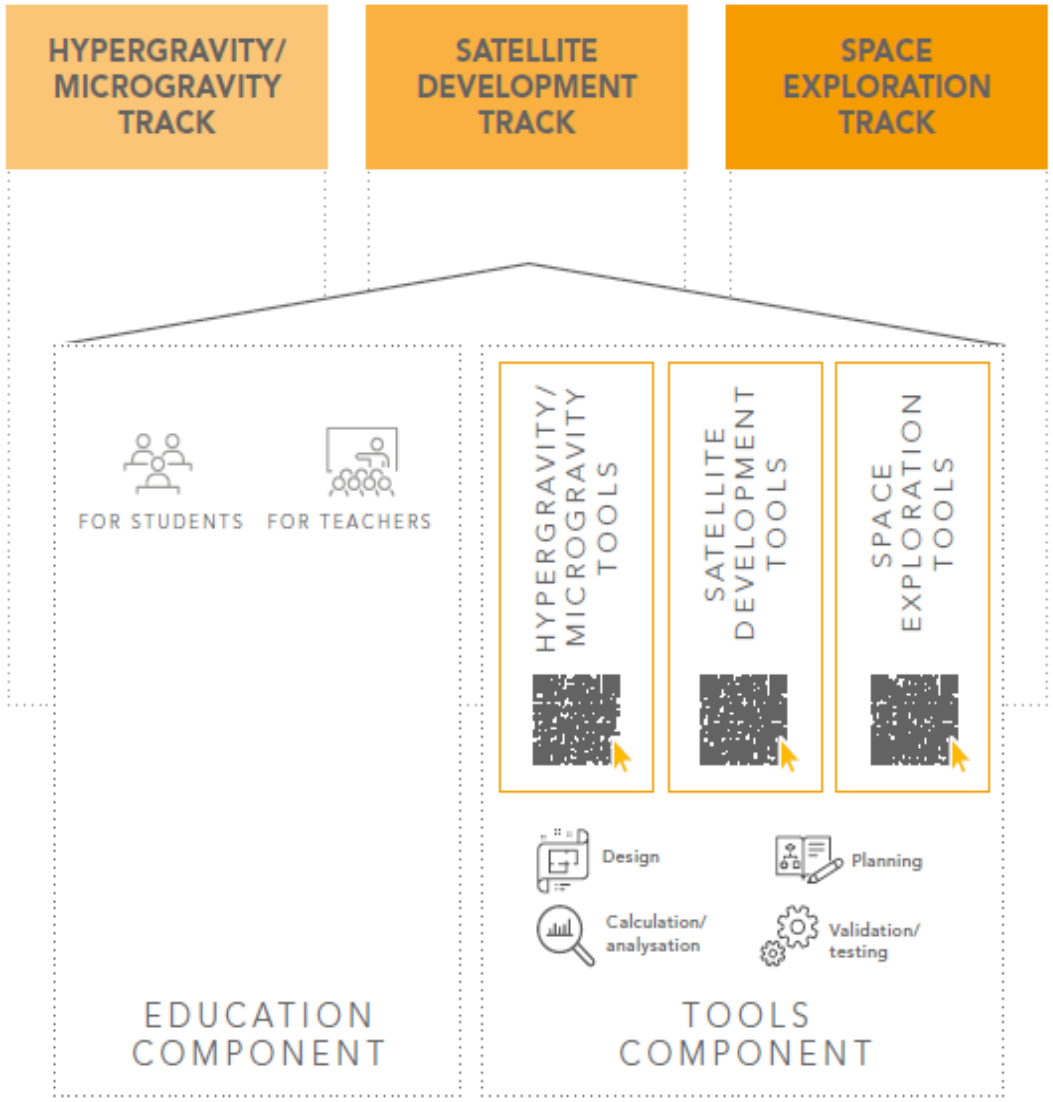

Tools Component

This list is work in progress. The tools listed are not endorsed by UNOOSA and are provided only for information. The tools are maintained by third parties. Each user bears sole responsibility for their use and the use of their results.

Design Development and Risk Assessment Tools

- CARA Analysis Tool Suit
  - *Conjunction Consequence Assessment* is an algorithm for determining the expected amount of debris production in case of collision
  - *Monte Carlo from TCA* is a method of determining the probability of collision
  - *Single Covariance Max Pc* is a method by which the maximum possible probability of collision could be determined for a close approach event for which only one object has position uncertainty information
  - *Two-Dimension Pc* is a method used to characterize and analyze close approach events and determine resultant probabilities of collision as a result of mitigation actions
- DAS The Debris Assessment Software
- DRAMA Debris Risk Assessment and Mitigation Analysis
- MASTER Meteoroid and Space Debris Terrestrial Environment Reference
- ORDEM Orbital Debris Engineering Model
- RABBIT Risk Avoidance assist tool based on debris collision proBaBIliTy
- Savi Satellite constellation visualizer and maker
- GMAT Trajectory optimization and design system
- Trajectory Browser A tool to find spacecraft trajectories to planets and small-bodies
- GNU Octave Scientific programming language featuring powerful mathematics-oriented syntax with built-in 2D and 3D plotting and visualization tool
- FreeCAD Computer-aided design software
- LibreCAD 2D-focused Computer-aided design software
- OpenSCAD Solid 3D Modelling-focused Computer-aided design softwar

Operations Tools

- GNU Radio Signal processing tool to implement software-defined radios and signal-processing systems
- gr-soapy A wrapper for GNU Radio
- gr-satnogs Telecommunications solution, operating in UHF and S-band. Closely integrated with SatNOGS Network
- gr-satellites A GNU Radio out-of-tree module encompassing a collection of telemetry decoders that supports many different Amateur satellites.
- Qubik Pocketqube mission for LEOP satellite identification and tracking
- LibreCube Software suite for space and earth exploration
- Polaris Machine learning for exploring and analyzing telemetry data
- PW-Sat2 Example of an On Board Computer (OBC)
- LAR-18740-1 Low Fidelity Space Systems Analysis Tools-Solar Cell/Fuel Cell/Battery Sizing Tool
- Open MCT A next-generation mission control framework for visualization of data on desktop and mobile devices
- Gpredict Real-time satellite tracking and orbit prediction application
- Operational Simulator for Small Satellites A suite of tools to aid in areas such as software development, integration and test, mission operations and training, verification and validation, and software systems check-out
- COSMOS Software that provides all the functionality needed to send commands to and receive data from one or more embedded systems
- Core Flight System A generic flight software architecture framework used on flagship spacecraft, human spacecraft, cubesats, and Raspberry Pi

End of Life and Deorbiting Tools

- ORIUNDO On-ground RIsk estimation for UNcontrolleD re-entries tOol

Access to Space for All
Education Component

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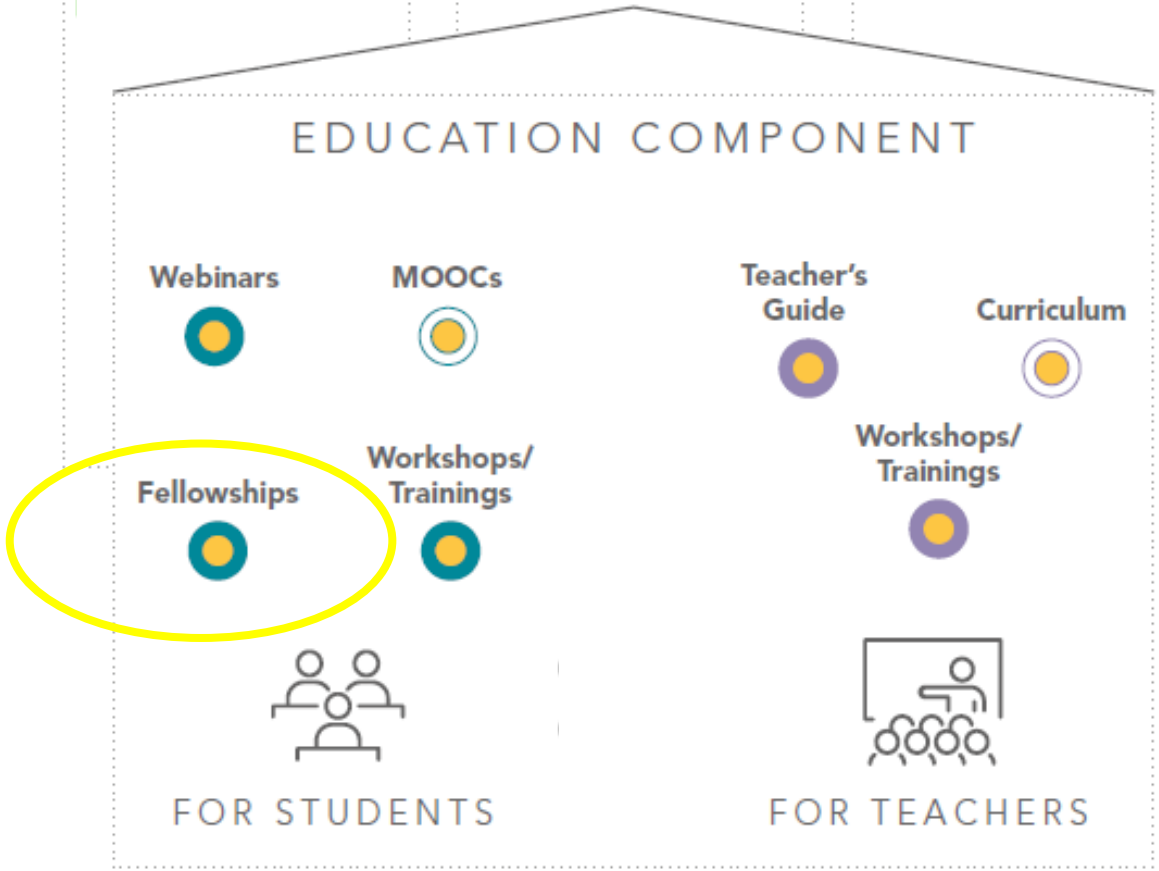
HYPERGRAVITY/ MICROGRAVITY TRACK

SATELLITE DEVELOPMENT TRACK

SPACE EXPLORATION TRACK

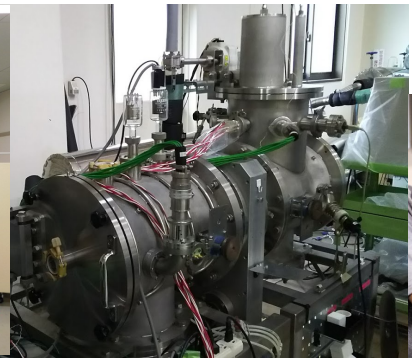


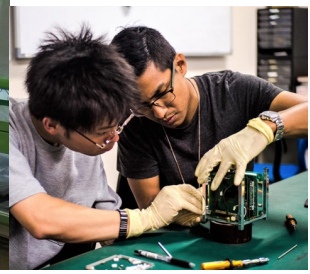
Fellowships

MEXT MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN

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

Kyutech
Kyushu Institute of Technology





Workshops

UN/IAF Workshop Space Technology for Socio-Economic Benefits

Access to Space for All
Satellite Development Track

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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

In partnership with: JAXA

Supported by: UNISEC University Space Engineering Consortium

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**

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Help us help #AccSpace4All

Download and learn more about us!

https://www.unoosa.org/documents/pdf/Access2Space4All/AccSpace4All_Brochure_final.pdf

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