UNISEC-Global The 30th Virtual Meeting

February 18, 2023, 22:00-24:00
(Standard Japan time GMT +9)

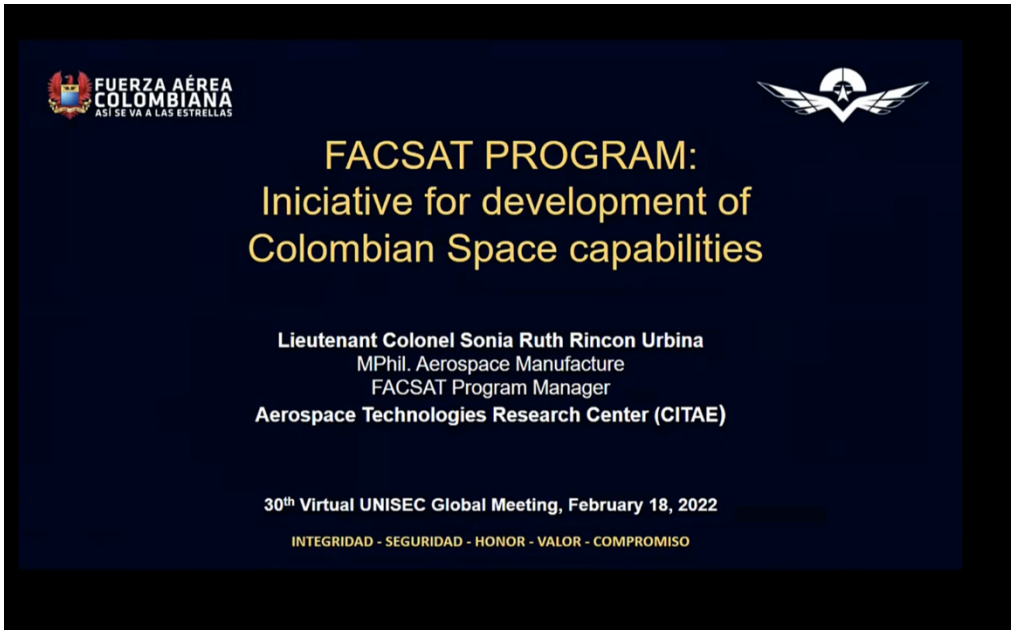
The following report was prepared by UNISEC-Global Secretariat
February 18, 2023
Japan

Table of Content

1. Presentation on “FACTSAT Program”

Sonia Ruth Rincon Urbina, Colombian Air Force

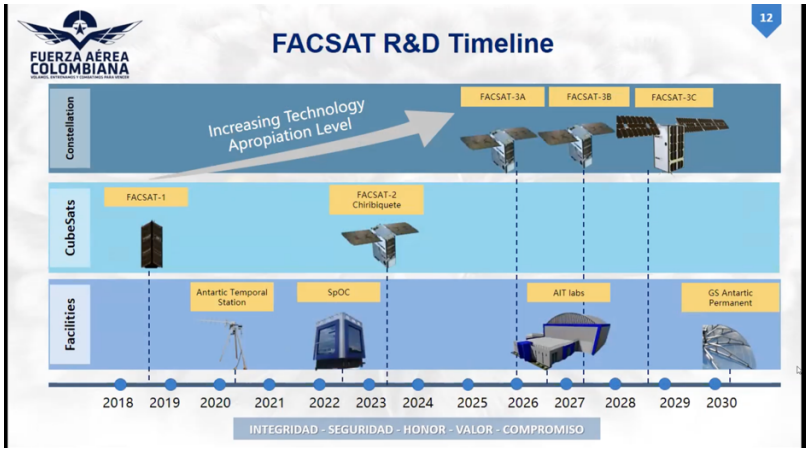
Col. Sonia Ruth Ricon Urbina studied at Universidad Industrial de Santander and Cranfield University. Col. Urbina has extensive experience in the Colombian Airforce spanning over two decades of experience. She is leading the Aerospace Research Center CITAE since 2018 at the air force and is currently the project manager for space mission FACSAT-2 from 2020. Her interests are aerospace, aircraft maintenance, manufacturing and testing.



Pictured: Col. Urbina’s presentation on Colombian space capabilities

Highlights:

- FACSAT program aimed to develop in-house satellite development capability
- Develop space culture and strengthen international cooperation through space
- Three programs include FACSAT-1, 2 and 3, maximize use of space technology in Colombia
- Colombia taking step up from space technology operating country to satellite manufacturing
- COLAF aims for four key aspects; legal, infrastructure, human capital and R&D
- Collaboration between civil society, academy, government, private sector and defense
- Space Complex include Space Operation Center (SpOc) and AIT Laboratory
- S-X band operation, testing of satellites up to 100kg class, "Horus" and "Kairos" data processing
- Creating space ecosystem by on-the-job training, degree programs, internships, local supply chain
- Constellation FACSAT-3A,3B and 3C by 2028 with establishment of AIT labs by 2026
- Established Antartic Temporal Station in 2020 and future plan: GS Antartic Parmanent by 2030
- Increasing complexity in design, FACSAT-2 Chiribiquete this year (2023)
- FACSAT-1 mission was Earth Observation (EO) mission with Ground Sampling Distance 30m
- Operation lifetime 3-5years with 3555 acquired data
- AI for data post-processing through super resolution and GEOMASK software for open mines
- FACSAT-2 Chiribiquete main mission is EO and Green House Gas (HGH) analysis
- Payloads on FACSAT-2
    - Simera Multiscape cis 100 with 4.7m/pixel
    - Argus 2000 Spetrometer 1000 to 1700nm
- Lifetime expected around 3-5 years and operations done by SpOc
- Achievement includes Ground Segment Software called KAIROS and payload data encryption
- End to End testing done in X-band between Engineering Model (EM) and Ground Segment (GS)
- Substantial progress by Colombia in space sector, development of space ecosystem is priority



Pictured: FACSAT program's timeline until 2030

Q&A

I am interested in the Antarctica ground station. What is the reason to choose Antarctica?
Col. Urbina: Maybe I forgot to mention but this is a Sun Synchronous Polar Orbit. That is why we wanted to have the ground segment in the poles to have more link connections with the satellites. This allows us to download more data using this ground segment. Initially we used the antenna to test the telemetry with FACSAT-1. We also got to understand functional and non-functional requirement for this concept to put an antenna in the Antarctica. With FACSAT-2, we plan on deploying a second antenna. That allows us to receive data from the satellite regarding gases which supports our scientific knowledge. That is the main reason. To have more opportunities to download the data.

I am wondering about the data collected by FACSAT-1. Can it be shared for academic purpose?
Col. Urbina: Yes it can be shared. You can find the data through the links on our FACSAT-1 website. You can also send us an email asking exactly what type of data, image of the territory and we can send it to you.

2. Presentation on "Aerospace Engineering at Universidad del Valle"

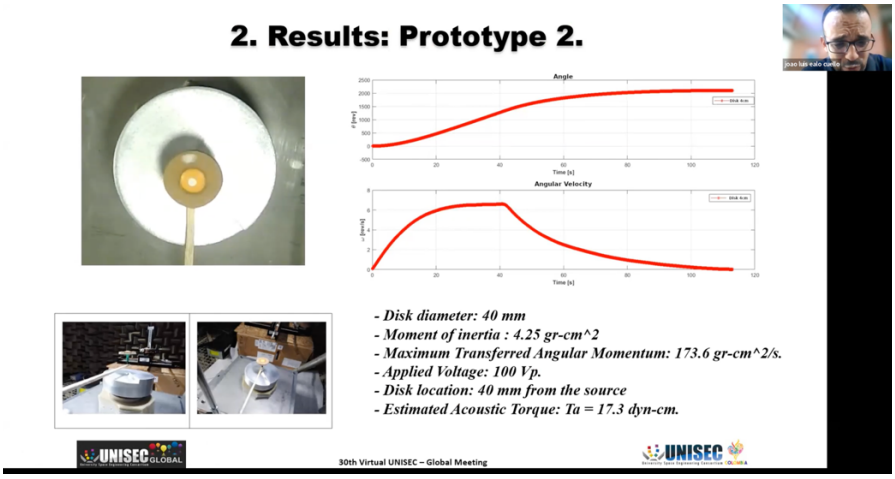
Jaolo Luis Ealo C., Universidad del Valle Cali

Dr. Jaolo Luis Ealo C. is with the School of Mechanical Engineering of the Universidad del Valle, Cali, Colombia, since 2002. In 2009, he obtained his doctorate degree in Mechanical Engineering from the Polytechnic University of Madrid, Madrid, Spain, supported by the Institute for Industrial Automation of the Spanish Research Council (CSIC) and the University of Valle. His current research interest is aimed to explore different transducers technologies to be used in air-coupled ultrasonic applications, such as, acoustic imaging, non-destructive testing and robot navigation. This comprises the design, fabrication, modeling and electro-mechanical-acoustical characterization of new devices.

Pictured: Dr. Ealo presents about 10 years of challenges and achievements of his academic institution

Highlights:

- Universidad del Valle has 348 academic programs, about 30,000 undergraduates, 3000 graduates
- Faculty of Engineering: 10 schools, 152 PhD students, 399 master students, 195 Professors
- Master program in Aerospace created in 2009 with the initiative of Colombian Airforce
- Research in
    - Aerodynamics and Propulsion
    - Aerospace materials and structure
- Navigation and Automatic control
- Alumni of the university is playing an important role in developing space tech in Colombia
- Master thesis include attitude control, orbit research, numeric modelling, antenna development
- Vortex beam research for angular momentum transfer, potential for particle/object manipulation
- Vortex beam generation: helical, multi-transducer, active diffraction gratings
- Acoustic-Structure Interaction: particle manipulation and angular momentum transfer
- Vortex beam generation technology
    - Phased array system + Multi-transducer which can transfer energy
    - Ferroelectret-based developable surface generators
- Exp results: for freq between 130-170 kHz, focal points shift from 20mm to 32mm approximately
- Sonotrode-based prototype produce AV in air (Acoustic Vibrations + Ultrasonic Vibrations)
- Vortex beam generators are available and can be used for water and air
- A good quality vortex can be produced as long as the helical geometry vibrates in phase
- At 180Vp, sound pressure levels of up to 148 dB can be obtained at 4cm from source
- Applications include ultrasonic propulsion, attitude control, microgravity simulation



Pictured: Dr. Ealo showing a protype of a vortex beam generator

Q&A

I was wondering how we can use this nice vortex for attitude control?

Dr. Ealo: Yes, once we generate the vortex beam, you are able to get the reaction to the vortex.

Follow up: You need to have a medium right?

Dr. Ealo: Yes, that is correct.

3. Presentation on "SeleneCo-1 Mission"

Mario Armando Higuero Garzon, Universidad Nacional de Colombia

Dr. Mario Armando Higuero Garzon has a PhD in Physics from Universidad Nacional de Colombia. He has worked in the same university as a researcher since 1996. Currently Dr.Garzon is an Associate Professor at Universidad Nacional de Colombia and is the head of Observatorio Astronomico Nacional-UNAL and AstroCo in Colombia. He is skilled in Matlab, physics, data analysis, strategic planning and science.

Pictured: Dr. Garzon presenting about UNAL's lunar space program

Highlights:

- The moon is again in the sights of most of the important space agencies again, working together
- Artemis program will form a base in the moon and test technologies for Mars
- Comision Colombiana Del Espacio (CCE) develops, coordinates and implements space policy
- CCE is an entity directly attached to the President of Colombia
- Benefits of space include technology development, commercial/social incentives, PPP collab
- Cheaper to go to space and all of non-space fairing nations can access space in the era Space 4.0
- May 10, 2022, Colombia became 19th country to sign the Artemis Agreement based on Peaceful exploration of space
- First astronomical observatory in America was built in Colombia back in 1803 AD
- Observation is targeted towards Garavito Craters
- During the 200th anniversary of the observatory, a dream to launch first rover to moon conceived
- Idea finally took shape in 2020 with a proposal to design a moon rover
    - Concept to deposit time capsule in the moon
    - Develop collaboration amongst industry, academia, society and government
    - Boost aerospace industry in the country, talent building
- SeleneCO-1 to Moon's Garavito Crater, technology demo of service module with payload
- Julio Garavito (part of Artemis plan) to demonstrate and test Colombian capabilities
- Initial stakeholders are group of Colombian companies
    - Fregata Space, Astronomico Nacianal De Colombia, ICRA, ACDA, Orion, ENCISO
- Primary need for Colombia is to be have competitive human and technology space resource
- Secondary need is to create economic activities for space development
- Also make discoveries in moon surface; frozen water, solar radiation, rock structure, composition
- Julio Garavito mission is to explore the lunar surface, tech demo using COTS and collaboration
- NASA's system's engineering methodology for product life cycle and space mission
- V-process methodology, currently defining preliminary mission requirements (MDR-PDR stage)
- Command and Telemetry using Deep Space Network-Artemis, space launch by SpaceX-Artemis
- Space segment are Microrover (Colombia), Space Transport, Orbiter and Lander (Astrobotics)

Q&A

Thank you, these are very ambitious projects. I was wondering about the preliminary results, especially with the rover and lander specification. Am I right?

Dr. Garzon: Yes, it's a very large project. Now we are in the first part to establish the minimum structure and subsystem we have to improve. The capabilities of the rover based on the dimensions because those requirements are necessary to put to place the lander to the moon. At this moment, we are working on subsystem basics to improve and create this kind of rover.

Dr. Murcia: Right now we are looking at all the possibilities, the outcome of the preliminary studies and looking for possible solutions. And we are looking at architecture and selection of the lander, and the commercial payload

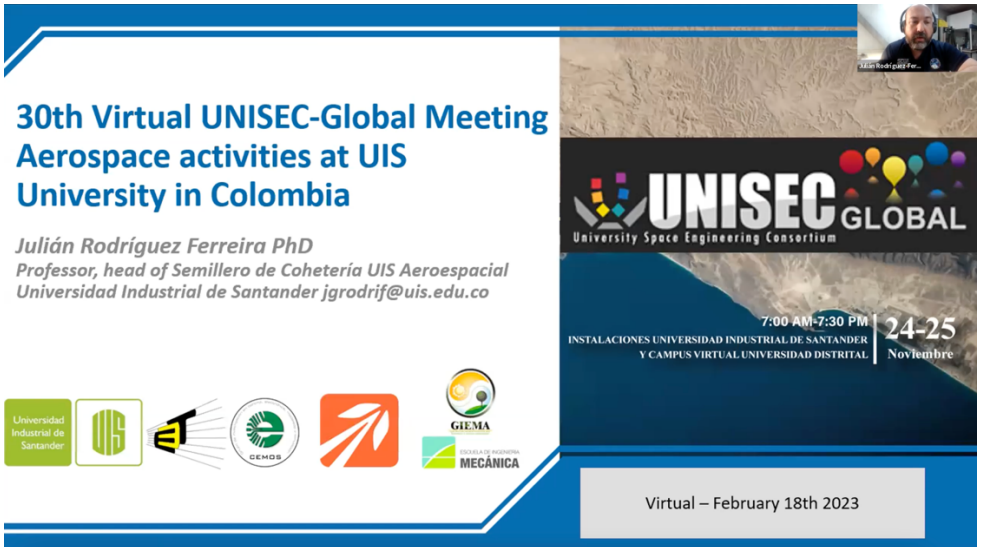
service of the launcher. Right now the main outcome is to develop and calculate the feasibility of the mission. It's a new project with a lot of risk and we are studying all of the risk, cost. The next part is to understand the outcome of the commercial transportation system. We are understanding the requirements of specific segment and space systems.
Dr. Garzon: I compliment with a final idea. It's a project that links our historical past with our observatory from 1983. Today for the people who are working in that area, hopefully we can launch this rover by 2030.

Thank you, for the interesting presentation. What is the expected time frame for deploying the rover in the moon?
Dr. Garzon: It is very difficult in this moment to put a date in the future. The idea is 2032 to put the rover on the moon. Depends on many situations. One of them is for Colombia to improve efficiency of our space activity. Also depends on collaboration with all the institutions involved in space. Also depends on the capability of Artemis program or Chinese program to put effort in this project in the future.

4. Presentation on "Aerospace Activities at UIS University in Colombia"

Julian Rodriguez Ferreira, Universidad Industrial de Santander

Dr. Julian Rodriguez Ferreira did his PhD from Institute d'Astrophysique Spatiale (CNRS), Paris in Astronomy and Astrophysics. He is currently an assistant professor in the department of School of Electric, Electronic and Telecommunications Engineering at Universidad Industrial de Santander. Dr. Ferreira does research in Experimental Physics, Optics and Climatology. Their current project is 'E3Tratos mission.'

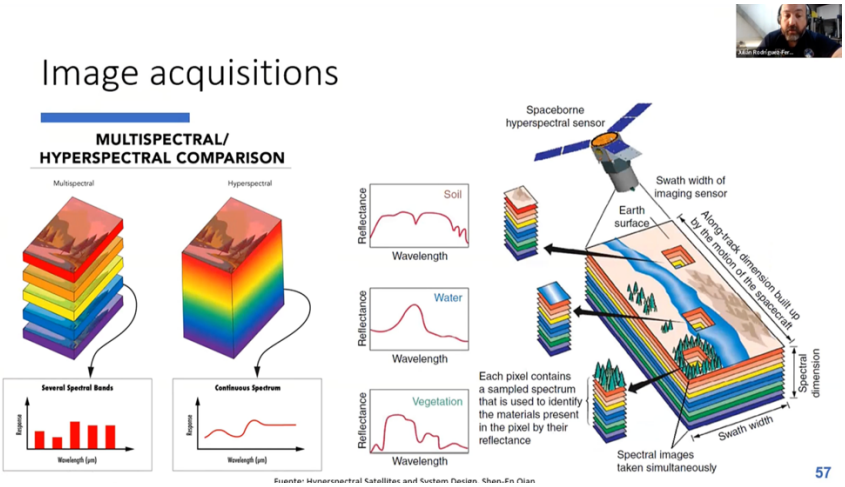


Pictured: Dr. Ferreira outlining some of the work being done at UIS University of Colombia

Highlights:

- Trained in Europe, back now in Colombia
- 4 Channel optical instrument developed
    - Spectrometers and Imagers for MPO BepiColombo Integrated Observatory System
    - Channels include VIHI (25mm), HRIC (90mm), STC up and STC down (both 15mm)
    - French and Italian collaboration and submitted to ESA, launched in 2021
- Earth observation payloads for forest protection, air pollution
    - mainly through several platforms, scientific instruments and telecommunication system
- Half of the country is forest, but rapid deforestation especially after peace agreement
- Organization Semillero de Coheteria UIS Aeroespacial focused on research, outreach, education
- Currently 40 undergraduate students (15 women), 7 postgraduate students, 5 Professors

- Started with small rockets in 2016, improving each year while increasing number of students
    - Rocket is small called Hickam
    - 300m, R-Candy
- Growth because of contests, school outreach and activities on campus
- Won several international competitions including "Deep Space Food Challenge" from NASA
- Research topics: ballooning, drones, CanSat, high powered rockets, satellites, human exploration
- Rocket is designed based on additive manufacturing and modularity
- Design for manufacturing and assembly (DFMA) approach
- CanSat inside the rocket to measure atmospheric data such as CO2, CO, NO2, NH3
- Balloon with embedded sensors will be launched from Barrancabermeja
- The proof-of-concept testing of the balloon
- Final stage dev. of Tunable Diode Laser Absorption Spectroscopy (TDLAS), measure CO2
- Working together with Colombian Airforce for satellite payload development
    - Hyperspectral camera to observe Colombia from space
    - Sunsynchronous orbit, 2 passes per day over Colombian territory
    - The camera has optics of 400nm-900nm RGB-NIR with a Jetson TX2 controller
    - The camera will take up 1.5U of the 3U CubeSat, currently being tested at the airforce
- Developing patch antenna for 2GHz communication with 5.5 dBi gain
- Currently in Antartica as part of the 9th Colombian Scientific Expedition to Antartica

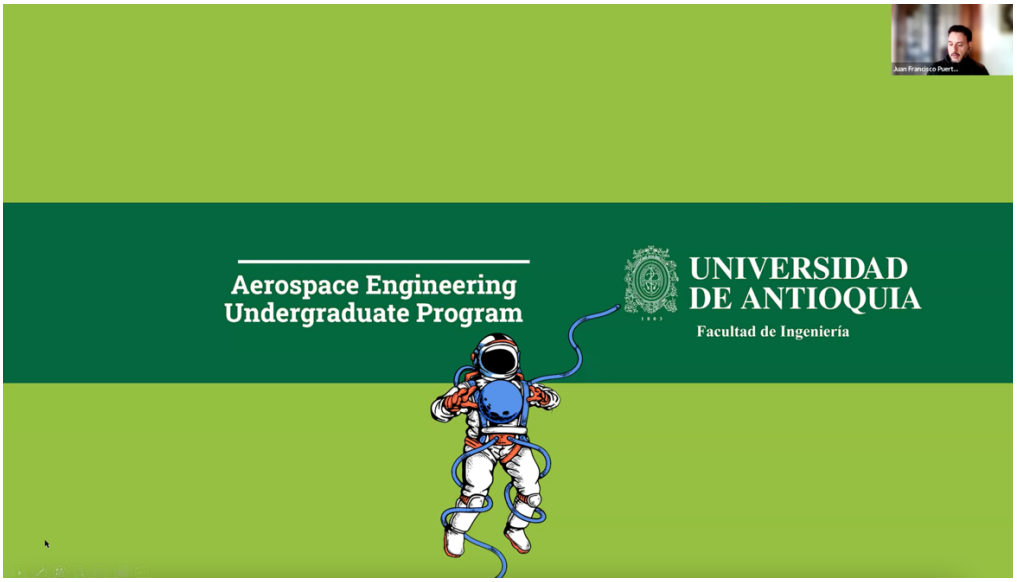


Pictured: Dr. Ferreira outlining hyperspectral camera development at the university

5. Presentation on “Aerospace Engineering Undergraduate Program at Universidad de Antioquia”

Juan Francisco Puerta Ibarra, Universidad de Antioquia

Mr. Juan Francisco Puerta Ibarra graduated from the University of Southampton with a Master of Science (MSc) in Space Systems Engineering. In his personal research project and dissertation, he completed the analysis of the future of space launch activities to create a new model based on the climate change approach to forecasting how populated can space get based on space exploration. I used the information gathered by the European Space Agency (ESA), The Intergovernmental Panel on Climate Change (IPCC) and The National Aeronautics and Space Administration (NASA) to develop a future feasible scenario for the creation of the model, establishing a new method for forecasting space launches. He is currently a lecturer for Universidad de Antioquia in the aerospace engineering faculty in subjects regarding orbital mechanics, space sustainability and software development.



Pictured: Mr. Ibarra's presentation on aerospace engineering program at Universidad de Antioquia

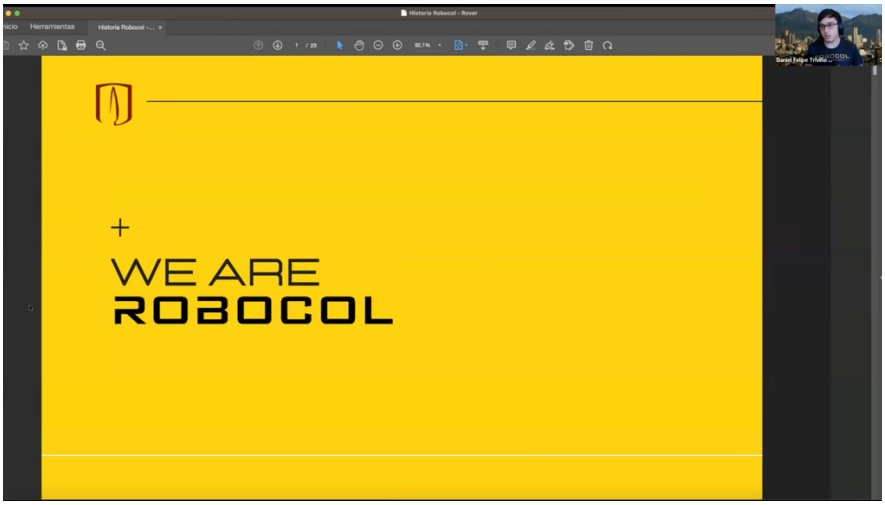
Highlights:

- La Universidad de Antioquia is the oldest public institution in Colombia located at Medelin
- Aerospace Engineering Program founded in 2017, almost 160 students involved from beginning
- Aerospace has Astonautics and Aeronautics program
- Program focused on research group called Aerospace Science & Technology Research (ASTRA)
- Voyager (Avioni cs, Space Vehicle), Delta-V (Rocketry, Propulsion) and Debrisk (Space debris)
- Student Activity: CanSat competition in 2020 participated nationally
- Student Activity: AIAA space design competition came third
- Student Activity: Zaggi AESS race came first in 2022
- First project is creating a module for spacecraft control in collaboration with Uni. de los Andes
- Second is a suborbital committee for launching suborbital missions using rockets
- Collaboration between university, air force and government

6. Presentation on "ROBOCOL Program and Student Initiatives"

Danial Trivino, University of Los Andes

Mr. Danial Trivino is an undergraduate student at University of Los Andes and is one of the student leaders of ROBOCOL Program at the university.



Pictured: Mr. Trivino providing information on ROBOCOL Program

Highlights:

- Team Robocol: more than 60 students from 7 majors in University de Los Andes
- Passion to develop robotics projects
- Working on three projects; submarine, drone, robot called Roberto for community purposes
- Values include innovation, learning, excellence, integrity, resilience and team work
- The past rover project: Robocol participated in NASA's Robotic Mining Competition
- Social impact: teach robotics to students in Bogata
- Participated in European Rover Challenge in Poland, 16 engineers built REM-U in 2018
- During pandemic, participated in virtual European Rover Challenge, where the team came 3rd
- For preparation for University Rover Challenge in Utah,USA, practiced in Tatacoa desert
- Qualified for University Rover Challenge, becoming the first South American team to do so
- 4th Gen of Robocol, improvement in engineering, design processes and organizational structure

7. Announcement and Acknowledgement

Rei Kawashima, UNISEC-Global

Pictured: Kawashima-san announcing the latest updates from UNISEC

- **New Point of Contact (POC)**
  - Dr. Pooja Lepcha from Bhutan

Pictured: Dr. Pooja Lepcha introducing herself as the new POC for Bhutan

- Dr. Lepcha is a postdoctoral fellow at Kyushu Institute of Technology, Japan
- Returning to Bhutan at the end of March
- Works for division of Telecommunication and Space
- Aims to get more participants from Bhutan for UNISEC activities

- **MIC 8 Overview**
    - Theme: “Missions by multiple nano-satellites”
    - Constellation mission or formation flying, constellation should be 6U or smaller
    - Clear benefits of having each satellite
    - Abstract submission due: **June 30, 2023**
    - Notification: August 8, 2023
    - Full Paper submission due: October 3, 2023
    - Final presentation: TBD (Nov or Dec, 2023, in Japan) at 9th UNISEC-Global Meeting
    - Full information: http://www.spacemic.net
    - Can also conduct national/regional competition to improve the quality of the MIC

- **31st Virtual Meeting (Special Event)**
    - Date: March 18, 2023 22:00 – 24:00 (JST)
    - Theme: Planetary Defense
    - Prof. Makato Yoshikawa from ISAS/JAXA and Dr. Naoya Ozaki from ISAS/JAXA
    - Host: UNISEC-Global
    - Virtual UNISEC-Global Meetings takes place third Saturday of almost every month of 2023
    - April 15: UNISEC-Tunisia
    - Seeking local chapters for May 20

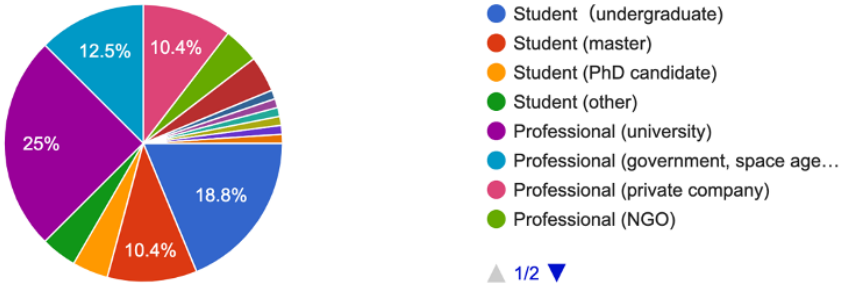
8. Participant Statistics

72 registered participants from **33** countries and regions for the 29th Virtual UNISEC-Global Meeting.

Country/Region	Number of registrations	Country/Region	Number of registrations
Argentina	1	Pakistan	2
Bangladesh	3	Perú	2
Bulgaria	2	Philippines	4
Colombia	23	Romania	1
Denmark	1	Russia	1
Dominican Republic	1	Rwanda	1
Egypt	4	South Africa	1
Spain	1	Sudan	1
Ghana	1	Thailand	1
India,	6	The Netherlands	1
Indonesia	1	Tunisia	1
Japan	14	Uganda	2
Kazakhstan,	4	United Kingdom	1
Kenya	7	USA	3
Nepal	2	Vietnam	1
Nigeria	1		

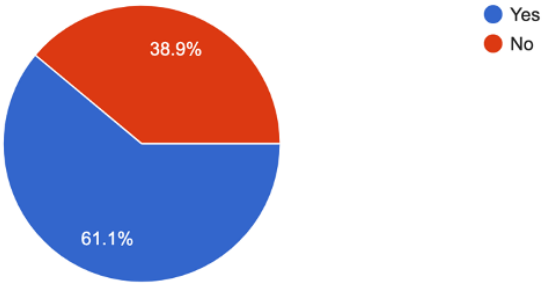
Student or professional?

96 responses



Have you participated in the UNISEC-Global Meeting previously?

95 responses



Thank you