UNISEC-Global The 34th Virtual Meeting

June 17, 2023, 22:00-24:00
(Standard Japan time GMT +9)

The following report was prepared by UNISEC-Global Secretariat
June 17, 2023
Japan

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1. Opening Remarks

Rei Kawashima, UNISEC-Global

Rei Kawashima has contributed to micro/nano/pico satellites for education and business applications through her leadership role in UNISEC –the University Space Engineering Consortium that she co-founded in 2002. In 2013, she was appointed as the Secretary-General of UNISEC-Global, an international NGO that she co-founded in 2013 and was accepted as a permanent observer of UNCOPUOS in 2017. She organizes training programs and technology competitions to facilitate university's participation in space projects worldwide and especially in emerging countries.

Pictured: Rei Kawashima providing the opening remarks

Highlights:

- Theme PER ASPERA AD ASTRA: Student and Experimental activities with the new space scenario
- UNISEC-Italy was started through a student's initiative with Alice Pellegrino as the Student Representative
- UNISEC-Italy has conducted small projects within itself, then moving to large global events
- Student Initiators of UNISEC-Italy was acknowledged during 3rd UNISEC Global Meeting at Tokyo in 2015
- UNISEC-Italy organized UNISEC In-person Global Meeting on Dec 4-7,2017 in Rome
- In 2019, Sapienza University of Rome through UNISEC-Italy bagged the 2nd place at MIC6 in Tokyo
    - Title was "Melanoma Apoptosis Reduced Gravity Experiment: MARGE"
- Announcement of the 9th UNISEC Global Meeting in Tokyo on Nov 27 - Dec 1, 2023

2. Presentation on "CubeSat Mission Concepts and Preliminary Design at UniNA: from Education to Research"

Alfredo Renga, University of Naples "Federico II"

Prof. Alfredo Renga is an Associate Professor at University of Naples (UNINA). He has been involved on research projects on the field of Synthetic Aperture Radar (SAR) systems for earth and planetary remote sensing, Carrier-based Differential GPS for high-accuracy relative navigation. He has also been involved in teaching modules of university-level courses since 2007 based on practice and exercises on direct and inverse Laplace Transform, star imager sensors for satellite attitude determination, outline of Wahba's Problem and satellite orbital elements and basic orbital maneuvers.

Pictured: Prof. Renga pictured during his presentation on CubeSat mission concepts

Highlights:

- FORCE is recent research project carried out by Aerospace Systems at UNINA
- The main goal of FORCE is the design of Modular CubeSat Based Platforms
- FORCE was funded by The Italian Ministry of University and Research in 2021
- Modules of FORCE:
    - Antenna Module - 1m diameter < 3kg
    - Propulsion Module
    - Relative Navigation Module
        - Designed for close proximity and on orbit servicing
        - Consists of Laser Range Finder (illumination and range measures) camera
        - Consists of Monocular camera (captures images of reflecting markers)
        - Being developed in GNC laboratory
        - Camera placed at 1.2m mock up distance
    - OBDH Module
- Student of space teams' course have 9 teams of 10-12 students who drafted CubeSat of max 3U
- DAPHNE is a multi-mission 3U CubeSat made by 30 students with 3 main applications:
    - Shielding from Environmental radiation
    - IOT experiments - Laura 1 standard
    - Ionospheric embodied characterization

Q&A:

Q: What is the frequency range to which the synthetic aperture radar should work and would it be possible to combine the data of the CubeSat missions the classical earth observation missions?
Prof. Renga: The frequency is about 10 GHz and yes, it is possible to combine the date of the CubeSat mission. The main goal of the mission is to combine the data collected by our satellite but in general, combination is possible mainly with other systems.

Q: What is the artificial intelligence you are using for processing?
Prof. Renga: From the point of view of image formation which is the toughest program when you are dealing with SARs, we are not using artificial intelligence. So, there are, we can say, deterministic algorithms. As I said before, we are working in time-domain. Basically, we are performing our own sequence of co-relation among the data that we collect trying to increase the resolution of the standard of the synthetic aperture. From the point of view of application, we are working with some kind of artificial intelligence mainly deep learning to try to perform some kinds of classification of the data explaining the fact we have data collected from different sources. Using the frequency, we can try to distinguish targets based on the frequency of response.

3. Presentation on “Human Space Exploration: Using CubeSats as Scientific Platforms and Technology Demonstrators”

Marta Del Bianco, Italian Space Agency

A graduate in biology at the Sapienza University of Rome, Dr. Marta Del Bianco carried out her PhD and Post-Doctoral courses at the University of Leeds. Since 2019, she has been a researcher at the Italian Space Agency (ASI), Science and Research Directorate. At ASI, she is involved in basic research in the field of plant response to gravity and closed bio-regenerative systems.

Pictured: Dr. Bianco given her talk about CubeSat as a platform for biological experiments

Highlights:

- The majority of the space biology research CubeSat were based on micro fluidic systems
- GENESAT1 carried a micro laboratory system that provided life system
- Metabolic functions for bacteria with two different imaging systems
    - for density and to monitor the fluorescent lights the bacteria were generating
- In microgravity and radiation condition, bacteria were able to grow
- Expressed the green fluorescent protein in space
- O/OREOS SESLO - pressure vessel providing life support to bacteria
- A rotating carousel with spectroscopic instrumentation: an LED light to detect the growth of bacteria
- Spore were resistant to radiation; they retained the ability to germinate and showed slow growth ability
- PharmaSat (2009-2012) - chip with 48 wells for yeast growth and tubes for growth solution
    - Test the response of yeast to an anti-fungal substance with sensors and optical sensors
- Growth of the yeast was really slowed down by the space condition
- The anti-fungal compound had a decreased effect on its high concentration
- BioSentinal- 2022 was a 6U CubeSat based on the Heliocentric Orbit
- Used the budding yeast *Saccharomyses Cerevisiae* with objective to:
    - detect and measure DNA damage response after exposure to deep space environment.
- No biological results yet
- On board of the Vega-C Maiden Flight, two of Italian payloads was present:
    - Astro CubeSat: A 3U CubeSat with fully autonomous lab-on-chip to perform bioassays
        - Microfluid paper-based analytical analysis
    - GreenCube: A collaboration of ASI, Sapienza University of Rome, University of Naples
        - Closed hydroponic system and growing room with IR and VIS Camera
- Growth to Microgreen stage was monitored
- Microgreen is a development stage of the plants which happens after sprouting
- Faster to grow (about 10 days) and are a good source of food
- The flight went up to 6000 km because it has very high radiation environment compared to the LEO
- GREENCUBE (IO-117) has a digipeater telecommunication functionality
- Available to the radio amateur community operating in real-time and "store and forward" mode

- The high altitude of orbit results in much longer visibility time
- Will enable communications up to 12,500 km
- Ovospace investigates GCs and TCs from mammalian ovaries which could affect endocrine function
- SpaceSlime: plates containing dehydrated slime mold would be uploaded to ISS

Pictured: Dr. Bianco explains temperature profile before launch

Q&A:

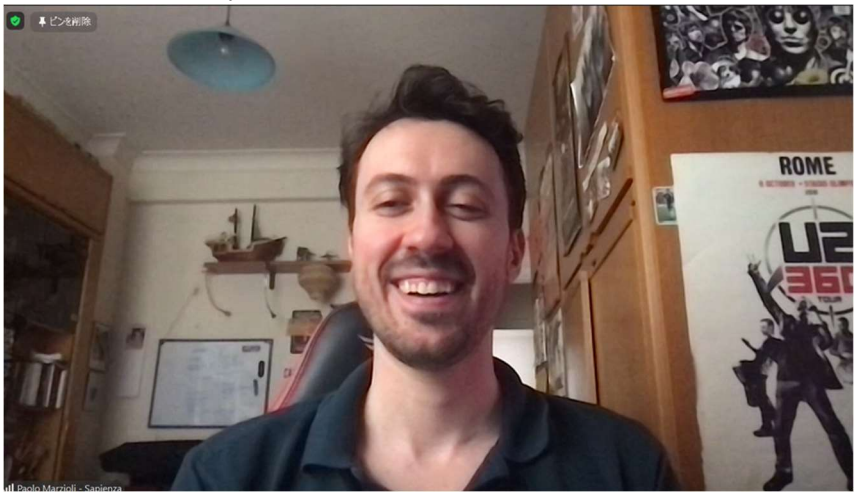
Q: In which kind of materials are the bacteria contained?
Dr. Bianco: I think the chips are normally made up of plastic

Q: Were the physical property of the material changing the effect of the radiation on the bacteria?
Dr. Bianco: There are studies about what type of secondary radiations you will have inside the CubeSat. Of course, there are models and I think, it's still something that is being studied. That is specifically something that is hard to study here on Earth.

4. Presentation on "From Caves to Space: the S5Lab Student Experiments in Stratosphere and Cave Analog Missions"

Paolo Marzioli, University of Sapienza Rome

Dr. Paolo Marzioli is an Assistant Professor in Aerospace Systems at the Department of Mechanical and Aerospace Engineering (DIMA) at University of Sapienza Rome where he teaches "Spacecraft Design" and "Aircraft Systems" with shared credit. His research topics are related to small space systems development, navigation and tracking systems for novel aerospace mission profiles and concepts, Space Traffic Management, space debris identification and tracking. He is also a part of S5Lab (Sapienza Space System and Space Surveillance Laboratory) where he participated in the development of four nano-satellites and three stratospheric payloads, as of 2022. He received his PhD in Aeronautical and Space Engineering in Sapienza University of Rome in 2021, with a thesis based on nano-satellite navigation systems. Until the end of his PhD, he was the student Representative for UNISEC-Italy.



Pictured: Dr Marziloli presenting about some of the activitie s of S5Lab

Highlights:

- The main mission of S5Lab is the development of space surveillance system and space systems
- Involvement in Stratospheric Systems Programs like
    - Resux/ Bexus Program for students: Bilateral agreement + ESA, new students from ESA
    - Hemura Program for researchers: European Commission Funding + CNES
        - receives support from ASI

    - participated in the 2018 call for a flight opportunity in 2020
- CubeSat Development Program at Sapienza S5Lab has a range of on-going and completed projects
- A global contest to connect and communicate to LEDSAT and GREENCUBE via digipeater

Pictured: Dr. Marzioli announcing about the global contest to communicate with via digipeater

- Stratosphere is a cheaper high orbital/ sub-orbital aviation experiments and simulations
- Carried out in a span of 3-4 hours, good for short time experimentation
- Temperature < LEO experiment setup
- Limitation of experiment size within large balloon launch is about 50 cm cube with 15-30 kg
- STRAINS aimed to test Passive RF-Based tracking systems
- The systems are for stratospheric and innovative high-altitude aircraft and spacecraft
- 6 teams of 13 students gathered information of the stratospheric segment
    - Size is about 30x30x50 cm approx.
    - Has Slave Portable Station (SPS) and Master Control Station (MCS)
- STRAINS was launched on 11 Sep, 2021 from Esrange Space Center
- Better precision in UHF band, S-band had some synchronization difficulties
- ROMULUS (on progress) to perform measurement in global navigation system
    - Check quality of signal received by GNSS for weather and climate change prospects
    - Tests a smallscale system for balloon borne GNSS - RO based on software defined receiver
    - Galileo and GPS signals are being investigated for its advantages
- LUNAR ANALOG MISSION - GEA: Analog Exploration Group
    - S5Lab and GS- CSI (Club Alpino Italiano) collaborated to form GEA
    - A speleology analog mission conducted in caves with 12 Speleonauts, 4 backup astronauts
    - At least 5 mission controllers
    - The Analog mission is a total of 72 hours where small scale experiments will be carried out
    - Psychological and Technical Training since 2022, the first 24hr test scheduled on July 2023
    - Caves with no sunlight perfect for simulations
    - Close to surface for telecommunication system and safety is recommended
    - Large dimension to execute mission of 12 individuals at once

Q&A:

Q: What could be the role of stratospheric platform systems in the space sector in the near future?
Dr. Marzioli: For me, there is a lot to be done. So, I don't know how to envision the future of the space sector but there is a lot of new concepts about stratospheric spaceships because they can guarantee basically very nice stability over a center of interest. Since I was a student, everyone is proposing like altitude platforms like disaster reliefs. Other than that, there are a very nice testbed for example, suburban exploration; we have a lot going on with virgin galactic. There is this possibility to testing technology to see if it's something that might be working or not. So, its relatively less expensive than southern lights and the list goes on.

Q: How can I apply for the astronaut position?
Dr. Marzioli: For our Analog Mission, it is for extremely young individuals, especially students. So far, I am open to Sapienza students who are based in Rome and can relatively stay in Rome for a long period of time but in future,

my plan is to open this up for foreign students and collaborators. So far, I am still developing such a concept. You can however, drop me an e-mail and I will let you know if anything as such opens.

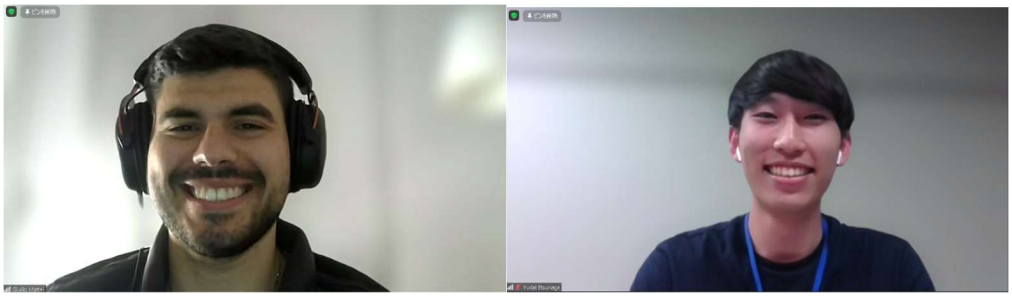
Q: I wanted to ask about disability?
Dr. Marzioli: So far, I am very much open to being inclusive as much as possible even with people with disabilities. With cave exploration, it can be a little bit of harm, because you need to go through an experienced progression in cave but it is 100% something we want to do because inclusion is very important. So far, it didn't happen simply because we didn't have any such requests from my students. But I am very much hoping to this.

Q: Is there any chance to join the Sapienza University in your lab as a M.Sc. student from outside Italy?
Dr. Marzioli: Yes, there are many opportunities. (The next talk is also based on that). You can go on the Sapienza website and there are opportunities depending on where you come from: outside the US, from EU. I am also very much open to enhance the cultural diversity in my laboratory, we have had many foreign individuals so far.

5. Presentation on "Student Exchange Program between Sapienza and Kyutech: Diary of an Experience Away from Home"

Giulio Mattei and Yudai Etsunaga, University of Sapienza Rome and Kyushu Institute of Technology

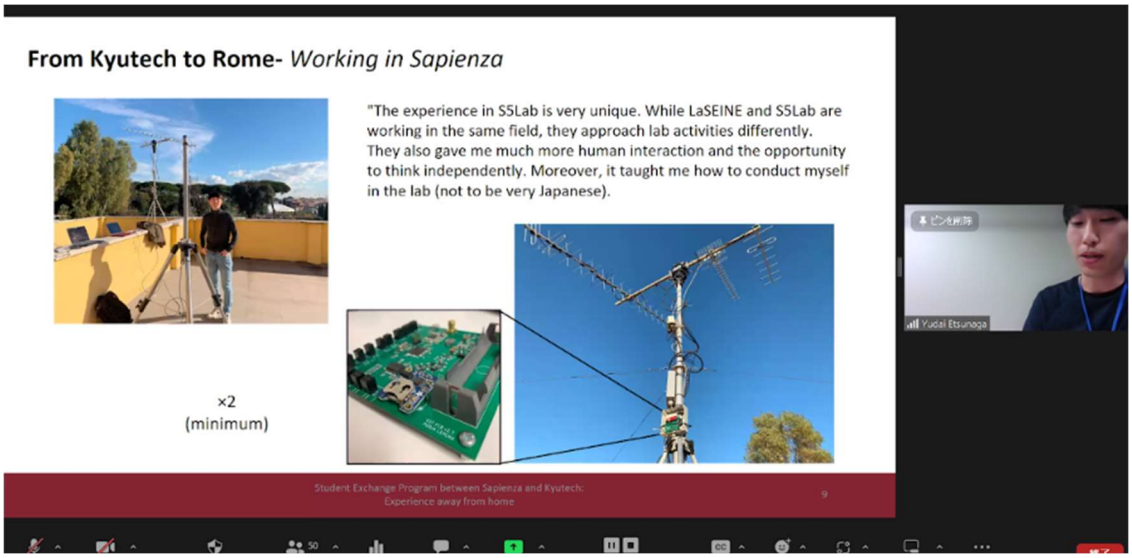
Sapienza University of Rome and Kyushu Institute of Technology hold a memorandum of understanding that allows student exchange program between the two institutions free of tuition costs. Guilio and Yudai both went on a research exchange from Italy and Japan respectively.



Pictured: Guilo (Left) and Yudai (right) share their research exchange experience

Highlights:

- Giulio Mattei, a student of University of Sapienza Rome left for Kyutech for 6 months
- Stayed from May to October, 2022 where he intended to carry out his master's degree research
- Based in aeronautics and space engineering focusing on
    - "Update on the alternative facility for thermal-vacuum tests of nano satellites which exploits the Peltier effect"
- Mattei was involved in Japanese academic practices
- Local culture and culinary became a big part although being far different to the lifestyle to Rome
- Yudai Etsunga is a student of Kyushu Institute of Technology
- Working at LaSEINE Laboratory under Prof. Mengu Cho
- Did his bachelor thesis in Sapienza
- Practically experienced the diverse culture/working practices in Rome
- Yudai states the working practice in the laboratory to be very different from that of Japan
- He got to be more expressive while in Sapienza
- Along with academics, Yudai learned about the value of friendships and essence of life
- Opened new doors for him when he attended the 6th Ground Station/Ground Sensor Terminal
- Organized by Kyutech and Government of Bhutan
- Both had an incredible and remarkable experience which has shaped them into what they are today



Pictured: Yudai talking about his experience in Rome

Q&A:

Q: I am trying to go to Kyutech for my Master's degree for two years. Do you have some advices to share?

Giulio: I have one suggestion that there is no suggestion! Each experience is different. In my opinion, the best way to live is just wait till everything happens. Please remember the *Mocha*, because in Japan, it is not the one you have been eating in Italy

Yudai: I can agree on not having the best coffee. We are quite open for international students and as you can see on the internet, there is so many information about Kyutech and also, Paolo knows about it. So, you can ask your colleague if any help required.

Dr. Marzioli: Prepare not to be prepared. Go and be surprised because it is an amazing environment, an amazing culture. I had expectations and everything was completely the opposite and 99% of the times in a positive way. I had the time of my life there and basically, try to be immerged in the culture in international environment and have fun.

6. Announcement and Acknowledgement

Haruka Yasuda, UNISEC-Global

Pictured: Yasuda-san announcing the latest updates from UNISEC

- **CLTP 12 (Cansat Leadership Training Program)**
  - Applications are closed

    - Program Date: August 21, 2023 - September 1, 2023
    - Selected participants are informed with the notice of acceptance
    - Candidates are from more than 10 countries

- **Mission Idea Contest (MIC8)**
    - Mission to be carried out by multiple satellite made up of 6U CubeSat or smaller
    - Number of satellites should be greater than one and must have clear benefits
    - Constellation Mission and Formation Mission are both encouraged
    - Regional/ national competitions are encouraged to be organized
    - Deadline to application submission: June 30, 2023 (Extended to July 10, 2023)
    - Register here: http://www.spacemic.net/application.html

- **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

- **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

- **20th Anniversary of UNISEC**
    - **This year is UNISEC's 20th anniversary**
    - A short message of less than 100 words to be emailed to secretariet@unisec-global.org
    - Display on their website on the 20th anniversary and will be appreciated

- **35th UNIGLO Virtual Meeting**
    - Date: July 15, 2023 22:00 - 24:00 (JST)
    - Theme: Women4Space: Space Related Projects and Programs led by Nepalese Women
    - Host: UNISEC- Nepal
    - Moderator: Ira Sharma
    - Virtual UNISEC-Global Meetings takes place third Saturday of almost every month of 2023

7. Participant Statistics

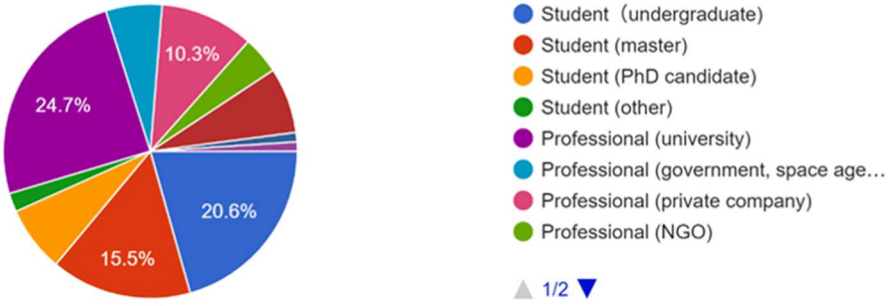
97 registered participants from **28** countries and regions for the 34th Virtual UNISEC-Global Meeting.

Country/Region	Number of registrations	Country/Region	Number of registrations
Algeria	1	Japan	16
Australia	1	Kazakhstan	4
Bangladesh	6	Kenya	3
Bhutan	1	Luxembourg	1

Bulgaria	3	Malaysia	1
Chile	2	Nepal	5
Colombia	2	Philippines	4
Dominican Republic	3	Russia	1
Egypt	4	South Africa	1
Ethiopia	1	Taiwan	2
France	2	Tunisia	2
India	2	Turkey	2
Indonesia	2	UK	2
Italy	22	Vietnam	1

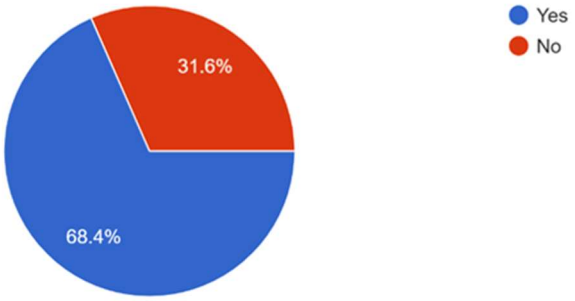
Student or professional?

97 responses



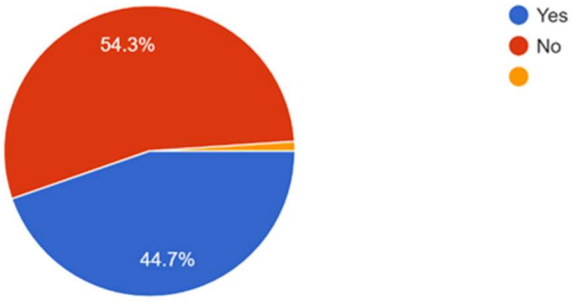
Have you participated in the UNISEC-Global Meeting previously?

95 responses



Are you familiar with Italian space projects?

94 responses



Thank you