

# **UNISEC-Global The 55th Virtual Meeting**

April 18<sup>th</sup>, 2025, 22:00-24:00 (Standard Japan time GMT +9)



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# **1** Opening Remarks

- Prof. Hiraku Sakamoto, UNISEC Japan

Prof. Hiraku Sakamoto is the current chairperson of UNISEC Japan. Dr. Sakamoto received a Ph.D. degree in Aerospace Engineering Sciences at the University of Colorado at Boulder, USA, in 2004. He obtained a Bachelor's degree in Mechanical Engineering Synthesis at the University of Tokyo, Japan, in 1999; a Master's degree in Aeronautics and Astronautics at the University of Tokyo in 2001. His research interest is mainly on the design and analysis of ultralightweight deployable membrane space structures. He took charge of the deployment analysis of the world-first solar sail satellite, IKAROS, launched in 2010. He has been a principal investigator in the development of 3U CubeSat, OrigamiSat-1, for space demonstration of an innovative multifunctional membrane deployment system (launched in 2019). Also, in 2010, he constructed a curriculum for university students to study Systems Engineering through the development of a simulated satellite, CanSat.



Pictured: Prof. Sakamoto while giving the opening remarks

## Highlights:

- Appointed as chairperson of UNISEC Japan in October 2024
- Has worked in OrigamiSat-1 (2019) and OrigamiSat-2 (2025)
- UNISEC brief history
  - Started in 1999
  - 1<sup>st</sup> CanSat launched from USA (ARLISS)
  - CubeSat launched by Univ. of Tokyo and Tokyo Tech on June 30, 2003
  - Officially established in 2002 and became an NPO in 2003
  - UNISEC-Global started in 2013
- UNISEC-Japan current activities
  - UNISEC Student Organization (UNISON)
    - Rover Competition
    - CanSat working group
      - ARLISS
    - Satellite working group
    - Rocket working group
  - UNISEC Academy: online lecture series
    - KiboCUBE Academy
  - Small satellite mission assurance activities led by Prof. Mengu Cho
  - UNISEC Job fairs
- Has written a message as the new chairperson of UNISEC Japan available on the website
  - Focuses on 3 key perspectives
    - Improving the reliability of space systems through practical system integration
    - Developing space missions into successive programs

- Contributing to human society, creating new space-era values and ethics

Message from new chairperson of UNISEC Hiraku Sakamoto, Ph.D.





3. Contributing to Human Society: Creating New Space-Era Values and Ethics

We must avoid limiting our activities to serving only a few and instead focus on embracing diversity. Our space missions aim to contribute to the sustainability of the world and the well-being of all people, leaving no one behind. Let us discuss and share the values and ethics of the new space era.

Pictured: Prof. Sakamoto sharing his message as the chairperson of UNISEC Japan

# 2 Overview of Tottori Rover Challenge

- Sota Kaneko, The Graduate University for Advanced Studies, SOKENDAI

Sota Kaneko is a PhD student at the National Institute of Informatics (NII)/ The Graduate University for Advanced Studies, SOKENDAI. Sota earned his Bachelor of Engineering degree from the University of Electro-Communications (UEC), Tokyo, where he studied from 2018 to 2022. Since May 2022, he has been serving as a Research Assistant at the National Institute of Informatics in Tokyo. Simultaneously, since August 2018, he has been engaged in computer system operation and management at SOUM Corp., Tokyo. He serves as a Student Editorial Board Member of The Japanese Society for Artificial Intelligence (JSAI) and as the Student Representative of the CanSat Working Group in UNISON2024, a UNISEC student organization. Additionally, he is a member of the Executive Committee for the Tottori Rover Challenge (TRC)- part of the management team for ARLISS (A Rocket Launch for International Student Satellites).



Pictured: Mr. Sota Kaneko during his presentation

### Highlights:

- Tottori Rover Challenge (TRC) a new rover challenge taking place in Japan
- Has provided opportunities for practical training in space engineering Especially through CanSat events

  - Help students design and test small satellites and space systems
- Various rover challenges have been conducted throughout the world
- Not all challenges accurately represent the Lunar or Mars surface



- Upon searching for a Mars/lunar-like surface in Japan, the Tottori Dunes were found
- First demonstration field for lunar exploration on 7th July 2023
- Demonstration of lunar rover/ space equipment can be conducted by domestic or foreign companies \_
- First lunar rover competition in Japan, TRC launched here -
- Objectives of the competition
  - To provide research opportunities
  - To promote the development of space exploration technology
  - To promote skill exchange through the competition
  - To demonstrate that lunar environmental tests can be conducted in Tottori Dunes
- **TRC 2025** 
  - March 22<sup>nd</sup> 2025
  - 8 participating universities
  - Two categories
    - Expert category
      - 1<sup>st</sup> : ARES Project
        - 2<sup>nd</sup> KARUKA Project
      - 3rd NAFT
      - Entry category
        - 1<sup>st</sup> Tokyo University of Information Sciences
        - 2<sup>nd</sup> Polytechnic College Shimane
        - 3<sup>rd</sup> Tottori University
  - Mission types and what they were asked to perform
    - Science Exploration Mission
      - Maintenance of the lander
      - Survey of rock samples \_
      - Hill climbing and wide area observation
      - Autonomous Running Mission
        - Path planning and autonomous running
        - Unmanned Construction Mission
          - Measurement
          - Transportation of materials (pick-and-place)
          - Tasks like using robot arms
- **TRC 2026** 
  - Scheduled for March 2026

- Looking to make it international in the future
- Official SNS (X): @TRC\_Official\_PR
- Website: www.tottori-rover-challenge.com/

### Q/Ans:

## Q: Danishi Ai: Are you seeking to make this competition international in the future?

A: Sota Kaneko: Next year is also domestic. But we want to make it international in the future.

### Q: George Maeda: I'm sure you would want more corporate sponsors? How are you managing it?

A: Sota Kaneko: We got some sponsors this year. for example, Bridgestone and other startup companies.

# 3 Challenge of ARES Project

## - Danishi Ai, Tohoku University

Danishi Ai is currently a PhD student at Tohoku University, where he also completed his graduate program. He did his undergrad at the University of Tsukuba. During his undergrad, he conducted research on developing a Mars-exploration UAV and demonstrated multi-rover exploration techniques. Danishi is the founder of the student Mars rover team and the ARES Project.



Pictured: Danishi Ai during his presentation

### <u>Highlights:</u>

- University Rover Challenge (URC)
  - URC is a Student Mars Rover Contest
  - This is conducted every year in Utah, US, at the Mars Desert Development Research Station (MDRS)
  - Students bring their own developed robot to compete in the competition
    - The competition has been international since 2006
  - The 4 missions of URC are
    - Autonomous Navigation
    - Science
    - Equipment Servicing
    - Extreme Delivery
    - Rover is assigned to detect tools like hammers, bottles, and so on
  - The team has to develop its own analysis instruments and try to collect samples
  - Camera data and sensors look for terrains and surroundings

- After all, the mission is complete, the result is shown to the jury
- ARES started with 3 members in March 2022 and now has more than 40 members
- They are now aiming to participate in the Student Mars Rover Contest
- Activity Report
  - Conducted mobility test of ARES-5 at "Lunaterrace"
  - Doing an exhibition and presentation for the public to join as sponsors
  - Appeared in CNN, TV Tokyo, Yahoo News, Apple CM, and so on
  - Does a yearly beach clean-up activity using the Mars rover
  - To teach small children about the importance of the environment, along with space robots
  - Won grand prize in the first-ever Japanese rover competition
- URC 2024
  - First Japanese Student Team to compete
  - 102 teams from 15 countries participated
  - ARES was one of the 38 teams selected for the Finals
  - The environment was difficult due to harsh winds and temperature
  - Achieved Spirit Award: an award for a great presentation
  - Rover received huge damage
  - Aim for the grand prize in URC 2025
- Future Aim
  - · Boosting student rover development in Japan
  - Win the world championship
  - Try real space missions
  - Planning to publish academic papers

#### Q/Ans:

#### Q: George Maeda: Last year you said you had huge damage to your rover, what kind of damage?

A: Danishi Ai: Yeah, so, we have four sterling wheel systems, which actually broke off while running. And rovers could not proceed after that. Unfortunately, no, we brought our 3D printer and spare parts. We were able to replace it the next day, but on that mission, we could not actually do further stuff than that so we pressed the emergency stop button. That was the huge damage.

# Q: Rei Kawashima: You have done so many things, what do you want to have now? What would make your dream more feasible?

A: Danishi Ai: From the project perspective, I just don't want to make this only a student project. It has some potentials inside, and when I met some rover team in Europe and states, some people were working together with Ford Motor Company or even ESA to develop some wheels or time controlling method that was actually usable for space-based and they were publishing papers and they were seeking for further proceedings on that. So, I believe, if you proceed more, fortunately, maybe in the future, we would like to join the actual space field. Starting from some parts of our rover. As my personal goal - I didn't mention in slide - but my future dream is to become an astronaut. Seems to be like a bit far away from what I am doing, but I believe astronaut who has engineering robotics technology is going to be needed in the future more. And that requires some team activities. Also leading the team or participating as a team member. And this other project taught me a lot about leading the team. And how the team changes time over time when we add the people, so that was actually good. But the further I push for this project and the research and other activities, I learned I need to develop more skills or more, you know, I need human skill, not only knowledge. My goal is to keep it up this work. First of all, I'm going to try to get a PhD. And I hope I get the opportunity to go to states next year, probably at the Georgia Tech doing my research as well. So, I want to proceed my research in this project. And hopefully enough that's going to leave my next goal to work in Betha or actually space field companies and then I'll proceed for my actual dream to become an astronaut.

#### Q: Willy Cabanas: What kind of organization you have for your team? The students, some other

#### authorities maybe of the university, what kind of organizations you have for this project?

A: Danishi Ai: So, I would say university organizations but basically, everything is led by ourselves. And only business sub-team has its sub-team leaders. That is how team is organized. And for funding more responsibility stuff, token universities take care of it. And I'm in the charge of contracts. That's how like our team is organized right now.

# Q: UNISEC participant: What type of microcontroller are you using, and tell me about the power and battery. what is the power you are using to run your full system?

A: Danishi Ai: Yeah, thank you. Starting from the microcontroller, we are using STM32, sponsored by the company. We have four STM32 microcontroller for each tailing wheel, and the wheel control. That leads the communication directly gets into the Arduino view on the mainboard. That is actually receiving the signal from the signal teleoperating center and all the communications are done there. Our laptop which is in communication room has a ROS operating system. We use ROS to control that. Just to teleoperate the rover, we just use a simple Python code. But for the autonomous we're using the iron-based communication. For the batteries we are using four lithium-ion battery which is commonly used for industrial tools like heavy drills or stuff like that. And it's going to last for three hours at maximum.

# 4 Introduction to ARLISS

- Kota Matsuhashi, Tohoku University

Kota Matsuhashi is the management team lead of the project A Rocket Launch for International Students (ARLISS).



Pictured: Mr. Matsuhashi during his presentation

## Highlights:

- Showed a short video compilation of ARLISS
- ARLISS is short for "A Rocket Launch for International Student Satellites."
- Founded in 1999 by UNISEC (Dr. Nakasuka) and AERO-PAC
- Location: Black Rock Desert, Nevada, USA
- This year's competition marks its 25<sup>th</sup> anniversary
- In this competition, an aircraft is loaded into a rocket and released from an altitude of above 3,000m
- Can Sat
  - CanSat is a can-sized satellite with sensors and communication units, and specific missions
  - Two classes in ARLISS
    - CanSat Class
      - Mass Limit is < 350 g
      - Diameter Limit is < 66 mm
      - Height Limit is < 240 mm
      - Launch Cost is 200USD/launch

- Open Class
  - Mass Limit is < 1050 g
  - Diameter Limit is < 146 mm
  - Height Limit is < 240 mm
  - Launch Cost is 600USD/launch
- Missions and Objectives of ARLISS
  - Hands-on: design, build, test, launch, recover
  - Cultivate system-level thinking, problem solving, and teamwork
- Competition Award Categories
  - Accuracy (distance from goal)
  - Best Mission, Technical System Award
  - Overall Winner
  - Last Year's Team & Highlights
    - 19 teams from all over the world
      - 16 Japan, 1 U, 1 Costa Rica, 1 Peru
      - Keio Team Wolve'z, Keio University, Japan
        - Competed with a CanSat with a complex mechanism to transport supplies
    - Flying Cactus
      - Developed a drone-based CanSat

How to Pa	articipate		
ARLISS2025 Sc	hedule	<b>Budget</b> The costs required to participate in ARLISS are as follows.	
To participate in the tourna registration form. The form will be released of websites in early May.	ment, you need to fill out the on various social media and		
Registration form closes	May 30	Launch fee (Open Class)	200 USD/Launch
Set Up	Sept 7	Launch fee (CanSat Class)	600 USD/Launch
Competition	Sept_8~11	Desert usage fee	15 USD/(Day · person)
Exchange day	Sept 12		
Result Meeting	Scheduled for early Oct.		

Pictured: Mr. Matsuhashi presenting the participation guidelines for ARLISS

• Contact info

- Email: arlis.management@gmail.com

#### Q/Ans:

# Q: Willy Cabanas: What are the requirements for universities or private companies to participate in ARLISS?

A: Kota Matsuhashi: We accept universities, teams, and private companies also.

*George Maeda:* Probably, if you go to the website, they will mention if there are any requirements for participation in ARLISS.

#### Q: Arifur Khan: Where is the launch location?

A: Kota Matsuhashi: Black Rock Desert, Nevada State in the United States.

# 5 Activities and Future Plans for UNISON Satellite Working Group

- Nagisa Sone, Nihon University

Nagisa Sone is curing doing a master's in aerospace engineering at Nihon University. She has previously worked in communication and attitude control subsystem for 6U CubeSat PRELUDE, worked in educational training HEPTA-SAT, and is part of UNISEC Student Organization.



Pictured: Nagisa Sone during her presentation

## Highlights:

#### - My Lab's Satellite "PERLUDE" Project Introduction

- PERLUDE is a CubeSat for the observation of seismic activity for earthquake prediction
- It is developed in the Yamazaki Laboratory at Nihon University
- PERLUDE will be launched between April 2025 and March 2026
- Development process
  - Students designed boards with ECAD, and the structure was manufactured at the company
  - EPS, ADCS, and TCS were analyzed and evaluated by MATLAB
  - Other analysis is done using home-made code, Excel, and purchased software
  - The lab also has a clean room and proper environmental testing facilities



Pictured: Nagisa Sone presenting overview of PERLUDE



Pictured: Nagisa Sone presenting BUS unit of PRELUDE

#### - UNISEC - "HEPTA-SAT" and "HEPTA-SAT LITE"

- HEPTA-SAT is 1U CubeSat education kit
- It contains a satellite bus system with
  - Microcomputer
- Contains a satellite bus system with
  - Microcomputer
  - Battery
  - Transceiver
  - Sensor devices
  - Structure
- Widely used to learn the basics of "Space Systems Design"
- Kit has a corresponding textbook by which anyone can understand satellite systems
- HEPTA-SAT LITE: a new simplified version of HEPTA-SAT
- 55mm x 55mm palm-sized board, so it easier to use with lower cost
- Most sensors are already included, making it easy to use for other applications
- Good opportunity to gain engineering skills and experience in international activity



Pictured: Nagisa Sone presenting HEPTA-SAT Training vision

- HEPTA-SAT works with weather data, as it is easy to evaluate
  - Understand and handle without any specialized background
- Much reference data is also available, making it easy to confirm
- Students also develop the ability to understand complex data
- Along with the engineering approach, an understanding of scientific theory is essential
- So HEPTA-SAT includes both the disciplines of science and engineering

#### - UNISON

- UNISON is a satellite working group of students

- Its purpose is to solve problems and share issues
- The main activities of UNISON are
  - Regular meetings to provide a platform for the exchange of ideas and knowledge
  - Providing a training program for new students
- UNISON works to improve satellite development in Japan through students' activities.

## Q/Ans:

# *Q:* UNISEC Participant: About the textbooks, are they available for purchase, and how much does it cost?

A: Nagisa Sone: Yeah, you can buy the tickets to work and kit. Please ask Kawashima-san or Yasuda-san about the cost and how to but it.

Haruka Yasuda: So basically, we sell the kits and books to students who take the HEPTA-SAT training. First, you need to take our HEPTA-SAT training. So, if you want any information about the training, please contact the secretariat.

# 6 Announcement and Acknowledgment

- Haruka Yasuda, UNISEC-Global



Pictured: Yasuda-San announcing the latest updates from UNISEC-Global

## Highlights:

### - Nano-satellite IoT Constellation Program

- A new program launched by UNISEC-Global
- Jointly design satellite bus (3-6U) with online guidance
  - Each satellite will be developed by each country with its own funding
    - If difficult, we will jointly search for international funds
- All the satellites have the **same mission payload** to contribute to solving global problems - Or local problems as a constellation
- Each country can have one specific mission payload for its own interest
- Web: <u>https://unisec-global.org/iot.html</u>
- Interested ones can submit the form here: https://forms.gle/WcdvQ9GiQV9rxssj6
- Deadline for "STEP 3: Hearing session with stakeholders": June 30, 2025
- Contact: iot@unisec-global.org

#### - The Mission Idea Contest

- The 9<sup>th</sup> Mission Idea Contest: to the Moon
  - Theme: Lunar Mission
  - https://www.spacemic.net/
  - 25 abstracts were submitted from 15 countries
- Important Dates:
  - Notification

- May 20, 2025 (Changed to June 2, 2025) August 5, 2025 (Finalists)
- Full Paper submission due :

- Final Presentation

November 1, 2025 at the 11<sup>th</sup> UNISEC-Global Meeting in Tokyo

- Contact: <u>info@spacemic.net</u>
- CLTP14 (CanSat/ CubeSat Leader Training Program)
  - Date: August 19 29, 2025
  - Venue: Nihon University, Chiba, Japan
  - Application Submission Due: April 22, 2025
  - CLTP14 Website: <u>https://cltp.info/cltp14.html</u>
  - Contact : <u>secretariat@cltp.info</u>
  - The 11<sup>th</sup> UNISEC-Global Meeting
    - Date: November 1 4, 2025
    - Venue: Tokyo, Japan
    - <u>https://www.unisec-global.org/meeting11.html</u>
    - Tentative Program (T.B.C)
      - November 1: Opening Ceremony, The 9th Mission Idea Contest: to the Moon, Reception
      - November 2: Deep Space Workshop, Student Session, and Party

:

- November 3: Supporting Ceremony Presentation, IoT Workshop, POC Meeting
- November 4: Local Chapter Regional Report, Company Tour, Gala Dinner
- Call for proposal for 15<sup>th</sup> Nano-Satellite Symposium and the 12<sup>th</sup> UNISEC-Global Meeting 2026
  - Next 11<sup>th</sup> UNISEC-Global Meeting will be held in Japan in 2025
    - Call for proposal for venue of Nano-Satellite Symposium and UNISEC-Global Meeting in 2026
    - Important Dates
      - Proposal submission due :
        - Proposal presentation :
      - Proposal presentationLocal Chapter voting
- May 8, 2025
- September 20,2025 (at Virtual UNIGLO meeting) October 2025
- oter voting :
- Download the format here:
  - <u>https://unisec-global.org/support.html</u>

#### - Launch Opportunity: J-Cube

- Special Discounted opportunities
- 1U, 2U, 3U, deployment from International Space Station
- Collaborate with UNISEC-Japan's University
- Technical support will be provided
- Contact:
  - info-jcube@unisec.jp
  - http://unisec.jp/serviceen/j-cube

#### - Next Virtual Meeting

- Date: May 17, 2025
- Theme: IoT Mission Idea Presentation (2)
- Host: UNISEC-Global

# 7 Participant Statistics

124 registered participants from 35 countries and regions for the  $55^{\text{th}}$  Virtual UNISEC-Global Meeting.

Country	Registrants	Country	Registrants
Argentina	1	Malaysia	1
Bangladesh	3	Mauritania	1
Botswana	1	México	1
Bulgaria	4	Namibia	2
Burkina Faso	4	Nepal	2
Chile	1	Nigeria	27
Cote d'Ivoire	1	Peru	5
Dominican Republic	2	Philippines	2
Egypt	7	Portugal	2
France	1	Rwanda	1
Ghana	1	South Africa	2
Guatemala	2	Taiwan	1
India	7	Tanzania	8
Indonesia	1	Tunisia	2
Japan	16	Turkey	5
Kazakhstan	1	UK	3
Kenya	2	Uruguay	1
		USA	3

Student or professional? 124 responses



- Student (undergraduate)Student (master)
- Student (master)
  Student (PhD candidate)
- Student (PhD can
- Professional (university)
- Professional (government, space age...
- Professional (private company)
- Professional (NGO)



Have you participated in the UNISEC-Global Meeting previously? 124 responses



Have you participated in any student activities in your local chapter or region? 122 responses





Thank you