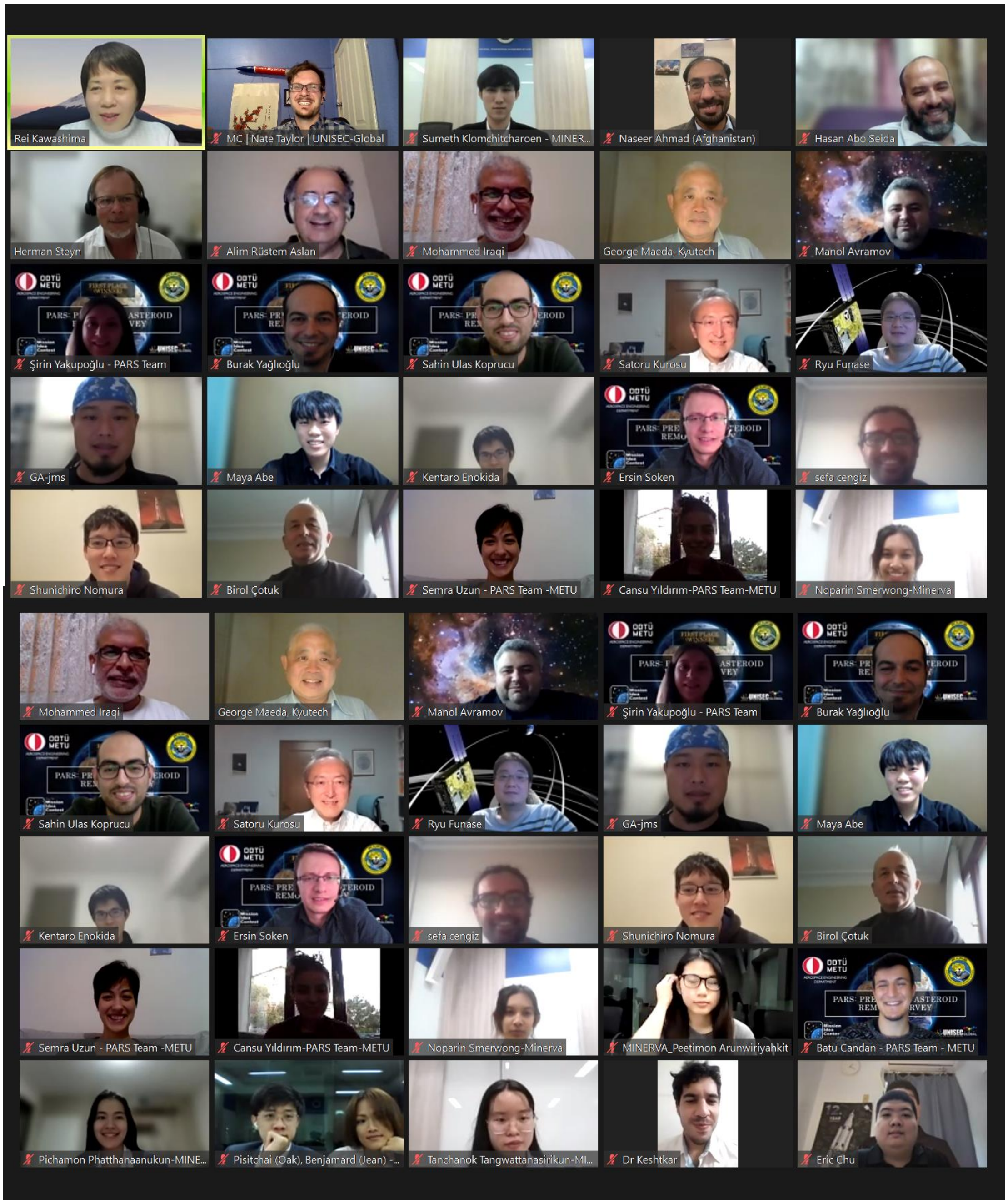
# UNISEC-Global The 15th Virtual Meeting

November 20, 2021, 22:00-24:00
(Standard Japan time GMT +9)



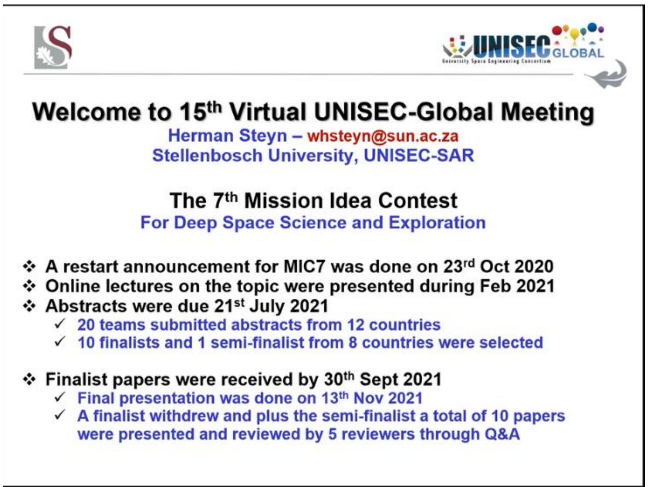

**The following report was prepared by UNISEC-Global Secretariat**
**November 20, 2021.**
**Japan**

# Table of Content

# 1. Opening Remarks & MIC7 Results

Prof. Herman Steyn, Stellenbosch University

Professor Herman Steyn graduates his Master's Degree in Electrical and Electronic Engineering from Stellenbosch University (SU), a Masters in Satellite Engineering from the University of Surrey in UK, and then PhD from SU. Prof. Steyn's space experience started with development of Africa's first fully indigenous satellite called SUNSAT in 90's. He worked as Principal Engineer and Team leader for satellite control systems at Surrey Satellite Technology Limited. In 2002, he returned to Africa as Head of Product Development and Executive Director at SunSpace Information Systems where he developed Earth Observation Satellites for international customers and government. In 2005, he joined SU and established a satellite engineering group in the Electronic Research Laboratory to develop nanosatellites. He was elected as Corresponding Member of the International Academy of Astronautics (IAA) in 2011. Prof. Herman worked as the project leader and his research team partnered with the Surrey Space Centre in UK and Europe space companies on several EU FP7 projects since 2010.



*Pictured: Prof. Herman Steyn giving the opening remarks & MIC7 Results during meeting*

Highlights:

- The 7th Mission Idea Contest for deep space Science and Exploration
- After COVID restart, announcement was made last year 23rd October 2020
- Online lecture and topics were presented during Feb 2021
- Abstract were due 21st July 2021
  - 20 teams submitted abstracts from 12 countries
  - From those, 10 finalists and 1 semi-finalist from 8 countries were selected
- Finalist papers were received ends of the September 2021
- Final presentation was done in 13th November 2021
- A finalist withdrew due to issues and total of 10 semi-finalist papers were presented and 5 reviewer reviewed papers through Q&A
- Mission Idea Contest: History
  - MIC was launched in 2010 to encourage basically innovative exploitation of micro/nano-satellites
  - Mission idea and satellite design varied from all the competition between 50kg plus micro-satellite to smaller nano satellite and also constellation of satellite was proposed and evaluated.
  - Books and one proceedings were published by International Academy of Astronautics (IAA)
- Requirement: propose deep space science and exploration mission with micro/nano satellites
- Learn more about competition in website: http://www.spacemic.net/
- Two of the satellite proposed is a micro satellite and 6U nanosatellite

## MIC Winners' Mission Ideas

| | Proposed idea | Country |
|---|---|---|
| **MIC 1 (2011) (constellation)** | Integrated Meteorological / Precise Positioning Mission Utilizing Nano-Satellite Constellation | Japan (professional) |
| **MIC 2 (2012) (Satellite Design)** | SOLARA/SARA:Solar Observing Low-frequency Array for Radio Astronomy/ Separated Antennas Reconfigurable Array | USA (student) |
| **MIC 2 (2012) (Business model)** | Underground and surface water detection and monitoring using a microsatellite | South Africa (student) |
| **MIC 3 (2013)** | Clouds Height Mission | Germany, Italy, Slovenia (professional) |
| **MIC 4 (2016)** | CubeSat constellation for monitoring and detection of bushfires in Australia | Australia (student) |
| **MIC 5 (2018)** | Smallsat Ionosphere Exploration at Several Times and Altitudes, | Taiwan, USA, India (student) |
| **MIC 6 (2019) (ISS-IceCube)** | MUSA: An ISS Experiment for research of a dual culture for Panama Disease | Costa Rica (student) |
| **MIC6 (2019) (ISS-iSEEP)** | Spectrum Monitoring from Space with i-SEEP (SMoSiS) | Philippines (professional) |

*Pictured: History MIC Winners' Mission Ideas*

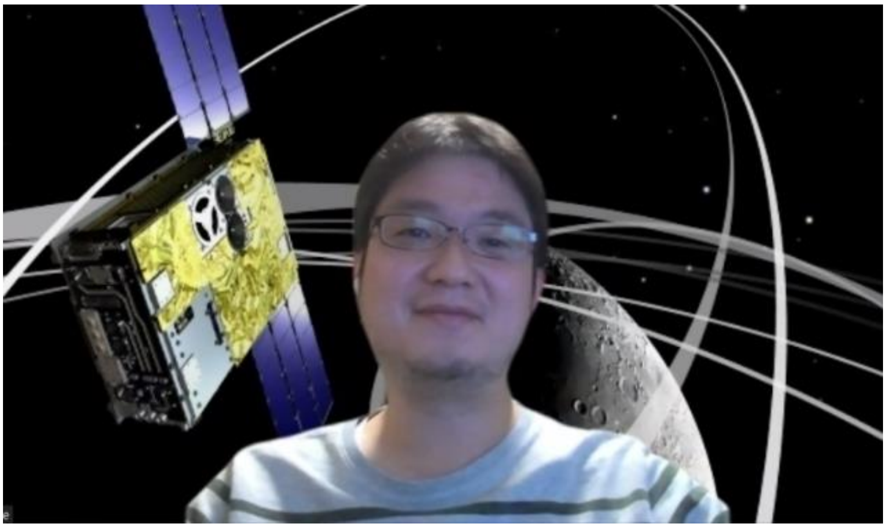
Highlights (continued):

- Most of the orbit chosen by participants was earth moon type of orbit, lunar flyby sequences, lunar orbits, high elliptical lunar orbits
- Constraints: Realistic Constraint are given
  - Design satellite not bigger than 1.0 m x1.0 m x1.0 m with less than 100Kg in weight
  - Can choose cis-lunar orbit or deep space trajectory type orbit
  - Can use transponder onboard, the PROCYON
  - Earth ground station that could be used to Deep Space Network
  - Up to 8 hours of spacecraft operation a day were allowed
  - Lifetime is a free parameter and effect of radiation should be taken in account
  - The proposed launch date should be before 2030
- Evaluation Criteria
  - 25 marks for Originality
  - 25 marks for Impact of mission
  - Engineering tow section: 20 marks for technical description and 15 marks for Operational
  - 15 marks for Feasibility
- **MIC7 winners**
  - **Winner 1st Place: PARS: Precursor Asteroid Remote Survey**
    Middle East Technical University, Istanbul Technical University and Yildiz Technical University, Ankara/Istanbul, TURKEY
  - **Winner 2nd Place: MINERVA: A CubeSat for demonstrating DNA damage mitigation against space radiation in C.elegans by using genetic modification**
    Mahidol University, Nakhon Pathom, THAILAND
  - **Student Prize 1: Disrupting Herpes virus investigation in lunar orbit: A system for animal cell analysis**
    University of Costa Rica and Costa Rican Institute of Technology, COSTA RICA
  - **Student Prize 2: SCORE: Observation and exploration of a long period comet using micro-satellites**
    University of Napels Federico II, Italy

## 2. Presentation on “Deep Space Exploration by Nano/Micro-Satellites --My Experience and Future Perspective—"

Prof. Ryu Funase, Japan Aerospace Exploration Agency (JAXA)

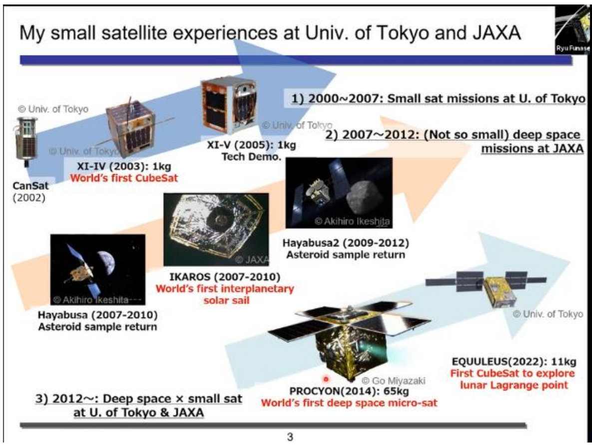
In 2007, Prof. Ryu Funase received his Ph.D. from the University of Tokyo's Department of Aeronautics and Astronautics. He has been an associate professor at the University of Tokyo since 2012, following five years of research and development for deep space exploration spacecraft at Japan Aerospace Exploration Agency (JAXA).

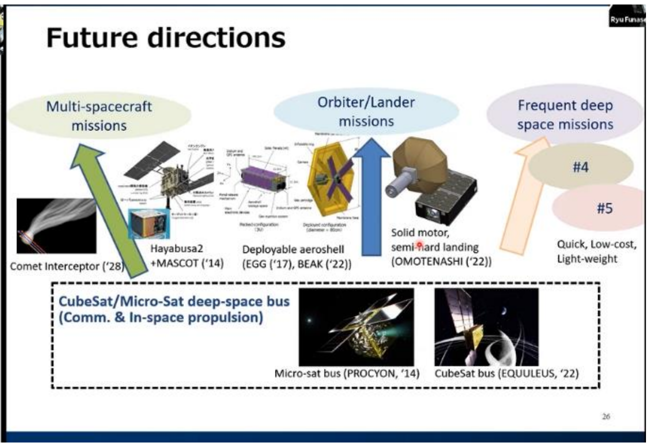


*Pictured: Prof. Ryu FUNASE gives a presentation on Deep Space Exploration*

Highlights:

- Seeing a picture of a view of Mars seen from the Mars Lander of NASA’s Mars Pathfinder Mission in 1997, where it was the first mission when humans drove a rover in Mars. Seeing that, Prof. Funase wondered how difficult it would be to operate something made by humans in a place so far away from the Earth. He wished he could do something like that and that made him motivated to pursue deep space exploration.
- After that, he joined Prof. Nakasuka’s laboratory at the University of Tokyo and started studying space engineering. Since then, he has had a lot of experience with most satellites at the University of Tokyo and the Japan Aerospace Exploration Agency (JAXA)
- First, when he was a graduate student at the University of Tokyo, he was involved in the development and launch of one CanSat and two CubeSat.
- After obtaining a Ph.D. and graduating from the University, he started to work for JAXA where he was involved in not so small but large deep space missions like Hayabusa, Hayabusa2, and IKAROS.
- Then he returned to the University of Tokyo and worked as an associate professor in 2012 and he has been challenging deep space explorations.
- The first challenge was to develop more than 50 kg deep space microsatellite named PROCYON. This was a joint mission by the University of Tokyo and JAXA.
- For this mission, Prof. Funase and the team took advantage of small satellite developing experiences, especially in Low Earth Orbit and JAXA’s deep space exploration experiences.
- PROCYON was the first interplanetary full-scale microsatellite
- Full-scale means the satellite has long-distance communication capability.
- The plan was to fly an asteroid in the observation mission but this was a little bit challenging for them as this was the first time to send a spacecraft into deep space. So they wanted to define relatively fundamental missions which can be achieved within not so long time scale. So, deep space bus system demonstration mission became their primary mission.
- In the mission, they implemented a lot of novel technologies for deep space microsatellite bus system.
- Developed two novel technologies for the Procyon mission. One is a very efficient deep space communication system that has almost the same performance compared with the conventionalized spacecraft like Hayabusa2 and the other is the Genum based unified propulsion system of galactic propulsion and chemical propulsion.






*Pictured: Prof. Funase shares his small satellite experiences at University of Tokyo and JAXA and the future directions of Deep Space Missions*

- Both technologies are the key to realizing practical deep space missions by small satellites and the main goal of Procyon was to demonstrate these new technologies.
- Procyon was integrated in the University of Tokyo by a lot of young engineering staff and graduate students.
- The final product of the spacecraft was completed in just 14 months and the Procyon was successfully launched in the planetary trajectory together with the asteroids of Hayabusa2 by the 82A rocket in December 2014.
- The primary mission was to demonstrate the deep space bus system and it was quite successful. They verified the normal operation of the spacecraft including deep space communication from a 60 million km distance and the trajectory guidance, navigation, and control in deep space.
- Also, for the science observation mission, they succeeded in the wide view of the Earth's corona observation by using the onboard UV telescope from deep space which is outside of the wide hydrogen atmosphere of the earth.
- After this observation, they came up with a new observation idea by using the same telescope. Then, they conducted an imaging observation of the hydrogen emission around the Churyumov-Gerasimenko from a far distance in deep space.
- Their results contributed to the evaluation of the water production rate from the comet.
- Unfortunately, due to the failure of a long-time ion thrust operation, they could not perform the earth swing-by as planned gave up going to the asteroid.
- However, they completed the rest of the technology demonstration mission and the science observation mission in the deep space flight environment.
- Prof. Funase and the team demonstrated the possibility of a deep space exploration mission by the small satellite and according to him, this was a huge achievement and an important milestone in deep space exploration by a small satellite.
- The next challenge is to develop a 6U CubeSat named EQUULEUS which will be the first CubeSat to go to the Lunar Lagrange point
- SLS (Space Launch System) is a rocket which NASA is newly developing for future human flight to the moon and beyond and they provide piggyback launch opportunity with its first flight next year
- Prof. Funase and the team feels very lucky to get this launch opportunity into the deep space.
- They proposed the EQUULEUS mission to NASA through JAXA and EQUULEUS was selected as one of the thirteen CubeSat to be launched into the lunar flight trajectory by the launch vehicle - SLS.
- Out of 13 CubeSat to be launched, the missions of the three CubeSat did not develop on time and they were dropped so 10 of them will be launched in the end.
- The missions are quite reversed from just flying into the deep space to asteroid flyby exploration, lunar orbit mission for lunar observation, and among them, EQUULEUS is a very unique mission that will fly to the long-range point over the Earth's moon system.
- EQUULEUS has four missions. One is an engineering mission and the other three are science missions.
- The prime mission is the engineering mission which is to demonstrate the trajectory control techniques within the Sun-Earth-Moon region. The achievement of this mission is through the flight to the second Earth-Moon Lagrange point which is called EML2.
- It nearly takes 6 months or 1 year or 1.5 years to arrive at EML2.

- The other three missions are science observation missions. The first science mission is the Earth's Plasmaspheric observation by UV telescope from outside of the plasmasphere. The second science mission is the Lunar impact DELPHINUS mission and the third science mission is the dust detector mission in the Lunar space.
- For the bus system in the EQUULEUS, they utilized the heritage from the PROCYON mission and managed to implement all the bus functions into CubeSat form factor including deep-space transponder and propellant system.
- Such miniaturization of the bus system was one of the major technological advancements since PROCYON and another technological challenge in the EQUULEUS mission is the development of the registered propellant system using water as the propellant. The reason why water is chosen as the propellant is that water is very safe and this fact will be an advantage when we consider any feedback launcher opportunity in the future.
- Till now, the flight model of the system has been completed and is ready for the launch with SLS next year.
- With PROCYON and EQUULEUS, microsat and nanosat deep space buses have been developed and demonstrated.
- One of the most promising directions for the utilization of small satellites is multi-spacecraft missions. A typical example would be the Hayabusa2 mission where the primary spacecraft carries very tiny probes such as mascot landing probes to perform more advanced but high-risk activities around the target object to be explored.
- In this direction, they are planning to perform the Comet Interceptor mission in 2028 as a next step.
- Comet Interceptor is a mission that explores a dynamically new comet or industrial object for the first time in history.
- This mission is performed by at least three spacecraft elements together and JAXA is considering providing one of the two daughter spacecraft with a science instrumental board. In this mission, Prof. Ryu Funase is the PI on the JAXA site and our research group is contributing to the technology development activity for this mission.
- Another direction to pursue is to realize the orbital/ lander mission for small satellites.
- The mission direction, the lightweight deployable aeroshell technologies have been developed and demonstrated in Japan and they hope Mars orbital or Mars landing mission by small satellites will be possible using such technologies in the near future.
- They also have a 6U CubeSat mission to demonstrate the CubeSat technology of semi-hard landing on the planet.
- The semi-hard landing technology demonstration will be done by JAXA's 6U lunar CubeSat mission called OMOTENASHI which will be on board SLS to the moon together with EQUULEUS.
- The lunar CubeSat has a solid rocket motor and after being inserted into the lunar impact trajectory, it will decelerate as large as 2.5 km/s and finally as small as 0.7 kg of surface probe grip performance semi-hard landing on the moon with its shock absorption mechanism.
- Yet another direction would be the realization of a frequent deep space mission for small satellites. We should dramatically increase the number of small satellites going into deep space.
- Currently, there is an enormous number of satellites in the Low Earth Orbit but in deep space, such a world has not been realized.
- At this moment, in order to reach small satellites in deep space, they have to take advantage of launch opportunities of large spacecraft going into deep space and such opportunities are extremely limited in frequency.
- To put small satellites in deep space and to realize the world where a lot of spacecraft can explore the solar system, we need to innovate how micro/nanosatellites reach deep space.
- One of the solutions Prof. Funase and the team are working on is to develop a small kick motor that can generate a large $\Delta V$ so that micro/nanosatellites can escape from earth's orbit such as GTO into deep space by themselves.
- If this became possible, small satellites will be able to venture into deep space at a high frequency ensuring the GTO launch opportunities that will happen regularly.
- In summary, PROCYON and EQUULEUS will be the basis of the deep space bus system especially for the communication and propulsion system for the deep space mission, and based on these achievements there are at least three directions that should be pursued on small spacecraft missions.
- Prof. Ryu Funase believes that many other directions will exist for smallsats taking advantage of its tweak, low cost, and lightweight property, and those various directions using smallsats will become a new pillar for future deep space explorations missions.

# 3. Presentation on “PARS: Precursor Asteroid Remote Survey”

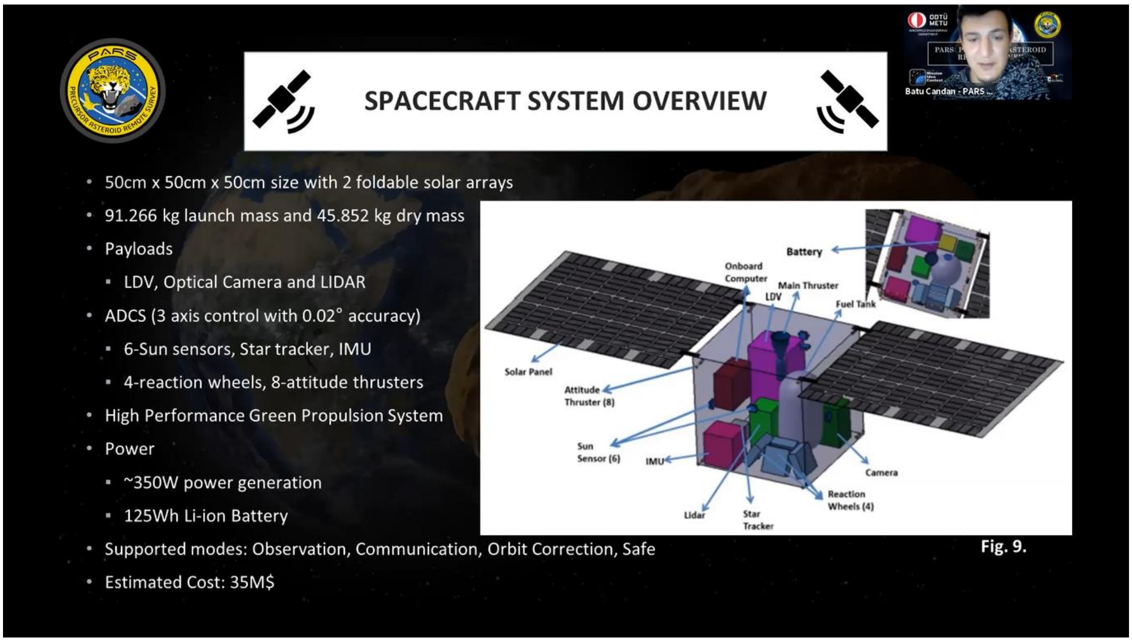
Batu Candan, Middle East Technical University

Batu Candan represented his team members and are graduate students from the Middle East Technical University and Istanbul Technical University.


*Pictured: Batu Candan from Middle East Technical University gives a presentation on PARS: Precursor Asteroid Remote Survey*

<u>Highlights:</u>

- In the presentation, Mr. Candan outlines their motives like starting with the introduction part, then going with mission objectives, the concept of operations, observations and outcomes, key performance, and spacecraft design.
- The motivations were literally the preliminary research about Apophis which is a suitable target for a low-cost technology demonstration and one of the most important motivations was the first time detection of seismic effects of Earth flyby. The first time in space in order to detect those disturbances, the team members proposed the use of a Laser Doppler Vibrometer.
- The motivation also includes a contribution to the future space economy and asteroid deflection missions and raising awareness of space science and technology in Turkey.
- An Apophis is easy to reach with a low-cost mission because it is coming on April 13, 2029, with a much closer than 1300 km, and also it is a unique opportunity to test Laser Doppler Vibrometer (LDV) which is one of the main technology demonstration purposes and also wanted to take reference images and data for the future landers to be utilized for their potential deflection mission because there is no enough mission about the morphology of the Apophis, just ground-based measurements.
- The mission objectives are actually scientific, technical, and social.
- In scientific objectives, they want to determine the shape and surface of the Apophis and in order to accomplish this, they will use the LIDAR and higher resolution camera images.
- Understanding the Tidal Force Effects is one of the major objectives of the scientific branch.
- So, again they try to measure the LIDAR and high-resolution camera images.
- The most important thing is the technology demonstration which could be a milestone for future missions because if they can succeed in the mission with a simple Laser Doppler Vibrometer (LDV) which is used to collect seismic vibration due to tidal forces in Apophis, it will be a milestone for future asteroid orbital systematic concept because it is very costly to land on an asteroid and to deploy a seismometer but if orbital seismometry is accomplished, then it would be very low cost and very feasible concept for asteroid internal structure determination is LDV can be increased.
- In this case, go with a single LDV and will look at whether data can be collected from the Apophis or not.




*Pictured: PARS Spacecraft System Overview*

- Attracting interest in space studies for sure is another important objective with the United Nations Sustainable Development course. So especially in Turkey, these kinds of projects can motivate people especially young people.
- So, qualified human resource development is another probe of this mission.
- The departure will be started in 2028.
- For detailed orbital calculation, the Lambert algorithm is used. The algorithms and results are checked with Demat software. In the same way, different departure and arrival dates are examined, the optimum departure date is determined, also all the details are examined.
- In the initial survey phase when came closer to the Apophis, it is aimed to estimate the initial mass, construct the initial shape, determine the spin axis and estimate the solar radiation pressure for correcting the orbit and also for the preliminary research of the Apophis.
- When captured by the Apophis, sit around the 1 km circular polar orbit and examine the details of the orbit.
- Scientific observation is one of the important parts because, for the first time in space, LDV is utilized. So, they try to take measurements from the surface of Apophis and they will see whether they can detect any seismic activity, any vibration with LDV. This will be the result of the tidal forces. They expect they will collect data because they think that and also from the literature there will be seismic vibrations inside the body because of induced forces due to flyby.
- Thus, the most important parameter is the LDV.
- The LDV basically works to send incident beam and is used to reflect the beam. From the frequency shift, it detects the surface vibration velocity and in this case, surface vibration magnitude velocity can be detected.
- For the spacecraft system overview, basic low-cost solar panels, thrusters, onboard computers are used.
- The main risk of failures is payload failure and main thruster failure. So, a mitigation strategy has been developed for the risks.
- These are the keywords:
  - LIDAR
  - Deep space
  - Surface space
  - Survey
  - Laser Doppler Vibrometry (LDV)
  - Seismic activity from orbit
  - High-resolution camera
  - Asteroid
  - Micro-sized satellite

Q&A:
***Alim Rustem Aslan:*** *First, congratulations Batu. This is the first time Ador Stem came first. Well, we heard the Turkish came first but the institution was not Turkish. So, congratulations again. I was wondering, can you compare the spacecraft vibrations to the vibrations of the asteroid, or what is the effect of spacecraft vibrations on your measurements?*
***Batu Candan:*** *This is one of the fundamental problems which might be faced during taking measurements because it is important as you said to separate the vibrations coming from instruments in spacecraft and vibrations taken from asteroids. So at that point, the mitigation strategy is actually solidly robustly fixed into the Laser Doppler Vibrometer instrument, and also if we can use an accelerometer on board, then we can develop a comma filter or some different algorithms for separating the spacecraft vibration and the vibration measurements coming from the asteroids. So, it is a compensation problem actually and here different compensation algorithms can be used like complementary filters or common filters.*

# 4. Presentation on "MINERVA mission - A CubeSat for demonstrating DNA damage mitigation against space radiation in C. elegans by using genetic modification"

Sumeth Klomchitcharoen, Mahidol University

Tanchanok Tangwattanasirikum is the sub-project manager of Minerva. Sean Gallup is the science co-lead of Minerva and Sumeth Klomchitcharoen is the project manager of Minerva.

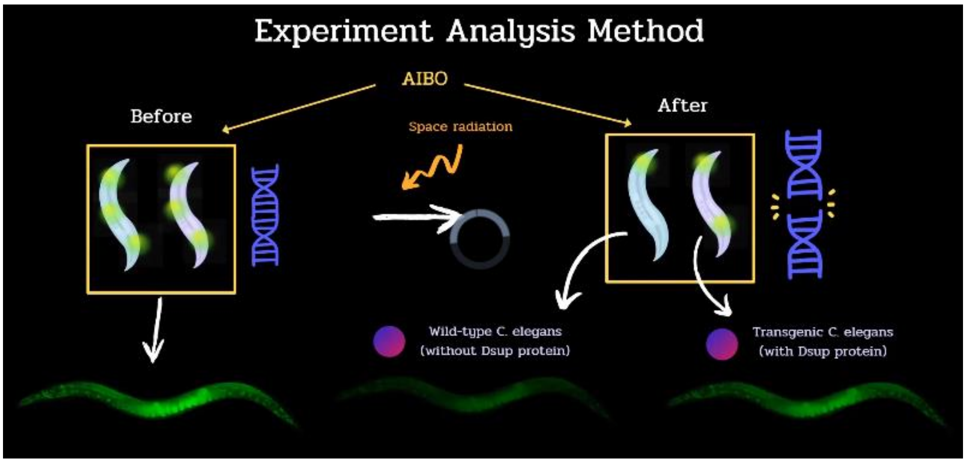
*Pictured:* Sumeth Klomchitcharoen gives a presentation on the MINERVA mission

<u>Highlights:</u>

- Space exploration has been always fascinating for humans we also want to explore new planets like Mars.
- Deep space exploration does not seem unrealistic.
- Space ionizing radiation causes massive damage to our genetic material inducing DNA lesions, double-strand break, and also decreasing the reparability efficiency of the cell. This leads to long-term chronic health diseases like cancer or apoptosis.

  For example: for Alzheimer's disease, when a person travels from Earth to Mars and when he arrives, he can get memory loss because some of the brain cells are dead. So, it can be seen how severe it is.
- The objective is to resolve the issue of space damage radiation, to mitigate DNA damage against deep-space radiation exposure by genetic modification.
- The main goal of developing the satellite is to make the satellite to be the first step towards space medicine that can be used to inhibit the DNA damage from space radiation.

- From the research, it is found that the damaged suppressor protein (Dsup) found in the tardigrade has proven DNA damage from space radiation and can tolerate radiation up to 4000 Gy where humans can tolerate only 1 Gy which is 1000 times difference for this animal. So from here, the researchers synthesize the protein in tardigrade and put it into the modeled organism which is an animal known as C. elegans.
- The unique thing about C. elegans they are able to survive in hibernation for up to 4 months and they are suitable for the mission as they have the ability to reduce human diseases. In addition, C. elegans contain 83% of human homologous genes.
- The CubeSat will be inhabited by an animal making it that much more different and unique from other CubeSat. Not only this, supporting genes are inserted into C. elegans but reinforcement protein is also added along with Dsup genes.
- The mission is going to be unique as the satellite is going to be inhabited by an animal for four months and conduct experiments also collect the data and relay back to the earth.
- During this mission, the modeled organism will be sent into three sets. The organisms will be put in microfluidic chips and sent into a near-rectilinear halo orbit to observe the effect of deep-space radiation.
- Observation of DNA damage in C. elegans after absorbing space radiations will be done by quantifying and comparing the appearance of co-expression GFP between white type C. elegans and C. elegans without protein.




*Pictured: C. elegans without absorbing the radiation (on the left side) and with absorbing the radiation (on the right side)*

- To determine the enhancement of radial resistance, a comparison of the GFP reminder is done. If the remainder of GFP in the transgenic group is lighter than the other ones, it can be said that the transgenic groups can tolerate more radiation than the wild type.
- Apart from the specification of Minerva mission, the cubesat is inhabited by humans so it is planned to make the lifetime of the CubeSat for four months. The total mass of the CubeSat is less than 12 kg and the cost of the mission will be US$ 1.2 million.
- The system consists of 8 micro fluid chips with optical sensor and thermal control system.
- The optical sensor utilizes multi colour imaging techniques to detect fluorescents. The optical sensor is composed of near-infrared LEDs which provide high resolution and high speed series structural imaging and the blue LED is used in detecting fluorescence protein in C. Elegans.
- The other part of the system is Radiation dosimeter which is used to observe the biological effect of the radiation in deep space.
- In this case, linear energy radiation spectrometer to detect the dose of galactic hospitray and solar particle event that C. elegan receives in the halo orbits.
- The CubeSat is moon-centric orbit which is expected for future lunar space exploration.
- To make sure the CubeSat rotates in its orbit, GMAP simulation is used with GMAP model to calculate the trajectory pathway which is the most suitable for the mission.
- In conclusion, the benefit which can be received is to provide a platform that can take animals into deep space and detect the biological response inside the CubeSat.
- If this mission works, this can be taken as a basis to develop future space medicine to prevent long term chronic health diseases that occur in astronauts. Also, future space exploration feasibility can also be increased.

Q&A:
***Rel Kawashima:*** *Do you think you can realize this mission in a reality in the future?*
***Sumeth Klomchitcharoen:*** *Actually yes, for now we are working under research which is the preliminary research for this satellite,*

## 5. Breakout Discussion and Sharing

Moderator: Nate Taylor, UNISEC-Global


*Pictured: The topic subject for the breakout session regarding any space mission idea*

Highlights:

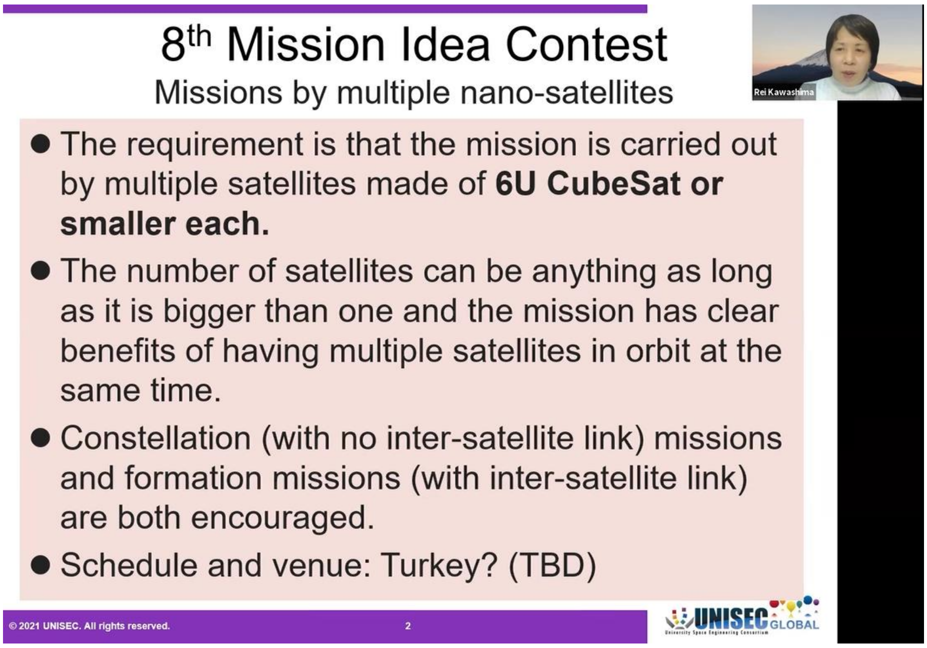
- 25 minutes Mission idea exercise is divided into 8 groups
- Discuss on designing ANY space mission with no constraints other than it utilizing micro/nanosatellites what would the mission be?

| Group | Speaker | Highlights |
|---|---|---|
| Room 1 | **Sumeth Klomchitcharoen**, George Maeda | No session<br>Comments:<br>- *Sumeth*: MIC7 is really good contest a lot of opportunity to express idea talk about our satellite we would like to develop and then there are some professors here who can give us how to develop satellite, how can we improve satellite better. It is really good.<br>- *Nate: would you prefer if there was predesigned mission that you had to work on or you prefer being to choose your own mission?*<br>- *Sumeth*: Actually, it might be better I can choose my own project. If you like to develop a satellite, I think is you need to be more passion to working on it, it not an easy to that you can't just thinking to do and finish in couple of months to finish it. you need like years maybe you need a time to study so you need a lot of passion can drive yourself to working on it.<br>- So maybe the best thing is to choose the mission you like to work on, to choose what you like to build and then you will have enough passion to do it. |

| Group | Speaker | Highlights |
| --- | --- | --- |
| Room 2 | **Satoru Kurosu,**<br>Rei Kawashima,<br>Jace Refran,<br>Japheth Korir | - First LEO constellation type of ideas to have a more accurate images for land use<br>- What if we do not have any initial budget money what do we do?<br>- Single nano-satellite to the next solar system and get picture back to planet (for example: Alpha Centauri Doctors Idea) |
| Room 3 | **Pisitchai,**<br>En shih,<br>Vess Vassilev,<br>Maria Rashid | - Tracking novel island ship ocean liner to predict the most efficient way to communication to like travel path to ocean wildlife and eco system something like that |
| Room 4 | **Maya abe,**<br>Alim Rustem Aslan,<br>Mohammed Iraqi,<br>Phichamon Phatthanaanuku | - Micro satellite Constellation which emitting microwaves to provide to forward other satellite<br>- Space weather investment constellation<br>- IoT constellation<br>- Prefer to launch Jem west private companies because their profit is something very commercial and interesting |
| Room 5 | Noparin Smerwong,<br>Tanchanok Tangwattanasirikun | - NA |
| Room 6 | **Burak Yaglioglu,**<br>Ersin Soken,<br>Kentaro Enokida | - Since no constrains expanding in terms of boundaries in terms of application and medium<br>- Scientific observation, Magnetic field radiation and environment media data collection, maybe unrevealing parts of electromagnetic spectrum,<br>- Distributed missions with nanosatellites to increase special term programmatic solutions anyone can build systems and we can close relationship with objective and use founders, society to get promoted. |
| Room 7 | **Hauang Chun,**<br>Ryu Funase,<br>Shunichiro Nomura | - Series of small satellite, build few hundreds of them send one by one like a train, a series of satellite of them will be heading toward a direction<br>- Potentially we can ram it and using the chasing one to investigate it degree backup at the higher altitude<br>- It is possible because Planetary Defense System by NASA using the similar method to ram asteroid that is potentially harmful to earth<br>- SpaceX started providing much cheaper and low-cost cargo and launch cost<br>- so even if there are no constraints we have to do in reasonable ways. |
| Room 8 | **Erik Chu,**<br>Nazli Can,<br>Peetimon Arunwiriyahkit | - Illegal issue and legal issue are very important<br>- Private companies and emergence of private startups dealing with issues is the key important factor<br>- Importance of Genetic and space research in the future of space studies |

# 6. New Member Acknowledgment, Announcements and Closing

Rei Kawashima, UNISEC-Global




*Pictured: Kawashima-san making announcements for the UNISEC-Global Community*

<u>Highlights:</u>

- No new Local Chapter
- **8th Mission Idea Contest**
  - Missions by multiple nano-satellites
  - Schedule and venue: Turkey (TBD)
- **27th APRSAF (Asia Pacific Regional Space Agency Forum)**
  - Nov 30-Dec 3, 2021 (virtual)
  - Venue: Online Conference (host country: Vietnam)
  - UNISEC will organize the higher education session as a part of Space Education for All Working Group (SE4AWG)
  - 14:10 – 16:40 (Vietnamese time), Dec 1, 2021.
  - Free event, Registration link https://www.aprsaf.org/
- **Launch opportunities (ISS deployment)**
  - **KiboCUBE 7th round application is open**
    - UNOOSA and JAXA joint program
    - Free launch opportunity (1U CubeSat)
    - Deadline: 31 December 2021
    - https://www.unoosa.org/oosa/en/ourwork/access2space4all/KiboCUBE/KiboCUBE_Rounds.html
  - **JCUBE – special (discounted) launch opportunities (1U- 3U)**
    - Shared link: http://unisec.jp/serviceen/j-cube/
- **Next Virtual Meeting**
  - Date: December 18, 2021 10:00 pm – 0:00 am (JST)
  - Program:
    - Theme: TBD
    - Confirmed Speaker: TBD
    - Local Chapter presentation: TBD
  - Virtual UNISEC-Global Meetings will take place on the Third Saturday almost every month in 2021.


*Pictured: Events for 2021 and 2022*

- **2021 Planned Events**
    - IAA 1st African Symposium for small satellite (South Africa) on Nov 29 – Dec 1
    - Asia-Pacific Regional Space Agency Forum (APRSAF) online on Nov 30-Dec 3
- **2022 Planned Events**
    - 10th Nano-satellite Symposium (Japan) on Feb 26 – March 4, 2022 (during 33rd ISTS)

*Pictured: Alim Rustem Alsan giving his thought on the meeting*

***Mohammed Iraqi***: I would like to thank UNISEC global for this regular online meeting it was really good to keep us connected to share the idea. I think it is good side of the pandemic is making us frequently connected compared to which before pandemic, we were actually meeting one time a year at that time and the for nano satellite definitely I will try to do my best. I would go to hot spring so I love to join. I stayed there 4 years ago near the famous hot spring. So, I would like to join and encourage other to join ISTS hopefully.

***Alim Rustem Aslan**:* I can say hello and I can say it was great and well there are also very nice onsen in Turkey everybody is welcome in Turkey**.**

***Ertan Umit:*** Hi everyone I was actually planning to have really nice speech about the symposium now you confuse me with all this talk about the hot springs so I don't know what to say I looking forward too good

***Ersin soken:*** It was great to be here. I can also say that the overall meeting of the organization was wonderful. I was one of the advisors for our winning group this year. You know it has been actually wonderful experience for our student it was kind a new experience for almost all of them. We would like to thank to all organizer once more and hopefully if we can have the next MIC 8 here in Turkey it will be wonderful to host in our country.

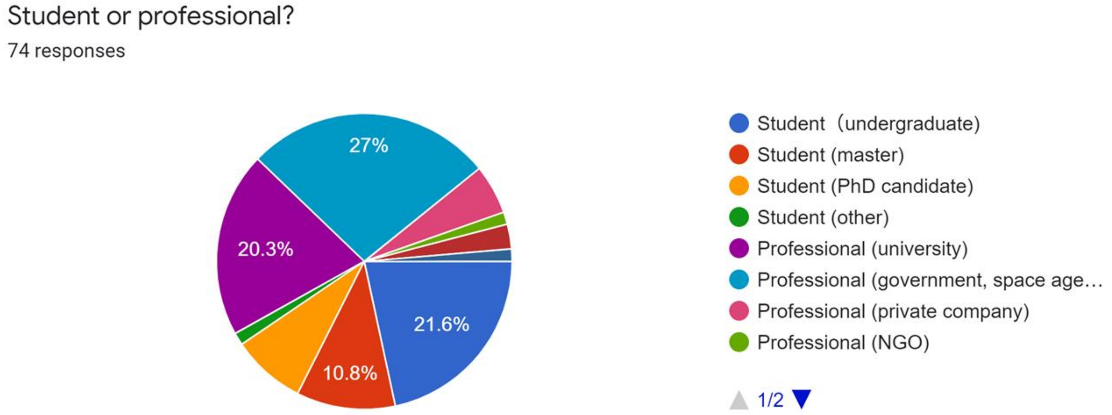
***Nate Taylor:*** This week the Australian Space Biology held some actually was held concluded over in 4 days all the session was recorded link [***https://www.asbx.com.au/***](https://www.asbx.com.au/)

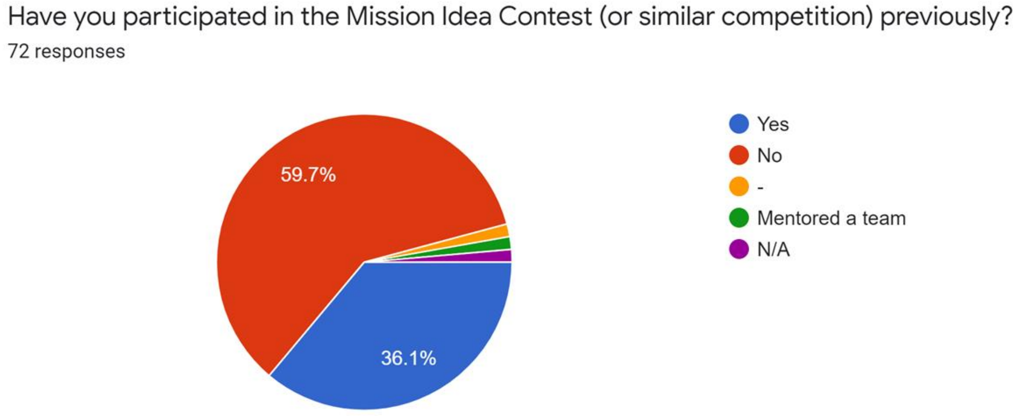

## 7. Participant Statistics

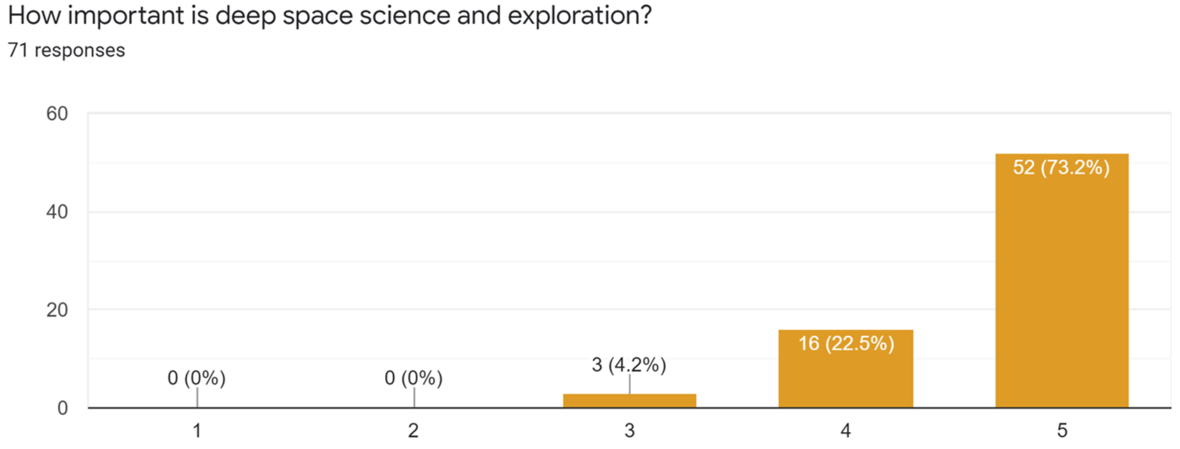
**78** registered participants from **24** countries/regions participated in the 15th Virtual UNISEC-Global Meeting.

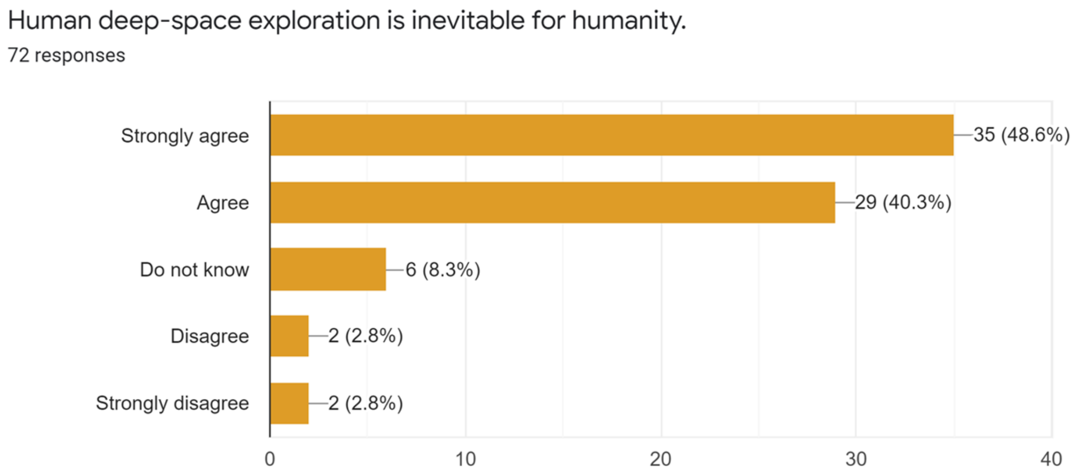
| **Country/Region** | **Number of registrants** | **Country/Region** | **Number of registrants** |
|---|---:|---|---:|
| Afghanistan | 3 | Oman | 1 |
| Australia | 1 | Pakistan | 1 |
| Belgium | 3 | Peru | 1 |
| Bulgaria | 1 | Philippines | 13 |
| Cameroon | 1 | Spain | 1 |
| Costa Rica | 1 | Sudan | 1 |
| Egypt | 8 | Taiwan | 1 |
| India | 2 | Thailand | 6 |
| Japan | 12 | Tunisia | 2 |
| Kenya | 3 | Turkey | 9 |
| México | 3 | United Kingdom | 1 |
| Nepal | 1 | Iraq | 2 |

# 8. Participant Questionnaire




Human deep-space exploration is inevitable for humanity.
72 responses
Strongly agree
Agree
Do not know
Disagree
Strongly disagree
35 (48.6%)
29 (40.3%)
6 (8.3%)
2 (2.8%)
2 (2.8%)
0
10
20
30
40

**Thank you**