Hiraku Sakamoto, Ph.D.
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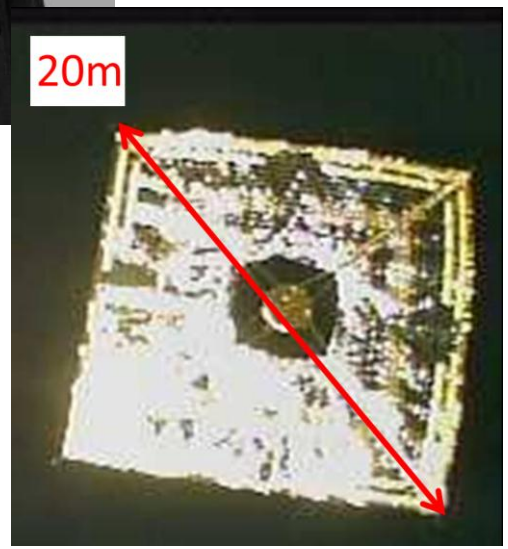
- ✓ **Education:** Ph.D. at the University of Colorado at Boulder, USA
- ✓ **Research:** Space demonstration of new deployable structure designs



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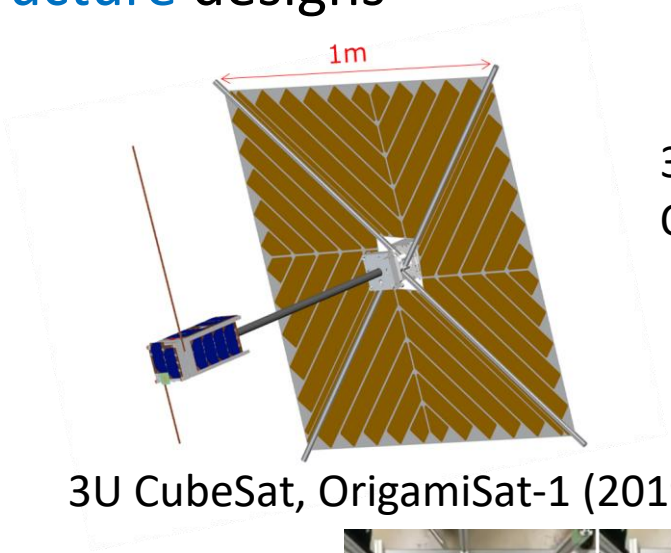
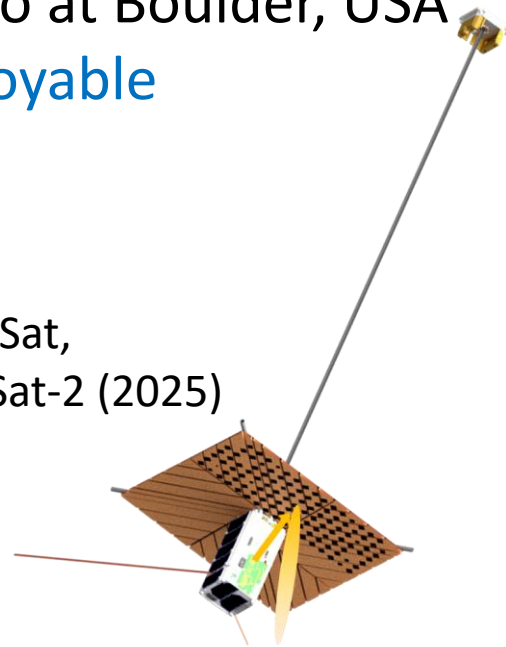
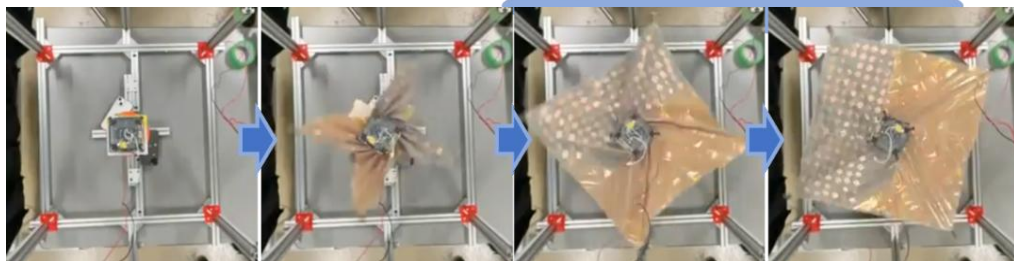
Solar sail demonstrator, IKAROS (2010)



3U CubeSat, OrigamiSat-1 (2019)



3U CubeSat,
OrigamiSat-2 (2025)



Hiraku Sakamoto, Ph.D.

Chairperson of UNISEC-Japan since Oct. 2024

Vision as Chairperson: “Creating the Future Together”

“The best way to predict the future is to create it.” — Alan Kay

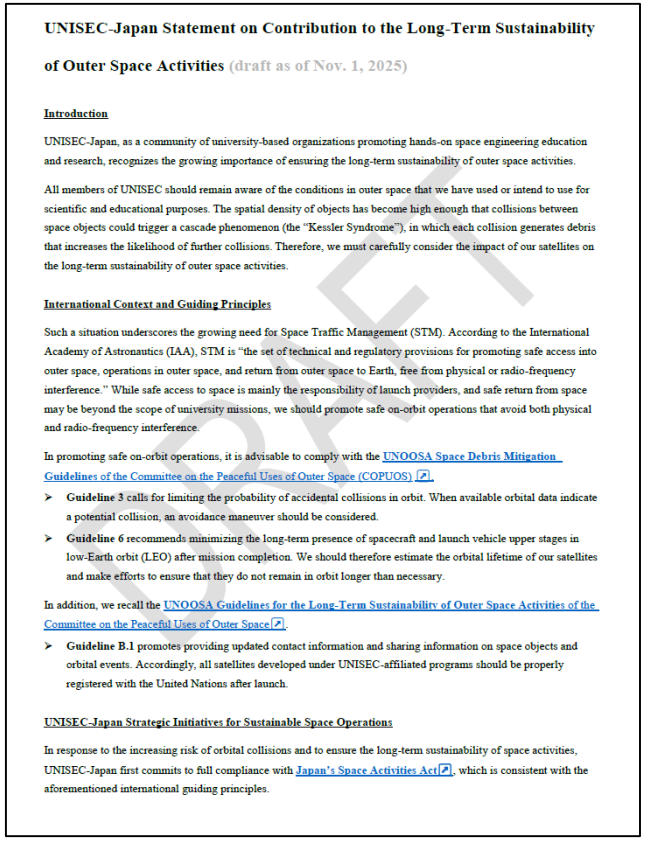
Focus on **three directions** for the next decade:

1. **Reliability:** Strengthen system integration and mission assurance.
2. **Continuity:** Build sustainable programs beyond single missions.
3. **Humanity:** Create new *values and ethics* for the space era — contributing to sustainability.

Invitation:

Join UNISEC as pioneers who will shape the next space generation — through collaboration, creativity, and courage.

UNISEC-Japan
Statement on Contribution to the Long-Term Sustainability of Outer Space Activities
(*Draft as of Nov. 2025*)



UNISEC-Japan Statement on Contribution to the Long-Term Sustainability of Outer Space Activities (draft as of Nov. 1, 2025)

Introduction

UNISEC-Japan, as a community of university-based organizations promoting hands-on space engineering education and research, recognizes the growing importance of ensuring the long-term sustainability of outer space activities.

All members of UNISEC should remain aware of the conditions in outer space that we have used or intend to use for scientific and educational purposes. The spatial density of objects has become high enough that collisions between space objects could trigger a cascade phenomenon (the "Kessler Syndrome"), in which each collision generates debris that increases the likelihood of further collisions. Therefore, we must carefully consider the impact of our satellites on the long-term sustainability of outer space activities.

International Context and Guiding Principles

Such a situation underscores the growing need for Space Traffic Management (STM). According to the International Academy of Astronautics (IAA), STM is "the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space, and return from outer space to Earth, free from physical or radio-frequency interference." While safe access to space is mainly the responsibility of launch providers, and safe return from space may be beyond the scope of university missions, we should promote safe on-orbit operations that avoid both physical and radio-frequency interference.

In promoting safe on-orbit operations, it is advisable to comply with the UNOOSA Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space (COPUOS).

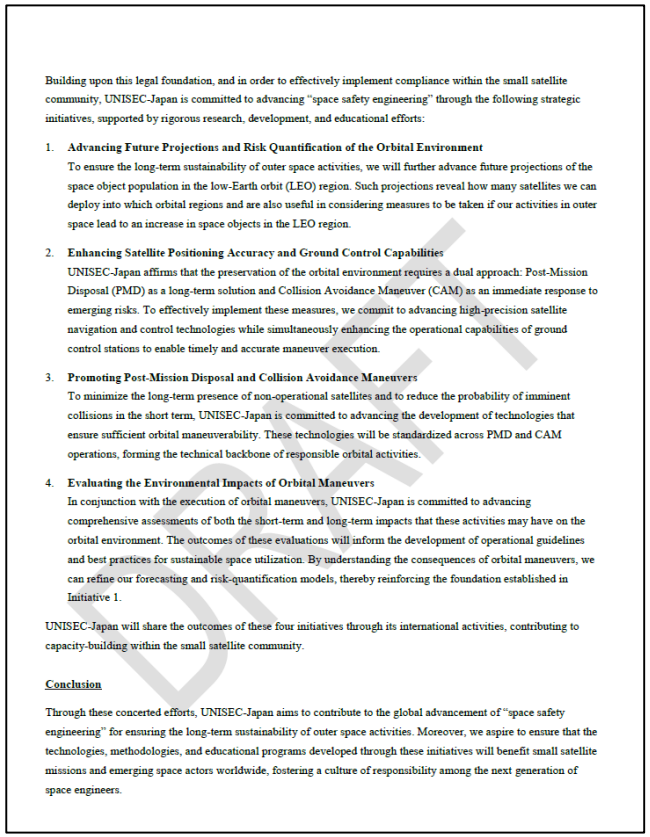
- **Guideline 3** calls for limiting the probability of accidental collisions in orbit. When available orbital data indicate a potential collision, an avoidance maneuver should be considered.
- **Guideline 6** recommends minimizing the long-term presence of spacecraft and launch vehicle upper stages in low-Earth orbit (LEO) after mission completion. We should therefore estimate the orbital lifetime of our satellites and make efforts to ensure that they do not remain in orbit longer than necessary.

In addition, we recall the UNOOSA Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space.

- **Guideline B.1** promotes providing updated contact information and sharing information on space objects and orbital events. Accordingly, all satellites developed under UNISEC-affiliated programs should be properly registered with the United Nations after launch.

UNISEC-Japan Strategic Initiatives for Sustainable Space Operations

In response to the increasing risk of orbital collisions and to ensure the long-term sustainability of space activities, UNISEC-Japan first commits to full compliance with Japan's Space Activities Act, which is consistent with the aforementioned international guiding principles.



Building upon this legal foundation, and in order to effectively implement compliance within the small satellite community, UNISEC-Japan is committed to advancing "space safety engineering" through the following strategic initiatives, supported by rigorous research, development, and educational efforts:

1. **Advancing Future Projections and Risk Quantification of the Orbital Environment**
   To ensure the long-term sustainability of outer space activities, we will further advance future projections of the space object population in the low-Earth orbit (LEO) region. Such projections reveal how many satellites we can deploy into which orbital regions and are also useful in considering measures to be taken if our activities in outer space lead to an increase in space objects in the LEO region.
2. **Enhancing Satellite Positioning Accuracy and Ground Control Capabilities**
   UNISEC-Japan affirms that the preservation of the orbital environment requires a dual approach: Post-Mission Disposal (PMD) as a long-term solution and Collision Avoidance Maneuver (CAM) as an immediate response to emerging risks. To effectively implement these measures, we commit to advancing high-precision satellite navigation and control technologies while simultaneously enhancing the operational capabilities of ground control stations to enable timely and accurate maneuver execution.
3. **Promoting Post-Mission Disposal and Collision Avoidance Maneuvers**
   To minimize the long-term presence of non-operational satellites and to reduce the probability of imminent collisions in the short term, UNISEC-Japan is committed to advancing the development of technologies that ensure sufficient orbital maneuverability. These technologies will be standardized across PMD and CAM operations, forming the technical backbone of responsible orbital activities.
4. **Evaluating the Environmental Impacts of Orbital Maneuvers**
   In conjunction with the execution of orbital maneuvers, UNISEC-Japan is committed to advancing comprehensive assessments of both the short-term and long-term impacts that these activities may have on the orbital environment. The outcomes of these evaluations will inform the development of operational guidelines and best practices for sustainable space utilization. By understanding the consequences of orbital maneuvers, we can refine our forecasting and risk-quantification models, thereby reinforcing the foundation established in Initiative 1.

UNISEC-Japan will share the outcomes of these four initiatives through its international activities, contributing to capacity-building within the small satellite community.

Conclusion

Through these concerted efforts, UNISEC-Japan aims to contribute to the global advancement of "space safety engineering" for ensuring the long-term sustainability of outer space activities. Moreover, we aspire to ensure that the technologies, methodologies, and educational programs developed through these initiatives will benefit small satellite missions and emerging space actors worldwide, fostering a culture of responsibility among the next generation of space engineers.

1. Introduction

UNISEC-Japan: A University-based Community for Space Education and Research

- Recognizing the growing importance of long-term sustainability of outer space activities
- UNISEC members must consider the long-term impact of their satellites on the orbital environment

2. International Context and Guiding Principles

- Growing need for Space Traffic Management (STM)
  - "The set of technical and regulatory provisions for promoting safe access, operations, and return from outer space free from interference." — IAA
- Key International Guidelines:
  - UNOOSA Space Debris Mitigation Guidelines (COPUOS):
    - Guideline 3: Limit probability of on-orbit collisions
    - Guideline 6: Minimize long-term orbital presence after mission end
  - UNOOSA LTS Guidelines:
    - Guideline B.1: Share contact/orbital information and register all satellites

3a. Strategic Direction

Legal and Ethical Foundation:

- UNISEC-Japan commits to full compliance with **Japan's Space Activities Act**, aligned with international guiding principles.
- The community will advance "Space Safety Engineering" through research, development, and education.

Strategic Goal:

- To ensure that small-satellite missions operate safely, sustainably, and responsibly within the global orbital ecosystem.

3b. Four Strategic Initiatives

1. Advancing Future Projections and Risk Quantification:

→ Forecast LEO population and evaluate potential risk trends

2. Enhancing Satellite Positioning & Ground Control Capabilities:

→ Develop appropriate **navigation** and responsive CAM/PMD **operations**

3. Promoting Post-Mission Disposal (PMD) and Collision Avoidance Maneuver (CAD):

→ Standardize maneuver technologies and demonstrate in orbit

4. Evaluating Environmental Impacts of Orbital Maneuvers:

→ Assess short/long-term effects; refine forecasting and reinforce Initiative 1

4. Conclusion & Reference

Conclusion:

- UNISEC-Japan contributes to the global advancement of *Space Safety Engineering*.
- Fostering a culture of responsibility among next-generation space engineers.
- Sharing results through international capacity-building efforts.

Reference:

ISO 20991: Orbital Debris Mitigation — Requirements (ISO, 2023)