INTERNATIONAL® SPACE UNIVERSITY

ISU SPACE STUDIES PROGRAM 2025

JUNE 30 - AUGUST 22

HANYANG UNIVERSITY ERICA, KOREA

PARTICIPATION REPORT

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Acknowledgments

I am deeply honored to have been selected for the International Space University Dispatch Program 2025, sponsored by the Institute of Fluid Science (IFS), Tohoku University, which enabled me to participate in the prestigious International Space University Space Studies Program 2025. I would like to express my sincere gratitude to Tohoku University for its continued commitment to supporting international academic exposure and global capacity-building through this dispatch initiative.

I am especially thankful to the Institute of Fluid Science for its generous support and facilitation of this opportunity, which made my participation in SSP25 possible. I am immensely thankful to Professor Atsuki Komiya and Ms. Natsuko Hatakeyama from the Institute of Fluid Science for their continuous guidance, encouragement, and support at every step of this program. I extend my heartfelt appreciation to my supervisor, Professor Kazuya Yoshida, for his invaluable mentorship, guidance, and encouragement throughout my academic journey. His support and confidence in my abilities played a crucial role in enabling me to pursue and fully engage in this transformative experience.

I would also like to convey my sincere thanks to the International Space University, the SSP25 academic and administrative teams, and all faculty members, lecturers, and staff whose dedication and expertise shaped an intellectually rigorous and inspiring program. I am deeply grateful to my fellow SSP25 participants, “The Lovebugs,” whose collaboration, cultural exchange, and shared enthusiasm created an exceptional learning environment and made this experience both enriching and memorable.

Finally, I extend my profound gratitude to my family and friends for their unwavering support, encouragement, and belief in me. Their constant motivation and understanding provided the foundation that allowed me to fully embrace this opportunity. This experience has been truly transformative, and I am sincerely thankful to everyone who contributed to making my participation in SSP25 both meaningful and impactful.

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1 Introduction

1.1 Overview of International Space University (ISU) and SSP

The International Space University (ISU) is an international higher education institution dedicated to advancing space education through interdisciplinary, international, and intercultural learning. One of its flagship programs, the Space Studies Program (SSP), was established in 1988 as an intensive educational initiative designed to foster collaboration across engineering, science, policy, and societal dimensions of space activities. Conducted annually in different host countries, SSP has continuously evolved to address emerging technological, policy, and sustainability challenges in the global space sector.

The Space Studies Program 2025 (SSP25) was held from June 30 to August 22, 2025, at Hanyang University ERICA in the Republic of Korea. The program brought together participants from diverse academic and professional backgrounds to engage in a comprehensive curriculum consisting of core lectures, departmental activities, team projects, and professional visits. Through its interdisciplinary structure and emphasis on international cooperation, SSP provides participants with perspectives on global space activities that extend beyond traditional disciplinary boundaries, while promoting collaborative problem-solving and systems-level thinking.

SSP25 represents the continuation of ISU's educational legacy, with a particular focus on strengthening collaboration between engineering innovation, sustainability, and international cooperation in space exploration and utilization. To place SSP25 within this broader institutional context, Table 1 summarizes key milestones in the historical development of ISU and the Space Studies Program, highlighting the evolution of ISU's educational offerings, the establishment of its central campus, and the continued growth of SSP as an annual international program.

	Timeline
1987	ISU was founded!
1988	First SSP at MIT
1993	Strasbourg, FR-selected as location for ISU Central Campus
1994	ISU relocated to SXB
2003	First Introductory Space Course (now the Executive Space Course)
1995	First MSS
2023	New Master of Science (MSc): Space Studies, Accredited by ASIIN
2025	SSP in South Korea 37th Edition!!

1.2 ISU's Educational Philosophy

ISU's educational philosophy is rooted in the "3Is"—Interdisciplinary, International, and Intercultural—principles that define its approach to spac e studies.

- **Interdisciplinary:** SSP25 emphasized systems-level thinking by integrating engineering, policy, business, and human factors. For my research in robotic manipulation and lunar assembly, this interdisciplinary exposure enhanced my ability to contextualize technical design decisions within mission, regulatory, and operational constraints.
- **International:** Working alongside participants from diverse national and professional backgrounds strengthened my ability to collaborate across cultural and institutional boundaries—an essential skill for international space missions.
- **Intercultural:** Daily collaboration and team-based problem-solving fostered adaptability and communication skills necessary for effective leadership in multicultural engineering environments.

1.3 International Space University Dispatch Program

The International Space University Dispatch Program, organized by the Institute of Fluid Science (IFS) at Tohoku University, supports the selection and participation of qualified graduate students and early-career researchers in the annual Space Studies Program (SSP) offered by the International Space University (ISU). The program has been active for several decades, reflecting IFS's commitment to developing global leaders in space science and engineering by enabling students to engage with an international, interdisciplinary, and multicultural cohort in SSP. Through this dispatch initiative, eligible doctoral students and researchers are provided with financial support for participation fees, travel, and related expenses, along with obligations to report and share their experiences within the university community after completion. Over the years, the program has dispatched numerous students who have subsequently pursued careers in academia, space agencies, industry, and research institutions, underscoring its role in fostering international mobility and professional growth in the space sector.

1.4 SSP25 Badge Overview

The SSP25 badge was collaboratively designed by International Space University (ISU) staff and SSP25 participants, reflecting a collective identity shaped through interdisciplinary and intercultural engagement. The design integrates symbolic elements representing the host country, the program's global character, and the shared aspirations of the SSP25 cohort. Inspired by Korean cultural motifs,

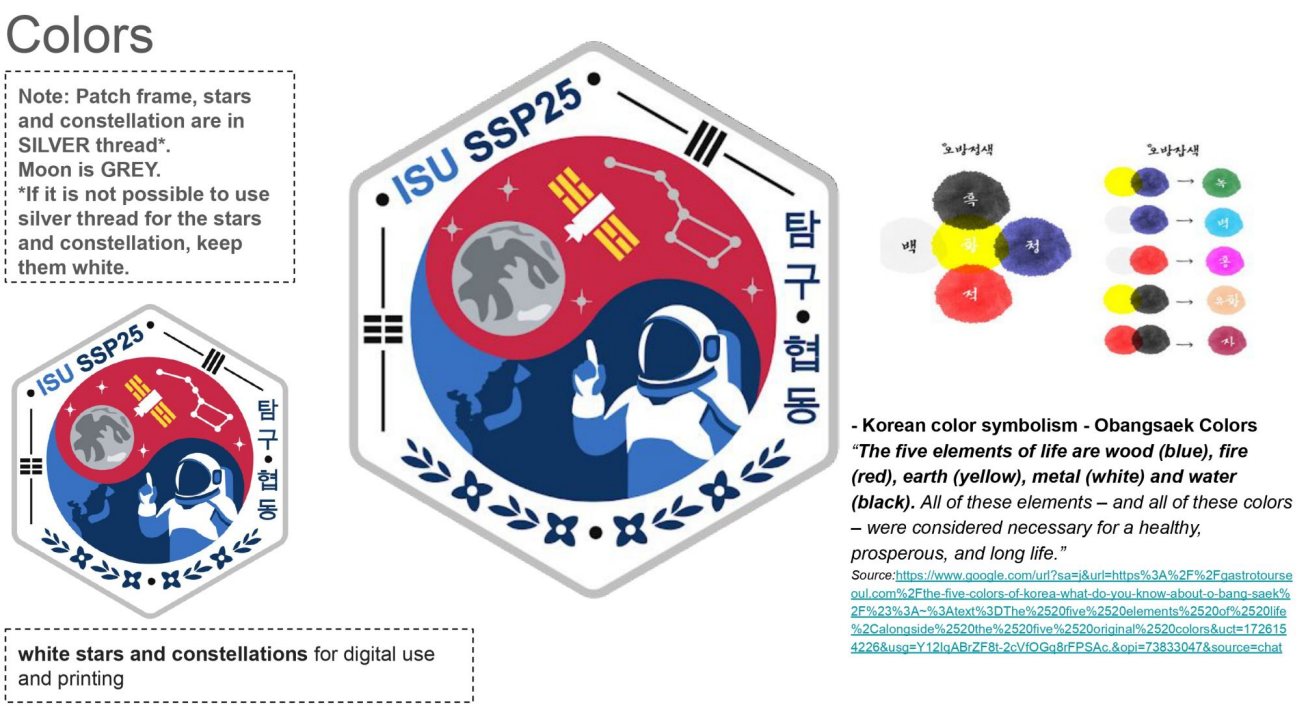

Figure 1. SSP25 Official Badge

space exploration themes, and values expressed by participants, the badge visually embodies exploration, collaboration, and unity. Its composition highlights the international nature of ISU, the significance of South Korea as the host nation, and the program's focus on advancing space science and technology through cooperative effort. By combining cultural symbolism with space-related

imagery, the SSP25 badge serves not only as an emblem of participation but also as a representation of the collective vision and shared experience formed during the program.

2 Program Overview

The Space Studies Program 2025 (SSP25), organized by the International Space University (ISU), was an intensive international educational program conducted over an eight-week period. Held at Hanyang University ERICA in the Republic of Korea, SSP25 brought together participants from diverse academic disciplines, professional backgrounds, and nationalities to engage in a comprehensive and multidisciplinary exploration of space science, engineering, policy, and applications.

The program curriculum was structured around core lectures, departmental activities, team projects, workshops, and professional visits. Through this framework, SSP25 provided exposure to both technical and non-technical domains, including space engineering and sciences, systems design, management, policy, law, and societal aspects of space activities. The combination of lectures by subject-matter experts and hands-on collaborative activities facilitated systems-level understanding and practical problem-solving.

Throughout SSP25, the program's educational philosophy—Interdisciplinary, International, and Intercultural ("3Is")—was consistently reflected in both academic and collaborative settings. Working in multinational and multidisciplinary teams enabled active exchange of perspectives and approaches, reinforcing the importance of international cooperation in addressing complex challenges in the space sector. This structure supported both professional development and the acquisition of skills essential for collaborative research and future international space missions.

2.1 Hosting Institution

The Space Studies Program 2025 (SSP25) was hosted by **Hanyang University ERICA Campus**, located in the Republic of Korea. The ERICA campus provided a well-integrated academic environment that supported both the educational and social components of the program. Core academic activities, including lectures and workshops, were conducted in designated classroom

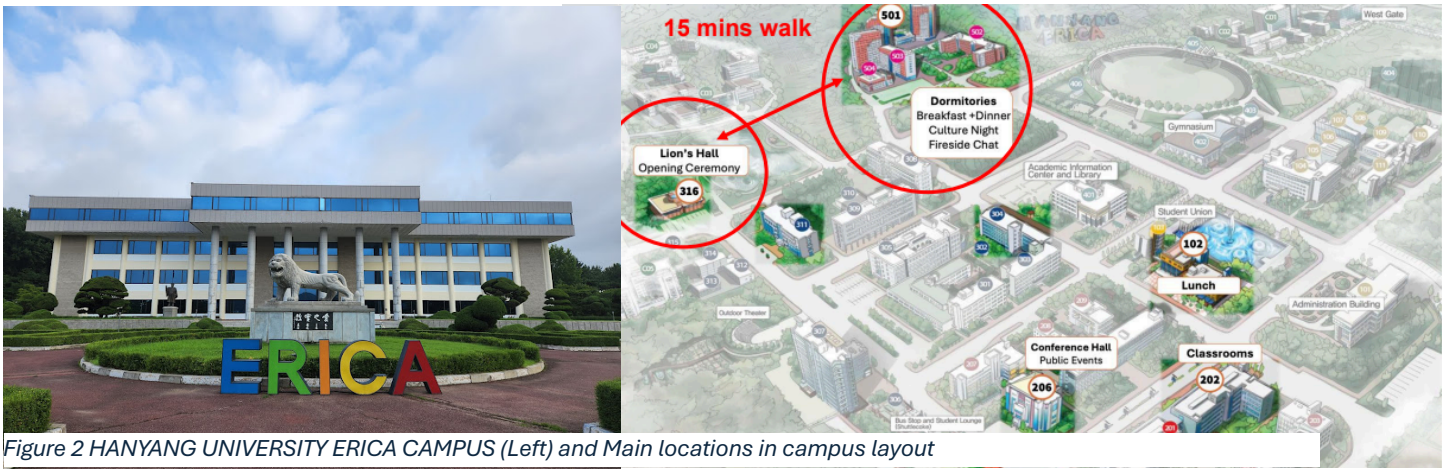

Figure 2 HANYANG UNIVERSITY ERICA CAMPUS (Left) and Main locations in campus layout

buildings, while conference halls were used for public events, panel sessions, and ceremonies. Meals were organized at centralized dining facilities within walking distance of the academic venues, ensuring smooth daily operations.

Participant accommodation was arranged in nearby dormitories, which also served as venues for informal discussions, fireside chats, and cultural exchange activities. Key program events, such as the opening ceremony at Lion's Hall, cultural nights, and group gatherings, were distributed across the campus, with all major facilities located within approximately a 15-minute walking radius. This compact layout facilitated efficient movement between academic, residential, and social spaces,

fostering continuous interaction and collaboration among participants throughout the program.

2.2 Daily life: Accommodation, Meals, Transport and Facilities

Accommodation for SSP25 participants was provided in gender-designated on-campus dormitories at Hanyang University ERICA. Participants were assigned single-occupancy rooms equipped with basic furnishings, including a bed, desk, storage space, and private bathroom facilities. Shared amenities within the dormitory complex included laundry rooms, convenience stores, automated teller machines, and common areas, ensuring a comfortable and self-contained living environment throughout the program. The proximity of the dormitories to academic buildings enabled convenient daily movement, with most key locations accessible within walking distance.

Figure 3. SSP Faculty, staff and participants dormitory overview

In addition to residential facilities, several on-campus social and recreational spaces supported informal interaction and community building among participants. Dedicated areas were used for cultural nights and social events, while recreational facilities such as gymnasiums, music rooms, and karaoke spaces were available for leisure activities outside the academic schedule. These shared

spaces played an important role in fostering intercultural exchange and strengthening social connections among participants from diverse backgrounds.

Figure 4. In-House recreational facilities and dedicated halls for social events

All participants were formally welcomed during the onboarding process on 28 June 2025. Upon arrival, participants were guided to the Hanyang University dormitory for check-in, where accommodation procedures were completed following the submission and verification of pre-filled and signed contracts along with the required supporting documents. As part of the onboarding activities, each participant received an official SSP25 welcome kit, which included ISU-branded materials such as identification badges, lanyards, stickers, wristbands, and a program bag. This structured onboarding process ensured a smooth transition into campus life and marked the official commencement of participants' engagement in the Space Studies Program.

Figure 5. Official SSP'25 Welcome Kit

As part of the onboarding process, each participant was issued an official SSP25 identification badge, which served both administrative and community-building purposes throughout the program. The front of the badge displayed the participant's name, photograph, affiliation, and role, while the reverse side listed the languages spoken and the participant's home country. This thoughtful design facilitated effective communication, encouraged cross-cultural interaction, and supported collaboration among participants from diverse linguistic and national backgrounds. The badges were worn throughout academic, social, and professional activities, reinforcing ISU's emphasis on internationalism, inclusivity, and intercultural exchange.

Meals were primarily provided at campus dining facilities, which offered a range of Korean and international dishes served in buffet-style or set-meal formats. Lunch and dinner were organized at designated cafeterias, providing balanced and consistent meals throughout the program. The availability of multiple dining locations within the campus allowed flexibility in meal arrangements, while nearby convenience stores and coffee shops supplemented daily needs. Overall, the dining and residential infrastructure effectively supported participants' daily routines, contributing to a stable and collaborative living environment during SSP25.

Figure 6. Daily food meals available at cafeteria and on-campus cafes

2.3 SSP25 Participants Demographics and Backgrounds

The SSP25 cohort consisted of 122 participants representing 39 countries, reflecting the international and interdisciplinary character of the Space Studies Program. Participants came from a wide range of academic and professional backgrounds, including undergraduate and graduate students, doctoral

researchers, early-career professionals, and individuals holding senior roles in space agencies, government institutions, defense organizations, and private corporations. In alignment with ISU's educational philosophy, participants are referred to as participants rather than students, underscoring SSP's role as a professional development program rather than a conventional academic course.

Despite this diversity in experience and career stage, the SSP25 cohort was unified by a shared interest in space-related disciplines and a strong commitment to collaborative learning throughout the eight-week program. Figure 1 summarizes the demographic composition of the cohort, illustrating distributions across academic backgrounds, gender, geographical regions, work experience, and educational levels. Together, these characteristics contributed to a dynamic learning environment that supported interdisciplinary dialogue, cross-cultural exchange, and collaborative problem-solving across both technical and non-technical domains. Figure 2 presents the country-wise distribution of SSP25 participants, illustrating the geographical diversity of the cohort and the broad international representation across multiple regions. The distribution highlights the program's global reach and reinforces the intercultural learning environment fostered throughout SSP25.

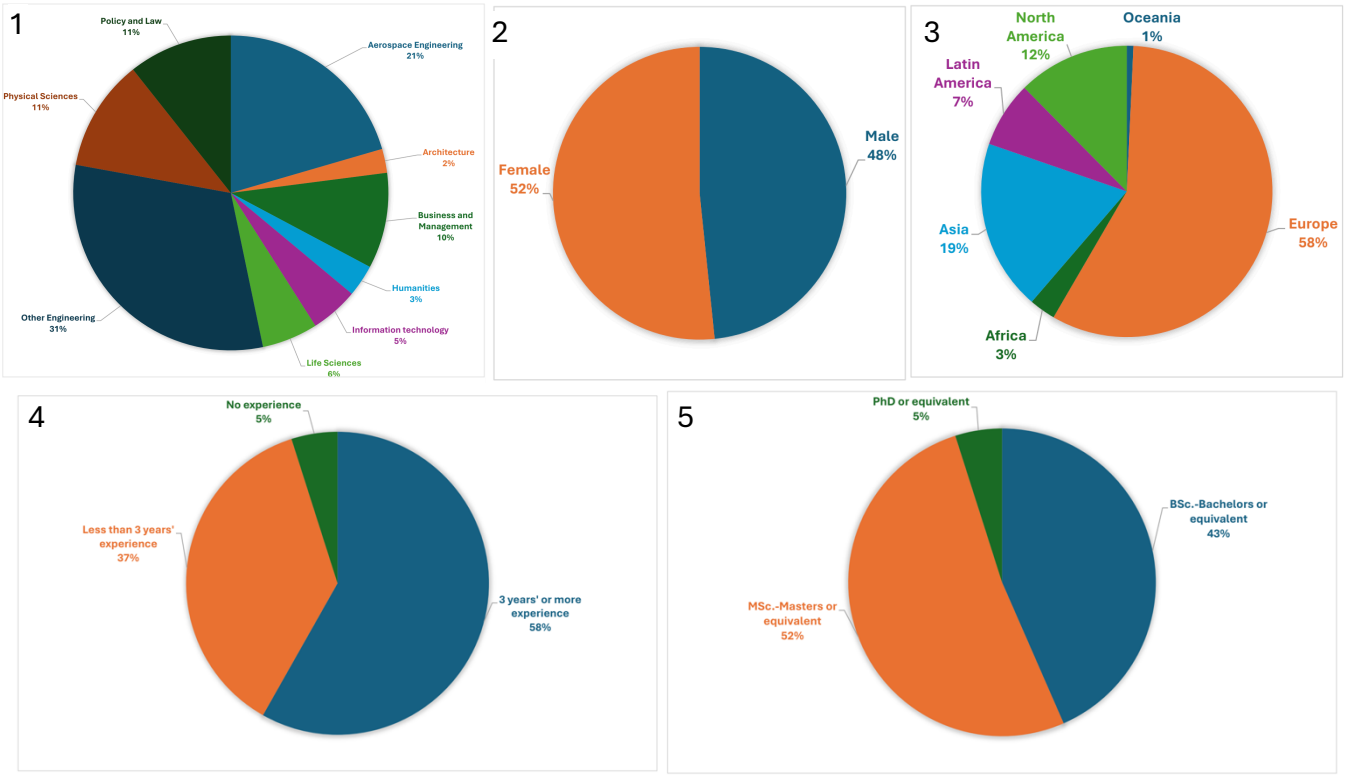

Figure 7. Participants Demographics Overview (1)Background Distribution, (2)Gender Distribution, (3)Geographical zone (4)Work Experience and (5) Educational Distribution

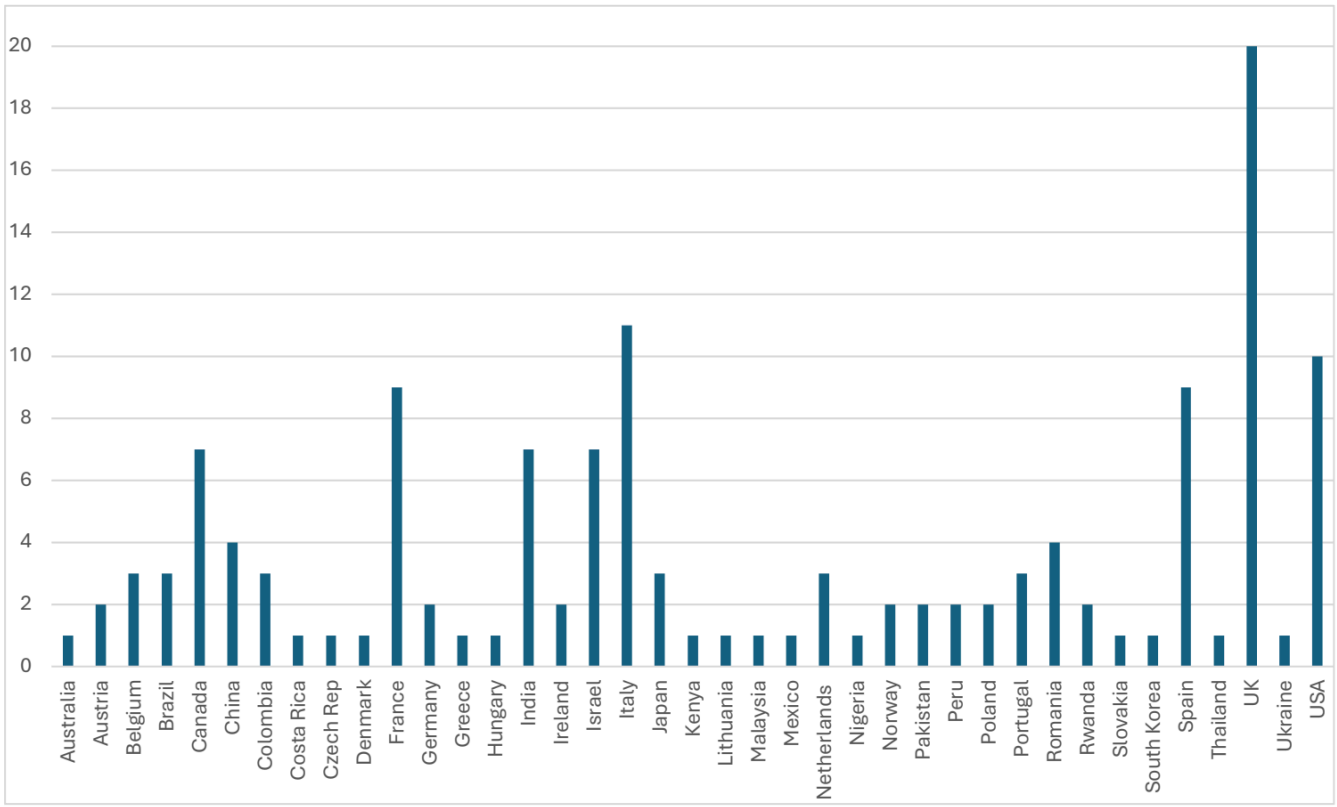

Figure 8: Country Distribution

2.4 Sponsors and Supporters

The Space Studies Program was made possible through the generous support of a wide range of international sponsors and partner institutions. Sponsorship and institutional support were provided by the European Space Agency (ESA), French Space Agency (CNES), UK Space Agency (UKSA), Indian Space Research Organization (ISRO), Japan Aerospace Exploration Agency (JAXA), National Aeronautics and Space Administration (NASA), China Satellite Launch and Tracking Control General (CLTC), EUMETSAT, Stichting Space Professionals Foundation (SSPF), France Air Force, Canadian Armed Forces, NewSpace Catalonia, American Astronautical Society, Dr. Kalpana Chawla Fund, Ilan Ramon Foundation, Association of Space Explorers (ASE), Japan Manned Space Systems Corporation (JAMSS), Polish Space Agency, Astroscale, and Inspire Space. Additional support was provided by Amazon Web Services (AWS), Royal Military College of Canada, The Aerospace Corporation, Tohoku University, University of Waterloo, Esri Canada, NV5 Geospatial, Gangnam-gu Smart Farm, National Aviation Museum of Korea, Hanwha System, Unmanned Exploration Laboratory, Ansan Industrial History Museum, Korea Aerospace Industries, Ltd., Naro Space Center, Korea Institute of Geoscience and Mineral Resources, Satrec Initiative, Korea Aerospace Administration (KASA), Nara Space, KairoSpace, Research Institute for Aerospace and Medicine at Inha University Hospital, Korea Institute

of Civil Engineering and Building Technology, T-UM, KVN Yonsei Radio Observatory, Gwacheon National Science Museum, Korea Aerospace Research Institute, Korea Astronomy and Space Science Institute, and KT sat. The collective contributions of these organizations were instrumental in supporting the academic, professional, and intercultural components of the program, and in fostering international collaboration and capacity building within the global space community.

3 Phase I: Core Lecture Series

The core curriculum of the SSP consists of the core lectures and fundamental workshops. The Core Lecture Series (CLS) and associated workshops ensure that participants have a basic grounding and common knowledge in the fundamentals of all the disciplines that are relevant to space programs. It also serves to ensure that participants understand the relationships among the various disciplines in any space-related activity. Attending the CLS and fundamental workshops is mandatory for all the SSP participants, which creates the basic foundation of knowledge to prepare them for informed and balanced judgment and subsequent teamwork.

3.1 Core Lecture Series

The Core Lecture Series was delivered over the first three weeks of the eight-week program and comprised three to four lectures per day, each with a duration of 60 minutes, and 15 minutes break in betweem including dedicated time for questions and discussion. The lectures were intentionally designed for a multidisciplinary audience and emphasized conceptual clarity, accessibility, and systems-level understanding rather than technical specialization. This approach ensured that participants with diverse academic and professional backgrounds could engage meaningfully with topics beyond their primary fields of expertise. The main lectures were delivered in core lecture hall

situated on third floor to accommodate 150 people at a time.

Figure 9. Core Lecture Series Main Hall

The lecture content spanned a broad spectrum of space-related disciplines, organized into six major thematic categories. The Space Policy, Economics and Law lectures introduced participants to the legal foundations of space activities, national and international regulatory frameworks, economic rationales for space programs, export control regimes, and the evolving dynamics of New Space and emerging spacefaring nations. These lectures provided essential context for understanding how governance, policy, and economics shape space activities at both national and global levels.

The Space Sciences category covered fundamental scientific principles underpinning space exploration, including the space environment, microgravity, the electromagnetic spectrum, solar and planetary sciences, astrobiology, stellar evolution, and cosmology. These lectures established a scientific foundation for understanding mission objectives, environmental constraints, and the broader astrophysical context in which space systems operate.

Lectures in the Space Engineering category addressed the technical backbone of space missions, introducing participants to orbital mechanics, mission design, spacecraft subsystems, propulsion, robotics, structures, power systems, and systems engineering. While not focused on detailed design calculations, these lectures emphasized how engineering trade-offs and subsystem interactions influence mission feasibility, performance, and reliability.

The Space Management and Business lectures explored the organizational, financial, and strategic dimensions of space activities. Topics included project management, business structures, financial planning, innovation, commercialization, launch services, and entrepreneurial approaches within the space sector. This category highlighted the growing role of private industry and New Space business models in shaping the future of space exploration and utilization.

Figure 10. Core Lecture Series – Multidisciplinary Lecture Session at Main Lecture Hall

The Space Applications category focused on the practical use of space-based systems for societal and commercial benefit. Lectures covered satellite communications, remote sensing, navigation and positioning systems, and emerging applications enabled by space technologies. Emphasis was placed on understanding how space assets support Earth observation, global connectivity, navigation services, and decision-making across multiple sectors.

Finally, the Human Performance in Space lectures addressed the physiological, psychological, and operational challenges associated with human spaceflight. Topics included human adaptation to microgravity, life support systems, space medicine, neuroscience, countermeasures, habitat design, and human factors. These lectures underscored the importance of integrating human-centered considerations into mission planning and long-duration exploration scenarios.

To support learning, Core Lecture Study Notes and presentation materials were provided to participants, offering concise summaries of key concepts, terminology, and references for further reading. Optional Core Lecture Review sessions were also offered to reinforce understanding, clarify complex topics, and assist with concept retention, particularly for participants encountering unfamiliar disciplines. Interactive engagement was encouraged throughout the Core Lecture Series, with participants actively contributing questions and discussions that enriched the learning environment.

Following the conclusion of the Core Lecture Series, the SSP Teaching Associates organized a brief celebratory activity for participants. The event featured a light-hearted performance involving symbolic props and balloons, followed by the presentation of a specially prepared rap performance created exclusively for SSP. This informal closing moment provided an opportunity to acknowledge the collective effort invested during the Core Lecture Series and contributed to a positive and engaging transition into the subsequent phases of the program.

Figure 11. Celebration Activity Following Completion of the Core Lecture Series

The disciplinary midterm examination was conducted on 14 July 2025 to assess participants' understanding of the Core Lecture Series within their respective disciplinary areas. Following the completion of the final core lecture, the disciplinary final examination was held on 21 July 2025. This

final assessment included an interdisciplinary essay component, in which participants selected two topics and were required to demonstrate integrated understanding across the three core principles of the program: interdisciplinary, international, and intercultural perspectives. Together, these examinations evaluated both subject-specific knowledge and the ability to synthesize concepts across multiple domains. After the examinations, each participant received individualized feedback on their performance, providing insight into strengths and areas for further development.

Overall, the Core Lecture Series provided a comprehensive and integrated overview of space activities, enabling participants to appreciate the interconnected technical, managerial, policy, and human dimensions of space programs. The knowledge and perspectives gained during Phase I established a strong foundation for interdisciplinary collaboration, systems-level thinking, and informed participation in subsequent phases of SSP25

Figure 12. Distribution of ESA and SSP Badges

3.2 Workshops

In addition to the Core Lecture Series, the SSP curriculum includes a series of workshops designed to enhance and complement lecture-based learning through active participation in smaller, interactive group settings. These workshops are scheduled intermittently during Phases I and II of the program and emphasize practical engagement, discussion, and applied problem-solving. By encouraging

direct interaction with instructors and peers, the workshops support individual learning while reinforcing interdisciplinary understanding.

3.2.1 Fundamental Workshops (FWS)

Fundamental Workshops are conducted during the first week of the program and are mandatory for all participants involved in team projects. These workshops are designed to establish a shared baseline of essential skills and perspectives that are critical for effective collaboration throughout the SSP. Participants rotate through the FWS in their assigned Team Project (TP) groups, ensuring consistent exposure and fostering early team cohesion.

The FWS focus on core competencies such as intercultural awareness, teamwork and communication, space debate and communication, and strategic foresight for space activities. Through guided discussions, collaborative exercises, and scenario-based activities, these workshops prepare participants for multidisciplinary teamwork and provide essential tools for navigating the international and intercultural environment of the program.

For Team Project AI (TP AI), the Fundamental Workshops placed particular emphasis on intercultural awareness, strategic foresight for space activities, and structured space debate and communication. The major highlight was team building session by astronaut Dr. Soyeon Yi which provided a foundational framework for effective teamwork within a diverse, multidisciplinary group and equipped participants with practical tools for engaging in constructive dialogue, negotiating differing perspectives, and addressing complex space-related challenges in a collaborative and culturally sensitive manner.

Figure 13. Fundamental Workshops (FWS) – Intercultural Awareness and Team-Building Sessions by Dr. Soyeon Yi

3.2.2 Elective Workshops (EWS)

Elective Workshops offer participants the opportunity to deepen and broaden their knowledge in specific areas of interest that complement the Core Lecture Series. These workshops are offered throughout Phases I and II and cover a wide range of technical, managerial, and interdisciplinary topics, including robotics, artificial gravity, spacecraft telecommunications, navigation techniques, satellite positioning, mission architectures, and emerging space technologies.

EWS sessions are conducted in parallel, requiring participants to select their preferred workshops in advance through an online registration system provided during the program. This system allows participants to tailor their learning experience according to personal interests and professional goals. In cases where participants do not complete the selection process, they are automatically assigned to an elective workshop to ensure full participation. To maximize accessibility, some workshops are offered multiple times, enabling a larger number of participants to benefit from high-demand topics.

As part of the Elective Workshop program, I participated in three workshops that focused on space policy, governance, and industry-oriented decision-making through scenario-based learning.

In Elective Workshop 1 (EWS-1E), *Developing Successful Global Space Policy Campaigns*, delivered during the Charity Weekend, participants were divided into multidisciplinary teams and presented with unique, realistic policy scenarios. Each team was tasked with brainstorming and developing a coherent global policy campaign tailored to the given scenario, taking into account political, economic, and societal constraints. The workshop emphasized collaborative problem-solving, stakeholder analysis, and the construction of persuasive policy frameworks, enabling participants to experience how space policy initiatives are shaped and communicated at an international level.

Figure 14. Developing Successful Global Space Policy Campaigns by Charity Weeknd

Elective Workshop 2 (EWS-2D), the rationale for the ESA geo-return system and a sector based procurement. scheme led by Pieter van Beekhuizen, focused on understanding different profit-generation models and business schemes within the space industry. Through case-based discussions, the workshop introduced participants to the European regulatory and institutional

framework governing space activities. Particular emphasis was placed on product assessment, technology readiness, and the processes required for securing contracts and negotiating agreements within the European space ecosystem. Participants were also given scenarios in teams to discuss the public procurement for different company stages. This session provided valuable insight into how commercial space projects transition from concept to contract under established institutional and regulatory structures.

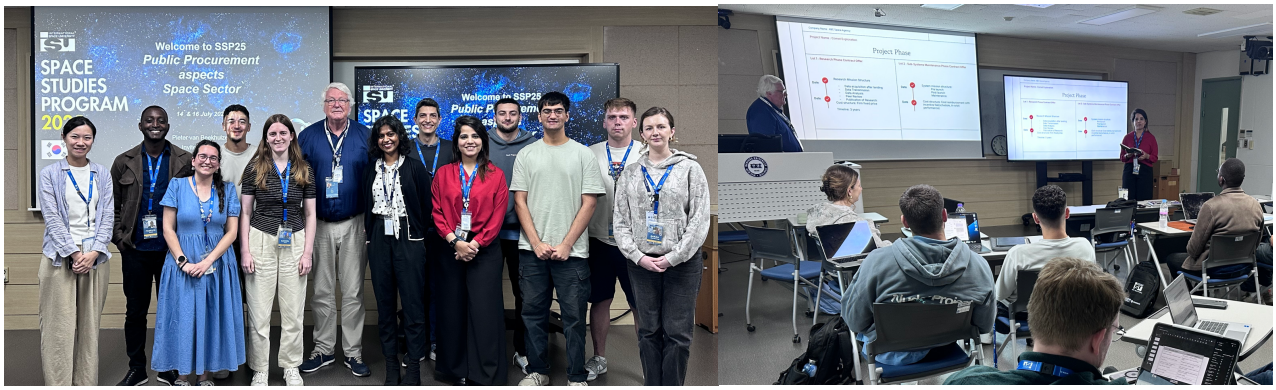

Figure 15. The rationale for the ESA geo-return system and a sector based procurement scheme by Pieter van Beekhuizen

In Elective Workshop 3 (EWS-3B), *National Space Laws*, delivered by Paola Breda, participants explored the legal and regulatory intricacies associated with launch activities and space operations across different regions. Teams were assigned specific countries and tasked with analyzing national space laws, regulatory authorities, and existing governmental frameworks. Based on this analysis, each team was required to make informed decisions on how space-based products and services could be developed, authorized, and channeled within the assigned national context, taking into account applicable legal constraints and institutional responsibilities. This exercise highlighted the critical role of national legislation in shaping space activities and reinforced the importance of aligning technical and commercial strategies with legal frameworks.

Figure 16. National Space Laws by Paola Breda

Overall, the workshop program plays a vital role in reinforcing the theoretical foundations established during the Core Lecture Series while promoting hands-on learning, interdisciplinary exchange, and active engagement. Together, the Fundamental and Elective Workshops contribute significantly to participants' skill development and readiness for collaborative project work in subsequent phases of the SSP.

4 Phase II: Departmental Activity

The Space Studies Program is structured around seven academic departments, which serve as focused learning anchors within the broader interdisciplinary framework of SSP. This departmental structure allows participants to explore specific disciplinary perspectives in greater depth while continuing to engage with the program's integrated, systems-level approach. Departmental activities include structured group sessions, individual or small-team assignments, and, where applicable, professional visits to space-related institutions.

During the initial weeks of the program, each participant is assigned to one department based on their top three preferences. Participants are encouraged to select a department outside their primary area of expertise in order to broaden their academic and professional perspectives. This approach reflects ISU's educational philosophy of interdisciplinary exposure and intellectual exploration.

The seven SSP departments are:Space Applications (APP), Space Engineering (ENG), Human Performance in Space (HPS), Space Humanities (HUM), Space Management and Business (MGB), Space Policy, Economics, and Law (PEL), and Space Sciences (SCI). In addition, departments may organize Professional Visits (PV), providing participants with opportunities to engage directly with space-related organizations and facilities. The nature and scope of these visits vary depending on local resources and the overall program curriculum.

Departmental activities are conducted in smaller group settings, enabling deeper examination of selected topics introduced during the Core Lecture Series. These sessions promote active exchange of knowledge, ideas, and perspectives through discussion, debate, and hands-on exercises. Participants benefit from close interaction with Department Chairs, faculty members, visiting lecturers, and Teaching Associates, contributing to professional development and network building. The departmental environment also encourages awareness of cultural diversity and supports the development of effective communication, presentation, and negotiation skills in an international setting.

As part of the departmental evaluation, participants complete an individual or small-team assignment assigned by the Department Chair. These assignments are coordinated in consultation with the participant(s) and are designed to align with departmental learning objectives and academic plans. Assignments may take various forms, including oral presentations, professional papers or posters, experimental design and data

analysis, technical demonstrations, or responses to requests for proposals. The scope and format of each assignment are tailored to ensure meaningful engagement with departmental content and applied learning outcomes.

Departmental activities may include advanced seminars following core lectures, visits to space-related facilities, hands-on technical exercises, applied research projects, policy and technology transfer analyses, participant-led presentations, experimental hardware interaction, and structured debates on the societal impacts of space exploration. Collectively, these activities enhance disciplinary depth while reinforcing the interdisciplinary, international, and intercultural values that define the SSP experience.

4.1 Space Management and Business Department (MGB): Detailed Overview

The Space Management and Business (MGB) Department focused on developing an integrated understanding of how space activities are planned, financed, managed, and commercialized within an evolving global space ecosystem. Through a combination of lectures, interactive sessions, and professional visits, the department addressed key topics such as space markets, business strategy, financial foundations, venture capital negotiation, leadership, export control, risk management, and sustainability. Led by an international team of experienced professionals from industry, policy, finance, and academia, the MGB curriculum emphasized practical decision-making and real-world application alongside strategic and managerial theory. Departmental activities included leadership development exercises, case-based discussions on financing and market entry, preparation for a competitive business plan exercise, and direct engagement with space companies and research institutions in South Korea. Collectively, the MGB department provided participants with a comprehensive perspective on the commercial, organizational, and regulatory dimensions of space activities, equipping them with essential skills to navigate and contribute effectively to the rapidly evolving space industry.

The workshops and competition details are as follows:

4.1.1 Leadership Day– Neta Vizel

The session led by Neta Vizel focused on practical leadership and project management skills, highlighting how managers can effectively coordinate teams, handle sensitive workplace challenges, and ensure timely delivery of results. Through an engaging simulation, participants gained a realistic understanding of the role of leaders working on the frontline of an organization.

The day also included team-based activities designed to strengthen team bonding and collaboration, helping participants reflect on group dynamics and interpersonal trust. The thread link was to demonstrate to what connects people in the organization

Overall, the theme day was dedicated to management and leadership development, featuring interactive workshops on expanding one's circle of influence, goal setting, effective feedback, and clear communication. These activities provided valuable insights into real-world leadership responsibilities and decision-making.

Figure 17. Leadership Day by Neta Vizel

4.1.2 Beyond Technology: Identifying and Controlling External Risks (Risk Management Workshop)

This workshop focused on understanding and managing external risks beyond technical challenges, led by an air and space law expert. Participants were introduced to structured risk-management methodologies commonly used in aerospace and space programs.

As part of the workshop activities, we were tasked with developing a risk assessment matrix to identify and evaluate the risk level of at least five potential adverse circumstances. The exercise emphasized assessing likelihood, impact, and mitigation strategies, highlighting the importance of legal, regulatory, environmental, and operational risks in complex projects.

The session provided practical insight into risk identification, analysis, and control, reinforcing the role of systematic risk management in ensuring project resilience and long-term mission success.

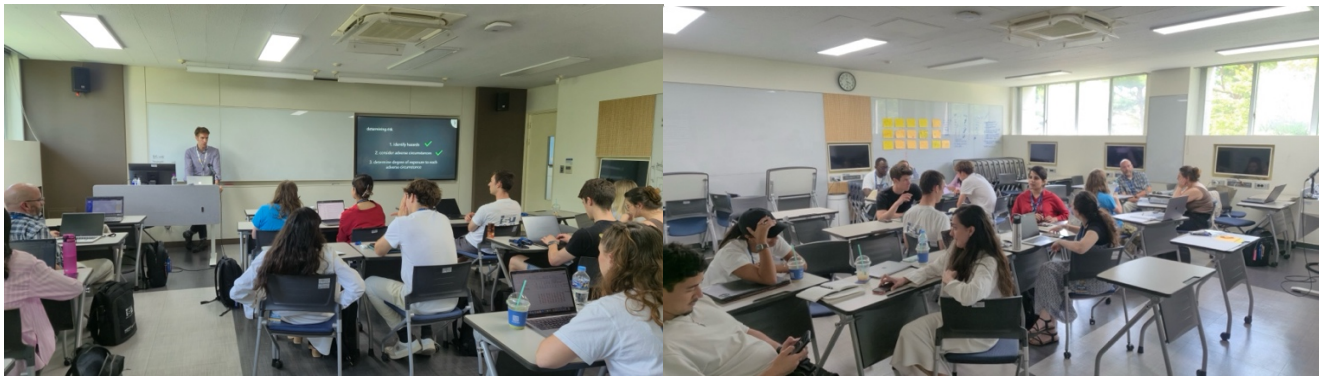

Figure 18. Identifying and Controlling External Risks by Scott Schneider

4.1.3 Export Control Workshop

The Guardians of Export Control: A journey to Mastery was conducted by Lisa Kuccher and Leonard de Guzman. The is workshop was conducted by renowned legal officers from leading space organizations and provided a comprehensive introduction to space export control frameworks across different jurisdictions. The sessions covered key topics including controlled product listings, intangible technology transfers, sanctions compliance, diversion risks, and due diligence requirements. Following the theoretical overview, teams were presented with practical scenarios requiring them to design a spacecraft launch plan involving component sourcing and shipment from neighboring countries. The exercise required careful consideration of sanctioned states, export restrictions, and pricing constraints in order to remain within a fixed budget. Our team successfully developed a compliant procurement strategy, sourcing essential spacecraft components, represented through LEGO elements, from permitted country markets managed by the workshop supervisors. Using this approach, we assembled a complete spacecraft configuration that met both legal compliance and budgetary requirements, demonstrating effective application of export control principles in a realistic, hands-on simulation.

Figure 19. (Left) Unassemble procurement of components and (Right) Final Ready-to-launch Assembled spacecraft

4.1.4 Financing Your Business: Mastering VC Negotiation (Simulation Workshop)

This session focused on venture capital financing and the art of negotiation through a simulation-based workshop. Together with my teammate Yubal, we developed a space startup called Altara, a disaster-response robotics company that leveraged satellite-imagery-based APIs for rapid assessment and decision-making.

As part of the simulation, we pitched Altara for a Series A funding round, engaging with realistic VC teams and navigating multiple negotiation rounds. The process required refining our value proposition, responding to investor concerns, and strategically negotiating terms to secure funding.

Among six competing teams, our team won the VC negotiation simulation, demonstrating strong pitching, negotiation, and strategic decision-making skills in a high-pressure, investor-driven environment.

Figure 20. Financing Your Business: Mastering VC Negotiation (Simulation Workshop) . (Left) VC Negotiation Round 2 and (Right) Winner of Compeition Award

4.1.5 2025 Carbon Neutrality: Lessons from Space – Byungil Jang

This session was led by Byungil Jang, Founder & Chief Product Officer of Green Idea Lab and Adjunct Professor at KAIST (Graduate School of Green Growth and Sustainability). The lecture focused on principles of resource efficiency and minimizing environmental impact in space missions, and how these principles can be applied to sustainability challenges on Earth.

As part of a departmental team activity, we worked in a group of three to develop a sustainable business concept aligned with the goal of carbon neutrality. Our team designed a concept called SunSquared, a carbon-free silicon production approach for next-generation solar panels, inspired by space-grade material efficiency and clean manufacturing principles.

Our team included professionals with strong industry backgrounds, including Aaron Paz, a senior engineer with 16 years of experience at NASA Johnson Space Center, and Sophia Ashford, a lead

electronics engineer at the Department of Transportation and former Formula Racing engineer. Through strong technical grounding, interdisciplinary collaboration, and a clear sustainability vision, our team won the competition, demonstrating the viability and impact potential of our carbon-neutral solution.

Figure 21. Goodies Awarded for winning the competion from Workshop organizer Byungil Jang

4.1.6 Business Competition – Space Startup Development

This business competition was conducted under the guidance of Adil Jafry, with contributions from industry experts including Ofer Lapid, Natalia Larrea, Anna Cordry (remote), Storm Boswick (remote), and other mentors.

Participants were tasked with developing a space startup supported by complete financial documentation, including business models, cost structures, and fundraising justification, to simulate a real-world investor-ready venture.

Our team proposed a startup named Exoscope, focused on in-orbit inspection and repair services using autonomous space drones. The concept addressed the critical issue of spacecraft losses due to minor failures by enabling rapid inspection and assisted repair through modular toolkits. The idea stemmed from the belief that repairing and servicing spacecraft in orbit can significantly reduce mission losses and extend asset lifetimes.

Through strong technical feasibility, a clear market need, and robust financial planning, our team won the final competition and was awarded certificates and recognition prizes, highlighting the strength and viability of our solution in the domain of on-orbit servicing.

Figure 22. Exsocope Team for Final Business Proposal Competition and (Right) Winner for the competition Award

4.2 Personal Contributions and Insights

From team-building exercises to participation in hands-on workshops, the activities within the Space Management and Business Department provided valuable insights into the practical requirements for launching a space startup. Through these sessions, participants gained a deeper understanding of the space ecosystem, including the structure of the global space network and the regulatory and policy limitations that influence commercial space activities. In addition to classroom-based learning, industrial visits offered direct exposure to space pioneers and companies in South Korea, highlighting their business models, product development frameworks, and approaches to market integration.

Participation in competitive departmental activities further strengthened practical skills related to teamwork, strategic planning, and decision-making under real-world constraints. Successfully performing in these competitions contributed to a significant increase in confidence and reinforced my motivation to pursue a space startup initiative, building upon the collaborative foundation established with my team during departmental activities.

Figure 23. Department Picture following the final business competition


Figure 24. Final Day Dinner Buffet from Department and group selfie at last department industrial visit

5 Phase III: Team Project

Phase III of the Space Studies Program focuses on the Team Project, a core experiential component in which participants work in international, interdisciplinary, and intercultural teams to develop a comprehensive analysis and proposal addressing a real-world space-related challenge. Participants select one project topic from several proposed themes and remain engaged with the chosen topic throughout the duration of the SSP. The Team Project serves as a capstone experience, integrating knowledge and skills acquired during lectures, workshops, departmental activities, and professional visits.

The primary objectives of the Team Project are threefold. First, it enables participants to apply their academic and professional expertise alongside newly acquired interdisciplinary knowledge in a practical, collaborative setting. Second, it provides hands-on experience in collective decision-making, task organization, and leadership within diverse teams, where differing technical, cultural, and professional perspectives must be reconciled through negotiation and compromise. Finally, the Team Project aims to produce a professional-level report that is publicly presented at the conclusion of the program and addresses technical, financial, organizational, political, scheduling, and risk-related dimensions of the proposed solution.

The Team Project process follows a structured progression common to all SSP projects. It begins with an exploratory and brainstorming phase to define the problem space and scope of work, followed by targeted lectures and an intensive research and fact-finding period specific to the project topic. Teams then navigate the challenge of organizing work across sub-teams, integrating diverse contributions, and converging on coherent strategies and recommendations. Throughout the process, participants engage extensively with departmental faculty members, teaching associates, and guest experts. An interim

presentation provides an opportunity for external review and expert feedback, which informs a final period of intensive collaboration leading to the completion of the final report.

Many past ISU Team Project reports have contributed valuable insights to the global space community, underscoring the professional relevance and impact of this collaborative effort. The Team Project experience at SSP25 thus represents a critical platform for developing systems-level thinking, leadership, and interdisciplinary collaboration skills essential for addressing complex challenges in the international space sector.

5.1 Team Project AI

he Team Project *Applying AI to Space Exploration: Enhancing Mission Success through Predictive Technologies*examined how artificial intelligence can improve the efficiency, reliability, and sustainability of space missions. Conducted over 20 full Team Project days, the work was supported by dedicated workshops on editing, graphics, and presentation to ensure professional-quality outputs. Team agreement was sent prior to organizing the TP in respective Case studies distributing group of 26 people total, divided into 2 teams of 13. Each team develops a case study ready for journal or conference submission. The project was chaired by Emeline Paat-Dahlstrom, with Carole Dangoisse serving as the Teaching Associate.

Figure 25. (Left) TP AI official Tshirt introduction and (Right) group photo with TP Chair and Teaching Associate

As space exploration advances toward increasingly autonomous operations, AI is playing a transformative role in addressing challenges such as communication delays, resource constraints, and uncertain environments. This interdisciplinary project investigated practical and scalable applications of AI in space exploration, focusing on real-world implementations that enhance mission success. Key areas of study included AI-driven spacecraft telemetry, predictive maintenance, anomaly detection, data analysis, and autonomous decision-making. Through case studies drawn from ongoing government and commercial space programs, the team assessed the effectiveness of machine learning algorithms and predictive models in reducing operational risk and optimizing mission performance.

In addition to technical considerations, the project examined broader societal, policy, and ethical implications associated with the deployment of AI in space missions, highlighting the growing importance of governance and responsibility in autonomous systems. By integrating technical analysis with policy and business perspectives, the team developed actionable insights relevant to industry stakeholders, policymakers, and international space agencies.

The Team Project activities were supported by dedicated workshops structured around specialized functional teams to ensure efficient collaboration and high-quality deliverables. These included an Editing Team responsible for drafting, refining, and ensuring consistency of the written report in

accordance with ISU academic standards; a Presentation Team tasked with transforming the report content into a clear, engaging, and professional presentation for public delivery; and a Graphics Team focused on developing figures, visual representations, and layout design to effectively communicate complex technical information. Technical experts and senior team members were assigned to supervise and guide each functional team, providing domain-specific oversight and ensuring alignment with the project's objectives.

I was primarily involved in the Editing and Graphics teams, where my responsibilities included compiling and organizing research contributions from multiple sub-teams into a coherent final report, refining content structure, and ensuring clarity and consistency across sections. In addition, I contributed to presentation design and the visual reimagining of information through the development of graphics and figures that supported both the written report and the final presentation. This role provided hands-on experience in integrating interdisciplinary inputs into a unified professional output while strengthening skills in technical communication, visual storytelling, and collaborative content development.

Overall, the TP AI project leveraged the diverse expertise of participants from space engineering, science, policy, business, and humanities to deliver an integrated assessment of AI's impact on future space exploration. The outcomes contributed to a deeper understanding of how intelligent systems can support efficient, resilient, and sustainable extraterrestrial missions.

Figure 26. Group Photo with TP AI

5.2 Final Report

The final report of the Team Project *Applying AI to Space Exploration: Enhancing Mission Success through Predictive Technologies* presents a comprehensive, interdisciplinary assessment of how artificial intelligence can be practically integrated into future space missions to improve reliability, autonomy, and sustainability. Developed collaboratively over the SSP Phase III period, the report synthesizes technical analysis, case-study research, policy considerations, and operational insights into a cohesive professional-level document intended for industry, academic, and governmental stakeholders.

The report is structured around two complementary case studies addressing mission-critical challenges in deep-space exploration. The first case study focuses on AI-enabled predictive maintenance for spacecraft systems, with particular emphasis on electrical power systems and battery health monitoring. It demonstrates how machine learning models can shift spacecraft maintenance strategies from reactive to proactive, reducing failure risks, extending system lifetimes, and lowering operational costs. The second case study introduces the ARES (Autonomous Resilience and EVA Support) framework, an AI-driven health monitoring and decision-support system designed to enhance astronaut safety and performance during extravehicular activities. Together, these studies establish a unified human–machine resilience framework applicable to long-duration lunar and deep-space missions.

Beyond technical development, the report critically examines the economic, legal, ethical, and policy implications of deploying AI in space operations. Issues such as data governance, medical data privacy, accountability in autonomous decision-making, and regulatory gaps in existing space law are analyzed alongside potential commercial models and cost-benefit considerations. This integrated approach ensures that AI adoption is assessed not only for technological feasibility but also for responsible and sustainable implementation.

The final report concludes with consolidated findings and actionable recommendations tailored to space agencies, commercial operators, policymakers, and international organizations. By combining rigorous analysis with forward-looking perspectives, the TP AI final report contributes meaningful guidance to the evolving discourse on intelligent space systems and supports the transition toward increasingly autonomous, resilient, and human-centered space exploration missions. The final report after internal review was made part of ISU library publically accessible.

Figure 27. TP AI editing and graphics team

5.3 Final Presentation

The Team Project *Applying AI to Space Exploration* concluded with a formal final presentation delivered to SSP faculty, advisors, and participants. The presentation was designed to concisely communicate the project's objectives, methodology, key findings, and recommendations to a diverse audience with varying technical backgrounds. Emphasis was placed on clarity, coherence, and visual storytelling to ensure that complex interdisciplinary concepts were accessible and impactful.

The presentation structure closely mirrored the final written report, beginning with the problem context and motivation for applying artificial intelligence in space exploration, followed by an overview of the project methodology and case study framework. Key technical insights from the case studies were presented alongside policy, ethical, and operational considerations, demonstrating how AI-enabled solutions can enhance mission autonomy, resilience, and decision-making while remaining aligned with regulatory and societal constraints. Visual elements, including figures, diagrams, and synthesized graphics, were used extensively to support understanding and highlight system-level relationships.

Preparation for the final presentation involved close collaboration between the Editing, Graphics, and Presentation teams to ensure consistency between the report and presentation materials. The presentation team coordinated speaker assignments, transitions, and timing, while the graphics and editing teams supported content refinement and visual integration. The final session also included a question-and-answer segment, during which team members collectively addressed technical, policy, and implementation-related questions, demonstrating both individual expertise and cohesive teamwork.

The final presentation was preceded by multiple rehearsal sessions, during which content flow, timing, speaker transitions, and visual consistency were carefully reviewed and refined. These rehearsals allowed the team to incorporate feedback from faculty advisors, technical experts, and peers, ensuring clarity, coherence, and alignment with the key messages of the final report. Following this iterative preparation process, the final presentation was delivered before all SSP participants and faculty members, providing an opportunity to showcase the project outcomes to a broad interdisciplinary audience and to engage in informed discussion during the question-and-answer session.

Overall, the final presentation served as a capstone to the Team Project experience, reinforcing participants' ability to translate interdisciplinary research into professional, stakeholder-oriented communication. It highlighted the team's collective capacity to synthesize complex information, defend analytical choices, and articulate actionable recommendations, skills that are essential for leadership roles in the international space sector.

Figure 28. Group Photo TP AI after presentation

5.4 IAC PAPER AND PRESENTATION

As a final extension of the Team Project, work continued beyond the on-site SSP period following the submission of the manuscript. After returning from South Korea, the team transitioned into preparing a condensed paper and presentation for submission to the International Astronautical Congress (IAC) 2025 in Sydney, with the manuscript due on 12 September. This phase required synthesizing the approximately 100-page Team Project report

into a concise and focused conference paper, while preserving the core technical contributions, insights, and conclusions. The process was both challenging and instructive, demanding careful prioritization of content, clarity of messaging, and alignment with conference publication standards. This final stage reinforced the importance of effective technical communication and demonstrated how extensive interdisciplinary research can be translated into a succinct, high-impact academic and professional output

76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.

IAC-25,D1,3,10,x97893

Applying AI to Space Exploration: Enhancing Mission Success through Predictive Technologies

Sofia Del Pozo Rodriguez[a]*, Anna Aldegheri[a], Davide Roversi[b], Kanupriya Govila[c], Arnau Dolz-Puig[d], Ayesha Habib[e], Albert Nicolás López[f], Ana Paula Guevara-Cerdán[a], Bibin Varghese[g], Simran Mardhani[a], Carole Dangoisse[h], Isabella Di Grazia[i], Jessica Kerr[a], Emeline Dulce Paat-Dahlstrom[j]*

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[i] *NASA Ames Research Center, Moffett Field, CA 94035-1000*
[j] *SpaceBase Ltd., Suite 5B2, 148 Quay Street, Auckland Central, 1010, New Zealand*
* Corresponding Author

Figure 29. IAC'25 Manuscript paper authors layout

6 Academic and Professional Engagement

6.1 Distinguished Lectures

6.1.1 The NASA Hubble Space Telescope – Dr Jeffrey Hoffman

Dr. Jeffrey A. Hoffman delivered a Distinguished Lecture titled “The Hubble Space Telescope: From Disaster to Triumph,” in which he recounted the early challenges faced by the Hubble Space Telescope following the discovery of its flawed optics. Drawing on his direct experience as a NASA astronaut involved in Hubble servicing missions, Dr. Hoffman described the complexity and risk of the corrective spacewalks that ultimately restored the telescope’s capabilities. Through a combination of archival slides and video footage, he illustrated how these repairs transformed Hubble from an initial

setback into one of the most scientifically productive instruments in history. The lecture highlighted key lessons in engineering resilience, problem-solving under extreme constraints, and the long-term scientific impact of human intervention in space missions.

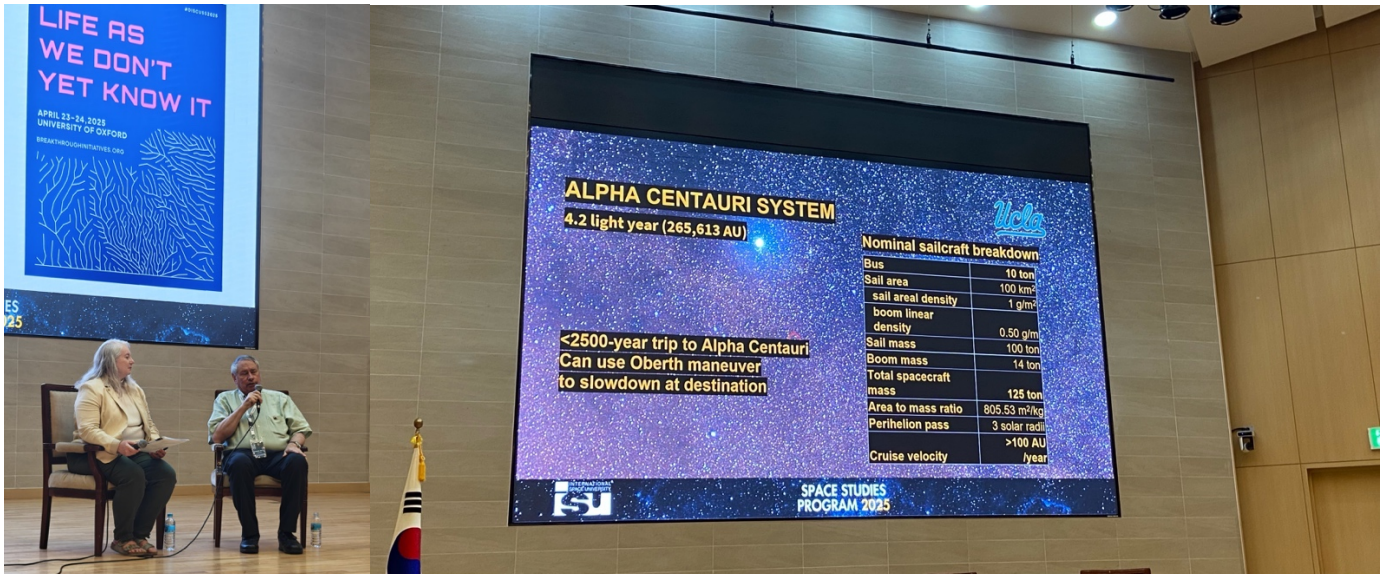
Figure 30. (Left)Rescuing Hubble by Prof. Jeffrey hoffma, (Middle)Space Walk and (Right)Picture with Prof. Jeffrey

6.1.2 Introduction of rover startup to the Changing Landscape of the Global Space Industry - Dr. Jaeho Lee

Dr. Lee, Vice President of the Unmanned Exploration Laboratory (UEL), delivered a lecture outlining the ongoing transformation of Korea's space sector from traditionally government-led programs toward a more privatized and diversified *New Space* ecosystem. He provided an overview of the current status of Korea's space industry, highlighting emerging commercial opportunities and the growing role of private actors alongside national agencies. The lecture introduced the background and mission of UEL, emphasizing its contributions to space research and development, particularly in

autonomous systems and unmanned exploration technologies. Dr. Lee further discussed UEL's current research and development activities and presented its future vision, focusing on advancing innovative, scalable solutions for planetary exploration and next-generation space missions.

6.1.3 The Alpha Centauri System: A beckoning neighbor – Dr Pete Worden



Dr. Pete Worden delivered a distinguished lecture titled *"The Alpha Centauri System: A Beckoning Neighbor,"*highlighting recent advances and future prospects in the search for life beyond Earth. He introduced the Breakthrough Initiatives, including Breakthrough Listen, Watch, and Starshot, which focus on detecting technosignatures, directly imaging nearby exoplanets, and developing lightsail-based interstellar probes to reach the Alpha Centauri system.

The lecture emphasized the scientific importance of Alpha Centauri due to its proximity to the Solar System and recent discoveries of exoplanets orbiting Proxima Centauri, including an Earth-sized planet within the habitable zone. Dr. Worden also discussed observations of radio emissions and the importance of distinguishing genuine astrophysical signals from terrestrial interference. Emerging concepts such as lightsail "sundiver" missions were presented as promising pathways for future deep-space and interstellar exploration. Overall, the lecture underscored the scientific motivation and technological potential for interstellar exploration and life-detection missions within this century.

6.2 Panel iscussions

6.2.1 Astronaut Panel

The International Astronaut Panel is an annual highlight of each International Space University Space Studies Program (SSP), offering participants a unique opportunity to engage directly with astronauts who have played significant roles in human spaceflight. The panel featured Jeffrey A. Hoffman, Soyeon Yi, and Robert Thirsk, who shared their personal experiences, insights, and perspectives on the past, present, and future of human space exploration. Through discussion and

audience interaction, the panel addressed topics ranging from life aboard space stations and international cooperation to the evolving direction of human spaceflight. This session provided participants with valuable first-hand perspectives on the technical, human, and societal dimensions of space exploration and served as an inspiring reflection on the role of astronauts in advancing global space endeavors.

6.2.2 Asetoirds impact and their fate for earth

Dr. **Pascale Ehrenfreund**, Dr. **James Green**, and Dr. **Makoto Yoshikawa**

This Distinguished Lecture explored the scientific, societal, and planetary implications of asteroids and their potential impacts on Earth. The speakers emphasized that asteroids are primordial remnants from the formation of the Solar System approximately 4.5 billion years ago, preserving material that was never incorporated into planets. These bodies are believed to have played a key role in delivering water and complex organic molecules to the early Earth during the first several hundred million years of planetary evolution.

The lecture highlighted the critical importance of asteroids in the context of planetary defense. Ongoing international efforts focus on identifying, tracking, and characterizing Near-Earth Objects (NEOs), with tens of thousands now catalogued and the rate of discovery steadily increasing. The speakers discussed global strategies aimed at mitigating potential asteroid threats, including trajectory deflection and disruption techniques, and stressed the necessity of international collaboration for effective preparedness and response. Special attention was given to upcoming close encounters with Earth by notable asteroids, including Apophis and 2024 YR4, which will pass near Earth within the next decade. Drawing on geological and astronomical evidence, the panel examined past asteroid impact events and their profound effects on Earth's biosphere, including firestorms, tsunamis, atmospheric dust loading, and "impact winters" capable of triggering mass extinction

events. The discussion also addressed the astrobiological implications of large impacts, highlighting how catastrophic events can simultaneously cause widespread destruction and create conditions for evolutionary diversification.

Recent and ongoing space missions dedicated to asteroid exploration, including sample-return missions, were presented as essential tools for understanding the physical and chemical properties of these objects. Such missions not only enhance planetary defense capabilities but also provide critical insights into the Solar System's formation and evolutionary history, reinforcing the role of asteroid science in safeguarding Earth and advancing planetary science.

6.2.3 Preparing for Mars

The panel discussion on *Preparing for Mars* brought together experts from diverse disciplines to explore the scientific, technical, human, and policy challenges associated with future human missions to Mars. The discussion addressed key topics such as long-duration human health and performance, mission architecture, life-support systems, autonomy, and international cooperation. Panelists emphasized the need for integrated planning across engineering, medical, operational, and societal domains, highlighting that successful Mars exploration will depend not only on technological readiness but also on human resilience, ethical considerations, and sustainable mission design. The session reinforced the importance of interdisciplinary collaboration in preparing for the next major milestone in human space exploration.

6.3 Fireside Chat

6.3.1 Canadensys Aerospace Corporation - Dr. Christian Sallaberger

Dr. Christian Sallaberger led a Fireside Chat in which he discussed the work of Canadensys Aerospace Corporation and its contributions to planetary exploration and space robotics. Drawing on his professional experience, he highlighted Canadensys' involvement in developing advanced robotic systems, surface mobility platforms, and exploration technologies for lunar and planetary missions. The discussion provided insight into how small and medium-sized space companies operate within international space programs, collaborate with major space agencies, and transition innovative concepts into flight-ready systems. The session also addressed the challenges of operating in harsh extraterrestrial environments and emphasized the importance of reliability, systems engineering, and long-term mission planning in planetary exploration initiatives.

6.3.2 Mindfullness from Weightlesssness - Dr. Soyoen Yi

The fireside chat led by Soyeon Yi, the first Korean astronaut to fly in space, was titled *"Mindfulness from Weightlessness."* Dr. Yi flew to the International Space Station in 2008 and after spending more than ten days in space, she returned to Earth with a different perspective on life. In her talk, she reflected on how her experience aboard the International Space Station reshaped her perception of Earth, humanity, and her own sense of purpose. Through personal stories and quiet reflection, she spoke about gratitude, humility, and the deep sense of connection that emerges when viewing Earth from orbit. Her insights grounded the audience and served as a powerful reminder of the human dimension of space exploration, emphasizing why space activities matter not only for technological progress but also for fostering perspective, responsibility, and shared stewardship of our planet.

6.3.3 Dr David Korsmeyer

Dr. Korsmeyer is the Deputy Center Director at NASA's Ames Research Center. This session was a unique chance for attendees to interact directly with Dr. Korsmeyer, gaining firsthand knowledge of the challenges and breakthroughs in the field of space related activities.

6.4 Theme Day

6.4.1 Theme day - Moon Exploration

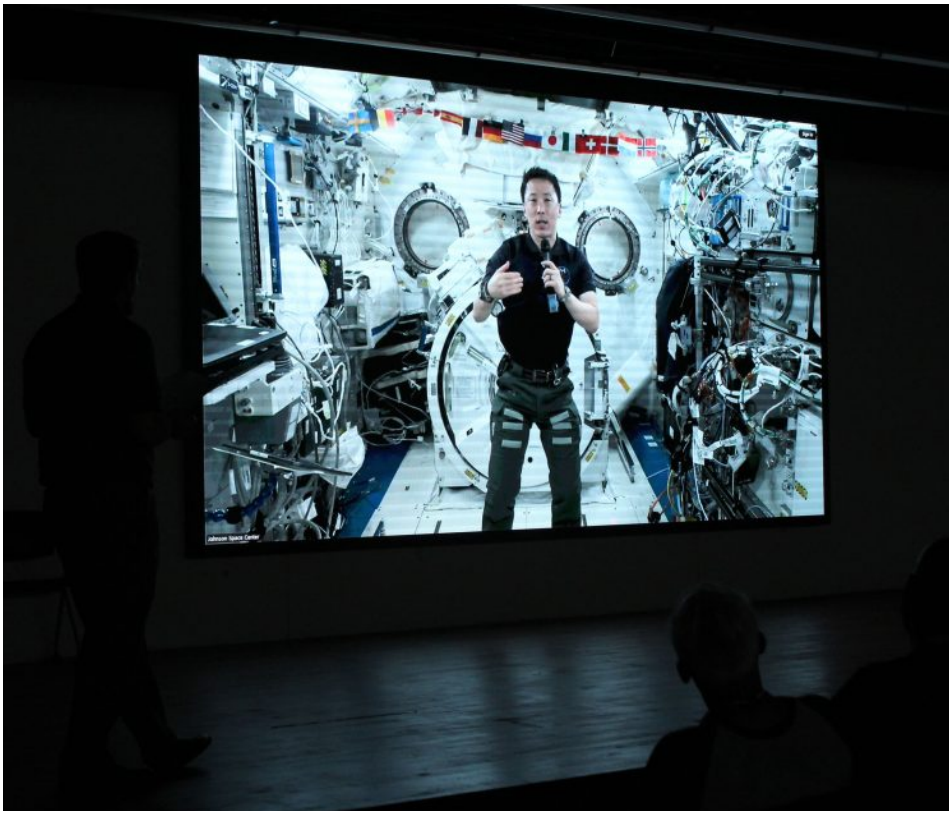
The *Moon Exploration* Theme Day examined the renewed global momentum toward lunar exploration involving national space agencies, commercial actors, and private enterprises. Moderated by John Connolly and featuring expert panelists Dr. Angel Abbud-Madrid, Dr. Matthew Cross, Neta Vizel, and Scott Schneider, the session explored the scientific, technological, legal, managerial, and societal dimensions of returning to the Moon. Discussions addressed key issues such as national and commercial lunar capabilities, robotic and human exploration strategies, space law and policy, and the role of the Moon as both a destination and a stepping stone for deeper planetary exploration. Participants were subsequently divided into small groups to analyze realistic case studies from multiple perspectives, including scenarios related to crew rescue operations, competition between major lunar programs, resource utilization and ownership, and the emergence of independent commercial lunar activities. This interactive format reinforced interdisciplinary thinking and highlighted the complexity of future lunar exploration efforts. We were given to decide in the case study of having Moon as Launch point or final destination.

6.1 Movie Night with Jim Green watching "The Martian"

Participants gathered for a Movie Night screening of The Martian, featuring a special session led by James Green, former NASA Chief Scientist who shared share insights on NASA's and his contribution to the making of this movie. The Martian was directed by Ridley Scott, and presents the story of an astronaut's struggle to survive on Mars and NASA's efforts to return him to Earth.Dr. Green provided behind-the-scenes context on NASA's collaboration with the filmmakers and shared insights into the scientific accuracy, mission planning, and engineering concepts portrayed in the film. His commentary enriched the viewing of Ridley Scott's extended edition, which depicts an astronaut's struggle to survive on Mars and the coordinated efforts to bring him safely home. The session offered an engaging blend of science communication and popular media, highlighting how realistic portrayals of space exploration can inspire public interest while reflecting real-world challenges in human spaceflight.

6.2 Live downlink from the International Space Station (ISS) – Jeremy Myers

Participants took part in a live downlink session from the International Space Station (ISS), facilitated by Jeremy Myers. During the 20–30 minute interactive session, participants had the opportunity to ask questions directly and engage in real-time dialogue with crew member(s) aboard the ISS. This live interaction provided a rare and impactful experience, offering firsthand insight into daily life, operations, and research conducted in microgravity, while reinforcing the human and operational dimensions of spaceflight discussed throughout the program.



7 Evaluation and Feedback

Throughout the Space Studies Program (SSP) 2025, continuous evaluation and structured feedback were provided across the Core Lecture Series (CLS), departmental activities, and the Team Project (TP). These evaluations served both as an academic assessment mechanism and as constructive guidance to support professional growth in an interdisciplinary and international environment.

7.1 Core Lecture Series (CLS) – Phase I Evaluation

SSP25, ISU Core Lecture Series – Phase I, Overall Evaluation Inbox ×

SSP Academic Office <sspacademics@isunet.edu> Fri, Aug 1, 12:10 AM
to me

To: Ayesha Habib

Dear Ayesha,

Congratulations!

The purpose of this e-mail is to share with you the overall SSP25 Phase I evaluation as follows:
Result: You **PASS the SSP25, ISU Core Lecture Series - Phase I** which took place from Tuesday, 1 July 2025 to Friday, 18 July 2025.

The Final Exam scheduled on Monday, 21 July 2025, included two parts: Disciplinary Quiz and Interdisciplinary Essay Exam. Please find below the feedback from the Exam Assessors for the Interdisciplinary Essay Exam questions that you completed:

Assessor 1 Feedback Q1: *Good job in articulating the key points that are important to a commercial space business.*
Assessor 2 Feedback Q1: *A good essay. However some items are a bit diluted*
Assessor 3 Feedback Q1: *na*
Assessor 1 Feedback Q2: *Your essay captures well the key considerations in evaluating the dilemma faced by Go Get Mars.*
Assessor 2 Feedback Q2: *Too much focus on PEL but well written otherwise*
Assessor 3 Feedback Q2: *na*

Note: Your overall SSP evaluation consists of four elements, of which the Core Examination has a final weighted grade of 30%. The Core Examination consisted of a: (i) Midterm Quiz and (ii) Final Exam. The Final Exam included two parts: Disciplinary Quiz and Interdisciplinary Essay Exam. With this e-mail, you are **receiving the overall Phase I Core Lecture Series evaluation (PASS/FAIL)**, which integrates the grades that you received for the: (i) Midterm Quiz and (ii) Final Exam.

Essay exam feedback may be reviewed with the Academics Office and Carol Carnett (English Program Lead) by appointment.

With kind regards,
Claudiu

The Phase I evaluation of the Core Lecture Series reflected a strong overall performance across the written examinations and integrative assessments. Feedback highlighted consistent engagement with interdisciplinary content and the ability to critically synthesize technical, policy, and managerial perspectives introduced during the lectures. The assessment emphasized analytical reasoning, clarity of argumentation, and responsiveness to complex, open-ended questions—key competencies expected in the SSP academic framework. Overall performance in the CLS demonstrated a solid grasp of foundational space studies concepts and effective application of knowledge across domains.

7.2 Departmental Evaluation – Space Management and Business (MGB)

SSP25, Department - Phase II, Overall Evaluation Inbox ×

SSP Academic Office <sspacademics@isunet.edu> Thu, Aug 14, 9:28 PM
to me

To: Ayesha Habib

Dear Ayesha,

The purpose of this e-mail is to share with you the SSP25 Department evaluation for **Space Management and Business (MGB) Department** as below:

Result: You **PASS** the Department - Phase II of the SSP25 Program

Project title: **Team 3 - Exoscope**

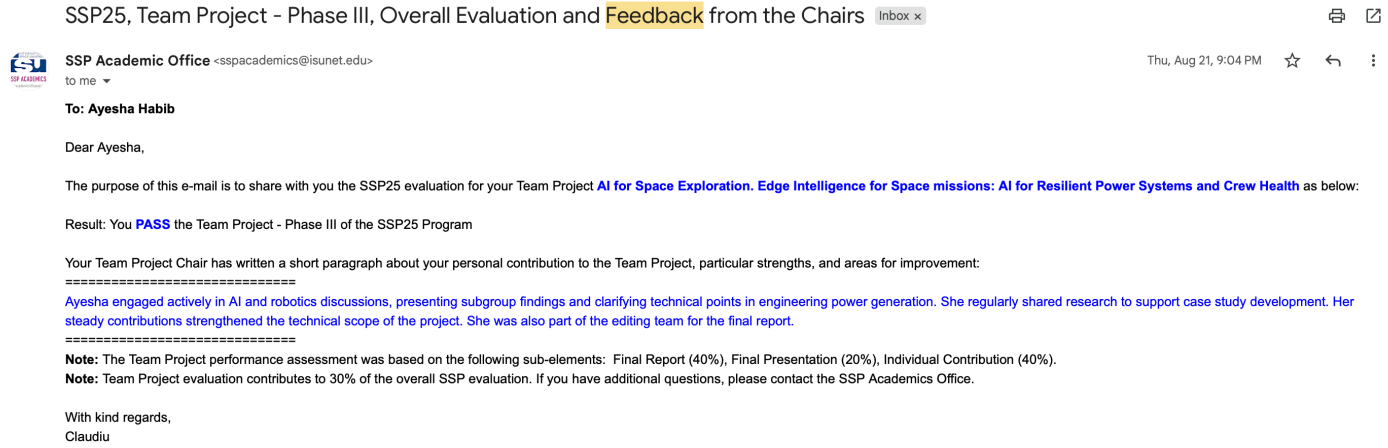
Your Department Chair(s) has/have written a short paragraph about your individual project, particular strengths, and areas for improvement:
==========
Ayesha is a composed, curious, and forward-looking participant who consistently demonstrated a high level of professionalism. She managed the VC competition with exceptional skill, asking insightful and pertinent questions throughout. Ayesha is an excellent team member, always maintaining a positive attitude and supporting those around her. Her strong performance was reflected in her achievements, as she was part of the winning team in both the VC competition and the final business competition. Her biography submission required a reminder, but she remained consistently engaged. Her drive, professionalism, and collaborative spirit made her an asset to the program.
==========
Note: The department performance assessment was based on three sub-elements, which include: (i) abstract submission; (ii) assignment and (iii) contribution to department activities. Department evaluation contributes to 30% of the overall SSP evaluation. If you have additional questions, please contact the SSP Academics Office.

With kind regards,
Claudiu

The departmental evaluation for the Space Management and Business (MGB) Department recognized strong academic engagement, adaptability, and professional conduct. Feedback highlighted active participation in departmental discussions, workshops, and collaborative exercises, as well as the

ability to integrate business, policy, and strategic considerations within space-sector contexts. Particular strengths noted included critical thinking, teamwork, and the capacity to contribute meaningfully to multidisciplinary group work. Areas for continued development were framed constructively, focusing on further refinement of analytical depth and professional presentation skills.

7.3 Team Project (TP) – Phase III Evaluation and Feedback



SSP25, Team Project - Phase III, Overall Evaluation and Feedback from the Chairs Inbox ×

SSP Academic Office <sspacademics@isunet.edu> Thu, Aug 21, 9:04 PM
to me

To: Ayesha Habib

Dear Ayesha,

The purpose of this e-mail is to share with you the SSP25 evaluation for your Team Project **AI for Space Exploration. Edge Intelligence for Space missions: AI for Resilient Power Systems and Crew Health** as below:

Result: You **PASS** the Team Project - Phase III of the SSP25 Program

Your Team Project Chair has written a short paragraph about your personal contribution to the Team Project, particular strengths, and areas for improvement:
==========
Ayesha engaged actively in AI and robotics discussions, presenting subgroup findings and clarifying technical points in engineering power generation. She regularly shared research to support case study development. Her steady contributions strengthened the technical scope of the project. She was also part of the editing team for the final report.
==========
Note: The Team Project performance assessment was based on the following sub-elements: Final Report (40%), Final Presentation (20%), Individual Contribution (40%).
Note: Team Project evaluation contributes to 30% of the overall SSP evaluation. If you have additional questions, please contact the SSP Academics Office.

With kind regards,
Claudiu

The Team Project evaluation provided comprehensive feedback on performance across research quality, collaboration, and final deliverables. The assessment covered individual contributions, teamwork dynamics, and the quality of the final report and presentation. Feedback acknowledged strong engagement in interdisciplinary research, effective collaboration within assigned sub-teams, and meaningful contributions to both written and visual outputs. The evaluation highlighted the ability to work under time constraints, coordinate across diverse roles, and contribute to a professional-level final product suitable for external stakeholders.

8 Achievements and Recoginition

A major highlight of my participation in the ISU Space Studies Program 2025 was my selection for, and active contribution within, the Space Management and Business (MGB) Department. Under the leadership of Natalia Larrea Brito and Adil Jafry, and with the guidance of Teaching Associate Lisa Kuchen, the department provided a highly rigorous and practice-oriented learning environment focused on space entrepreneurship, strategy, and policy.

Through hands-on workshops, simulations, and competitive exercises, I developed applied competencies in financial modeling and business pitching, venture capital negotiation and export control considerations, leadership and external risk management, and sustainability-driven decision-making within the space sector. Working closely with an international and interdisciplinary cohort further strengthened my ability to collaborate effectively across cultural and professional boundaries.

Within the MGB departmental activities, I participated in three competitive challenges and, together with my teams, secured first-place positions across all competitions. These included :

- VC Financing Simulation and Negotiation Workshop, the development of Altara, a disaster-response robotic concept leveraging satellite-imagery-based APIs,

- Carbon Neutrality Business Proposal focused on sustainable space ventures, Sun-Squared, a carbon-free silicon production concept for solar panels,

- Business Plan Competition through Team Exoscope, proposing space-based drone solutions for spacecraft in-orbit inspection

These achievements reflect not only technical and analytical capability, but also strategic thinking, teamwork, and the ability to translate complex space technologies into viable business and policy-aligned solutions. The recognition received through these competitions significantly reinforced my confidence and preparedness to pursue future leadership roles in the global space ecosystem.

9 Industrial Field Trips

9.1 Hanwha Systems

As part of the SSP25 Field Trips program, participants undertook a professional visit to Hanwha Systems on 25 July 2025 at the Yongin R&D Center in South Korea. The visit included guided tours of Hanwha Systems' research laboratories and control room facilities, where participants were introduced to system-level testing, integration, and monitoring processes associated with space and defense programs. Particular attention was given to Hanwha Systems' involvement in satellite systems, space-based observation technologies, and its contributions to Korea's launch ecosystem,

including programs affiliated with the Nuri launch vehicle. Participants gained insight into how testing, verification, and operational readiness are managed within a high-reliability industrial environment.

In addition, the visit provided an overview of Hanwha Systems' currently active and affiliated programs across space, aerospace, and defense domains, highlighting ongoing developments in intelligence, surveillance and reconnaissance (ISR), command and control systems, radar and electro-optics, and integrated platform solutions. Through direct engagement with technical staff and facility demonstrations, participants were able to observe how advanced space systems are developed, tested, and coordinated within a large-scale industrial organization. This visit offered valuable exposure to real-world operational practices and reinforced the connection between academic learning and industrial implementation in contemporary space programs.

9.2 Unmanned Exploration Laboratory (UEL)

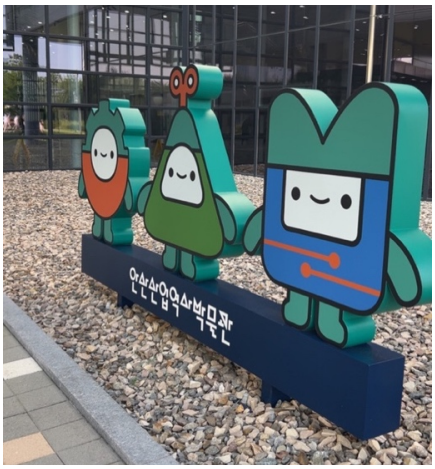
As part of Professional Visit 2, participants visited the Unmanned Exploration Laboratory (UEL) in Seoul, where a technical demonstration and hands-on session were conducted to showcase robotic systems developed for space and planetary exploration. The visit included an introduction to UEL's existing robotic rover models, with explanations of their mechanical design, mobility concepts, sensor integration, and intended mission applications. Participants were given insight into how these systems are prototyped, tested, and iteratively improved within a laboratory environment.

In addition to the demonstrations, participants engaged in a practical assembly exercise using an acrylic-based prototype kit provided by UEL. Working in small groups, participants assembled a functional two-wheeled robotic platform and integrated basic actuation and control components. The assembled models were subsequently tested in a simulated sand field, where participants operated the robots via teleoperation to evaluate mobility, controllability, and system behavior under terrain-like conditions. This hands-on activity provided valuable experience in rapid prototyping, system integration, and operational testing, and offered practical insight into the challenges associated with robotic mobility and teleoperation in exploration environments.

9.3 Ansan Industrial History Museum

We also had the opportunity to visit the Ansan Industrial History Museum, where the post-war industrial development of South Korea was presented through immersive exhibits and multimedia installations. A key highlight of the visit was a 3D video screening that illustrated Korea's rapid industrialization following the Korean War, showcasing the transformation of Ansan into a major industrial hub. The exhibits provided historical context on how manufacturing, infrastructure development, and technological innovation contributed to national economic recovery and growth.

This visit offered valuable perspective on the link between industrial policy, technological capability, and long-term national development, complementing the broader discussions on space industry ecosystems and industrial strategy covered during the program.



9.4 KIGAM

The Korea Institute of Geoscience and Mineral Resources (KIGAM) is a national research institute focused on geological resources and geoscience research in South Korea. As part of a joint activity with the Space Management and Business (MGB) department in Daejeon, participants visited key facilities at KIGAM, including the Earthquake Research Center, the Geological Museum, and the Center for Space Resource Exploration and Utilization (CSREU). The visit provided insights into earthquake monitoring and geohazard analysis, geological surveying techniques, and the application of planetary geology for space resource exploration. Presentations and facility demonstrations highlighted how geoscience research supports planetary exploration missions, in-situ resource utilization, and sustainable management of space and terrestrial resources. The experience emphasized the interdisciplinary link between geoscience, space exploration, and policy and business considerations within the global space ecosystem.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KIGAM
KIGAM

As part of the program activities, participants were presented with a commemorative pin symbolizing remembrance and respect. The pin, inspired by the Korean Taegeuk, reflects themes of peace, resilience, and national history, serving as a reminder of the Korean War and its lasting significance. This gesture provided participants with an opportunity to reflect on the historical and cultural context of the host country, reinforcing the importance of remembrance, mutual respect, and shared values within an international and intercultural setting.

9.1 KAIST

A brief visit was also made to the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, one of South Korea's leading research universities in science, engineering, and technology. KAIST is internationally recognized for its contributions to advanced research, innovation, and industry collaboration, particularly in areas relevant to space systems, robotics, artificial intelligence, and advanced materials. The visit provided participants with an overview of KAIST's research environment and its role in fostering technological innovation and talent development within South Korea's national and global space and technology ecosystem.

9.2 The Korea Institute of Civil Engineering and Building Technology (KICT)

The visit to the Korea Institute of Civil Engineering and Building Technology (KICT) provided valuable insight into Korea's national-level research efforts in infrastructure, materials, and space-relevant

construction technologies. During the visit, participants were introduced to KICT's advanced research facilities, including large-scale experimental laboratories used for structural testing, materials evaluation, and environmental simulation. A key highlight was the visit to a lunar-like simulation facility designed to replicate extraterrestrial surface conditions, where ongoing research focuses on construction methods, material behavior, and operational challenges relevant to lunar and planetary environments. This facility demonstrated how civil engineering research is increasingly contributing to future space exploration and off-Earth infrastructure development. Participants were also provided with a symbolic lunar regolith sample created by the institute, representing KICT's work on space resource utilization and planetary surface studies. The visit underscored the critical role of civil engineering and construction research in enabling sustainable human presence beyond Earth and highlighted Korea's growing contributions to space-related infrastructure innovation.

9.3 KT SAT

The visit to KT SAT, located in a remote area outside Daejeon, provided valuable insight into Korea's satellite communications operations and supporting ground infrastructure. As Korea's leading commercial satellite operator, KT SAT delivers broadcasting, maritime, government, and secure communication services through integrated space-to-ground networks. Participants were introduced to the rationale behind locating satellite facilities away from dense urban areas, where reduced

electromagnetic interference and enhanced operational security are critical. In addition to observing a full-scale satellite model and its major subsystems, the visit highlighted the underlying communication architecture between satellites and distributed ground systems. Participants learned how multiple ground boards and field-based stations support telemetry, tracking, command, and data relay, illustrating how coordinated ground infrastructure enables reliable satellite operations. This visit provided practical context to the theoretical concepts covered in the Core Lecture Series, particularly in satellite communications, space operations, and space applications.

9.4 Satrec Initiative

As part of Professional Visit 6, our department conducted an industrial visit to Satrec Initiative, in Daejeon, South Korea. Founded in 1999, Satrec Initiative is a leading South Korean aerospace company specializing in the design and manufacture of Earth-observation satellites, most notably the KOMPSAT series. The company also develops high-resolution electro-optical payloads, ground systems, and AI-driven geospatial analytics through its subsidiaries, SI Imaging Services and SI Analytics.

During the visit, we toured Satrec Initiative's satellite systems production lines, gaining first-hand insight into the processes involved in satellite integration, testing, and mission readiness. The visit highlighted the evolution of the KOMPSAT program and demonstrated how satellite hardware, imaging

technologies, ground infrastructure, and AI-based analytics are tightly integrated to support commercial Earth-observation services.

This professional visit provided valuable exposure to the commercial space sector, illustrating how advanced satellite engineering is translated into scalable data services and sustainable business models. It offered a practical industry perspective that complemented our academic learning department, particularly in understanding the end-to-end value chain of Earth-observation missions—from spacecraft development to data exploitation.

10 Academic and Social Events

10.1 Pre-program onboarding

The pre-program onboarding sessions were conducted to prepare participants academically, logistically, and socially ahead of their arrival in South Korea for SSP25. These sessions provided a

comprehensive overview of the SSP25 curriculum, including the structure of Core Lecture Series, departments, team projects, workshops, and distinguished academic events. Participants were introduced to essential ISU resources such as the ISU Library, research support services, and digital platforms including Google Drive, Google Calendar, and the Cvent system to ensure smooth coordination throughout the program.

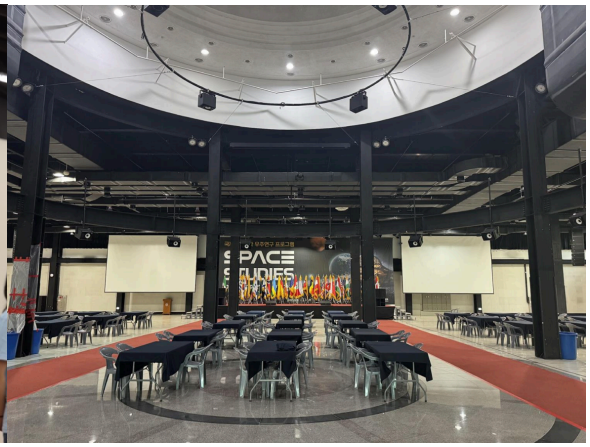
The onboarding agenda also addressed pre-arrival logistics, IT access, outreach and social media engagement, and expectations for academic conduct and collaboration. An academic briefing outlined the roles and responsibilities of the academic team, clarified assessment structures, and explained the requirements and timelines for Team Projects. Dedicated time was allocated for questions and open discussion, allowing participants to clarify concerns and align expectations. Overall, the pre-program onboarding played a critical role in establishing a shared understanding of the program structure, fostering early engagement among participants, and ensuring readiness for the intensive academic and collaborative experience of SSP25.

10.2 Welcome Event and Orientation

The Welcome Event and Orientation marked the formal commencement of the SSP25 program and provided participants with an introduction to the academic, administrative, and social framework of the Space Studies Program. The session brought together participants, faculty, and staff, fostering an early sense of community within the international and interdisciplinary cohort. Program leadership and academic representatives outlined the structure of SSP25, key expectations, and core values of ISU, emphasizing the principles of international, intercultural, and interdisciplinary collaboration.

During the orientation, participants were introduced to essential academic components, including the Core Lecture Series, departments, workshops, team projects, and evaluation criteria. Practical guidance was also provided on program logistics, use of ISU digital platforms such as Google Drive, calendars, and communication tools, as well as access to library and research resources. Dedicated time for questions and discussion allowed participants to clarify expectations and better understand the academic journey ahead. Overall, the Welcome Event and Orientation ensured that all participants began the program with a shared understanding of objectives, resources, and responsibilities, laying a strong foundation for effective engagement throughout SSP25.

A buffet lunch was served to participants at Lion Hall prior to the opening ceremony. The meal provided an opportunity for informal interaction and early networking among the SSP25 cohort, faculty, and staff. The buffet featured a diverse selection of Japanese and Korean cuisine, offering participants a welcoming introduction to the local culture while fostering a relaxed and collegial atmosphere ahead of the formal commencement of the program.



10.3 Opening Ceremony

During the opening ceremony, participants took part in a formal flag parade representing their home countries. I had the honor of serving as the flag bearer for Pakistan, marching alongside fellow participants representing their respective nations. In addition, I represented both Pakistan and Japan, reflecting my academic affiliation and cross-cultural engagement. This moment symbolized the international and intercultural spirit of the Space Studies Program and highlighted the program's

emphasis on global collaboration and mutual respect among participants from diverse backgrounds.

The opening ceremony was live-streamed on YouTube, allowing a wider international audience to witness the commencement of SSP25. The event also featured cultural performances by students of the host university, including several K-pop dance performances, which added a vibrant and celebratory atmosphere to the occasion. These performances showcased Korean culture and helped create an engaging and welcoming environment for participants at the start of the program.

10.4 Cultural Nights

During Cultural Night, I served as the main lead for the Pakistan cultural presentation, coordinating activities ranging from food management to the overall program design and presentation. With the support of a local Pakistani restaurant and funding assistance from ISU, the event featured authentic Pakistani cuisine and cultural elements. The initiative was further supported by the MGB Pakistan Chair, Adil Jafry, whose guidance contributed to the successful execution of the event. A dance performance set to music from Coke Studio Pakistan was also prepared and presented, creating an energetic atmosphere that was enthusiastically received by participants. In addition, I was actively involved in managing the Japan Cultural Night held on the same day, contributing to event coordination and execution. Cultural Night was organized as a recurring weekly event held every Thursday, during which participants were selected to represent their respective countries. These activities promoted cross-cultural exchange, strengthened community engagement, and highlighted the international and intercultural spirit of the Space Studies Program.



10.5 Space Masquerade Ball

The Space Masquerade Ball served as a formal social highlight of the SSP25 program, bringing together participants, faculty, and staff in a celebratory setting that complemented the program's intensive academic schedule. The event encouraged creative expression through space-themed attire and masks, reflecting the imaginative and interdisciplinary spirit of the Space Studies Program. Beyond its social significance, the evening fostered informal networking, strengthened interpersonal connections across cultures and disciplines, and reinforced a strong sense of community within the SSP cohort.

I attended the event dressed as an astronaut and participated in a coordinated astronaut-themed dance performance alongside fellow participants who were similarly dressed. The performance added an element of creativity and energy to the evening and was warmly received by attendees, further highlighting the program's emphasis on shared experiences, cultural exchange, and the celebration of space-inspired creativity in an inclusive and engaging environment.

10.6 Rude Goldberg

The Rube Goldberg activity was conducted as a collaborative and interactive social-academic exercise designed to promote teamwork, creativity, and problem-solving. Participants were organized into multidisciplinary and intercultural teams and tasked with designing and assembling a complex chain-reaction system to accomplish a simple objective. The activity required careful planning, coordination, and iterative testing, encouraging teams to think creatively while managing constraints related to time, materials, and system reliability. Through this exercise, participants strengthened their communication and collaboration skills, experienced hands-on systems thinking, and gained practical insight into how small components interact within larger engineered systems, paralleling challenges commonly encountered in space mission design and operations.

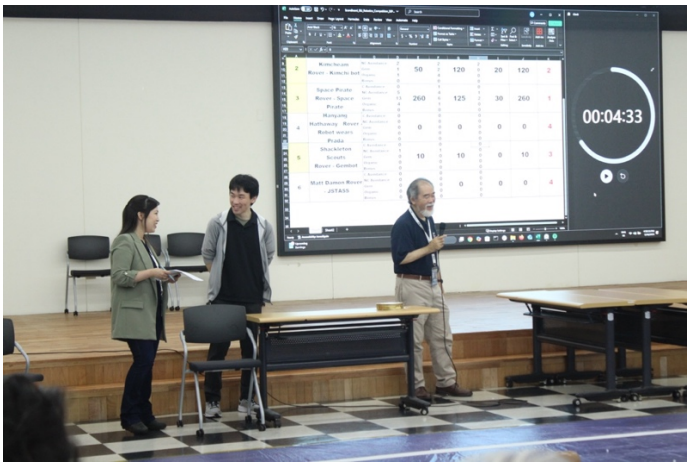
10.7 Alumni Night

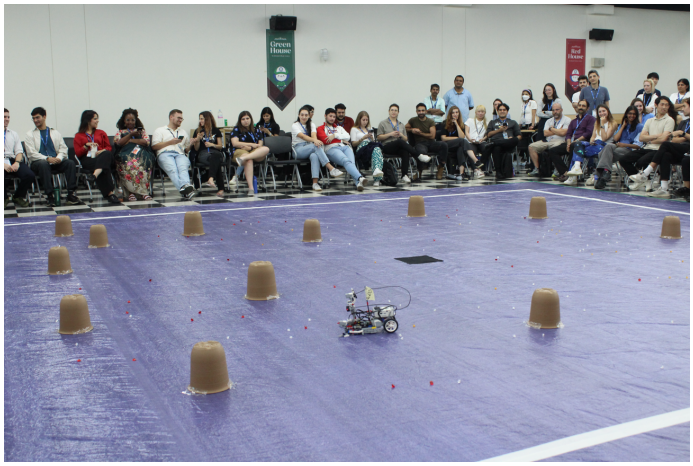
Alumni Night provided an opportunity for SSP25 participants to engage with ISU alumni from diverse professional backgrounds within the global space sector. The event facilitated informal discussions and networking, allowing participants to learn from alumni experiences across academia, industry,

government, and international organizations. Alumni shared insights into career pathways, professional challenges, and the long-term impact of the ISU network. This interaction reinforced the value of the ISU alumni community as a lasting professional resource and highlighted the role of mentorship, collaboration, and global connectivity in shaping careers within the international space ecosystem.

10.8 Robotics Competiition

The Robotics Competition, organized under the guidance of Professor Kazuya Yoshida, provided participants with a practical and engaging opportunity to apply robotics concepts in a competitive setting. Teams were tasked with designing, assembling, and operating robotic systems using LEGO-based platforms to complete defined challenges. I actively assisted one of the teams in troubleshooting and enabling their robot to function correctly, contributing to system integration and operational testing. The competition encouraged hands-on learning, teamwork, and creative problem-solving, while reinforcing key concepts in robotics, control, and system design within a dynamic and collaborative environment.





10.9 Closing ceremony

The Closing Ceremony marked the formal conclusion of the SSP25 program and served as a moment of reflection and celebration for all participants. During the ceremony, participants were awarded certificates of completion in recognition of their academic achievements, contributions, and successful participation in the program. The event highlighted the collective accomplishments of the cohort and acknowledged the dedication of participants, faculty, and staff throughout the intensive eight-week program.

During the ceremony, the SSP25 cohort was also officially given the batch name “Lovebugs,” symbolizing the strong bonds, collaboration, and shared experiences developed throughout the program. The Closing Ceremony provided a meaningful conclusion to SSP25, reinforcing the lasting sense of community and shared identity among participants.

I also had the opportunity to participate in the SSP25 Retrospective Video, where I shared reflections on my experience in the program and discussed the inspiration drawn from ISU's core principles of internationality, interculturality, and interdisciplinarity. In the video, I highlighted how the "3Is" shaped meaningful collaboration, broadened perspectives, and reinforced the importance of inclusive, global cooperation in addressing future challenges in space exploration. This contribution served as a personal reflection on the program's impact and its relevance to the evolving international space community.

10.10 Impact of Cultural and Social Events

The cultural and social events throughout SSP25 played a vital role in strengthening the program's international, intercultural, and interdisciplinary ethos. These activities complemented the academic curriculum by fostering informal collaboration, mutual understanding, and community building among participants from diverse backgrounds. Through shared cultural expression, creative engagement, and social interaction, participants developed lasting connections that enhanced teamwork, communication, and cross-cultural awareness. Collectively, these events significantly enriched the overall SSP experience and reinforced the human dimension of international space collaboration.

11 Cultural Excursions

11.1 Busan

I also took part in a group trip to Busan, where I explored the city's coastal and cultural highlights. The visit included time at Haeundae Beach, where we enjoyed open sea views, a relaxed atmosphere, and watched a drone shoot along the coastline. We also visited Gamcheon Culture Village, exploring its colorful hillside streets and unique artistic character. One of the most memorable moments was strolling through the seaside temple area at Haedong Yonggungsa, which offered a peaceful contrast to the city's vibrant energy. In the evening, we rode the Songdo Marine Cable Car, enjoying scenic sunset views of Busan's skyline and the ocean. Overall, the trip was a memorable opportunity to experience Korea beyond Seoul while sharing meaningful moments with fellow participants.

11.2 Hiking trip to Bukhansan

With a group of four fellow SSP participants, I planned and undertook a hiking trip to Bukhansan Peak, one of the highest peaks in South Korea, reaching an elevation of approximately 836 meters. The trail was physically demanding and challenging, featuring steep ascents, rocky sections, and exposed paths that required careful navigation and endurance. Completing the hike was both rewarding and memorable, offering a strong sense of accomplishment as well as panoramic views from the summit. The experience strengthened teamwork and resilience while providing a meaningful opportunity to explore Korea's natural landscape alongside fellow participants.

11.3 Gyeongbokgung Palace

I also visited Gyeongbokgung Palace, one of the most iconic historical sites in Seoul. During the visit, I tried renting a hanbok, the traditional Korean dress, which made the experience even more memorable. Walking through the palace courtyards in hanbok allowed me to feel more connected to

Korea's royal history and culture. The vibrant colors and elegant design of the outfit added a special charm to the surroundings and made the visit feel immersive. Exploring the palace grounds, observing the traditional architecture, and seeing the ceremonial spaces offered a fascinating glimpse into Korea's past and made the trip a truly unique cultural experience.

11.4 Gangnam

I visited the Starfield Library at COEX in Seoul with a fellow SSP participant, where the striking open architecture and floor-to-ceiling bookshelves created a unique space that blended culture, design, and public learning. Walking through the library offered a calm contrast to the surrounding city energy and sparked conversations about how shared public spaces can inspire creativity and reflection. Later, I explored the nearby K-pop road in Gangnam, experiencing the vibrant street atmosphere shaped by music, pop culture, and fan art. The visit highlighted South Korea's global cultural influence and provided a memorable opportunity to connect informally with fellow participants while engaging with contemporary Korean urban culture.

11.5 Eland River Cruise

As part of the TP AI social activities, I participated in a group visit to the Eland River Cruise, which provided a relaxed and informal setting for team bonding outside the academic environment. The cruise offered an opportunity to interact with fellow team members across sub-teams, allowing discussions to extend beyond technical work into cultural exchange and personal experiences. This social activity helped strengthen interpersonal relationships within the TP AI group, fostering trust, open communication, and collaboration that later translated positively into our intensive project work. The experience highlighted the importance of balanced team dynamics and informal interactions in supporting effective multidisciplinary collaboration during the Team Project phase.

11.6 DMZ

visited the Korean Demilitarized Zone (DMZ) to gain a deeper understanding of the historical, political, and security dynamics of the Korean Peninsula. During the visit, I explored the infiltration tunnels constructed by North Korea, which were designed for covert military movement across the border. Walking through these tunnels provided a tangible perspective on the scale, intent, and strategic planning behind past infiltration efforts.

The visit also offered valuable insight into the realities of inter-Korean relations, the ongoing division between North and South Korea, and the broader implications for regional and global security. Through guided explanations and on-site observation, I developed a clearer understanding of North Korea's military posture, historical conflicts, and the lasting impact of the Korean War. This excursion was both educational and reflective, reinforcing the importance of diplomacy, security awareness, and historical context in shaping contemporary geopolitical realities.

12 Conclusion

12.1 Reflections on SSP25

The Space Studies Program 2025 represented a transformative academic and professional milestone, offering a uniquely immersive environment that combined rigorous interdisciplinary learning with meaningful international and intercultural collaboration. Through its carefully structured phases—core lectures, departmental activities, team projects, professional visits, and cultural engagement—SSP25 enabled a holistic understanding of the space sector that extends well beyond technical expertise alone.

Participation in SSP25 significantly broadened my perspective on space exploration by integrating engineering, policy, business, human factors, and societal considerations into a unified systems-level framework. Exposure to diverse viewpoints, professional practices, and global space ecosystems reinforced the importance of collaboration across disciplines and cultures in addressing complex space challenges. The program's emphasis on applied learning, critical thinking, and collective problem-solving strengthened my ability to navigate ambiguity, synthesize knowledge, and contribute constructively within international teams.

The Team Project Applying AI to Space Exploration, in particular, provided a capstone experience that translated theory into practice. Working within a large, multidisciplinary team to produce a

professional-level report and presentation reinforced skills in coordination, technical communication, and strategic integration. Beyond academic outputs, the project highlighted the responsibility associated with deploying advanced technologies such as artificial intelligence in space, emphasizing ethical, legal, and societal dimensions alongside technical innovation.

Overall, SSP25 reaffirmed the value of ISU's educational philosophy and its relevance to the future of space exploration. The experience not only enhanced my technical and analytical capabilities but also deepened my appreciation for the human, cultural, and governance dimensions that shape sustainable and responsible space activities.

12.2 Final Thoughts

The Space Studies Program 2025 was not only an academic endeavor but a deeply formative experience that reinforced the importance of international cooperation, intercultural understanding, and interdisciplinary thinking in the space domain. The relationships built, perspectives gained, and skills developed during SSP25 will continue to influence my academic research and professional trajectory.

As space exploration advances toward increasingly complex, autonomous, and globally interconnected missions, the lessons learned at SSP25 remain highly relevant. The program strengthened my resolve to contribute responsibly and collaboratively to the future of space exploration, guided by the values embodied in ISU's "3Is." SSP25 stands as a defining chapter in my professional development, and its impact will extend well beyond the duration of the program into future research, innovation, and leadership endeavors within the global space community.

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