SPACE GENERATION ADVISORY COUNCIL

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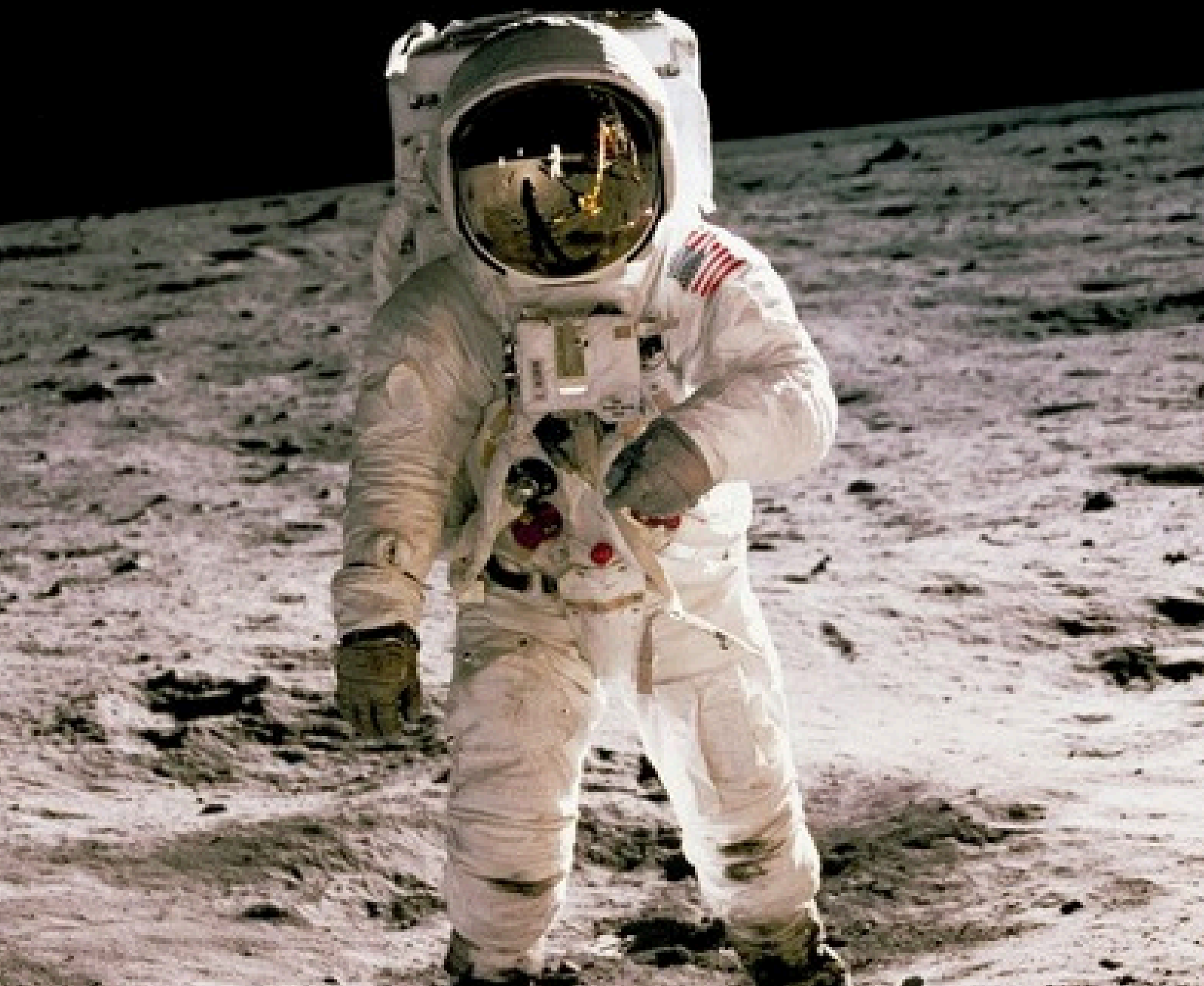
SPACE SAFETY AND SUSTAINABILITY PROJECT GROUP



SPACE SAFETY AND SUSTAINABILITY PROJECT GROUP NEWSLETTER-OCTOBER 2024

Welcome to the latest edition of our Space Safety and Sustainability Newsletter!

As we wait anxiously for the 22nd edition of Space Generation Congress (SGC) being held in Milan from 10-12 October 2024, monthly dose of space safety and sustainability info is here. Our newsletter is dedicated to keeping you informed about pressing issues related to space safety and sustainability. From the latest research on mitigating space debris and innovative sustainability practices to updates on international collaborations and policy developments, we cover a broad spectrum of topics essential for anyone invested in the future of space exploration. Stay informed, stay engaged, and be part of the conversation that is driving responsible and forward-thinking space activities.

In this newsletter, we'll dive into a captivating selection of topics including...

- News essential
- Member spotlights
- Previous and upcoming important launches
- Stats related to Orbital carrying capacity
- Scholarship, competitions and SGAC vacancies
- Upcoming events
- Recent activities of Space Safety and Sustainability (SSS) Project Group
- Few important definitions

WORLD IN BRIEF: TODAY'S NEWS ESSENTIAL

FALCON 9 GROUNDED FOR THIRD TIME IN THREE MONTHS

After Space X launched two astronauts to the International Space Station for NASA, the rocket body that had boosted the crew further into space **failed to properly re-light** its engine for its "deorbit burn," a routine procedure that discards the booster into the ocean after completing its flight. The astronaut crew were carried on to the ISS safely, docking as planned. The FAA said there were no injuries or property damage linked to the booster mishap. However, the workhorse of Space X was grounded to investigate the root cause of the occurence.

Falcon 9

Polaris Dawn Crew

POLARIS DAWN' MISSION CONCLUDES WITH SUCCESS

Jared Isaacman, Kidd Poteet, Sarah Gillis, and Anna Menon spent nearly five days in orbit, during which they completed **multiple objectives** including the study of the effects of spaceflight and space radiation on human health, first ever commercial Extra Vehicular Activity (EVA) and test of Starlink laser-based communications in space.

EUROPEAN SPACE POLICY INSTITUTE (ESPI) ISSUES NEW REPORT, AN ANALYSIS OF INTERNATIONAL EFFORTS IN SPACE DEBRIS MITIGATION DOMAIN

The ESPI report notes increasing presence of stricter guidelines. At the same time, the **report** highlights a lack of broad international alignment on concrete implementation pathways and a fragmented landscape of a multitude of frameworks with heterogenous involvement.

SPACE X AND FAA CONTINUE TO ENGAGE IN A HEATED AND PUBLIC DEBATE OVER LAUNCH LICENSING AND ALLEGED VIOLATIONS

Earlier this September, the FAA announced that it planned to fine SpaceX a total of **$630,000 for violations** stemming from two launches in 2023. SpaceX fired back with a letter to the U.S. Congress contesting the_fines, arguing that the two alleged infractions were frivolous and should not be viewed as violations at all. In addition to the letter, SpaceX founder and CEO Elon Musk said in a post on X, that his company intended to sue the FAA for "regulatory overreach."

PSN SATRIA mission

A UAE COMPANY IN AGREEMENT WITH CHINA TO SUPPORT ITS AMBITIOUS PLAN TO BUILD A RESEARCH STATION ON THE MOON IN THE NEXT DECADE

Orbital Space, **a UAE based private company**, will help to develop lunar exploration technologies, or payloads, for missions that could launch as part of China's International Lunar Research Station programme. An agreement was signed between Orbital Space and China's Deep Space Exploration Lab at the International Deep Space Exploration Conference, being held in China.

Moon Base Project

IMPORTANT LAUNCHES

1. Name: NASA's SpaceX Crew-9 mission
Launch site: Kennedy Space Center, Florida
Launch Date: 28 September 2024
Description: SpaceX Falcon 9 rocket and Dragon spacecraft carried two astronauts instead of four astronauts to the International Space Station. This mission is part of NASA's Commercial Crew Program and this is ninth operational Space-X Dragon spacecraft flight to carry the astronauts to ISS. This Dragon spacecraft will also bring back the two stranded NASA astronauts from ISS.

2. Name: Falcon 9 - Hera
Launch site: SLC-40, Cape Canaveral Space Force Station, Florida
Launch Date: 07 October 2024
Description: SpaceX will launch the Hera European Space Agency mission to study the Didymos binary asteroid system that was impacted by the DART mission in September 2022.

3. Name: SpaceX Falcon Heavy Europa Clipper
Launch site: Launch Complex 39A - Kennedy Space Center
Launch Date: 10 October 2024
Description: Europa Clipper will conduct a study to determine if Europa, the icy moon of Jupiter, has conditions suitable for life.

4. Name: Blue Origin New Glenn-NASA ESCAPADE
Launch site: Cape Canaveral Space Force Station, Florida
Launch Date: 13 October 2024
Description: NASA and Blue Origin are preparing for the agency's ESCAPADE (Escape and Plasma Acceleration and Dynamics Explorers) mission, which begins on the inaugural launch of the company's New Glenn rocket. The mission will study the solar wind's interaction with the magnetosphere on Mars.

5. Name: Ionosfera-M 1 & 2
Launch site: Vostochny Cosmodrome, Siberia, Russian Federation
Launch Date: Nov. 5, 2024
Description: A constellation of four ionospheric and magnetospheric research satellites developed by Roscosmos for the project Ionozond. The satellites will operate on circular sun-synchronous orbits (SSO) at an altitude of about 800 km.

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MARK YOUR CALENDARS: UPCOMING EVENTS

ASSOCIATION OF SPACE EXPLORERS (ASE) PLANETARY CONGRESS
SEP 29-OCT 06
Ned

EARTH-SPACE SYMPOSIUM ON SUSTAINABILITY, GOVERNANCE & FUTURES
Nov 12-13
Ultrecht Netherlands

SPACE GENERATION CONGRESS
Oct 10-12
Milan, Italy

INTERNATIONAL ASTRONAUTICAL CONGRESS
Oct 14-18
Milan, Italy

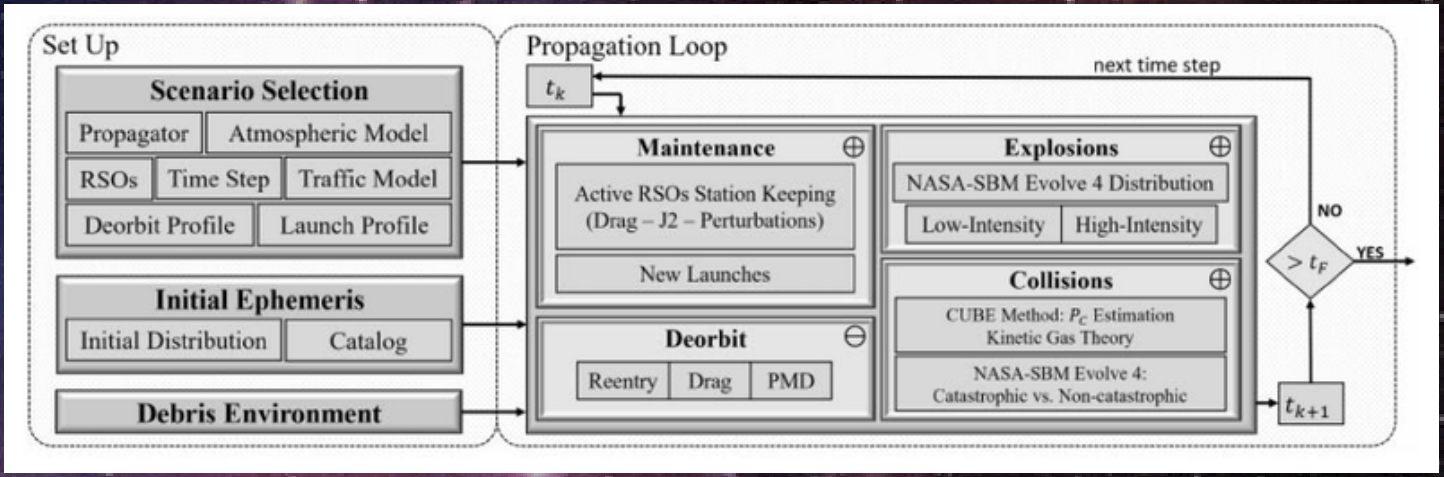
SPACE TECH EXPO EUROPE
Nov 19-21
Bremen, Germany

WORLD SPACE WEEK
Oct 04-10
Worldwide

STATS FOR YOU

STATS RELATED TO ORBITAL CARRYING CAPACITY

- Orbital carrying capacity is the concept of how much "traffic" a particular orbit can safely hold. This metric is determined by the volume of satellites and space debris that can safely orbit the Earth without increasing the likelihood of collisions past an acceptable level of risk. As the number of satellites increases in near-Earth orbits, an orbital carrying capacity threshold is one important way to help avoid over-crowding and collisions in these orbits.
- Determining orbital carrying capacity is complex and not readily available. Complicating matters further is the fact that the data is ever-changing and evolving.
- The closer an orbit gets to its carrying capacity, the more likely collisions between space objects become. At some point, the chance becomes so great that the entire orbital space can be rendered unusable for decades or longer. **The "Kessler Syndrome"** is the worst-case scenario where an initial collision creates even more debris that can then collide with other debris and so on and so forth until the near-Earth orbits are completely unusable.
- Several models have been developed and **utilized by space agencies** to model the future space environment. These include NASA's Orbital Debris Engineering Model (ORDEM), European Space Agency's Orbital Debris Evolutionary Model (ODEM), Chinese Academy of Sciences' SOLEM (Space Objects Long-term Evolution Model), LUCA model from Technische University at Braunschweig, MIT Orbital Capacity Assessment Tool (MOCAT) & NEODEEM model from Kyushu University and the JAXA.
- These tools efficiently model the evolution of the orbital population characterized by dynamics such as launches, collisions, explosions, deorbit methods, and more. One such schematic of the model is shown below in the figure.



- The increasing number of launches, mega constellations and absence of not enough sinks for the space debris underscores the importance of a multitude of debris mitigation strategies that include international policies and technological solutions.

SCHOLARSHIPS, COMPETITIONS AND SGAC VACANCIES

Name: The Human Lander Challenge
Activity: The 2025 Human Lander Challenge asks teams of students and their faculty advisors to design innovative solutions and technology developments addressing in-space cryogenic liquid storage and transfer systems for long duration NASA missions to the Moon. A prize of substantial amount will be granted to three winning teams.
Deadline: 16.10.2024

Name: Regional Social Media Manager
Award: Keeping track of social media metrics, promoting SGAC-related content by other SGAC accounts and reviewing and replying to messages, account tags, story repost requests, under guidance by the Regional Coordinators and Regional Communication Managers.
Deadline: 12.10.2024

SGAC Vacancies are announced **here**

SSS PROJECT GROUP UPDATES

FOLLOWING PAPERS WILL BE PRESENTED BY SSS MEMBERS IN THE UPCOMING INTERNATIONAL ASTRONAUTICAL CONGRESS

1) Title: State of the art for proximity and docking procedures throughout the latest years
Member(s): Diya Jose, Javier Maldonado-Romo, Atzin Constantino, Yuti Antani, Virgile Gautier and Yakov Bobrov
Objective: On-Orbit Servicing (OOS) improves space sustainability and safety through remediation and mitigation strategies. A thorough analysis of past RPO events reveals recurring trends and critical variables impacting mission success. The study suggests safety guidelines and best practices to enhance the security of spacecraft and the longevity of the orbital environment.
2) Title: Characterization of orbits in cislunar space for space traffic management
Member(s): Sourav Ghosh
Objective: Lunar exploration missions have increased, necessitating traffic management in cislunar space. Characterizing orbits for specific use cases, such as communication relays and space stations, can improve coordination and efficiency.
3) Title: Constraints and challenges in guidance, navigation and control architectures for beyond earth orbit cubesat missions
Member(s): Sourav Ghosh
Objective: Interplanetary CubeSats face unique challenges in Guidance, Navigation, and Control (GNC) systems due to limited space, power, and communication. Addressing these challenges requires innovative solutions, such as optical navigation and autonomous guidance, to enable successful and cost-effective exploration of the cosmos.
4) Title: Rigid Electrodynamic Tether System (RETS)
Member(s): Ahmad Faisal and Faith Tng
Objective: A Rigid Electrodynamic Tether System (RETS) is proposed for active debris removal in Low Earth Orbit. The system utilizes rigid tethers made of carbon fiber and/or fiberglass composites, which can be deployed efficiently and provide significant thrust and torque for orbital maneuvers.

SSS PROJECT GROUP UPDATES

4) Title: The new voyager: astronauts and the modern myth of space exploration
Member(s): Chiara Limardi
Objective: Space exploration's impact on Millennials and Zoomers is explored, examining how globalization and technology influence the creation of an internationally shared narrative on astronauts. The study analyzes national depictions of astronauts from the US, India, Italy, and Japan to understand the extent to which a universally shared mythology of space exploration can be presented.

5) Title: Policies and international cooperation in support of the ASEAN community for the use of space technologies to manage environmental fragilities
Member(s): Chiara Limardi
Objective: Climate change in Southeast Asia has led to natural and anthropological disasters, impacting economies and societies. The Italian Space Agency (ASI) proposes collaboration with ASEAN to utilize space technologies for disaster prevention and management.

6) Title: MaiaSpace solutions for space mobility
Member(s): Antoinette Ott
Objective: MaiaSpace, a European NewSpace company, is developing a mini launcher with reusability, bio-methane fuel, and a kick-stage to enhance competitiveness and sustainability. The launcher's methane fuel could reduce climate change impact by up to 94% compared to RP-1 fuel.

7) Title: An attributional assessment of a prospective global space traffic management system

Member(s): Mahhad Nayyer, Sanaa Rashid, Javier Maldonado-Romo, Geetanjali Kamat and Roshaan Nadeem

Objective: The need for a global Space Traffic Management (STM) system is growing due to increasing space debris and potential collisions. A comprehensive review of international legal frameworks, multilateral initiatives, and private sector endeavors identifies gaps that could hinder future developments in traffic management. The proposed guidelines for a global STM system emphasize modularity, decentralization, standardization, and equity.

8) Title: Femtosatellite for studying thermal atmosphere dynamics: a step towards space debris mitigation

Member(s): Atzin Constantino and Javier Maldonado-Romo

Objective: Femtosatellites, small and inexpensive satellites, are being developed to study space debris and its impact on the thermal atmosphere. These satellites can gather data on atmospheric density and help mitigate risks associated with space debris.

9) Title: Flood Risk Assessment and Early Warning Systems Integrating Earth Observation Technologies for Improved Resilience in Pakistan

Member(s): Talha Noor, Anupam Kumar, Muhammad Najeeb, Sonalli Madhanraj, Zain Ahmed, Andrea Staffieri, Roshaan Nadeem, Nazmus Saadath

Objective: Floods pose a significant threat to the socio-economic fabric of Pakistan, emphasizing the critical need for effective flood risk assessment and early warning systems. The 2022 floods submerged one third of the country, affecting 33 million people, half of whom were children.The paper offers recommendations for policy enhancements, infrastructure development, and international collaboration to fortify the nation's resilience against future flood events. This comprehensive and holistic approach to flood risk management, integrating cutting-edge EO technologies, not only contributes to the scientific understanding of disaster resilience but also provides actionable insights for policymakers, disaster management authorities, and communities striving to mitigate the impact of floods in Pakistan.

SOME IMPORTANT DEFINITIONS

Orbit Determination: Orbit determination is the process of calculating the precise trajectory of a spacecraft or celestial object using observational data. This involves measuring its position, velocity, and other parameters over time to model its orbital path around a central body (e.g., Earth, the Sun, or another planet). Accurate orbit determination is crucial for spacecraft navigation, collision avoidance, and mission planning. It typically involves a combination of ground-based tracking stations, onboard sensors, and mathematical models..

Coronal Mass Ejections (CME): Coronal Mass Ejections (CMEs) are massive bursts of solar wind and magnetic fields released from the Sun's corona, the outermost layer of its atmosphere. These ejections carry billions of tons of plasma into space, and when directed toward Earth, they can cause geomagnetic storms that disrupt satellite communications, GPS systems, and power grids. CMEs are a significant concern for space safety, as they pose risks to both astronauts and spacecraft through increased radiation exposure and potential damage to electronic systems.

Inter-Agency Space Debris Coordination Committee (IADC) Guidelines: The IADC, composed of space agencies like NASA, ESA, and JAXA, has issued debris mitigation guidelines that are widely adopted by the global space industry. These guidelines recommend best practices such as passivation (deactivating leftover energy in spacecraft to avoid explosions) and moving retired satellites into "graveyard orbits" to prevent future collisions.

Hypergolic Propellant Safety: Hypergolic fuels ignite on contact with their oxidizer, requiring special handling protocols to prevent accidental ignition. Proper safety measures include rigorous containment, shielding, and handling techniques to avoid explosions during rocket operation.

End of Life Disposal (EOL): Procedures followed to safely decommission satellites or spacecraft once they are no longer operational. This includes either moving them to a graveyard orbit or deorbiting them to burn up in the Earth's atmosphere, preventing long-term debris accumulation.

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