UTMUN 2024

United Nations Office for Outer Space Affairs

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Contents

Equity Disclaimers

Throughout this committee, delegates will be engaging in complex debates and discussions covering a wide array of topics. As UTMUN seeks to provide an enriching educational experience that facilitates understanding of the implications of real-world issues, the content of our committees may involve sensitive or controversial subject matter for the purposes of academia and accuracy. We ask that delegates be respectful, professional, tactful, and diplomatic when engaging with all committee content, representing their assigned country's or character's position in an equitable manner, communicating with staff and other delegates, and responding to opposing viewpoints.

This Background Guide and the United Nations Office for Outer Space Affairs presents topics that may be distressing to some Delegates, including but not limited to the following: Gender Inequity, Radiation, Death, Death in Space, Over-Surveillance, Space Colonization. Great care will be taken by staff in handling any/all of these topics should they arise.

UTMUN recognizes the sensitivity associated with many of our topics, and we encourage you to be aware of and set healthy boundaries that work for you. This may include: preparing yourself before reading this background guide, seeking support after reading the background guide, or filling out the committee switch form beforehand. We ask that all Delegates remain considerate of the boundaries that other Delegates set.

UTMUN expects that all discussions amongst delegates will remain productive and respectful of one another. If you have any equity concerns or need assistance in setting boundaries or navigating sensitive subject matter or have any questions at all, please do not hesitate to reach out to our Chief Equity Officer, Harvi Karatha, at equity@utmun.org. We want you to feel safe and comfortable at UTMUN.

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1. Fill out the UTMUN 2024 Committee Switch Request Form, https://forms.gle/EVfikp6r6ACnBooR6.

If you have any equity concerns, equity-based questions, or delegate conflicts, please do any of the following:

1. Email equity@utmun.org to reach Harvi Karatha or email deputy.equity@utmun.org to reach Iva Zivaljevic or reach out to me at uncct@utmun.org.
2. Fill out the (Anonymous if preferred) UTMUN Equity Contact Form: UTMUN Equity Contact Form
3. Notify/Ask any staff member to connect you to Harvi Karatha or Iva Zivaljevic

Model United Nations at U of T Code of Conduct

The below code of conduct applies to all attendees of UTMUN 2024 for the entire duration of the conference, and any conference-related activities (including but not limited to committee sessions, conference socials, committee breaks, and the opening and closing ceremonies).

1. Harassment and bullying in any form will not be tolerated, the nature of which includes, but is not limited to, discrimination on the basis of race, national origin, ethnicity, colour, religion, sex, age, mental and physical disabilities, socioeconomic status, sexual orientation, gender identity, and gender expression,
    a. Harassment and bullying include, but are not limited to, insulting and/or degrading language or remarks; threats and intimidation; and intentional (direct or indirect). discrimination and/or marginalization of a group and/or individual;
        i. The above prohibition on harassment, bullying, and inappropriate behaviour extends to any and all behaviour as well as written and verbal communication during the conference, including notes, conversation both during and outside committees, and general demeanour at all conference events;
        ii. UTMUN reserves the right to determine what constitutes bullying and/or inappropriate behaviour toward any individual and/or group;
    b. Attendees must not engage in any behaviour that constitutes physical violence or the threat of violence against any groups and/or individuals, including sexual violence and harassment, such as, but not limited to,
        i. Unwelcome suggestive or indecent comments about one's appearance;
        ii. Nonconsensual sexual contact and/or behaviour between any individuals and/or groups of individuals;
        iii. Sexual contact or behaviour between delegates and staff members is strictly forbidden;

2. UTMUN expects all attendees to conduct themselves in a professional and respectful manner at all times during the conference. Specific expectations, include, but are not limited to,
    a. Attendees must, if able, contribute to the general provision of an inclusive conference and refrain from acting in a manner that restricts other attendees' capacity to learn and thrive in an intellectually stimulating environment;
    b. Attendees must adhere to the dress code, which is Western business attire;
        i. Exceptions may be made on a case-by-case basis depending on the attendees' ability to adhere to the previous sub-clause;
        ii. Attendees are encouraged to contact Chief Equity Officer, Harvi Karatha, at equity@utmun.org with questions or concerns about the dress code or conference accessibility;

c. Attendees must refrain from the use of cultural appropriation to represent their character and/or country, including the use of cultural dress, false accent, and any behaviour that perpetuates a national or personal stereotype;
d. Delegates must not use music, audio recordings, graphics, or any other media at any time unless approved and requested to be shared by the Dais and/or the Chief Equity Officer, Harvi Karatha at equity@utmun.org;
e. Attendees must abide by instructions and/or orders given by conference staff, members;
i. Attendees are exempt from this above sub-clause only if the instructions and/or orders given are unreasonable or inappropriate;

3. Delegates, staff, and all other conference participants are expected to abide by Ontario and Canadian laws and Toronto by-laws, as well as rules and regulations specific to the University of Toronto. This includes, but is not limited to,
a. Attendees, regardless of their age, are strictly prohibited from being under the influence and/or engaging in the consumption of illicit substances, such as alcohol or illicit substances for the duration of the conference;
b. Attendees are prohibited from smoking (cigarettes or e-cigarettes, including vapes) on University of Toronto property;
c. Attendees must refrain from engaging in vandalism and the intentional and/or reckless destruction of any public or private property, including conference spaces, venues, furniture, resources, equipment, and university buildings;
i. Neither UTMUN nor any representatives of UTMUN is responsible for damage inflicted by attendees to property on or off University of Toronto campus;
ii. Individuals will be held responsible for any damages.

4. The Secretariat reserves the right to impose restrictions on delegates and/or attendees for not adhering to/violating any of the above stipulations. Disciplinary measures include, but are not limited to,
a. Suspension from committee, in its entirety or for a specific period of time;
b. Removal from the conference and/or conference venue(s);
c. Disqualification from awards;
d. Disqualification from participation in future conference-related events.

5. UTMUN reserves the right to the final interpretation of this document.

For further clarification on UTMUN's policies regarding equity or conduct, please see this form. For any questions/concerns, or any equity violations that any attendee(s) would like to raise, please contact UTMUN's Chief Equity Officer, Harvi Karatha, at equity@utmun.org or fill out this anonymous Equity Contact Form: https://forms.gle/Psc5Luxp22T3c9Zz8.

Letter from the Director

Dear delegates,

The Dais and I are pleased to welcome you to UTMUN 2024's United Nations Office for Outer Space Affairs (UNOOSA) committee! My name is Amelia Hui, and I am a first-year student at UofT hoping to major in International Relations or Peace, Conflict, Justice. When I'm not frantically trying to optimize my schedule on Google Calendar, you can find me drawing, playing Tetris, or dyeing my friends' hair. My very first conference experience was at UTMUN 2021, so being able to direct a UTMUN committee three years later feels like a true full circle moment.

Joining me on the Dais is our Vice-Director, Sania Abidi. She is a second-year Rotman Commerce student, specializing in Management. In her free time, she likes to draw, listen to music, find new places to hang out with friends, and work out to maintain some peace of mind throughout the academic year. Despite her business related major, she has always been interested in political science and finding solutions to political and international conflicts. She is excited to develop new skills and expand her knowledge at UTMUN.

Lastly, joining me on the Dais is our Moderator, Pranav Chaturvedi. Pranav is a first-year Social Sciences student, intending to pursue double majors in Economics and Public Policy. He's originally from New York City, and in addition to UTMUN he's heavily involved with NAMUN, Canadian Moot Court, Bhangra Indian Folk Dance, among other on-campus organizations. In his free time, he loves to go biking, play golf, and snowboard! He couldn't be more excited to get to know you all and for all that is to come during this year's conference.

In this committee, you will discuss topics that pertain to the birth and development of outer space exploration, including issues like space tourism, commercial mining, and ethical implications. We welcome debate and discussion, but ask that you keep equity in mind when delving into sensitive topics—please remain diplomatic and considerate throughout the entire conference.

First, I recognize that this background guide is INSANELY LONG. I do not expect you to discuss every single thing covered in this guide; however, it would be worthwhile to read it carefully in order to gauge which topics your country is most invested in.

To prepare, we encourage you to develop a good understanding of your country's policies and stances on the issues discussed in this committee. If you have any trouble researching any of the topics, please refer to the guiding questions located at the end of each topic. If you have any questions about the background guide material and this committee, feel free to email me at amelia.hui@mail.utoronto.ca.

I'm looking forward to listening to your speeches and seeing the resolutions you collaborate on to transform international outer space exploration!

Sincerely,

Amelia Hui
Director, UNOOSA

Position Paper Policy

At UTMUN 2024, position papers are required to qualify for awards. Each committee will also give out one Best Position Paper award. Only delegates in Ad Hoc are exempt from submitting a position paper. To learn more about position paper writing, formatting and submission, please check out the position paper guidelines. Please read through the guidelines carefully as this page will describe content recommendations, formatting requirements and details on citations. If you have any questions about position paper writing, feel free to contact your Dais via your committee email or reach out to academics@utmun.org.

Introduction:

The United Nations Office of Outer Space Affairs (UNOOSA) operates as an office of the United Nations Secretariat. It works alongside the Committee on the Peaceful Uses of Outer Space (COPUOS) to advise and assist; its main goal is to promote and facilitate peaceful international cooperation in outer space.[1]

UNOOSA was established in 1958 for the purpose of supporting governments in building legal, technical, and political infrastructure to support global space endeavours.[2] It does this by aiding states in understanding space law, and developing policies which comply with the established framework. UNOOSA also maintains a complete registry of all objects which are launched into space for the purpose of space safety, transparency and accountability, and international coordination. In addition, UNOOSA contributes to the formation of international organizations that address specific space regulation issues. These organizations play a vital role in setting guidelines, norms, and rules for responsible space behaviour, such as the Outer Space Treaty and the Guidelines for the Long-Term Sustainability of Outer Space Activities.[3]

Additionally, it's important to note that UNOOSA's role in space development and regulations carries significant importance for society. Firstly, it plays a critical role in safeguarding our telecommunications and global positioning systems; secondly, the regulation of activities in outer space holds both geo-strategic and economic significance.[4] However, in the contemporary context, its significance in space governance is particularly pronounced due to the failure of existing space regulations to adapt to evolving industry practices and technological advancements.[5]

Recognizing the importance of space development and regulations is crucial because a strong global space governance framework contributes directly to enhancing the safety and sustainability of space for future generations.[6] Space is on the common agenda: by furthering space policy in the international forum, we sustain and build upon relationships between nations, while also fostering innovation for generations to come.[7] Multilateral solutions are required to ensure the changes in the outer space field and its impacts are addressed properly.[8]

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1 "About Us", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/aboutus/index.html.
2 Sophie Goguichvili et al., "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?", Wilson Center, Oct. 1, 2021, https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rules-final-frontier.
3 Ibid.
4 Ibid.
5 Scott Atkins et al., "Governance in outer space: The case for a new global order", Norton Rose Fulbright, Nov. 2022, https://www.nortonrosefulbright.com/en/knowledge/publications/e8862684/governance-in-outer-space-the-case-for-a-new-global-order.
6 "For All Humanity - the Future of Outer Space Governance", United Nations, May 2023, https://indonesia.un.org/sites/default/files/2023-07/our-common-agenda-policy-brief-outer-space-en.pdf.
7 Ibid.
8 Ibid.

Definitions:

Détente
Easing of hostilities or tensions between nations.

Normative instruments
Implying, creating or prescribing a norm or a standard.[9]

Non-binding instruments
Creates a moral or political commitment that is less enforceable and more of a goal.[10]

Space debris
Any piece of machinery or debris left by humans in space, such as dead satellites, screws, and cameras, that still orbit Earth but are no longer functional.[11]

Abbreviations:

UNOOSA: United Nations Office for Outer Space Affairs

NASA: National Aeronautics Space Administration (United States' Space Agency)

ISS: International Space Station

COPUOS: Committee on the Peaceful Uses of Outer Space

OST: Outer Space Treaty

JAXA: Japan Aerospace Exploration Agency (Japan's Space Agency)

WMD: Weapons of Mass Destruction

IP: Intellectual Property

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[9] "Normative Instruments Definition", ReversoDictionary, https://dictionary.reverso.net/english-definition/normative+instruments.
[10] "Non-Legally Binding Agreements and Instruments in International Law", Swiss Confederation, 2022, https://www.un.org/en/ga/sixth/77/pdfs/events/26_october_2022_3.pdf.
[11] E. Gregersen, "Space debris." Encyclopedia Britannica, September 23, 2023. https://www.britannica.com/technology/space-debris

Historical Background:

On October 4, 1957, the Soviet Union launched Sputnik 1, the world's first artificial satellite.[12] This monumental event marked the beginning of the Space Age. The launch propelled the United States to steer its national agenda towards space exploration, prompting the creation of the National Aeronautics and Space Administration (NASA). This fuelled competition between the two nations, leading to the rapid development of space capabilities.[13]

Soon after, the first General Assembly resolution on outer space was adopted in December of 1958; it established the Committee on the Peaceful Uses of Outer Space (COPUOS) to discuss the scientific and legal aspects of outer space exploration and use.[14] The United Nations Office for Outer Space Affairs (UNOOSA) was created alongside COPUOS as a small expert unit, but was moved and transformed twice until it was finally relocated to the United Nations Office in Vienna, Austria.[15] Today, UNOOSA helps states understand and develop space law in line with global frameworks, maintain a registry of objects launched into outer space, and plays a crucial role in establishing international organisations to address specific issues in space regulation.[16]

The Cold War and The Space Race

The Second World War transformed both the United States (US) and the Soviet Union (USSR) into formidable world powers. Consequently, tensions resulting from ideological and political differences—communism and capitalism—rose between the Soviet Union and the United States.[17] This conflict, known as the Cold War, was punctuated by the space race.

The space race officially began after the USSR launched Sputnik 1. Both the US and the USSR were superpowers that sought to prove their technological and intellectual superiority by becoming the first nation to put a human into space.[18] Ultimately, there was no official "winner": while most agree that the United States' Apollo 11 mission and lunar landing marked the final triumph, the Soviet Union succeeded through a series of pioneering achievements.[19] The USSR launched the first Earth-orbiting satellite, was the first nation to successfully send a living organism into orbit, and created the first spacecraft to reach the surface of the Moon, among other crucial milestones in space history.[20] In May 1972, the two nations negotiated and finally settled their hostile relations, "thawing" the Cold War and space race.[21] This led to cooperation between the two nations on future missions: space exploration and development became a joint venture.[22]

[12] John Uri, "60 years ago, the Space Age begun", Johnson Space Center - NASA, Oct. 4, 2017, https://www.nasa.gov/feature/60-years-ago-the-space-age-began.
[13] Ibid.
[14] "A Timeline of the Exploration and Peaceful Use of Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/timeline/index.html.
[15] "History", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/aboutus/history/index.html.
[16] Sophie Goguichvili et al., "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?", Wilson Center.
[17] Kristen D. Burton, "Cold Conflict", The National WWII Museum, https://www.nationalww2museum.org/war/articles/cold-conflict#:~:text=As%20World%20War%20II%20transformed,start%20of%20the%20Cold%20War.
[18] "Space race timeline", Royal Museums Greenwich, https://www.rmg.co.uk/stories/topics/space-race-timeline#:~:text=The%20space%20race%20and%20the%20Cold%20War&text=The%20Cold%20War%20lasted%20until,put%20a%20human%20into%20space.
[19] Ibid.
[20] Maddie Davis, "The space race", UVA - Miller Center, https://millercenter.org/the-presidency/educational-resources/space-race.
[21] "Détente and Arms Control, 1969-1979", Office of The Historian - United States Department of State, https://history.state.gov/milestones/1969-1976/detente.
[22] Ibid.

During a period of improved relations known as a “détente”, both the United States and the Soviet Union joined forces to pursue broader shared interests.[23] Notably, the United States and Soviet Union collaborated on the first crewed international space mission, the Apollo-Soyuz Test Project. Many historians consider this mission to mark the formal end of the space race and the consequent start of international cooperation in space.[24] The Apollo-Soyuz was politically symbolic: docking a Soviet capsule with an American one in low-Earth orbit could be considered a “handshake in space”.[25] Moreover, both nations had scientific ventures that the other was interested in learning about. To this day, space has been one of the few spheres of collaboration that have survived the tensions of the Cold War: it has kept both countries engaged in friendly competition while expanding human frontiers.[26]

The International Space Station

Space cooperation pushes general relations between nations that would otherwise be rivals; it also provides nations the opportunity to pool resources and establish links to innovate for the benefit of humanity.[27] Accordingly, the creation of the International Space Station (ISS) epitomizes cooperation in the realm of space exploration.

The building of the International Space Station was preceded by the Shuttle-Mir program. Its goal was to gain experience with longer duration space flights, which proved to be crucial in planning for the assembly of the ISS.[28] From February 1994 to June 1998, American STS-71 space shuttles made 11 flights to Russian space station Mir.[29] This project reinforced cooperation between Russia (previously the Soviet Union) and the United States; it brought the US and Russia together in the first cooperative human spaceflight endeavour since the Apollo-Soyuz mission.[30] As Shuttle-Mir Program Director Frank Culbertson explained, “it was important that people realise we were not only teaching each other, but observing each other and learning from each other, and that both sides had a lot to offer.”[31]

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[23] “Détente”, Center for Slavic, Eurasian and East European Studies at UNC Chapel Hill, https://coldwar.unc.edu/theme/detente/.
[24] Eric Betz, “Apollo-Soyuz Mission: When the Space Race Ended”, Discover Magazine, Jul. 22, 2020, https://www.discovermagazine.com/the-sciences/apollo-soyuz-mission-when-the-space-race-ended.
[25] Ibid.
[26] “U.S.-Soviet Cooperation in Outer Space, Part 1: From Yuri Gagarin to Apollo-Soyuz”, National Security Archive, Apr. 12, 2021, https://nsarchive.gwu.edu/briefing-book/russia-programs/2021-04-12/us-soviet-cooperation-in-outer-space-part-1-1961-1975.
[27] “Space Exploration and Innovation”, United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/topics/space-exploration-and-innovation.html.
[28] “STS-71: The First Shuttle-Mir Docking & 100th American human spaceflight mission”, Space Center Houston, Jun. 27, 2019. https://spacecenter.org/sts-71-the-first-shuttle-mir-docking-100th-american-human-spaceflight-mission/#:~:text=A%20precursor%20to%20the%20International,for%20the%20assembly%20of%20ISS.
[29] Ibid.
[30] John Uri, “ISS20:STS-71, FIrst Shuttle-Mir Docking”, RoundUp - NASA, June 25, 2020, https://roundupreads.jsc.nasa.gov/roundup/1455/ISS20%20STS71%20First%20ShuttleMir%20Docking.
[31] Ibid.

The International Space Station took 10 years and more than 30 missions to assemble; it was the cumulation of scientific and engineering collaboration amongst the United States, Russia, Japan, and Canada, representing 15 countries.[32] The space station has developed into a unique research facility that houses multidisciplinary scientific research. On the ISS, astronauts have produced a fifth state of matter—a Bose-Einstein condensate—which can provide insight into fundamental laws of quantum mechanics.[33] The station has also allowed for astronauts to identify microbes in real time, in space, without having to send them back to Earth for identification first.[34] This has been revolutionary for the world of microbiology and space exploration. The ISS has ultimately served as a gateway to new frontiers in human space exploration.[35]

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[32] "History and Timeline of The ISS", ISS National Laboratory, https://www.issnationallab.org/about/iss-timeline/.
[33] NASA, "6 Out of the World Scientific Discoveries from the ISS", Google Arts and Culture, https://artsandculture.google.com/story/6-out-of-this-world-scientific-discoveries-from-the-iss-nasa/6gXhNXno-k5rIA?hl=en.
[34] Ibid.
[35] "Space Station", PBS, https://www.pbs.org/spacestation/station/purpose.htm.

Topic 1: Space Law, Governance, and Development

Introduction

Space law is the body of law governing space-related activities. Much like other branches of international law, it includes international agreements, treaties, conventions, and UN General Assembly resolutions.[36] Notably, states also have national legislation to govern their own space-related activities. There are several fundamental principles that guide the conduct of space exploration and development. Some of these principles include the notion of space as the province of all humankind, the freedom of exploration and use of outer space by all states without discrimination, and the principle of non-appropriation of outer space.[37] Equally, it is important to note the differences between binding or normative instruments and non-binding agreements.[38] The first category—binding—consists of treaties, standards, and national regulations, whereas non-binding instruments are used to convey voluntary or aspirational ideals that may be too difficult to achieve international consensus on.[39]

Recent technological developments have revolutionized the realm of space exploration; however, it also inevitably gives rise to new problems.[40] In this topic, we will discuss major areas of concern and contention; particularly, the increase in private and non-traditional stakeholders, environmental impacts of outer space exploration, and contradictions between intellectual property rights and the Outer Space Treaty's principles on exploration.

[36] Daniel Garcia-Yarnoz, "Space Law", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html#:~:text=Space%20law%20can%20be%20described,and%20regulations%20of%20international%20organizations
[37] Ibid.
[38] Sophie Goguichvili et al., "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?", Wilson Center. https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rules-final-frontier
[39] Ibid.
[40] Landry Signé and Hanna Dooley, "How space exploration is fueling the Fourth Industrial Revolution", Brookings, March 28, 2023, https://www.brookings.edu/articles/how-space-exploration-is-fueling-the-fourth-industrial-revolution/

Subtopic 1: The Legal Framework for Outer Space Activities

Introduction

International space law informs the standard when it comes to spacefaring activities.[41] The treaties and agreements that make up space law link to states on a national level through a variety of binding national governance and enforcement mechanisms.[42] However, there are disparities in each state's interpretation which leads to the circumvention of tougher and stricter regulations; this means space operators and the commercial industry prefer non-binding, voluntary agreements.[43] For the purposes of this committee, the most significant and formative treaties and agreements include the Outer Space Treaty (OST) and the Moon Agreement.[44]

The Five UN Space Treaties

The UN treaties and agreements regarding space activities have a significant impact on states at a national level.[45] The implementation of UN space treaties at the national level requires states to pass legislation that incorporates treaty provisions into their domestic legal systems.[46] This step ensures that the obligations outlined in the treaties are enforceable within each state.[47] Additionally, governments establish regulatory bodies responsible for overseeing space activities and ensuring compliance with international agreements.[48] These agencies play a crucial role in developing and enforcing regulations that align with the UN treaties.[49]

However, there can be disparities in how states interpret these treaties, influenced by legal traditions, political considerations, and national interests.[50] This diversity in interpretation may lead to variations in how the treaties are applied and enforced within each state.[51] Some states may adopt more lenient interpretations, potentially creating regulatory environments that allow for activities that might be deemed non-compliant elsewhere.[52] This highlights the importance of ongoing dialogue and cooperation among states to ensure consistent implementation and enforcement of space regulations on an international scale.

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[41] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.
[42] Ibid.
[43] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] Ibid.
[48] Ibid.
[49] Ibid.
[50] Steve J. Hoffman et al., "International treaties have mostly failed to produce their intended effects", Proceedings of the National Academy of Sciences (PNAS), Aug. 1, 2022, https://www.pnas.org/doi/10.1073/pnas.2122854119.
[51] Ibid.
[52] Ibid.

The following treaties form the foundation of the global space governance system:

Outer Space Treaty (OST) - The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies is the first and most significant treaty that provides the basic framework for all of international space law.[53] It includes 111 ratifications and 23 signatories.[54]

Article I: Exploration and use of outer space for peaceful purposes by all states for the benefit of mankind
Article II: Outlawing national appropriation or claims of sovereignty to outer space/celestial objects
Article IV: Banning WMDs in orbit/on celestial bodies (this is problematic because it doesn't include conventional weapons esp. ASAT weapons)
Article V: Astronauts should be seen as the "envoys of mankind"
Article VI: States are required to supervise the activities of their national entities (problematic as it allows states to define terms based on their own national interests)

For instance, Article I has been exemplified by countries like Japan, whose space agency JAXA, through missions like the Hayabusa series, aims to expand our understanding of asteroids and contribute to global scientific knowledge.[55] Article II of the treaty is particularly significant, as it bars any nation from asserting sovereignty or making claims of ownership over outer space or celestial objects.[56] This has been crucial in maintaining space as a domain for peaceful cooperation rather than territorial disputes.[57] For instance, during the Apollo moon landings, the United States deliberately avoided making territorial claims and instead focused on scientific exploration, setting a precedent for international cooperation in space.[58]

However, challenges persist, as seen in Article IV, which focuses on the prohibition of weapons of mass destruction in orbit or on celestial bodies.[59] The article does not explicitly address conventional weapons, like Anti-Satellite (ASAT) weapons, which can also pose significant threats to space security.[60] This highlights the need for ongoing discussions and potential revisions to the treaty to address evolving threats and technologies in space exploration.

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[53] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.
[54] Ibid.
[55] "Asteroid Explorer Hayabusa2", Institute of Space and Astronautical Science, https://www.isas.jaxa.jp/en/missions/spacecraft/current/hayabusa2.html.
[56] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.
[57] "Fourth Committee Shifts Focus to Peaceful Uses of Outer Space with Speakers Emphasising Need to Close Technological Gap", United Nations Meetings Coverage and Press Releases, Oct. 26, 2022. https://press.un.org/en/2022/gaspd760.doc.htm.
[58] Sarah A. Loff, "Apollo 11 Mission Overview", NASA, Par. 17, 2015. https://www.nasa.gov/history/apollo-11-mission-overview/.
[59] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.
[60] Ibid.

Rescue Agreement - The Agreement on the Rescue of Astronauts, the Return of Astronauts and Return of Objects Launched into Outer Space is the second treaty meant to supplement the gaps in OST.[61] This treaty is not as relevant and or not used as much as the first treaty.[62]

The articles of the Rescue Agreement establish clear responsibilities for countries involved in space activities, ensuring the safety and proper management of personnel and objects returning to Earth.[63] For instance, consider the scenario where a spacecraft personnel incident occurs in international waters. According to Article III, contracting parties capable of doing so must provide search and rescue assistance. This means that countries like the United States or Russia, with advanced space capabilities, would be responsible for assisting in the rescue efforts.[64] They would then update the launching authority and the UN Secretary-General on their progress.

In the event of a spacecraft personnel landing in a country's territory due to an accident or emergency, Article II mandates immediate rescue and assistance.[65] If the launching authority's assistance is vital, the country and the authority must cooperate.[66] This principle would apply to situations like the emergency landing of a crewed spacecraft in a country like Kazakhstan, where Russia's assistance might be essential.[67] The Baikonur Cosmodrome, located in Kazakhstan, is one of the world's oldest and largest space launch facilities. It has been used extensively by both the Soviet Union and later Russia for launching spacecraft. In the event of an emergency landing of a crewed spacecraft, such as a Soyuz capsule, Kazakhstan's proximity to the launch site is crucial.[68] The country's cooperation and assistance would be vital in ensuring the safe recovery of astronauts. Furthermore, Article V emphasizes the duty of states to rescue and assist astronauts in case of accidents or emergencies, and to facilitate their return to their launching state.[69] This was exemplified in the Apollo 13 mission, where the United States promptly organized a rescue operation after the spacecraft encountered a life-threatening malfunction.[70] The Apollo 13 mission was the third planned crewed mission intended to land on the moon. However, it became famous for its dramatic turn of events. On April 13, 1970, the spacecraft's oxygen tank exploded, leading to a life-threatening situation for the astronauts on board.[71] The explosion led to the cancellation of the planned moon landing and forced the mission to focus on getting the astronauts safely back to Earth. This became a monumental challenge for NASA engineers and flight controllers.[72]

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[61] "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introrescueagreement.html.
[62] Ibid.
[63] Ibid.
[64] Ibid.
[65] Ibid.
[66] Ibid.
[67] The Associated Press, "2 astronauts safe after Soyuz forced to make emergency landing", CBC News, Oct. 11, 2018. https://www.cbc.ca/news/science/soyuz-iss-incident-emergency-landing-1.4858238.
[68] Ibid.
[69] "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introrescueagreement.html.
[70] The Associated Press, "2 astronauts safe after Soyuz forced to make emergency landing", CBC News, Oct. 11, 2018. https://www.cbc.ca/news/science/soyuz-iss-incident-emergency-landing-1.4858238.
[71] "Apollo 13: Mission Details", NASA, Jun. 8, 2009. https://www.nasa.gov/missions/apollo/apollo-13-mission-details/.
[72] Ibid.

Liability Convention - The Convention on International Liability for Damage Caused by Space Objects elaborates on procedure for the settlement of claims for damages endured, and states are responsible for space assets launched from their territory.[73]

This framework ensures that accountability is maintained in the event of accidents or incidents involving space objects. For example, let's consider the 1978 incident involving the USSR's Cosmos 954 satellite.[74] When the satellite reentered Earth's atmosphere and scattered radioactive material over northern Canada, it resulted in significant environmental and health risks.[75] According to this treaty, the USSR, as the launching state, would be fully accountable for the damage caused, and they would be required to provide compensation to Canada for the harm caused.[76]

Furthermore, Article IV specifies that if damage occurs from one state's space object to another state's object or individuals, and third parties are affected, liability is shared based on fault.[77] This principle would apply in situations where a space object from one country collides with or causes damage to a space object from another country. The liability for compensation would be determined based on the level of fault of each party involved. Additionally, Article VII provides an exemption from certain damages.[78] It states that if individuals directly associated with the space object's operations are affected, the convention may not apply, and liability could be determined under different legal frameworks.[79]

[73] Ibid.
[74] "Previous nuclear incidents and accidents: COSMOS 854", Government of Canada, https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/radiological-nuclear-emergencies/previous-incidents-accidents/cosmos-954.html.
[75] Ibid.
[76] Ibid.
[77] Ibid.
[78] Ibid.
[79] Ibid.

Registration Convention - The Convention on registration of objects launched into outer space deals with the registration and jurisdictional aspects of launched outer space objects.[80] They ensure that the responsible parties, often countries, abide by agreed-upon rules to maintain order and safety in outer space.[81]

For instance, consider the application of Article II in the context of a space launch jointly conducted by the United States and Russia.[82] In this scenario, both nations must agree on the registry where the space object will be listed. This collaborative decision-making process is essential to prevent conflicts and ensure clarity in the management of space objects. Article VI, on the other hand, highlights the importance of cooperation in identifying space objects that may pose a threat or have caused damage.[83] If, for example, a European country encounters a space object that it cannot identify, it can seek assistance from other nations with advanced space monitoring capabilities, such as the United States or China. This mutual aid strengthens global space safety efforts.[84]

Furthermore, Article VII extends the application of the convention to intergovernmental organizations engaged in space activities.[85] For instance, the European Space Agency (ESA) would be subject to the same rights and responsibilities outlined in the convention, provided it accepts these terms and a majority of its member States are parties to the convention and the Treaty on Principles Governing Activities in Outer Space.[86]

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[80] "Convention on Registration of Objects Launched into Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introregistration-convention.html.
[81] Ibid.
[82] "3235 (XXIX). Convention on Registration of Objects Launched into Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html
[83] Ibid.
[84] "National Interest Analysis: United Nations Convention of Registration of Objects launched into Outer Space", New Zealand Ministry of Business, Innovation & Employment, May 2016. https://www.mbie.govt.nz/dmsdocument/1395-registration-convention-national-interest-analysis-pdf.
[85] Ibid.
[86] "ESA Council Rules of Procedure", The European Space Agency, https://www.esa.int/About_Us/Corporate_news/Convention-Rules.

Moon Agreement - The agreement governing activities on the Moon and other celestial bodies plays a crucial role in maintaining peace and prohibiting aggressive actions in space. This treaty, however, received relatively limited support from member nations, indicating some divergence in perspectives on its implementation.[87]

For major players in space exploration, such as the United States, Russia, China, and emerging space-capable nations like India, this agreement holds significant implications.[88] It strictly prohibits any form of aggression on the Moon, including the deployment of weapons of mass destruction. This affects the strategic considerations and military posturing of these countries in their space endeavours.[89] For example, the prohibition of military bases on the Moon means that these nations must focus on peaceful research and exploration efforts, aligning with the treaty's objectives.[90]

Furthermore, the Moon Agreement extends its provisions to all celestial bodies in the solar system, excluding Earth. This broader scope potentially impacts future endeavours in space, especially in terms of preventing militarization in certain regions.[91] Countries with advanced space monitoring capabilities, like the United States and Russia, would be crucial in identifying and mitigating potential hazards in space, as outlined in Article VI of the treaty. This emphasizes the collaborative nature of space activities and highlights the importance of international cooperation in maintaining space safety.[92]

The Five Declarations and Legal Principles - All of the following principles are non-binding. These declarations and legal principles include more detailed, challenging, and aspirational goals.[93]

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[87] "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html.
[88] Ibid.
[89] Ibid.
[90] Sa'id Mosteshar, "Space Law and Weapons in Space", Planetary Science, May 23, 2019. https://oxfordre.com/planetaryscience/display/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-74;jsessionid=081CC3C4E4AD603B1E4F033E6BDC002E.
[91] "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html.
[92] Ibid.
[93] "Space Law Treaties and Principles", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.

Declaration of Legal Principles - The exploration and use of space should fall in line with international law, should be carried on for the benefit of all mankind, and should not be subject to national appropriation (sovereignty). This principle highly signifies cooperation and mutual assistance.[94]

It is emphasized that outer space and celestial bodies are beyond any claims of national ownership or appropriation.[95] States engaging in space activities must do so in compliance with international law, including the United Nations Charter, with the aim of preserving global peace, enhancing cooperation, and fostering mutual understanding.[96] Nations are accountable for both governmental and non-governmental space endeavours, and non-governmental activities require approval and ongoing oversight from the respective State. Cooperation, respect for the interests of other States, and pre-activity consultations to prevent interference are foundational principles in space exploration.[97]

The State that registers a space object retains jurisdiction and control over it, even while it is in outer space. If an object is found beyond the registering State's borders, it must be returned upon request.[98] Moreover, any State responsible for launching an object into outer space, as well as the State from whose territory or facility the launch occurs, bears international liability for any harm caused by the object or its parts on Earth, in airspace, or in outer space.[99] Astronauts are to be recognized as ambassadors of humanity in space, and in the event of accidents, distress, or emergency landings on foreign territory or the high seas, they are to be promptly returned to the State of their space vehicle's registration.[100]

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[94] Ibid.
[95] "The Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/travaux-preparatoires/declaration-of-legal-principles.html.
[96] Sophie Goguichvili et al., "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?", Wilson Center, Oct. 1, 2021, https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rules-final-frontier.
[97] Ibid.
[98] Ibid.
[99] "1962 (XVIII). Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html.
[100] "C. Rights and Benefits - 37/92. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/dbs-principles.html#:~:text=Every%20State%20has%20an%20equal,the%20benefits%20from%20such%20activities.

Broadcasting Principles - International direct television broadcasting by satellite should respect the sovereign rights of nations, including non-intervention principles, and uphold individuals' rights to seek, receive, and share information as outlined in UN instruments.[101]

These activities should aim to foster the free flow of information, cultural and scientific knowledge exchange, and support educational and socio-economic development, particularly in less developed nations, while respecting the political and cultural integrity of States.[102] It is important to note that, Every state has an equal right to conduct activities in the field of international direct television broadcasting by satellite. The principles aim to foster cooperation and support the progression of developing countries. When intergovernmental organisations are involved, both the organisation and participating states share responsibility.[103]

States engaged in satellite television broadcasting should engage in consultations upon request, without impeding other discussions. States conducting such broadcasts should inform the UN Secretary-General to enhance international cooperation, sharing this information with relevant agencies, the public, and the global scientific community.[104] Before establishing an international satellite television broadcasting service, a state must promptly notify and consult with receiving states. This service can only proceed after meeting specified conditions and adhering to agreements in line with the International Telecommunication Union's instruments and these principles. The rules of the International Telecommunication Union exclusively govern overspill radiation.[105]

[101] Ibid.
[102] Ibid.
[103] Ibid.
[104] Ibid.
[105] Ibid.

Remote Sensing Principles - These principles set forth a framework for responsible remote sensing activities, emphasizing the equitable benefits to all countries, irrespective of their development status. This framework applies to ensure that every nation, from advanced economies to developing nations, can utilize remote sensing for the betterment of natural resource management and environmental protection.[106]

For instance, consider the application of these principles in the context of the United States and Brazil. Both nations engage in extensive remote sensing activities, utilizing satellites to monitor their vast territories. Under Principle II, they must ensure that the benefits of these activities are extended to all countries, including those in need of advanced environmental monitoring capabilities, such as many developing nations in Africa and Southeast Asia.[107]

Furthermore, international cooperation is paramount, as highlighted in Principle V. Countries like China, with advanced remote sensing capabilities, have a role in providing opportunities for participation and technical assistance to other nations. This cooperative approach can be seen in China's involvement in projects like the China-Brazil Earth Resources Satellite Program, which aims to jointly develop and operate remote sensing satellites.[108] In cases of natural disasters, such as hurricanes or wildfires, Principle XI emphasizes the prompt sharing of data and information that can aid in disaster response and management.[109] This applies to instances like the European Space Agency's Copernicus program, which provides real-time remote sensing data for disaster monitoring and response across Europe and beyond.[110]

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[106] "41/65. Principles Relating to Remote Sensing of the Earth from Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/remote-sensing-principles.html.
[107] Ibid.
[108] "CBERS-1 and 2 (China-Brazil Earth Resources Satellite)", oePortal, May 28, 2012. https://www.eoportal.org/satellite-missions/cbers-1-2#overview.
[109] Ibid.
[110] "Europe's Copernicus programme", the European Space Agency, https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Europe_s_Copernicus_programme.

Nuclear Power Sources - The principles of Nuclear Power Sources outline a framework for the responsible use of nuclear power sources in space activities, with a focus on adherence to international law.[111]

For instance, consider the application of these principles in the context of two countries, the United States and Russia.[112] Both nations have a significant history in space exploration and have deployed space objects with nuclear power sources. Adhering to Principle II, they must define the "launching State" and clarify safety terms to ensure the safe operation of such objects.[113] Additionally, both nations must conduct thorough safety assessments, as per Principle IV, to guarantee the protection of space assets and minimize potential harm.[114]

Furthermore, in the event of a re-entry, cooperation between States is essential. For example, if a Russian space object with a nuclear power source were to re-enter Earth's atmosphere, Russia would be obligated, under Principle VII, to provide assistance in mitigating any potential harm.[115] Other nations with technical capabilities, like the United States, would also be expected to offer support upon request. In cases of joint launches, such as those involving multiple nations or private entities, Principle VIII emphasizes that all parties involved share responsibility for compliance with space treaties and principles.[116] This applies to instances like international collaborations in the International Space Station, where multiple countries are jointly responsible for the operation of the station.

[111] "47/68. Principles Relevant to the Use of Nuclear Power Sources In Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/nps-principles.html.
[112] Ibid.
[113] Ibid.
[114] Ibid.
[115] Ibid.
[116] Ibid.

Benefits Declaration - These principles emphasise the importance of international cooperation in outer space activities, guided by international law and the UN Charter. Cooperation should benefit all States, regardless of their level of development, and should prioritize the needs of developing countries.[117] States have the freedom to determine their participation terms, ensuring fairness and respect for intellectual property rights.[118]

Countries with space capabilities are urged to contribute to equitable cooperation, especially benefiting developing nations and those with emerging space programs. Cooperation can take various forms, including governmental, non-governmental, commercial, and non-commercial, at different levels of development.[119] Goals of cooperation include advancing space science and technology, developing relevant space capabilities, and facilitating the exchange of expertise and technology on mutually acceptable terms.[120] Efforts should be made to utilise space applications for development purposes, and the role of the Committee on the Peaceful Uses of Outer Space should be strengthened as a platform for information exchange.[121] Finally, all States are encouraged to participate in the United Nations Program on Space Applications and other cooperation initiatives according to their capabilities and involvement in space exploration.

[117] "Space Benefits Declaration", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/space-benefits-declaration.html.
[118] Ibid.
[119] Ibid.
[120] Ibid.
[121] Ibid.

Subtopic 2: Space Resource Utilization, Ownership, and Liability

Introduction

Resources have been the driving force behind human exploration. Space is, accordingly, the next destination in this quest for the further expansion of humanity. The multitude of celestial bodies surrounding Earth and the space beyond holds rich potential for applications for robotic and human space missions, and future use on Earth.[122] In the short term resources such as, unlimited solar energy, vacuum, radiation, and low gravity in space, as well as the minerals, metals, water, atmospheric gases, and volatile elements on the Moon, asteroids, and comets can be turned into they can extend space mission duration while also reducing the dependency on materials sent from Earth.[123] Additionally, using grained dust and rocks can serve for habitat and infrastructure construction, radiation protection, manufacturing parts, and growing crops.[124]

In the long term, solar energy and the materials obtained from the resources could also be brought to Earth if meeting energy demands locally and obtaining the resources are no longer acceptable for environmental or economic reasons. Although, As countries and private enterprises progress in obtaining and materializing space resources, it is imperative to establish a global legal framework.[125] This will guarantee that the utilization of these resources serves the collective welfare of humanity, and it prevents states from defining terms based on their own national interests.

Moreover, according to the liability convention, in the event that anything goes wrong and there is damage caused by space objects, states are liable for space assets launched from their territory.[126] Finally, it's our job, as Earth's residents, to find the best ways to use extraterrestrial resources wisely and sustainably. This is crucial for making our commitment a real success.

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[122] Angel Abbud-Madrid, "Space Resource Utilisation", Planetary Science, Jun. 28, 2021. https://oxfordre.com/planetaryscience/display/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-13
[123] Ibid.
[124] Ibid.
[125] Ibid.
[126] Ibid.

Resource Utilization

The era of space mining to further obtain space resources has successfully begun as NASA awarded contracts to four small companies to extract small amounts of lunar regolith by 2024.[127] Although the reality that space belongs to no country has complicated matters. Since the demand for energy on earth is increasing rapidly, this creates room for new industries to arise, and new technological and business progresses. Countries with more access to space materials and solar energies, have a rising economy to look forward to. These matters have resulted in an emerging geopolitical competition to pursue space mining. For example, due to America's Artemis program which aims to lead a multinational consortium to the moon, it is emerging a front-runner in the geopolitical competition.[128] Moreover, Luxembourg and the United Arab Emirates are following in the United States footsteps in recognizing space resources law stating the property rights of individuals and private companies for materials gathered in space.[129] In addition China plans to challenge U.S economic and security primacy in space and other countries such as Russia, Japan, India and European space agencies all have space mining ambitions. Therefore, due to these emerging interests, frameworks of governing must be renewed from the outstanding cold war agreements.[130]

The natural resources that can be obtained from space mining have significant value. For example, water itself due to its Hydrogen and Oxygen can be used for in space fueling which would lead to longer stays in space, providing more time for exploration and discovery.[131] The moon itself is a prime space mining target and likely the first location for commercial mining. The moon is close and has low gravity which saves energy and time.[132] Additionally, the moon has substantial amounts of water in the form of ice which due to its hydrogen and oxygen can make the moon a potential gas station in space, which would aid the development of space exploration. Asteroids are another natural space resource that have precious metals such as iron and nickel, which could be used for in-space manufacturing.[133]

Therefore, utilising these space resources reduce the mass, cost and risk of space missions which in return would enable longer stays, specially because these resources would fuel space transportation systems.[134] Furthermore, the finely grained surface dust and rock would be used for habitat and infrastructure construction purposes, while also being used for radiation protection, manufacturing parts, and growing crops.[135] It is necessary to utilise these space resources and bring them to earth for when obtaining such resources and meeting energy needs on earth becomes unsustainable.[136] In that case when earth is no longer environmentally or economically able to provide these essential resources, these space substitutes would fill in. Although again, the essentiality of these resources causes competition between countries for its access, and vindicates the need for a new and up to date frame-work of governing.[137]

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[127] Alex Gilbert, "Mining in Space Is Coming", Milken Institute Review, Apr. 26, 2021. https://www.milkenreview.org/articles/mining-in-space-is-coming.
[128] Ibid.
[129] Ibid.
[130] Ibid.
[131] Ibid.
[132] Ibid.
[133] Ibid.
[134] "Using Space-Based Resources for Deep Space Exploration", NASA, Jul. 26, 2023. https://www.nasa.gov/overview-in-situ-resource-utilization/.
[135] Ibid.
[136] Ibid.
[137] Ibid.

However, there are concerns regarding certain aspects of the accords. Notably, they do not currently include major space players like Russia, China, and India. Additionally, the accords introduce the concept of "safety zones" around mining sites.[138] While meant to ensure safety, this provision raises worries about potential exclusion of other countries from valuable locations and the possibility of de facto national ownership. This highlights the complexity of balancing individual space exploration efforts with the broader international community's interests and rights in the exploration and utilization of space resources.[139]

Case Study 1: Artemis Accords, NASA's Mining Program

The Artemis Accords, negotiated by the United States in 2020, aim to address challenges in space resource ownership and potential conflicts.[140] This multilateral agreement guides lunar exploration in the near term and has been signed by several U.S. space partners including the United Kingdom, Luxembourg, UAE, Australia, Canada, Japan, Italy, and Ukraine. Some provisions of the accords align with the Outer Space Treaty and promote cooperation, such as ensuring compatibility between different nations' space technologies.[141]

Case Study 2: Hayabusa2 Spacecraft

The Hayabusa2 spacecraft, launched by the Japan Aerospace Exploration Agency (JAXA) in 2014, stands as a remarkable testament to human capability in space exploration.[142] Its mission to the carbon-rich asteroid Ryugu, which it reached in 2018, has significantly advanced our understanding of the universe. In 2019, Hayabusa2 executed a series of precise manoeuvres, including firing small bullets into the asteroid's surface to collect particles for analysis.[143] The spacecraft then deployed a larger projectile, descending to the surface to retrieve additional ejected material. This mission represents a pivotal achievement in space technology, showcasing the capacity to not only land on asteroids but also to mine them and bring back samples to Earth. The precursor to Hayabusa2, simply named Hayabusa, remains the only spacecraft to have accomplished such a feat thus far.[144] The Hayabusa2 mission, building upon the knowledge gained from its predecessor, is slated to return to Earth in late 2020, bearing invaluable samples from the asteroid Ryugu.[145] This significant milestone exemplifies the progress made in our ability to explore and utilize resources in the vastness of space.[146]

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[138] Lucas Mallowan, Lucien Rapp, and Maria Topka, "Reinventing Treaty Compliant ""Safety Zones"" in the Context of Space Sustainability," ScienceDirect, June 14, 2021. https://www.sciencedirect.com/science/article/abs/pii/S2468896721000379.
[139] Ibid.
[140] Ibid.
[141] "Artemis Accords - NASA," NASA, November 2, 2023. https://www.nasa.gov/specials/artemis-accords/index.html
[142] Erin Winick, "Japan's Hayabusa 2 spacecraft is about to fire bullets into an asteroid," MIT Technology Review, February 19, 2019. https://www.technologyreview.com/2019/02/19/137341/japans-hayabusa-2-spacecraft-is-about-to-fire-bullets-into-an-asteroid/
[143] Ibid.
[144] Neel V. Patel, "Japan is about to bring back samples of an asteroid 180 million miles away," MIT Technology Review, December 2, 2020. https://www.technologyreview.com/2020/12/02/1012890/japan-jaxa-sample-return-mission-hayabusa2-ryugu/
[145] "Hayabusa2 Asteroid Ryugu Samples," NASA. https://curator.jsc.nasa.gov/hayabusa2/
[146] Ibid.

Resource Ownership and Liability

Ownership in space brings forth both positive and negative implications. On the positive side, it provides a powerful incentive for individuals and organizations to actively utilize and develop space resources.[147] This drive stems from the understanding that they have a vested interest in making the most productive use of these assets. For instance, this could manifest in endeavours like space tourism, mining operations, and the establishment of advanced communication systems. These activities not only facilitate progress in space exploration but also pave the way for further developments in the field.[148]

However, there is a notable downside to consider. The opportunity to claim ownership of space resources is primarily accessible to those who are already economically privileged and possess significant resources.[149] This raises concerns about the potential exacerbation of existing wealth disparities. When ownership in space is concentrated among the wealthy, it may inadvertently perpetuate and widen the wealth gap.[150] This has implications for both national and international dynamics, potentially influencing the participation and opportunities available to different countries in the global space arena.[151] For example, if ownership rights in space are not regulated effectively, it could lead to a scenario where powerful nations or wealthy individuals dominate the space industry, potentially leaving smaller or less economically advantaged countries at a disadvantage.[152]

Striking a balance between encouraging productive use of space resources and ensuring equitable access and opportunities for all nations will be a critical challenge for the international community as we navigate the evolving landscape of space exploration and utilisation.[153]

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[147] Daniel Munro, "Who Owns Outer Space, and Everything in It?," Centre for International Governance Innovation, May 25, 2022. https://www.cigionline.org/articles/who-owns-outer-space-and-everything-in-it/

[148] Ibid.

[149] Dominic Basulto, "How property rights in outer space may lead to a scramble to exploit the moon's resources," The Washington Post, November 18, 2015. https://www.washingtonpost.com/news/innovations/wp/2015/11/18/how-property-rights-in-outer-space-may-lead-to-a-scramble-to-exploit-the-moons-resources/

[150] Daniel Munro, "Who Owns Outer Space, and Everything in It?," Centre for International Governance Innovation, May 25, 2022. https://www.cigionline.org/articles/who-owns-outer-space-and-everything-in-it/

[151] Ibid.

[152] Ibid.

[153] Ibid.

The concept of the First-Mover Advantage suggests that the right to claim resources in space should be granted to those who are the first to seize them.[154] While this approach prioritizes swift action and initiative, it does not align entirely with the principles laid out in earlier space treaties. The 2015 US Commercial Space Launch Competitiveness Act is a notable example of a legislative move towards this perspective.[155] This Act grants private corporations the right to own all non-living resources they extract from celestial bodies.[156] This means that companies, under this law, have the legal authority to claim ownership of resources they mine in space. Notably, this Act was signed into law by President Barack Obama, signifying a significant shift in space resource ownership rights.[157]

Other countries, including Japan, Luxembourg, and the UAE, have also passed similar laws, reflecting a global trend towards enabling private entities to assert ownership over space resources.[158] However, this trend raises concerns regarding the potential determination of space ownership through the principle of "first-come, first-served".[159] This approach may inadvertently prioritize those with the financial means and technical capabilities to access space resources quickly.[160]

This perspective on space resource ownership also brings up legal implications. It potentially contradicts the Outer Space Treaty, specifically Article II, which clearly states that outer space, including celestial bodies, is not subject to national appropriation.[161] On the other hand, the Moon Agreement acknowledges that while celestial bodies are considered the common heritage of mankind, there is recognition that those who invest and take risks to extract resources should be duly rewarded for their efforts.[162] Balancing these competing interests and interpretations of ownership rights in space remains a complex challenge for the international community.

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[154] Ibid.
[155] "U.S. Commercial Space Launch Competitiveness Act", U.S. Government (GPO), Nov. 25, 2015. https://www.congress.gov/114/plaws/publ90/PLAW-114publ90.pdf.
[156] Daniel Munro, "Who Owns Outer Space, and Everything in It?," Centre for International Governance Innovation, May 25, 2022.
[157] Ibid.
[158] Morgan M. DePagter, "Who Dares, Win:" How Property Rights in SPace Could be Dictated by the Countries Willing to Make the First Move", The University of Chicago - Chicago Journal of International Law, https://cjil.uchicago.edu/online-archive/who-dares-wins-how-property-rights-space-could-be-dictated-countries-willing-make.
[159] Ibid.
[160] Ibid.
[161] Ibid.
[162] "34/69. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html

Subtopic 3: Commercial Space Activities and Regulation

Introduction

Government agencies, private companies, international organisations, and end users each play pivotal roles in supporting the space industry.[163]

- Governments establish policy and collaborate with corporations;
- Companies like SpaceX, Blue Origin, and Planet Lab develop the technology and offer launch services;
- International organizations help regulate and establish guidelines; end users consume space-based products and services like GPS, weather forecasting, and telecommunications.[164]

The Bank of America predicted the space industry will octuple to over $2.7 trillion over the next three decades: clearly, outer space is a profitable sector that will continue to grow exponentially.[165] Virgin Galactic, SpaceX, and Blue Origin—space exploration companies founded by the likes of Elon Musk and Jeff Bezos—are leading a change from primarily government centric ventures to commercial ventures; SpaceX alone launched 21 missions in 2018, and that number appears to be rising, along with the commercial space industry.[166] Defence contractors like Boeing, Airbus, and Lockheed Martin are equally responsible for this commercialization.[167] Ultimately, experts and authorities in the field agree that "commercial space" is rapidly overtaking and will soon outpace "government space". The extensive and rapid growth of the commercial space sector becomes relevant to UNOOSA because of its impact on the global economy, environment, and beyond.

[163] "The dynamic role of government and private sector in the space economy", New Space Economy, July 2, 2023, https://newspaceeconomy.ca/2023/07/02/the-dynamic-role-of-government-and-private-sector-in-the-space-economy/
[164] Ibid.
[165] Jack Stuart and Michael Martensen, "Intellectual property rights in the global commons of space", 35th Space Symposium - Technical Track, Apr. 8, 2019. https://www.spacesymposium.org/wp-content/uploads/2019/11/Paper-Stuart-Jack-Intellectual-Property-Rights-in-the-Global-Commons-of-Space.pdf.
[166] Ibid.
[167] Ibid.

Commercial Mining in Space

Commercial mining, also known as asteroid mining or space mining, is becoming an increasingly lucrative field. The idea was first proposed in the late 1800s by a Russian scientist named Konstantin Tsiolkovsky; he suggested it could allow humanity to acquire new resources and expand capabilities.[168] In the 1970s, the idea began to gain traction when NASA initiated a series of studies on the feasibility of space mining; in the 1990s, private companies began exploring its possibilities and renewed interest in space mining.[169] There are several resources that are most commonly found, extracted, or used from space, including water, minerals, helium-3, solar power, and oxygen. Minerals such as iron, nickel, cobalt, and platinum, and helium-3 are of particular interest to commercial mining groups.[170] These resources have the potential to support human exploration and colonisation of space; they are most often mined for on asteroids, the Moon, and Mars.[171] The biggest assortment of resources can be found in or on asteroids: C-type asteroids have a high abundance of water, which can be processed into rocket fuel and breathable oxygen; S-type asteroids contain numerous rare and useful metals; M-type asteroids hold up to 10 times more metal than the S-type.[172] The Moon and Mars both have deposits of helium-3, water, and other minerals.[173]

Moon Express, for example, was the first company to receive U.S. government approval to send a robotic spacecraft to the Moon, beyond traditional Earth orbit. It was part of NASA's initiative to further space technology development, while allowing companies to practise extracting and selling resources from the lunar surface.[174] Moon Express' case was the first time in history any government signatory to the OST —in this case, the United States—exercised its rights and obligations to formally authorise and supervise a commercial entity to fly a mission beyond Earth's orbit.[175] Japan, Luxembourg, the United Arab Emirates, China, and Russia have also developed ambitions in space mining.[176]

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[168] "Space Resource Mining: What is it and How Real is it?" New Space Economy, https://newspaceeconomy.ca/2023/03/12/a-short-history-of-asteroid-mining/#:~:text=Commercial-,Introduction,around%20for%20quite%20some%20time.
[169] Ibid.
[170] "Mining asteroids could unlock untold wealth—here's how to get started", The Conversation, May 2, 2018. https://theconversation.com/mining-asteroids-could-unlock-untold-wealth-heres-how-to-get-started-95675.
[171] Ibid.
[172] "Asteroids: Facts", NASA, Sept. 2023, https://solarsystem.nasa.gov/asteroids-comets-and-meteors/asteroids/in-depth/.
[173] Ibid.
[174] Christian Davenport, "A dollar can't buy you a cup of coffee but that's what NASA intends to pay for some moon rocks", The Washington Post, Dec. 3, 2020. https://www.washingtonpost.com/technology/2020/12/03/moon-mining-contracts-named/.
[175] "Redefine Possible", Moon Express, https://moonexpress.com/.
[176] Jan Osburg and Mary Lee, "Governance in Space: Mining the Moon and Beyond", RAND Corporation, Nov. 18, 2022. https://www.rand.org/blog/2022/11/governance-in-space-mining-the-moon-and-beyond.html#:~:text=Luxembourg%2C%20the%20United%20Arab%20Emirates,each%20other%20on%20moon%20missions.

However, only a small number of nations have the level of wealth required to pursue an asteroid mining venture; there is a large disparity between nations who are actively pursuing these resources and those who cannot afford to prioritise space commercialization.[177] Accordingly, commercial mining is perpetuating the inequality between nations on Earth; this not only makes it unethical, but also contradicts the principles of international cooperation this committee stands for. Furthermore, international law is ambiguous about private companies setting up space mining operations.[178] Its vague nature makes it possible for enterprises, states, and other stakeholders to use and mine celestial bodies without repercussions, despite not having sovereignty over the planet.[179] This lack of regulation highlights the importance of the Outer Space Treaty (OST): allowing companies to proceed with space mining operations indirectly violates the OST, which prohibits national appropriation or claims of sovereignty to outer space or celestial objects.[180]

[177] Andrew S. Rivkin, "The problems with space mining no one is talking about", The Tribune India, Feb. 2, 2022. https://www.tribuneindia.com/news/schools/the-problems-with-space-mining-no-one-is-talking-about-366397

[178] Yasmin Ali, "Who owns outer space?", BBC, Sept. 25, 2015. https://www.bbc.com/news/science-environment-34324443.

[179] "I've always wondered: could someone take ownership of a planet or a moon?" The Conversation, Aug. 21, 2018. https://theconversation.com/ive-always-wondered-could-someone-take-ownership-of-a-planet-or-a-moon-101464

[180] Jaela Bernstien, "Humans want to mine the moon. Here's what space law experts say the rules are", CBC News, Sept. 1, 2022, https://www.cbc.ca/news/science/moon-mining-outer-space-treaty-1.6568648

Space Tourism, Borders, Regulation, and Implications

With the rise in commercial space mining, space tourism or recreational space travel has also gained traction. The industry has the promising potential to create new jobs, and develop new technologies and discovery of resources.[181] India, South Korea, Israel, and the EU, for example, have all encouraged the growth of their private space sector by creating and implementing policies and increasingly investing in space missions.[182]

The OST states: "outer space shall be free for exploration and use by all".[183] However, international law does not specify an official definition for space. Due to the variety of definitions of where space actually begins and no definitive law that confirms the true boundary, several nations have varying notions of what constitutes outer space, and act upon their own definitions rather than one that is internationally agreed upon.[184] For example, NASA and the U.S. military believe space starts at an altitude of 50 miles.[185] For the other majority of the international community, including the Fédération Aéronautique Internationale (FAI), space starts higher at 62 miles.[186] Although some believe the international committee should focus on where the Earth's atmosphere ends rather than defining where space starts, experts see this as a more confusing alternative. Having the exosphere mark the beginning of space would alter the standards and terms used in the space field: most Earth-orbiting spacecraft would no longer be considered "spacecraft", and any ISS visitors would no longer be called astronauts.[187] Furthermore, UNOOSA is considering implementing a physical demarcation at the Karman Line—a boundary that borders Earth's atmosphere and the supposed beginning of space.[188] This demarcation would force commercial spaceflight companies to abide by both international aviation laws as well as space laws, regardless of the time spent "in space".[189] Virgin Galactic, for example, is developing a sub-orbital tourist space plane; despite the mere five or six minutes the Virgin Galactic craft spends "in space" or past the demarcation line, it would still need to follow international aviation laws.[190]

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[181] Matthew Weinzierl and Mehak Sarang, "The Commercial Space Age Is Here", Harvard Business Review, Feb. 12, 2021, https://hbr.org/2021/02/the-commercial-space-age-is-here

[182] Landry Signe and Hanna Dooley, "How space exploration is fueling the Fourth Industrial Revolution", Brookings, Mar. 28, 2023. https://www.brookings.edu/articles/how-space-exploration-is-fueling-the-fourth-industrial-revolution/

[183] "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies", McGill Institute of Air and Space Law, https://www.mcgill.ca/iasl/research/space-law/outer-space-treaty

[184] Daisy Dobrijevic and Andrew May, "The Karman Line: Where does space begin?", Space.com, Nov. 14, 2022. https://www.space.com/karman-line-where-does-space-begin

[185] Ibid.

[186] Ibid.

[187] Daisy Dobrijevic and Andrew May, "The Karman Line: Where does space begin?", Space.com.

[188] Yasmin Ali, "Who owns outer space?", BBC.

[189] Ibid.

[190] Ibid.

Virgin Galactic, SpaceX, and Blue Origin are the three leaders in the space tourism industry. Elon Musk's SpaceX seeks to expand its reach beyond Earth and the ISS. It was the first private company to successfully launch, operate, and recover a spacecraft with its Dragon craft; its Starship was also selected by NASA to carry astronauts and equipment to the moon as part of its 2025 Artemis initiative.[191] Jeff Bezos' Blue Origin is the oldest privately funded aerospace and private spaceflight company in the U.S.; its goal is to preserve Earth and humanity's future by obtaining new energy sources and material resources in the solar system.[192] However, while SpaceX and Blue Origin have a focus on humans living and working in space in the future, Virgin Galactic is committed solely to space tourism.[193] Despite being the "youngest" of the biggest players in the commercial space industry, Virgin Galactic aims to provide suborbital space experiences and to develop a supersonic transport airliner.[194]

For those considering space tourism, the biggest perk seems to be the view. Passengers onboard Virgin Galactic or Blue Origin spacecrafts, for example, would be able to see a stunning view of Earth juxtaposing the wide expanse of space.[195]

		
The view from Virgin Galactic. Photo via Space.com.	The view from SpaceX. Photo via CNN.	The view from Blue Origin. Photo via GeekWire.

[191] Amanda Stevens, "SpaceX vs. Blue Origin vs. Virgin Galactic: What's the difference?", TechTarget, Dec. 21, 2021. https://www.techtarget.com/whatis/feature/SpaceX-vs-Blue-Origin-vs-Virgin-Galactic-Whats-the-difference.
[192] Ibid.
[193] Michael Sheetz, "How SpaceX, Virgin Galactic, Blue Origin and others compete in the growing space tourism market", CNBC, Sept. 26, 2020. https://www.cnbc.com/2020/09/26/space-tourism-how-spacex-virgin-galactic-blue-origin-axiom-compete.html
[194] Ibid.
[195] Rebecca Heilweil, "How bad is space tourism for the environment? And other space travel questions, answered.", Vox, Jul. 25, 2021. https://www.vox.com/recode/22589197/space-travel-tourism-bezos-branson-rockets-blue-origin-virgin-galactic-spacex.

The Overview Effect is a term used to describe the human condition attached to the space travel experience. It encapsulates the intense emotions that viewing Earth from space produces, and allows for a greater appreciation of Earth and humanity as a whole.[196] Those who experience the Overview Effect often return to Earth with a renewed sense of wonder, and a strong desire to protect the planet.

Environmental, Social, and Economic Implications

Right now, space tourism flights from Virgin Galactic and Blue Origin can only reach suborbital space; flights enter space but do not orbit Earth.[197] Tickets are in the low hundreds of thousands, keeping spaceflight out of reach for the majority of humanity.[198] Yet, there is enough garnered interest from the wealthy that makes the notion of space tourism feasible.[199] Ultimately, people who go to space for a leisure trip are demonstrating their exclusivity and wealth. Space tourism is a privilege: it costs beyond the reach of the average person and therefore exacerbates wealth gaps.

The environmental implications of space tourism are perhaps the most ethically troubling: the emissions of a flight to space can be worse than those of a typical airplane flight, since the emissions per passenger are much higher.[200] Each commercial space flight's carbon footprint is close to 100 times higher than a long-haul flight.[201] Rocket emissions—carbon dioxide, for example—affect the Earth's atmosphere, temperatures, and the ozone layer; noise from space launches can disrupt ecosystems and species that rely on sound for navigation and communication.[202] Space tourism in general produces black carbon particles that are almost 500 times more efficient at warming the Earth's atmosphere than all surface and airline sources of soot combined.[203] These black carbon particles circulate in a fine layer for four to five years, and absorbs solar radiation while blocking it from the Earth's surface, negatively affecting ecosystems.[204] Varying factors that affect each flight, like fuel type and manufacturing, also make it difficult to predict and model their environmental impact.[205] Ultimately, experts know the evolution of the space tourism industry is bound to result in drastic environmental costs; many aspects of commercial spaceflight, like the release of soot, still need to be closely studied.[206] Finally, an increase in space tourism has the potential to create space debris, inducing problems for satellites and spacecrafts orbiting the Earth; this, in turn, can cause damage to people, property, and the environment if the debris falls to the Earth's surface.[207]

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[196] "The Overview Effect", NASA, Aug. 30, 2019, https://www.nasa.gov/podcasts/houston-we-have-a-podcast/the-overview-effect/#:~:text=Space%20philosopher%20and%20author%20Frank%20White%20coined%20the%20term%20the,by%20astronauts%20describing%20the%20experience.
[197] Rebecca Heilweil, "How bad is space tourism for the environment? And other space travel questions, answered.", Vox, Jul. 25, 2021.
[198] Ibid.
[199] Ibid.
[200] Ibid.
[201] Ibid.
[202] Phil McKenna, "Space Tourism Poses a Significant 'Risk to the Climate'", Inside Climate News, Jun. 29, 2022. https://insideclimatenews.org/news/29062022/space-tourism-climate/.
[203] "Virgin Galactic's use of the 'Overview Effect' to promote space tourism is a terrible irony", The Conversation, Jun. 13, 2023. https://theconversation.com/virgin-galactics-use-of-the-overview-effect-to-promote-space-tourism-is-a-terrible-irony-206868#:~:text=A%202022%20study%20found%20space,years%20in%20a%20fine%20layer.
[204] Ibid.
[205] Ibid.
[206] Ibid.
[207] Ibid.

UBS, a financial service company, estimates the space travel market to be worth $3 billion by 2030: the industry would therefore create many jobs and an overall thriving industry.[208] However, safety remains a major concern. More research and regulation is needed while taking into account the international scope of the space tourism industry, whether it be legal, cultural, or religious considerations.[209] Regulations should be periodically adapted and updated as the space tourism industry evolves, and should remain relevant, accessible, and effective.

Case Study 1: Virgin Galactic and The VSS Unity Launch - Galactic 02

Anastasia Mayers looks out of the spacecraft's windows while in space. Photo via Virgin Galactic/AFP/Getty Images.

This year on the mission known as Galactic 02, Virgin Galactic launched VSS Unity a rocketplane carrying an 80-year-old former British Olympian, Jon Goodwin, and a mother and daughter, Keisha Schahaff and Anastatia Mayers, from Antigua and Barbuda.[210] Although tickets for Virgin Galactic flights typically range from $250,000 to $450,000, the mother-daughter pair won their tickets through a fundraising lottery for the nonprofit Space for Humanity. Goodwin, who was diagnosed with Parkinson's in 2014, bought his ticket to fly in 2005 and was the fourth person to reserve a seat.[211] Schahaff expressed her wonder and pride at being able to represent her country in space.[212] Ultimately, she was thankful for how accessible space was becoming: "The fact that I am here, the first to travel to space from Antigua, shows that space really is becoming more accessible," Schahaff said in a preflight statement.[213]

[208] Marcin Frackiewicz, "The Ethical Considerations of Space Tourism", TS2 Space, Mar. 10, 2023. https://ts2.space/en/the-ethical-considerations-of-space-tourism/.
[209] Ibid.
[210] William Harwood, "Virgin Galactic launches its first space tourist flight, stepping up commercial operations", CBS News, Aug. 10, 2023. https://www.cbsnews.com/news/virgin-galactic-launching-space-tourist-flight/.
[211] Ibid.
[212] Ibid.
[213] Ibid.

This flight was the company's second commercial mission; however, it was the first to carry private customers.[214] The first Galactic mission—Galactic 01—carried three crew members from the Italian Air Force and the National Research Council of Italy. However, despite its victories in the realm of space accessibility, a 1.5-hour Virgin Galactic flight generates emissions equivalent to a ten-hour trans-Atlantic commercial air flight.[215] The company's launch emits 4.5 tonnes of carbon per person—more than twice the Paris Agreement's recommended annual individual carbon budget.[216]

Case Study 2: The dearMoon Project

SpaceX announced plans for the dearMoon project in 2021. Financed by Japanese Billionaire Yusaku Maezawa, dearMoon aims to be the first ever lunar space tourism mission: it plans to launch, fly around the Moon, and safely return to Earth.[217] The crew consists of artists, content creators, and athletes from all around the world; they all have specific interests and connections with space and the Moon through their passions and lifework.[218] Maezawa has already gone to space for 12 days in December 2021, paying for seats to and from the International Space Station for himself and his videographer.[219] SpaceX's project demonstrates the promising nature and interest in commercial space travel and tourism. Despite the social, environmental, and ethical implications, the mission will still mark a significant milestone for humanity: it is the first time private individuals will be able to experience space travel on such a long trip.[220]

Case Study 3: William Shatner's Commercial Space Flight Experience

In 2022, William Shatner, the famed *Star Trek* actor, travelled aboard one of the Blue Origin missions financed by billionaire Jeff Bezos.[221] Aged 90, he became the world's oldest space traveller.[222] The Blue Origin flight that carried him into space was the sixth private passenger launch in 2021; the mission lasted about 10 minutes.[223]

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[214] Maya Yang, "Virgin Galactic successfully flies tourists to space for first time", The Guardian, Aug. 10, 2023, https://www.theguardian.com/science/2023/aug/10/vigin-galactic-space-flight-vss-unity-landing.

[215] Ariane Moore, "Virgin Galactic's use of the 'Overview Effect' to promote space tourism is a terrible irony", The Conversation, June 13, 2023, https://theconversation.com/virgin-galactics-use-of-the-overview-effect-to-promote-space-tourism-is-a-terrible-irony-206868#:~:text=A%201.5%2Dhour%20Virgin%20Galactic,tonnes%20of%20carbon%20per%20person.

[216] Debra Kamin, "The Future of Space Tourism Is Now. Well, Not Quite.", The New York Times, May 7, 2022. https://www.nytimes.com/2022/05/07/travel/space-travel-tourism.html.

[217] Federico Coppola, "dearMoon project: the first tourist mission to the Moon", SpaceVoyaging, Feb. 20, 2023. https://www.spacevoyaging.com/dearmoon-project-the-first-tourist-mission-to-the-moon/#:~:text=%E2%80%9CdearMoon%E2%80%9C%20is%20a%20lunar%20tourism,on%20such%20a%20long%20trip.

[218] Elizabeth Howell, "Meet the dearMoon crew of artists, athletes and a billionaire riding SpaceX's Starship to the moon", Space.com, Dec. 26, 2022. https://www.space.com/meet-dearmoon-crew-spacex-moon-mission.

[219] Ibid.

[220] Ibid.

[221] William Shatner, "William Shatner: My Trip to Space Filled Me With 'Overwhelming Sadness' (EXCLUSIVE)", Variety, Oct. 6, 2022. https://variety.com/2022/tv/news/william-shatner-space-boldly-go-excerpt-1235395113/.

[222] Joey Roulette, "In a Blue Origin Rocket, William Shatner Finally Goes to Space", The New York Times, Oct. 13, 2021, https://www.nytimes.com/2021/10/13/science/william-shatner-space-blue-origin.html.

[223] Ibid.

Upon returning from his successful trip, he experienced profound grief in space as a result of the Overview Effect.[224] Shatner later explained that, despite expecting his trip to be the "ultimate catharsis", he was overwhelmed with the "vicious coldness of space".[225] When the crew landed, he wept. Shatner stated: "Leaving that behind made my connection to our tiny planet even more profound. It was among the strongest feelings of grief I have ever encountered. The contrast between the vicious coldness of space and the warm nurturing of Earth below filled me with overwhelming sadness."[226] Shatner's reaction was in contrast to many of the typical expectations of going to space.[227]

Subtopic 4: Intellectual Property Rights

Introduction

Nations have different ideas of what constitutes claiming ownership over a celestial body. The United States, for example, does not see resource extraction for commercial gain as a claim to ownership; on the other hand, Russia considers all space-mining activities to violate the principles of the OST, regardless of explicit claims of ownership.[228] In essence, the idea that no one can claim space or celestial bodies as their own is a foundational aspect of the Outer Space Treaty; however, IP laws focus on the property rights of the individual holder, to the exclusion of all others.[229] These two ideals starkly contrast one another.

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224 Ibid.
225 Jonathan Edwards, "William Shatner says his trip to space 'felt like a funeral' for Earth", The Washington Post, Oct. 10, 2022. https://www.washingtonpost.com/nation/2022/10/10/william-shatner-space-flight-grief/
226 Ibid.
227 Ibid.
228 Jack Stuart and Michael Martensen, "Intellectual property rights in the global commons of space", 35th Space Symposium - Technical Track, Apr. 8, 2019.
229 Ibid.

Intellectual Property Rights and Its Application to Space

Intellectual property rights, or IP rights, comprises the fields of "branding", copyrights, patents, trade secrets, and licensing agreements.[230] The purpose and theories behind a national and international patent system, however, do not always align with the goals and ideals of international space law. IP rights emphasize the individual; international agreements emphasize the importance of unity and cooperation.[231] Nations that have ratified the OST are obligated to "carry out the agreement in good faith"; because Article II of the OST "establish[es] that space is res communis, a 'common area'", this would mean never laying claim to space or celestial bodies.[232] Additionally, states must "refrain from any acts which might adversely affect the use of the [common area]".[233]

Notably, the OST does not discuss private entities or resources found on the moon or other celestial bodies.[234] The absence of clauses regarding private entities implies that this treaty does not control private actors; therefore, countries would only violate the treaty if they made a sovereignty claim.[235] Accordingly, there may be neither a law preventing private corporations from claiming space resources, nor an obligation for companies to share resources collected from outer space.

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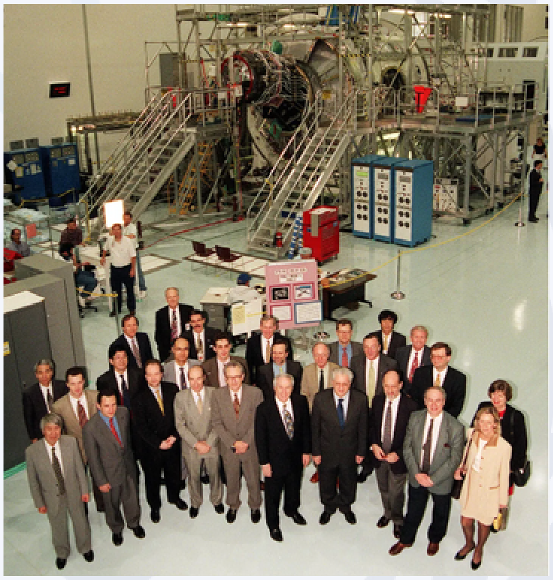
230 Ibid.
231 Ibid.
232 Ibid.
233 Ibid.
234 "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies", McGill Institute of Air and Space Law, https://www.mcgill.ca/iasl/research/space-law/outer-space-treaty.
235 Maeve Dineen, "For the Betterment of All Mankind: Claiming the Benefits of Outer Space Through Intellectual Property Rights", 13 Hasting Science and Technology Law Journal, 2022. https://repository.uclawsf.edu/cgi/viewcontent.cgi?article=1111&context=hastings_science_technology_law_journal.

Case Study 1: Property Rights on the International Space Station (ISS)

The International Space Station (ISS) is a habitable artificial satellite in low Earth orbit; its first component was launched in 1998.[236] However, as the ISS was nearing completion in 2011, the issue of space-related intellectual property rights became increasingly important: members such as the United States, Russia, Japan, Canada, and the European Union had to work together to establish a legal framework to define the rights and obligations of each of the partner states, and their jurisdiction over their ISS elements.[237] These factors raised a multitude of questions regarding which laws applied to which experiments occurring on the station, as well as which IP laws to use in varying scenarios.



Signatories of the 1998 IGA visit Kennedy Space Center's Space Station Processing Facility, posing in front of the Unity Node 1 module being prepared for launch. Photo via NASA.

A commemorative plaque prepared on the occasion of the signing of the IGA. Photo via NASA.

The intergovernmental agreement on the ISS—the ISS Intergovernmental Agreement (IGA)—was signed on the 29th of September 1988 by the United States, Japan, Canada, and ten other member states to protect the exclusive rights of inventors.[238] The IGA established the overall cooperative framework for the entirety of the ISS, especially in the realm of intellectual property and the operational responsibilities of the participating partners; lower level bilateral Memoranda of Understanding (MOU) were signed that same day by member state representatives which covered roles and responsibilities in more detail.[239]

[236] "Patents in the field of outer space", Khurana and Khurana, Oct. 22, 2014. https://www.khuranaandkhurana.com/2014/10/22/patents-in-the-field-of-outer-space/.
[237] Ibid.
[238] John Uri, "20 Year Ago: Station Partners Sign Intergovernmental Agreement (IGA)", NASA, Jan, 29, 2018, https://www.nasa.gov/history/20-years-ago-station-partners-sign-intergovernmental-agreement-iga/
[239] Ibid.

Article 21 of this agreement recognizes the jurisdiction of each partners' courts and allows for national laws to be applied in the modules belonging to the partners.[240] In other words, the different IP laws of nations must coexist on the ISS; ownership would be determined by the registry of the Station's element in which the invention had taken place. For example, if an invention is created in a USA space element, the USA Patent Act would be applicable; an invention made on a Japanese element, it would be deemed to have occurred in Japan.[241] Notably, an invention created by an enterprise astronaut on ISS will be patented in the nation that has jurisdiction over the module where the invention took place, not the nation of the inventor.[242]

Questions to Consider:

1. What can this committee do to ensure that all nations have sufficient opportunities and resources to share in the benefits of outer space? How can spacefaring nations support smaller nations to bolster their space programs?
2. How can we design an outer space ownership regime that is more than a "finders-keepers" race?
3. Where does "outer space" start? Should the international community agree to use the Karman Line as a boundary?
4. How can we mitigate or eliminate the environmental harms of space travel and tourism?
5. Should countries with national policies that do not prioritise space exploration be nonetheless supported by nations that invest heavily in space?
6. Do private corporations' mining projects contradict the Outer Space Treaty?
7. How can this committee promote private space exploration while also honouring the principles governing outer space?
8. Should amendments be made to the Outer Space Treaty to reflect the rise in commercial space endeavours? If so, what should it include?
9. How can this committee regulate the commercial space industry while also being considerate of the potential it holds for outer space exploration?
10. How can this committee continue to incentivize nations to work cooperatively in outer space?

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[240] Ibid.
[241] Ibid.
[242] Ibid.

Topic 2: Ethical Dimensions of Space Exploration

Introduction

Scientific curiosity, discovery, improved communications, resource extraction, and geopolitical factors are all motivators of space exploration. Yet, at the same time, there are risks that threaten astronauts, the Earth—both physically and economically, and celestial bodies.[243] The dilemmas and issues that surround the space industry are multifaceted and nuanced. Space travel inevitably includes risks—especially to astronauts and ecosystems.[244] Without clear regulation, deliberation on space exploration could be framed in strategic rather than ethical terms, conducted in "opaque" ways, and reserved for only select officials. Furthermore, the exploration of space is a trade-off: governments spend public dollars on space rather than on improving the health and well-being of people on Earth. Accordingly, space ethics prompts individuals to ask what motives are justifiable, which activities should be permitted, and what limits should be placed on space activities in light of important values and principles.[245]

Subtopic 1: Human Spaceflight Ethics

Introduction

Space travel is an inherently perilous undertaking. When embarking on a mission beyond Earth, astronauts rely on intricate and sophisticated machinery to navigate through the vast expanse of space. Moreover, the space environment poses considerable threats to human safety. Surfaces of celestial bodies like the Moon and Mars, for instance, present exceptionally hostile conditions characterized by extreme temperatures, hazardous space debris, and perilous radiation levels.[246] These inhospitable factors make it clear that sending humans to explore other celestial bodies inevitably places them in harm's way.[247]

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[243] Richard B. Setlow, "The hazards of space travel", National Library of Medicine, Nov. 4, 2003, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1326386/.
[244] "5 Hazards of Human Spaceflight", NASA, Sept. 10, 2018. https://www.nasa.gov/directorates/smd/space-life-physical-sciences-research-applications-division/human-resea.rch-program/5-hazards-of-human-spaceflight/#:~:text=Above%20Earth's%20natural%20protection%2C%20radiation,function%20and%20prompt%20behavioral%20changes.
[245] Daniel Munro, "If Humanity Is to Succeed in Space, Our Ethics Must Evolve," Centre for International Governance Innovation, April 4, 2022. https://www.cigionline.org/articles/if-humanity-is-to-succeed-in-space-our-ethics-must-evolve/.
[246] Emmanuel Detsis, "Chapter 9 - Ethics in Space: The Case for Future Space Exploration", National Library of Medicine, Nov. 3, 2022. https://www.ncbi.nlm.nih.gov/books/NBK589344/.
[247] Ibid.

Throughout the history of space exploration, tragic incidents have highlighted the grave risks involved in human space travel. One such case is the story of Valentin Bondarenko, a Soviet cosmonaut who lost his life in a training accident in 1961.[248] Another poignant example is that of Vladimir Komarov, a Russian astronaut who met a tragic end during the Soyuz 1 mission in 1967. Komarov's spacecraft encountered a catastrophic failure during re-entry, leading to a fatal crash landing. These incidents serve as sombre reminders of the sacrifices made by astronauts in the pursuit of scientific advancement and exploration.[249]

These instances also underscore the need for rigorous safety protocols and advanced technology to protect astronauts during space missions.[250] It is imperative for space agencies and organizations worldwide to continuously improve safety measures and develop innovative technologies that mitigate risks and ensure the well-being of those brave individuals who venture into the cosmos.[251] This commitment to safety is a fundamental aspect of responsible space exploration and is vital for the continued progress of human space travel.

The Dangers of Space Travel

Radiation stands as the primary health peril in the realm of space travel. Unlike on Earth, where our atmosphere and magnetic field provide significant protection against radiation, space is inundated with various forms of this hazardous energy.[252] This becomes a pressing issue when humans venture beyond the protective barriers of our planet, such as on missions to the moon or Mars. There are three main types of space radiation: galactic cosmic rays originating from outside our solar system, solar particles emitted by the sun during events like solar flares, and radiation trapped by Earth's magnetic field.[253]

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[248] "Gone With The Space: Astronauts Lost In Space Forever," Orbital Today, May 11, 2022. https://orbitaltoday.com/2022/05/11/gone-with-the-space-astronauts-lost-in-space-forever/.
[249] Ibid.
[250] Ibid.
[251] Ibid.
[252] "How does radiation affect the human body in space?," Government of Canada | Gouvernement du Canada. https://www.asc-csa.gc.ca/eng/astronauts/space-medicine/radiation.asp.
[253] Ibid.

Exposure to space radiation can yield both immediate, or acute, effects as well as long-term consequences.[254] The acute effects may range from mild and recoverable symptoms like changes in blood composition, to more severe outcomes including diarrhea, nausea, and vomiting.[255] In the case of a large solar particle event, such as a solar flare, the dose of radiation can be exceedingly high, leading to severe consequences like damage to the central nervous system or even fatality.[256] Over the long term, the impact of radiation exposure can result in conditions like cataracts, an increased susceptibility to cancer, and sterility.[257] It's noteworthy that some of these health effects can transcend generations, as mutated genes can be passed on to descendants of the exposed individuals.

In response to the gravity of this health hazard, various international bodies have taken measures to establish exposure limits and recommendations. For instance, the ISS Multilateral Medical Operations Panel (ISS MMOP) and Radiation Health Working Group (RHWG) play pivotal roles in setting exposure limits for astronauts aboard the International Space Station.[258] These limits, in turn, are guided by the recommendations set forth by the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurement (NCRP).[259] These concerted efforts highlight the global collaboration required to safeguard the health and well-being of space explorers as they venture into the cosmos.

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[254] Ibid.
[255] Ibid.
[256] Ibid.
[257] Zi Guo et al., "Carcinogenesis induced by space radiation: A systematic review", National Library of Medicine, Oct. 2022, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9340504/.
[258] Konrad Szocik and Martin Braddock, "Bioethical Issues in Human Modification for Protection against the Effects of Space Radiation," ScienceDirect, Nov. 2022. https://www.sciencedirect.com/science/article/pii/S0265964622000315.
[259] Ibid.

Protecting Astronauts

When it comes to safeguarding astronauts during space travel, a range of sophisticated technologies and protocols are put into action. One of the primary concerns is radiation exposure, which poses a significant health risk for astronauts.[260] To address this, flight surgeons and scientists work tirelessly to monitor the levels of radiation that astronauts are exposed to, ensuring they remain within established safety limits.[261] The Space Radiation Analysis Group (SRAG) plays a crucial role in this process, providing around-the-clock monitoring of astronauts in space. This data is then relayed to the medical team for assessment and further action.[262]

Additionally, organizations like the National Oceanic and Atmospheric Administration (NOAA) contribute to astronaut safety by producing critical data and "radiation weather" forecasts.[263] These forecasts are invaluable for mission planners, allowing them to schedule activities such as spacewalks during periods of lower radiation levels, minimizing potential risks to astronauts.[264] The ALARA principle, which stands for "As Low As Reasonably Achievable," serves as a guiding principle in efforts to limit radiation exposure as much as possible.[265]

In addition to technological safeguards, ethical considerations play a pivotal role in protecting astronauts. Given the unique nature of space travel, astronauts often serve as research subjects in various experiments. To ensure their rights and well-being are upheld, they are covered by the Common Rule, which grants them the right to withdraw from an experiment at any time or to refuse participation without facing any penalties.[266] However, this dynamic presents its own set of challenges. Some astronauts have declined participation in experiments due to concerns about factors like sleep deprivation in microgravity or the privacy of their medical information.[267] Striking a balance between advancing scientific knowledge and safeguarding astronaut well-being remains a critical aspect of space exploration.[268] These measures are not confined to a single nation; they are applied internationally to prioritize the safety and ethical treatment of astronauts across various space programs worldwide.[269]

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260 "Space Radiation is Risky Business for the Human Body," NASA. https://www.nasa.gov/humans-in-space/space-radiation-is-risky-business-for-the-human-body/
261 Ibid.
262 "About the Space Radiation Analysis Group," NASA. https://srag.jsc.nasa.gov/
263 "Marine Science Organizations", NOAA Fisheries, https://www.fisheries.noaa.gov/international/international-affairs/marine-science-organizations.
264 Konrad Szocik and Martin Braddock, "Bioethical Issues in Human Modification for Protection against the Effects of Space Radiation," ScienceDirect. https://www.sciencedirect.com/science/article/pii/S0265964622000315.
265 Ibid.
266 Claudia Dreifus, "Scientist Tackles Ethical Questions of Space Travel," The New York Times, Aug. 10, 2009. https://www.nytimes.com/2009/08/11/science/space/11conv.html
267 Jeffery C. Chancellor, Graham B. I. Scott, and Jeffrey P. Sutton, "Space Radiation: The Number One Risk to Astronaut Health beyond Low Earth Orbit", https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4206856/
268 Ibid.
269 Ibid

Case Study 1: Scott Kelly's Year in Space

In a scientific endeavour, NASA conducted a landmark study involving twin astronauts Scott and Mark Kelly. Scott Kelly embarked on an extraordinary journey, spending an entire year aboard the International Space Station (ISS), while his identical twin brother, Mark Kelly, remained on Earth.[270] This experiment sought to comprehend the long-term effects of long-term space travel on the human body, encompassing an array of physiological, psychological, and genetic investigations.

The study closely monitored various aspects of the Kelly brothers' health, including cardiovascular function, bone density, cognitive performance, and psychological well-being. It also investigated into the molecular and genetic alterations that occur in response to prolonged exposure to space.[271] This research initiative provided invaluable insights into the challenges faced by astronauts during extended missions, offering critical data for the development of effective countermeasures and protocols to safeguard their health.[272]

This case study shows that keeping astronauts safe in space is essential. It teaches us that thorough medical check-ups and strong safety measures are crucial to reduce the risks during long space missions. It also reminds us that countries around the world need to work together and share what they know to keep astronauts safe.[273] Following the ethical guidelines set by UNOOSA helps countries cooperate in exploring space while making sure astronauts are protected and treated fairly, for the greater good of humanity.

Case Study 2: Apollo 11 Astronaut Buzz Aldrin

Another notable example of safeguarding astronauts during space travel is the case of Apollo 11 astronaut Buzz Aldrin.[274]

During the Apollo 11 mission in 1969, Buzz Aldrin encountered a potentially life-threatening situation. While on the lunar surface, Aldrin noticed that a critical circuit breaker switch had broken off.[275] This switch was essential for the ascent engine to fire and lift them off the Moon's surface to rendezvous with the command module and return to Earth.[276]

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[270] Jeremy Rehm, "How a year in space affected Scott Kelly's health," ScienceNewsExplores, May 17, 2019. https://www.snexplores.org/article/how-year-space-affected-scott-kellys-health#:~:text=Most%20changes%20that%20Scott%20experienced,were%20now%20back%20to%20normal
[271] Ibid.
[272] Rachel Beker, "Scott Kelly's year in space highlights risks to DNA and brains," The Verge, April 11, 2019. https://www.theverge.com/2019/4/11/18306525/scott-mark-kelly-twins-year-international-space-station-nasa-dna-genes-health. .
[273] Ibid.
[274] "Buzz Aldrin", National Air and Space Museum, https://airandspace.si.edu/explore/stories/buzz-aldrin
[275] Lesley Kennedy, "When Buzz Aldrin and Neil Armstrong Were Nearly Stranded on the Moon", History, Mar. 28, 2023. https://www.history.com/news/buzz-aldrin-moon-landing-accident.
[276] Ibid.

The mission control team at NASA's Johnson Space Center quickly assessed the situation. They devised a workaround solution by using a felt-tip pen to manually push the circuit breaker in, allowing the ascent engine to ignite when needed. This improvised solution was successfully communicated to Aldrin and his fellow astronaut Neil Armstrong, and they were able to lift off from the Moon's surface without further incident.[277]

This case exemplifies how astronauts and mission control work together to address unexpected technical challenges in real-time.[278] It also showcases the adaptability and problem-solving skills that are crucial in space missions. The incident highlights the importance of thorough training and preparation, as well as the ability to think on one's feet when faced with unforeseen circumstances in the challenging environment of space.[279]

Subtopic 2: Environmental Challenges of Space Experimentation

Introduction

Space travel results in space debris—pieces of machinery left by humans in space.[280] These objects are launched from Earth, and then remain in orbit until it re-enters the atmosphere, proving disastrous if it were to collide with something.[281] Only 4,852 satellites out of the 8,261 orbiting Earth are actually active; this makes the rest of the satellites "space junk".[282] In 2019, for example, India blew apart one of its satellites orbiting the Earth, resulting in 400 pieces of debris that threatened to collide with the ISS.[283]

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[277] Ibid.
[278] Ibid.
[279] Ibid.
[280] Jonathan O'Callaghan, "What is space junk and why is it a problem?", Natural History Museum, https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html
[281] Ibid.
[282] Nibedita Mohanta, "How Many Satellites are Orbiting Around Earth in 2022?", Geospatial World, Apr. 20, 2023. https://www.geospatialworld.net/prime/business-and-industry-trends/how-many-satellites-orbiting-earth/.
[283] Michael Safi and Hannah Devlin, "'A terrible thing': India's destruction of satellite threatens ISS, says NASA", The Guardian, Apr. 2, 2019. https://www.theguardian.com/science/2019/apr/02/a-terrible-thing-nasa-condemns-indias-destruction-of-satellite-and-resulting-space-junk

Kessler Syndrome

The term Kessler Syndrome was coined by John Gabbard, who worked at the North American Aerospace Defense Command (NORAD) and kept an unofficial record of big satellite breakups in orbit.[284] It posits that if there is too much space junk in orbit, it could result in a chain reaction where an increasing number of objects could collide and continue to create more space junk.[285] This, in turn, could destabilise the Earth's orbit.[286] Random collisions between objects large enough to catalogue would produce a hazard to spacecrafts, and cause long term debris.[287]

More broadly, space junk lingers above the Earth's atmosphere for years until it decays, orbits, explodes, or collides with another object—which, in turn, creates more debris.[288] More than 500,000 pieces of space junk are considered to be "mission-ending threats" because of their ability to impact protective systems, fuel tanks, and spacecraft cabins.[289] In recent years, space debris has been a growing problem; experts warm than unless the amount of junk is regulated, collisions will become more frequent and could eventually trigger an "apocalyptic cascade".[290] This chain reaction between orbiting junk and in-use satellites happens when one collision produces a cloud of debris, creating fragments that continue to trigger further collisions—even collisions involving smaller objects can be catastrophic in space.[291]

On January 11th of 2007, China intentionally destroyed their own Fengyun-1C weather satellite, creating a flurry of fragments through space.[292] This event is one that caused a significant amount of space debris: it is often viewed as the most prolific and severe fragmentation in the course of five decades of space operations.[293] Experts have been concerned by the potential for the destruction to seriously disrupt or terminate missions of operational spacecraft in low Earth orbit because of the risk of further collision.[294]

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[284] Mike Wall, "Kessler Syndrome and the space debris problem", Space.com, July 14, 2022, https://www.space.com/kessler-syndrome-space-debris.
[285] Ibid.
[286] Donald J. Kessler et al., "The Kessler Syndrome: Implications to Future Space Operations", University of Western Ontario, https://aquarid.physics.uwo.ca/kessler/Kessler%20Syndrome-AAS%20Paper.pdf.
[287] Ibid.
[288] Jonathan O'Callaghan, "What is space junk and why is it a problem?", Natural History Museum, https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html
[289] Ibid.
[290] Ibid.
[291] Ibid.
[292] Leonard David, "China's Anti-Satellite Test: Worrisome Debris Cloud Circles Earth", Space.com, Nov. 17, 2021. https://www.space.com/3415-china-anti-satellite-test-worrisome-debris-cloud-circles-earth.html
[293] Ibid.
[294] Ibid.

Mega Constellations

Mega constellations are large groups of hundreds to thousands of satellites which work together to deliver low latency broadband data services for all regions.[295] While mega constellations are often used to support military missions, they apply vastly across fields, including services for banking, and internet access to remote areas.[296] However, the existence of these satellite networks is being threatened by an ever-increasing amount of space debris.[297]

Currently, SpaceX's Starlink is the largest satellite constellation, consisting of 4,487 satellites.[298] The company's goal is to provide low-cost internet to remote locations, and asserts that their services have helped people around the world "gain access to education, health services, and even communications support during natural disasters".[299] Users are able to track Starlink internet availability around the world through an interactive map detailing the locations of various satellites, and install a small satellite dish to receive the signal and pass the bandwidth on to a router.[300] On the other hand, experts are raising concerns about the impact of Starlink's satellites on night sky visibility. In 2019, shortly after Starlink's first broadband satellite deployment, the International Astronomical Union released a statement warning of the unintended consequences for stargazing and the protection of nocturnal wildlife.[301] Experts are still not entirely sure how this expanse of satellites will affect natural life and space studies from Earth.[302] SpaceX has begun testing designs to reduce the brightness and visibility of its satellites; since 2020, all satellites launched have been equipped with visors.[303]

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[295] Francis Kinsella, "Mega-constellations in space: revolutionising the satellite industry", Airbus Secure Communications, https://securecommunications.airbus.com/en/meet-the-experts/mega-constellations-in-space-revolutionising-satellite-industry#:~:text=Mega%2Dconstellations%3A%20a%20web%20of,services%20anywhere%20on%20the%20planet.
[296] Ibid.
[297] "Managing mega-constellation", The European Space Agency, https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/Managing_mega-constellations#:~:text=The%20existence%20of%20thousands%20of,debris%20management%20and%20mitigation%20techniques.
[298] Tereza Pultarova et Elizabeth Howell, "Starlink satellites: Everything you need to know about the controversial internet mega constellation", Space.com, Aug. 2, 2023, https://www.space.com/spacex-starlink-satellites.html.
[299] "High-speed internet available almost anywhere on Earth", Starlink, https://www.starlink.com/.
[300] Ry Crist and Trey Paul, "Starlink Explained: What You Need to Know About Elon Musk's Satellite Internet Service", Jun. 20, 2023. https://www.cnet.com/home/internet/starlink-satellite-internet-explained/.
[301] Ibid.
[302] Ibid.
[303] Ibid.

Space Clean Up Efforts

Several clean up efforts have launched to clear out space junk and debris.[304] Under the United Nations Space Debris Compendium agreement, standards for Space Debris Mitigation have been set, and were signed by several states and international organizations including the European Space Agency; numerous mitigation techniques are currently being studied, with the objective of reducing the number of satellite failures and actively finding adequate end-of-life disposal options.[305] Active removal of inactive satellites could be more beneficial than developing collision avoidance manoeuvres, and accordingly avoid risk of creating more debris. De-orbiting strategies, for example, may help bring inactive satellites out of orbit in a non-destructive way: the inactive satellite could move automatically from its operational orbit into a non-protected low-Earth orbit region or re-enter into the Earth's atmosphere.[306]

Other initiatives include ELSA-d (End-of-Life Services by Astroscale), a Japan-based service launched by Astroscale carried out by a servicer satellite and client satellite.[307] Designed to capture future satellites from becoming space junk by incorporating docking plates, a servicer satellite will track down and dock the target, and remove an inactive satellite from orbit. In 2018, a device called RemoveDebris worked towards this goal as well; it successfully casted a net around the satellite or piece of space junk.[308] The European Union also plans to send a self-destructing robot to launch into orbit nicknamed the "vacuum cleaner" to bring inactive satellites out of orbit.[309]

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[304] Vijay Iyer, "How Do You Clean Up 170 Million Pieces Of Space Junk?" Federation of American Scientists, May 24, 2023, https://fas.org/publication/how-do-you-clean-up-170-million-pieces-of-space-junk/
[305] "Managing mega-constellation", The European Space Agency.
[306] Ibid.
[307] Chloee Weiner, "New Effort To Clean Up Space Junk Reaches Orbit", NPR, Mar. 21, 2021. https://www.npr.org/2021/03/21/979815691/new-effort-to-clean-up-space-junk-prepares-to-launch.
[308] Ibid.
[309] Ibid.

Subtopic 3: Inclusivity and Equity in Space Exploration

Introduction

Inclusivity and equity in space exploration are pivotal for the advancement of the space industry and its diverse array of career paths. Embracing individuals from various backgrounds and perspectives is not only a matter of fairness, but it also enhances the effectiveness and innovation of space programs.[310] Collaborative achievements in space exploration often result from the collective knowledge and experiences of a globally diverse team.[311]

For instance, pioneers like JoAnn Morgan, who served as an instrumentation controller for Apollo 11,[312] and Katherine Johnson, a Black female mathematician who contributed significantly to Project Mercury, exemplify how diversity enriches the space industry.[313] These remarkable individuals broke barriers and demonstrated the immense value of inclusivity in space endeavours.

Countries like the United States recognize the importance of inclusivity and equity in space exploration.[314] Initiatives such as the Interagency Roadmap to Support Space-Related STEM Education and Workforce highlight a commitment to fostering a diverse and skilled workforce capable of tackling the challenges of space exploration on an international scale.[315] These efforts not only promote equality but also enhance the overall effectiveness and success of space missions.

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[310] Arnie Clovers, "The Importance of Diversity, Equity, and Inclusion in Space Exploration," Slooh. https://www.slooh.com/post/the-importance-of-diversity-equity-and-inclusion-in-space-exploration
[311] International Space Exploration Coordination Group, "Benefits Stemming from Space Exploration," NASA, September 2013. https://www.nasa.gov/wp-content/uploads/2015/01/benefits-stemming-from-space-exploration-2013-tagged.pdf
[312] Thalia K. Patrinos, "Rocket Fuel in Her Blood: The Story of JoAnn Morgan," NASA, July 12, 2019. https://www.nasa.gov/feature/the-story-of-joann-morgan
[313] Ibid.
[314] Ibid.
[315] "OBSERVER: Towards equality in the cosmos and diversity & inclusion in the space sector," Copernicus, September, March 9, 2023. https://www.copernicus.eu/en/news/news/observer-towards-equality-cosmos-and-diversity-inclusionhttps://www.copernicus.eu/en/news/news/observer-towards-equality-cosmos-and-diversity-inclusion-space-sector-space-sector

Access To Space For All

"Access To Space For All" is a collaborative venture aimed at providing access to essential space research facilities, infrastructure, and critical information.[316] This initiative stands as a beacon of international cooperation in the peaceful and inclusive utilization of outer space.[317] It is composed of three distinct tracks, each tailored to address specific facets of space exploration and research.

The first track, the Hypergravity/Microgravity Track, focuses on building the capacity to conduct experiments in the unique environments of orbit.[318] This track offers scientists and researchers the unprecedented opportunity to study phenomena under both hypergravity and microgravity conditions.[319] By doing so, it significantly contributes to our understanding of fundamental scientific principles that can have far-reaching implications for various fields of study.

The second track, known as the Satellite Development Track, is geared towards creating the capacity needed for the comprehensive development, deployment, and operation of satellites.[320] This is particularly vital for nations, especially those with burgeoning space programs, to actively engage in the satellite technology sector.[321] By participating in this track, countries can unlock the vast potential of satellite technology for a wide array of applications, ranging from communication and navigation to Earth observation and environmental monitoring.[322]

The third track, the Space Exploration Track, is centred on expanding global involvement in the exploration of outer space.[323] This track encourages nations to take part in missions that extend beyond Earth's orbit, with the overarching goal of pushing the boundaries of human space exploration.[324] Through endeavours like this, countries can work together on ambitious space exploration projects, pooling resources, expertise, and knowledge to achieve shared progress in space exploration capabilities.

An illustrative example of such international collaboration can be seen in the participation of countries from different regions in joint space missions.[325] For instance, the International Space Station (ISS) is a testament to the success of international cooperation in space exploration, with nations like the United States, Russia, European Space Agency (ESA) member states, Japan, and Canada working together to operate and conduct research on the station.[326] This demonstrates how joint initiatives like "Access To Space For All" can lead to meaningful progress in humanity's exploration of outer space.[327]

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[316] "Access to Space for All Latest Information", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/access2space4all/index.html.
[317] Ibid.
[318] "Access to Space for All Initiative: opportunities, achievements and way forward beyond 2020", Committee on the Peaceful Uses of Outer Space, Apr. 2021. https://www.unoosa.org/res/oosadoc/data/documents/2021/aac_105c_12021crp/aac_105c_12021crp_15_0_html/AC105_C1_2021_CRP15E.pdf.
[319] Ibid.
[320] Ibid.
[321] Ibid.
[322] Ibid.
[323] "Access to Space for All Latest Information", United Nations Office for Outer Space Affairs.
[324] Ibid.
[325] Ibid.
[326] "International Space Station," NASA, May 23, 2023. https://www.nasa.gov/reference/international-space-station/.
[327] Ibid.

Gender Equality

"Gender Equality" is a crucial aspect of ensuring inclusivity and diversity in space exploration. The UNOOSA project "Space4Women" plays a pivotal role in advancing this cause by acting as a gateway to provide women worldwide with access to space science and technology.[328] By facilitating opportunities and resources, the project aims to bridge the gender gap in the space sector and empower more women to actively participate in space-related fields.[329]

Recent developments indicate positive strides towards achieving gender equality in the space industry. A survey of ISO committees has revealed encouraging progress, especially among women aged 35 and under.[330] This signifies a positive shift in the demographics of the space sector, indicating that efforts to promote gender inclusivity are gaining traction and resonating with younger generations.[331]

Despite these advancements, it is important to acknowledge that there is still work to be done. As of now, women account for just over 10% of all human space travellers.[332] This statistic underscores the need for continued initiatives and policies that foster equal opportunities for women in the field of space exploration.[333]

The United Nations reports that women represent only around one in five workers in the space industry.[334] This figure has remained relatively stable over the past 30 years, with women comprising up to 22% of the workforce as of 2021.[335] While there has been progress, it is clear that there is room for further growth in achieving gender parity within the space industry.

Efforts to promote gender equality in space are exemplified by countries that actively support and encourage women in the field.[336] For instance, the European Space Agency (ESA) has been making concerted efforts to increase the representation of women in space-related activities. Initiatives like these serve as a testament to the global commitment towards achieving greater gender inclusivity in space exploration.[337]

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[328] Roxanne Oclarino, "Defying gravity women in space," ISO, April 26, 2022. https://www.iso.org/contents/news/2022/04/defying-gravity-women-in-space.html#
[329] Ibid.
[330] Ibid.
[331] Ibid.
[332] "Meet the women who made history in space," ITU, April 12, 2021. https://www.itu.int/hub/2021/04/meet-the-women-who-made-history-in-space/.
[333] Ibid.
[334] "Only around 1 in 5 space industry workers are women," United Nations, October 4, 2021. https://news.un.org/en/story/2021/10/1102082.
[335] Roxanne Oclarino, "Defying gravity women in space," ISO, April 26, 2022. https://www.iso.org/contents/news/2022/04/defying-gravity-women-in-space.html#.
[336] Ibid.
[337] "Empowering young women to reach for the stars," European Space Agency, February 2, 2017. https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Space_for_Earth/Space_for_Sustainable_Development/Empowering_young_women_to_reach_for_the_stars

Case Study 1: Former NASA Astronaut Dr. Sandra Magnus

Dr. Sandra Magnus stands as an exemplary figure in the realm of space exploration. Armed with degrees in physics and electrical engineering, she furthered her education with a PhD in materials science and engineering, supported by a fellowship from the NASA Lewis Research Centre.[338] Dr. Magnus made significant strides in her career by joining the esteemed NASA Astronaut Corps, where she undertook three shuttle missions, accumulating over 150 days of living in space.[339] Her accomplishments extended to leadership roles within NASA, where she contributed her expertise at the agency's headquarters in the Exploration Systems Mission Directorate. Later, she took on the role of Deputy Chief of the Astronaut Office, showcasing her leadership and administrative capabilities.[340]

Dr. Sandra Magnus's influence in the aerospace field transcends national boundaries and resonates internationally. Her journey from astronaut to Executive Director of the American Institute of Aeronautics and Astronautics (AIAA) underscores her impact on the global aerospace community.[341] This role, within the world's largest aerospace technical society, attests to her far-reaching influence in shaping the discourse and progress of space exploration.[342] Dr. Magnus's numerous accolades, including the NASA Space Flight Medal, NASA Distinguished Service Medal, and NASA Exceptional Service Medal, serve as a testament to her sustained dedication and contributions to NASA's programs and initiatives.[343] Her achievements inspire future generations of space enthusiasts worldwide and exemplify the collaborative and pioneering spirit advocated by UNOOSA in advancing human space exploration.[344]

Case Study 2: Sally Ride's Spaceflight – First American Women in Space

Sally Ride's historic spaceflight marked a pivotal moment in space exploration. In 1983, she became the first American woman to journey into space, breaking barriers and inspiring generations to come.[345] Her achievement not only demonstrated that space exploration was not limited by gender, but it also shattered the perception that careers in science and space were exclusively reserved for men. Sally Ride's journey encouraged countless women to pursue careers in STEM fields and space exploration.[346]

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[338] "Sandra H. Magnus", NASA, https://www.nasa.gov/sites/default/files/atoms/files/magnus_sandra.pdf.
[339] Andrew Careaga, "Dr. Sandra Magnus, S&T grad and former NASA astronaut, elected to National Academy of Engineering," Missouri S&T, February 10, 2022. https://news.mst.edu/2022/02/dr-sandra-magnus-st-grad-and-former-nasa-astronaut-elected-to-national-academy-of-engineering/
[340] Ibid.
[341] Ibid.
[342] Ibid.
[343] "Former NASA Astronaut Sandy Magnus gives special talk during COPUOS", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/informationfor/articles/sandy_magnus_talk_copuos_2015.html.
[344] Ibid.
[345] "Sally Ride (1951-2012)", NASA, https://solarsystem.nasa.gov/people/1760/sally-ride-1951-2012/.
[346] Ibid.

Sally Ride's spaceflight continues to serve as a beacon of progress in the pursuit of gender equality. Her groundbreaking mission challenged the prevailing norms and contributed to a shift in societal attitudes towards the roles and capabilities of women in the aerospace industry.[347] It paved the way for more opportunities for women to participate in space exploration, both as astronauts and in various technical and leadership roles.[348] Sally Ride's legacy continues to inspire women worldwide to break through barriers and pursue their passions in space science and technology, further advancing the cause of gender equality in this dynamic field.[349]

Subtopic 4: Privacy and Surveillance in Space

Introduction

In recent years, there has been a rise in the use of satellites for a variety of industries, especially in military and commercial fields.[350] In order to identify and tackle the issues surrounding satellites on privacy, this committee must first understand the scope of their applications. In general, military satellites are used for a variety of purposes, including intelligence gathering, communications, navigation, and surveillance.[351] Additionally, they can be used to detect and monitor the activities of individuals, as well as to gather information that can be used to predict or prevent potential threats.[352]

[347] Erin Blakemore, "When Sally Ride Took Her First Space Flight, Sexism Was the Norm", History, https://www.history.com/news/sally-ride-first-astronaut-sexism.
[348] Ibid.
[349] Ibid.
[350] Kolja Brockmann and Nivedita Raju, "Newspace and The Commercialization of the Space Industry: Challenges for the Missile Technology Control Regime", Stockholm International Peace Research Institute, Oct. 2022, https://www.sipri.org/sites/default/files/2022-10/2210_newspace_and_the_commercialization_of_the_space_industry.pdf
[351] Ibid.
[352] Marcin Frąckiewicz, "The Legal and Ethical Implications of Military Satellites," TS2 Space, March 3, 2023. https://ts2.space/en/the-legal-and-ethical-implications-of-military-satellites/

Satellite-Based Surveillance

Satellite-based surveillance has become increasingly popular for many nations. It is an effective tool to monitor and track activity from a distance, particularly for law enforcement and security purposes.[353] Its primary advantage is that it is able to provide real-time information from a distance, and therefore allows authorities to quickly identify and respond to potential threats.[354] Proponents of satellite-based surveillance argue that it is necessary for national security because it can be used to detect suspicious activity, such as the presence of explosives or weapons, and can therefore aid in combating terrorism. For example, the United States' National Security Agency has been using military satellites to monitor and collect data on suspected terrorists and other threats.[355] However, this use of satellite surveillance raises serious concerns about privacy: it creates more potential for privacy violations because it can be used to track individuals without their knowledge or consent. This information can be used to build detailed profiles of individuals, allowing them to be targeted.[356]

Implications on Human Rights

Satellite-based satellites have the potential to violate the right to privacy, freedom of expression, and raise international constitutional issues.[357] The widespread monitoring prompts self-censorship, impeding the legitimate exercise of expression, and limits individual autonomy and dignity. It can also lead to discrimination and profiling, and targeting of certain individuals or groups; this, in turn, restricts or even entirely violates their ability to access services and opportunities.[358] It is essential that government, businesses, and other organisations ensure that their use of their technology is consistent with international human rights standards. Individuals should be aware of how their data is being used, that their data is protected from unauthorised access, and that they have the right to access and challenge any data that is collected about them.

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[353] Ibid.
[354] Ibid.
[355] Ibid.
[356] Marcin Frąckiewicz, "The Ethics of Satellite-Based Surveillance and Privacy," TS2 Space, June 7, 2023. https://ts2.space/en/the-ethics-of-satellite-based-surveillance-and-privacy/
[357] Daniel Munro, "Who Owns Outer Space, and Everything in It?," Centre for International Governance Innovation, May 25, 2022. https://www.cigionline.org/articles/who-owns-outer-space-and-everything-in-it/
[358] Ibid.

Subtopic 5: Planetary Protection

Planetary protection, a critical aspect of space exploration, is focused on safeguarding celestial bodies from contamination.[359] This is essential to preserve the natural environments of these celestial bodies and ensure that any potential signs of extraterrestrial life are not compromised.[360] It raises ethical considerations in the context of exploration and potential colonization.

Throughout history, human exploration has brought about both incredible discoveries and challenges. The pursuit of resources, such as spices, sugar, and oil, has not only driven global exploration but also ignited struggles for political and economic dominance. In the context of space, Mars stands as a compelling example.[361] It harbours a delicate ecosystem, and introducing humans could disrupt the natural balance, potentially endangering any existing life forms.[362]

Mars is also speculated to possess minerals with exceptional properties and potential benefits.[363] However, we are well aware of the environmental devastation that can accompany mining activities, as demonstrated here on Earth.[364] This prompts a crucial ethical consideration: how do we balance the potential gains from resource utilization with the need to protect the integrity of celestial bodies? Striking this balance will be essential as we venture further into space, and international cooperation and agreements will play a vital role in shaping the ethical framework for space exploration and resource utilization.[365]

[359] "Planetary Protection," Office of Safety & Mission Assurance. https://sma.nasa.gov/sma-disciplines/planetary-protection#:~:text=Planetary%20Protection%20is%20the%20practice,from%20other%20solar%20system%20bodies.
[360] Nicholas Dirks, "The Ethics of Sending Humans to Mars," Scientific American, August 10, 2021. https://www.scientificamerican.com/article/the-ethics-of-sending-humans-to-mars/
[361] Ibid.
[362] Ibid.
[363] Ibid.
[364] Ibid.
[365] Ibid.

Cross-Contamination

Cross-contamination in space exploration presents two significant concerns: forward-contamination and backward-contamination. Forward-contamination entails the risk of introducing viable organisms, including microorganisms, from Earth to celestial bodies we visit.[366] In essence, humans act as invasive species on any celestial body beyond our home planet.[367] This has crucial implications for the preservation of extraterrestrial environments and any potential life forms that may exist.

Conversely, backward-contamination pertains to the potential contamination of our own planet following space missions. It involves the transfer of extraterrestrial organisms, if they exist, back to Earth's biosphere.[368] This longstanding concern predates even the launch of Sputnik and underscores the need for rigorous protocols to prevent unintended consequences of space exploration.

These concerns have been codified in the Outer Space Treaty, reflecting the international recognition of the importance of planetary protection. The treaty emphasizes the need to avoid both the contamination of celestial bodies we explore and the inadvertent introduction of extraterrestrial organisms to Earth.[369] By adhering to these principles, spacefaring nations collectively work towards responsible and sustainable exploration, ensuring that the quest for knowledge does not inadvertently harm the environments we seek to study.[370]

Guarding Against Cross-Contamination

Guarding against contamination is of paramount importance in space exploration, especially when it comes to missions like the Martian Sample Return. This endeavour requires a meticulous process of sealing and welding techniques to create multiple layers of containment, ensuring that there is no potential contamination between the returning spacecraft and the Mars rock samples.[371] This approach exemplifies the measures taken to preserve the integrity of extraterrestrial samples.

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[366] Ibid.
[367] Ibid.
[368] Ibid.
[369] Ker Than, "How do we protect planets from biological cross-contamination?," Stanford Engineering, May 11, 2020. https://engineering.stanford.edu/magazine/article/how-do-we-protect-planets-biological-cross-contamination
[370] Ibid.
[371] Ibid.

With the emergence of new players in the space exploration arena, particularly space entrepreneurs like Elon Musk, the need for stringent planetary protection guidelines becomes even more critical.[372] Space agencies, such as NASA, lack their own regulatory bodies to issue licences for commercial launches. Therefore, it becomes imperative to plan for the oversight of emerging commercial and entrepreneurial space activities, especially in deep space missions.[373] This proactive approach ensures that all participants in space exploration, whether government agencies or private enterprises, adhere to established planetary protection protocols.[374]

Efforts to reduce the "bioburden" - the microbial load that a spacecraft carries - involve a combination of techniques.[375] This includes chemical cleaning, heat sterilization, accounting for time spent in the highly sterilizing space radiation environment, and employing clever mechanical systems.[376] These methods have proven effective in meeting the stringent requirements for planetary protection. Additionally, attention is given to spacesuits, human habitats, and the use of robots as assistants to further minimize the risk of contamination during space missions.[377] By implementing these measures, countries and organizations around the world contribute to a collective commitment to safeguarding celestial environments and ensuring the integrity of scientific discoveries.

Case Study 1: Mars Colonization and Terraforming

Mars, often envisioned as humanity's next frontier for exploration and potential colonization, presents both exciting possibilities and significant challenges. As scientists and space agencies contemplate the long-term occupation of the red planet's surface, several complex issues emerge.[378]

One of the foremost concerns revolves around the ethical implications of exploration and colonization. Mars, like any celestial body, has its own ecosystems, though they may be vastly different from Earth's. Human presence and activity on Mars could potentially disrupt these delicate environments, potentially harming any native Martian organisms that may exist.[379] This raises ethical questions about our responsibility to preserve the natural state of other celestial bodies.

[372] Ker Than, "How do we protect planets from biological cross-contamination?," Stanford Engineering, May 11, 2020. https://engineering.stanford.edu/magazine/article/how-do-we-protect-planets-biological-cross-contamination
[373] "NASA's Transition of the Space Launch System to a Commercial Services Contract," NASA Office of Inspector General, October 12, 2023. https://oig.nasa.gov/docs/IG-24-001.pdf
[374] Ibid.
[375] G.C. Mendes et al., "Bioburden", ScienceDirect, 2012. https://www.sciencedirect.com/topics/nursing-and-health-professions/bioburden
[376] "Assessment of the Report of NASA's Planetary Protection Independent Review Board," National Academies of Sciences, Engineering, Medicine, 2020. https://nap.nationalacademies.org/catalog/25773/assessment-of-the-report-of-nasas-planetary-protection-independent-review-board
[377] Ibid.
[378] Raphaël Costa, "The law of Mars' colonisation," https://academic.oup.com/book/45429/chapter-abstract/389422746?redirectedFrom=fulltext
[379] Ibid.

Furthermore, the prolonged occupation of Mars introduces logistical and psychological challenges.[380] Maintaining a sustainable life support system, shielding against hazardous radiation, and ensuring a stable and self-sufficient habitat for humans are formidable tasks.[381] Additionally, the psychological well-being of astronauts during extended missions will require careful attention.[382]

Guarding against cross-contamination is integral to addressing these concerns. As humans interact with Mars, there is a risk of introducing terrestrial microorganisms that could potentially thrive in the Martian environment.[383] This could contaminate the planet and complicate future scientific investigations. Consequently, stringent measures, such as advanced sealing and welding techniques, will be imperative to prevent any bioburden from Earth inadvertently reaching Mars.[384]

In conclusion, while Mars colonization and terraforming offer a promising frontier for human exploration, they come with a host of ethical, logistical, and biological challenges.[385] Guarding against cross-contamination is a crucial aspect of these efforts, ensuring that our presence on Mars is both responsible and respectful of the unique environments we may encounter. Through careful planning and adherence to planetary protection protocols, we can pave the way for a sustainable and ethically sound era of interplanetary exploration.

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380 Ibid.
381 Ibid.
382 Dietrich Manzey, "Human missions to Mars: new psychological challenges and research issues," ScienceDirect, June 24, 2004. https://www.sciencedirect.com/science/article/pii/S0094576504001705
383 Konrad Szocik et al., "Political and legal challenges in a Mars colony," ScienceDirect, November 29, 2016. https://www.sciencedirect.com/science/article/abs/pii/S0265964616300200
384 Ibid.
385 Ibid.

Questions to Consider:

1. How can governments protect travellers from or at least mitigate the harms of space travel?
2. How can satellites be regulated and removed once they become inactive?
3. What is the international standard for space debris? How can this committee ensure the 2007 China anti-satellite event does not reoccur?
4. How can this committee work to minimize space junk and its environmental risks?
5. Would an international space clean up initiative be plausible? If so, how?
6. How can we regulate the rise in commercial space activities to ensure they follow planetary protection rules?
7. What can this committee do to promote diversity internationally in the field of outer space?
8. How can larger space faring countries support smaller countries with emerging space policies and programs?
9. Is surveillance from space ethical?
10. How can this committee urge spacefaring nations to be environmentally responsible to ensure a sustainable solution?

Tips for Research

Position Papers:

- In your position paper, we would like to see information about both Topic 1 and 2. We recommend going through the Questions To Consider above, and identifying which issues are most important for your country—this will help narrow down what aspects you should focus on in your paper. Ultimately, a good position paper should concisely summarize the country's stance; claims should be supported by citations (MLA or Chicago).

Researching Your Stance:

- Delegates should be familiar with the five space treaties, especially the Outer Space Treaty.
- Government websites, non-governmental organisation websites, and news articles tend to be reliable ways to establish your stance. Past UN resolutions and proposals from think tanks can also help in building your solutions.
- Research should be guided by keywords (i.e.: [country name] space commercialization), and you should refer to past actions to reinforce your points and solutions.
- We recommend speeches be relevant, insightful, and specific to the motion and topic. It may also be useful to include a call to action.

Key Resources:

Topic 1:

- Sophie Goguichvili et al., "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?", Wilson Center, Oct. 1, 2021, https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rules-final-frontier
    - This article effectively sums up the importance of updating international space law to reflect the current developments in the space industry, especially when it comes to commercialisation, mining, and tourism.

- Scott Atkins et al., "Governance in outer space: The case for a new global order", Norton Rose Fulbright, Nov. 2022, https://www.nortonrosefulbright.com/en/knowledge/publications/e8862684/governance-in-outer-space-the-case-for-a-new-global-order
    - This paper provides a good summary of topics covered in this first section, and is useful to contextualise the most prominent issues related to outer space.

- Vijay Iyer, "How Do You Clean Up 170 Million Pieces of Space Junk?", Federation of American Scientists, May 24, 2023, https://fas.org/publication/how-do-you-clean-up-170-million-pieces-of-space-junk/
    - This article provides an overview of the space debris issue, Kessler Syndrome, and methods of mitigation. It identifies three solutions by referring to NASA research, which may be a source of inspiration for solutions.

- Space Foundation Editorial Team, "Space Briefing Book: Space Law - International Space Law", Space Foundation, https://www.spacefoundation.org/space_brief/international-space-law/
    - This resource offers a concise summary of each of the five UN space treaties.

- Alex Gilbert, "Mining in Space Is Coming", Milken Institute Review, Apr. 26, 2021, https://www.milkenreview.org/articles/mining-in-space-is-coming
    - This article runs through the era of commercial space mining and explains the vast resources available in the realm of space. It emphasises the impact it has on the field, as well as the way the industry is evolving.

Topic 2:

- Daniel Munro, “If Humanity Is to Succeed in Space, Our Ethics Must Evolve”, Centre for International Governance Innovation, Apr. 4, 2022, https://www.cigionline.org/articles/if-humanity-is-to-succeed-in-space-our-ethics-must-evolve/
    - By outlining the key issues in space ethics, this article stresses the significance of fostering discussion and finding solutions as exploration and private interests evolve more rapidly than ever before.
- Zi Guo et al., “Carcinogenesis induced by space radiation: A systematic review”, National Library of Medicine, Jul. 28, 2022, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9340504/
    - This source delves into the harms of space radiation.
- “OBSERVER: Towards equality in the cosmos and diversity and inclusion in the space sector”, Programme of the European Union and Copernicus, Sept. 3, 2023, https://www.copernicus.eu/en/news/news/observer-towards-equality-cosmos-and-diversity-inclusion-space-sector
    - This article emphasises equality, diversity, and inclusion in the space sector while outlining the issues this committee needs to tackle in order to mitigate barriers.
- Marcin Frackiewicz, “The Ethics of Satellite-Based Surveillance and Privacy”, TS2 Space, June 7, 2023, https://ts2.space/en/the-ethics-of-satellite-based-surveillance-and-privacy/
    - This article examines the pros and cons of satellite-based surveillance and privacy, its implications on human rights, and its legality. This may help frame your argument for or against the use of satellite-based surveillance.
- Petra Rettberg et al., “Biological Contamination Prevention for Outer Solar System Moons of Astrobiological Interest: What Do We Need to Know?”, National Library of Medicine, Aug. 1, 2019, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6767865/
    - This article outlines the importance of ensuring that scientific exploration does not contaminate or harm planetary conditions.

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"34/69. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html.

"41/65. Principles Relating to Remote Sensing of the Earth from Outer Space", United Nations Office for Outer Space Affairs,
"47/68. Principles Relevant to the Use of Nuclear Power Sources In Outer Space", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/nps-principles.html.

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"C. Rights and Benefits - 37/92. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting", United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/dbs-principles.html#:~:text=Every%20State%20has%20an%20equal,the%20benefits%20from%20such%20activities.

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