THE FINAL FRONTIER: NAVIGATING OWNERSHIP IN SPACE MINING

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ABSTRACT

Space mining raises questions regarding the ownership and exploitation of space resources. The Outer Space Treaty of 1967 declares space as the province of all mankind. Yet it does not address the commercial exploitation of celestial resources such as different minerals of water or metals from planets of the moon or near-earth asteroids.[1] Space mining technologies, such as NASA's Osiris-Rex Mission, have demonstrated the possibility of resource extraction with significant benefits for space exploration. However, the absence of a clear legal framework leads to uncertainties about property rights, fair resource distribution, and environmental sustainability.[2] The challenges include balancing the economic benefits of space mining with a heightened risk of market disruption, political tensions, and environmental contamination. A cooperative global legal framework is key to preventing unchecked exploitation, ensuring fair and equitable access, and maintaining the peaceful use of outer space. The future of space mining depends on establishing legal, ethical, and environmentally sustainable guidelines to save the interest of all mankind.[3] The future of space mining will also require the collaboration of government, private enterprises, and international bodies. The development needs laws governing property rights, safety protocols, and environmental standards that will be crucial to ensure that space mining does not become a frontier for conflict for careless exploitation. Furthermore, establishing multilateral agreements that address the sharing of benefits derived from space resources can help prevent monopolization by powerful nations and ensure that smaller, less developed countries can also benefit from space exploration.[4]

Keywords: Space Mining, Resource Extraction, Monopolisation, Market Disruption.

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[1] 'The Outer Space Treaty at a Glance' (The Outer Space Treaty at a Glance | Arms Control Association), accessed 19 October 2024

[2] Abbasi I, 'Mining Equipment in Space: The Future of Extraterrestrial Resource Extraction' (Azo Mining, 23 November 2023), accessed 19 October 2024

[3] The Laws of Space Mining' (UW School of Law), accessed 19 October 2024

[4] Skibba R, 'Things Are Looking Up for Asteroid Mining' (Wired, 20 October 2023) accessed 19 October 2024

INTRODUCTION

The question that strikes everybody's mind is "Who owns the space resources?" as we see every other nation striving and competing to achieve space resources.

No nation owns the moon, as stated by a UN agreement from 1967. Instead, the Outer Space Treaty says it belongs to everyone and that any exploration has to be carried out for the benefit of all humankind and in the interest of all nations.[5] Let us first understand what space mining is. Space mining is nothing but exploration, exploitation, and utilization of the natural resources that are to be found on the moon or other planets or near-Earth asteroids (NEAs), which are to be encountered for a rich diversity of useful materials, such as minerals, gases, water, and metals.[6]

Ownership of space resources could be beneficial from one point of view because it encourages people or organizations to make the most productive use of any given resource. This idea emerges from the philosopher John Locke's theory of property, which establishes that ownership ensures that one can enjoy the benefit of one's efforts rather than have them arbitrarily appropriated by another.[7] But we also need to remember that a person, a company, or any organization that dominates a sector or industry can very easily use its advantages to create artificial scarcity or to exploit the resources. This article is prepared after a deep analysis of the subject matter and will make you (the reader) understand the legal complexities in deep space mining and ownership of space resources. Let's begin:

JOURNEY BACK TO THE SPACE RACE

The space race was a tooth-tooth fight-type competition in the 20th century between the erstwhile Soviet Union and the United States of America trying to achieve dominance in space technology. Everything started on August 2, 1955, when the Soviet Union announced the launch of an artificial satellite[8]. The roots of the space race can be traced back to the era when there was a nuclear arms race that followed World War II, where both nations relied on German

[5] Morelle R., 'Who Owns the Moon? A New Space Race Means It Could Be Up for Grabs' (BBC News, 8 June 2024) <https://www.bbc.com/news/articles/cxwwjlrk1mlo> accessed 8 October 2024
[6] 'Space Mining' (*Space Generation Advisory Council*, 22 March 2022) <https://spacegeneration.org/sgac-ecsl-un-model/67883-2> accessed 10 October 2024
[7] Tuckness A, 'Locke's Political Philosophy' (*Stanford Encyclopaedia of Philosophy*, 6 October 2020) <https://plato.stanford.edu/entries/locke-political/> accessed 10 October 2024
[8] 'The Space Race' (National Air and Space Museum, 6 March 2023) <https://airandspace.si.edu/explore/stories/space-race> accessed 11 October 2024

missile technology and scientists. Both nations believed that advancement in space technology was vital for national security and complete global dominance and influence. The space race led to many amazing achievements, including the launch of satellites, human space missions, and space probes.[9]

Let's check up on the timeline:

August 1955: the USSR announces plans for its satellite in response to the US. October 1957: the USSR successfully launches Sputnik 1. November 1957: the USSR launches sputnik 2. January 1958: the US launches Explorer 1. October 1958: NASA is established in the United States. January 1959: The USSR launches Luna 1. August 1959: The US launches Explorer 6. September 1959: The USSR launches Luna 2. August 1960: aboard the Soviet Union's Sputnik 5, the first animals and a range of plants returned alive from space. May 1961: Alan Shepherd became the first American in space with a 15-minute orbital flight. June 1963: Valentina Tareshkova becomes the first civilian and woman in space. July 1965: the US satellite Mariner-4 sends back the first close-up images of Mars. December 1968: Apollo 8 becomes the first spacecraft to orbit the moon and return safely to Earth. July 1969: Neil Armstrong and Aldrin become the first humans to walk on the moon during the Apollo mission. April 1970: US Apollo 13 experiences its first explosion onboard a spacecraft, where the crew survived. July 1975: The US and USSR conducted the Apollo-Soyuz mission, which was the first cooperation in space and symbolically ended the space race.[10]

TREATY ON THE PRINCIPLES REGULATING STATE ACTIVITIES IN THE EXPLORATION AND USE OF OUTER SPACE, INCLUDING THE MOON AND OTHER CELESTIAL BODIES

The Outer Space Treaty was discussed by the legal subcommittee in 1966, and an agreement was reached in the general assembly that very year. The treaty was based on the declaration of legal principles, which governed the activities of countries in the exploration and use of outer space. The treaty was open for signature by three depository governments, which were the

[9] 'Space Race Timeline' (Royal Museums Greenwich) <https://www.rmg.co.uk/stories/topics/space-race-timeline> accessed 11 October 2024

[10] History.com Editors, 'The Space Race: Timeline, Cold War & Facts' (History.com), <https://www.history.com/topics/cold-war/space-race> accessed 11 October 2024

Russian Federation, the United Kingdom, and the United States of America, in January 1967, and it came into force on October 1967.[11]

WHAT TECHNOLOGY IS USED FOR RESOURCE EXTRACTION, AND WHAT ARE ITS ADVANTAGES AND DISADVANTAGES?

Space mining technology already exists; the US agency NASA has launched a $1 billion, 7-year mission to map and extract materials from an asteroid called Bennu. The Osiris Rex spacecraft was given a task to extract a sample of frock and soil from the asteroid's surface before returning to Earth in 2023. Scientists have hoped that the samples will help them to better understand how the solar system began, but now it also demonstrates that we can remove materials and resources from asteroids. The biggest and most astonishing prize or outcome is likely to be water, not because it has any shortage over on earth, but because it has the potential to be used as fuel to continue the exploration of space by ships outside our atmosphere. Water is a good source of hydrogen fuel for spaceships; as well, it can provide drinking water for crews, while oxygen in H2O can be used to make air for them to breathe. This will be a game changer for space exploration, as it would allow spaceships to refill in space and travel significantly further. Many asteroids are studied and were found to be rich in minerals, including gold, platinum, aluminium, nickel, and titanium. There is a very good possibility that these materials could be used as construction materials for the colonization of space or they can be brought back to Earth.[12] The Japanese space agency's Hayabusa-1 returned a small amount of regolith dust from the asteroid Ito Kawa in 2010, while Hayabusa-2 returned a larger sample from the asteroid Ryugu in 2020. Ryugu and Bennu are composed of some of the oldest materials in the solar system, which have been unaltered for over 4.5 billion years. It was also found that meteorites contain organic molecules, including amino acids.[13] The Harvard International review discusses that mining the top 10 most cost-effective asteroids could bring profits of around US$1.5 trillion, while also the point to note here is that asteroids like 16 Psyche Harbour materials are worth $700 quintillion.[14]

[11] (Outer Space Treaty) <https://2009-2017.state.gov/t/isn/5181.htm> accessed 12 October 2024
[12] 'Who Owns the Water on Mars and the Resources in Space?' (World Government Summit, Detail) <https://www.worldgovernmentsummit.org/observer/articles/2017/detail/who-owns-the-water-on-mars-and-the-resources-in-space> accessed 12 October 2024
[13] Byers M. and Boley A., 'Space Mining (Chapter 5): Who Owns Outer Space?' (Cambridge Core) <https://www.cambridge.org/core/books/who-owns-outer-space/space-mining/994B288E0E0016EF7B6353240556D3A5> accessed 12 October 2024
[14] Jones R., 'How Could Space Mining Increase Sustainable Growth?' (Azo Mining, 8 March 2024) <https://www.azomining.com/Article.aspx?ArticleID=1795> accessed 13 October 2024

However, one of the notable negative impacts that space, mining, or asteroid mining can bring is that it raises concerns about market disruption. Experts in this field fear that mining these vast quantities of materials could devalue global raw materials, which are currently valued at around $660 billion. This could eventually lead to economic instability, specifically in those countries that rely on mineral exports only. The high cost associated with space missions, which was evidenced by NASA's Osiris Rex mission, which was a $1 billion project, presents a substantial barrier to entry. Other potential risks include space debris and the disruption of celestial bodies, which need careful consideration; this could alter the space ecosystem[15]. The readers should also note that the more activity there is, the more pristine the conditions of space will become. Space mining could contaminate special bodies with microbes from Earth, and it may produce clouds of asteroid dust or loose stones, which in turn could very easily pose a hazard to satellite operations and hamper the balance of the space ecosystem, although it reduces the environmental impact on Earth.[16]

NATIONAL AND INTERNATIONAL SPACE LEGISLATION

The international agreement on space personnel rescue outlines the responsibilities of states in rescue operations. Currently, 22 states have signed the Liability Convention of 1972, which defines liability for space-related damage and aims to govern international liability for space-caused damage. As of February 2022, 72 states have ratified the registration convention of 1975, which mandates states to provide the United Nations with data on the orbit of each space object they launch.[17]

The activities of states and exploration and uses of outer space are governed by legal principles, as declared in 1963. There is also a declaration governing the use of satellites for television broadcasting. Additionally, there is a declaration regarding remote sensing from outer space. Another declaration concerns the use of nuclear power sources in outer space. Lastly, there is a declaration regarding international cooperation in space exploration for the benefit of all less developed countries.[18]

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[15] *Ibid*.
[16] 'Who Owns the Water on Mars and the Resources in Space?' (World Government Summit, Detail) <https://www.worldgovernmentsummit.org/observer/articles/2017/detail/who-owns-the-water-on-mars-and-the-resources-in-space> accessed 13 October 2024
[17] Dunk FG von der, 'The Registration Convention: Background and Historical Context' (Digital Commons @University of Nebraska-Lincoln), <https://digitalcommons.unl.edu/spacelaw/32/> accessed October 19, 2024.
[18] Drishti IAS, 'Space Law and the Future of Space Exploration' (Drishti IAS, 8 April 2024) <https://www.drishtiias.com/blog/space-law-and-the-future-of-space-exploration> accessed 19 October 2024

Currently, India's legal framework concerning space exploration is notable; sparking statutes like the Indian Space Research Organization Act of 1969 and the National Remote Sensing Centre guidelines of 2011[19] exist. They only offer limited regulation of space-related activities; some of the existing space regulations in India primarily consist of policy frameworks rather than comprehensive laws. Some of these policies include the satellite communication policy, which was introduced in 1997[20] and aims to advance satellite communication launch capabilities and encourage private investment. Norms, guidelines, and Procedure Policy 2000: These regulations outline procedures for setting up satellite systems by private Indian companies with less than 74% foreign equity. Remote Data Sensing Policy 2011 allows the transfer of higher-resolution imaging services for the private use of sensitive imagery data. ISRO technology transfer policy[21], which is designed to boost private participation and investment. It enables outsourcing and manufacturing of satellite components to national and international companies.

LEGAL CHALLENGES

Resource utilization: all nations must address questions regarding property rights and sharing of space resources such as minerals or energy sources, and developing international agreements is key to ensuring fair access and preventing war over resource exploitation. Sovereignty and non-appropriation: the outer space treaty prevents nations from claiming celestial bodies as their own, prioritizing peaceful use. Environmental concerns: all space activities could generate debris and contamination affecting the space environment; hence, developing legal frameworks for responsible and sustainable practices is necessary to mitigate the impact. [22]

The lack of clear and transparent laws leads to uncertainty regarding the rights and responsibilities concerning space mining activities and could potentially result in disputes for claims or certain resource extraction methods. Experts advocate for global cooperation to enable a governing framework to address priority rights, safety zones, and dispute resolution mechanisms to elevate future potential conflicts.[23] The campaign to reach for the resources

[19] 'National Remote Sensing Policy' (EOP IRS Data Policy Page 1 | NRSC Web Site) <https://www.nrsc.gov.in/EOP_irsdata_Policy/page_1?language_content_entity=en> accessed 19 October 2024
[20] 'Indian Satellite Communication Policy: The Recent Reforms' (Lex Counsel, 18 November 2022) <https://lexcounsel.in/newsletters/indian-satellite-communication-policy-the-recent-reforms/> accessed 19 October 2024
[21] (Technology transfer) <https://www.isro.gov.in/TechnologyTransfer.html> accessed 19 October 2024
[22] *Ibid.*
[23] Dusina MG, 'Esil Reflection—Space Mining in Practice—an International Space Law Perspective on Upcoming Challenges—European Society of International Law: Société Européenne de Droit International'

could lead to tensions between nations and private companies. If one-sided actions are taken without a shared regulatory framework, also, the ethical implications of these mining operations on celestial bodies raise specific questions about sustainability and preservation, necessitating regulations that not only consider economic benefits but also environmental impacts.[24]

CONCLUSION

Space mining presents an astonishingly profound challenge to the existing national and international legal frameworks. While treaties like the Outer Space Treaty aim to preserve space for peaceful and collective views. However the problem with this treaty is that it does not explicitly address the commercial exploitation of these very celestial resources. As nations and private enterprises have already started to campaign to push the boundaries of space exploration, some very critical questions about ownership or resource distribution and environmental sustainability arise. The benefits are numerous, where access to vital minerals and resources and advanced space exploration could very well mitigate resource shortages on Earth. However, this progress not only brings advantages and benefits but also concerns about economic disruption, geopolitical conflicts, and environmental damage. At last, a robust and cooperative legal framework is essential. We must have to balance resource utilization with principles of sustainability and equitable access. Without global cooperation and impactful legislation, space mining could lead to very unchecked exploitation and conflict where it could threaten the benefits it promises to deliver. Therefore, the future of space exploration and resource extraction depends on creating legal, ethical, and environmentally responsible guidelines that protect and ensure the peaceful and fair use of space for all humankind.

(European Society of International Law | Société européenne de droit international, 20 May 2024) <https://esil-sedi.eu/esil-reflection-space-mining-in-practice-an-international-space-law-perspective-on-upcoming-challenges/> accessed 19 October 2024

[24] Avuthu VSR, 'Commercial Space Mining: Economic and Legal Implications' (orfonline.org, 4 December 2023) <https://www.orfonline.org/research/commercial-space-mining-economic-and-legal-implications> accessed 19 October 2024

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