THE LAGGING REGULATION BEHIND THE RAPID COMMERCIALIZATION OF SPACE

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ABSTRACT

The United Nations (UN) played a pivotal role in establishing international rules for space activities following the launch of the first artificial satellite in 1957. This led to the creation of five key international conventions, including the Outer Space Treaty of 1967, forming the basis of space law. Initially focused on ensuring peaceful space exploration, these conventions did not anticipate the rapid commercialization of space. Despite early successes in telecommunications, remote sensing, and global navigation services, the emergence of space tourism and mining in recent years has outpaced existing regulations. The outdated conventions struggle to address the complexities of commercial space activities, prompting a shift towards soft laws and national legislation. However, reaching consensus on new international rules is challenging due to diverging national interests. Consequently, states are encouraged to enact their own space laws to guide domestic commercial activities. In the future, the development of soft laws and national regulations is expected to dominate space governance, aiming to ensure uniform access and utilization of space resources on an international scale. This paper provides an overview of current space commercialization trends and recommends strategies for enhancing international governance to accommodate the evolving landscape of commercial space activities.

Keywords: Space Commercialization, Space Governance, Space Law, United Nations.

I. INTRODUCTION

A strong global space economy has emerged as a result of new funding sources and emerging technology. Historically, space was only used by governments and big telecom corporations. Private sector involvement in the space industry was mostly restricted to television broadcasting, and satellites were big, costly, and took years to create. However, innovation has made it possible for more and more businesses to participate. Thousands of satellites are currently in service in dozens of countries, and the majority of them are commercial rather than military. The findings, which the World Economic Forum and McKinsey & Company plan to publish in early 2024, show that as of 2023, the overall value of the global space economy, including direct and indirect use cases was quickly reaching the $600 billion threshold[1]. Despite the fast-paced commercialization, space entrepreneurs typically encounter unsettlingly ambiguous legal frameworks. It may take several years for governments to precisely ascertain the degree of autonomy to be granted to private operators.

Government and defense industry spending, despite this regulatory uncertainty, has spurred a wave of investment and information technologies that have boosted commercial space ventures: 3D printing to build structures in space too large to be launched from Earth; cloud computing and cheaper processing power to enable more powerful data analysis; reusable launch vehicles that significantly lower the cost of spaceflight; and satellites that provide connectivity. The biggest industry growth area is space-based communication, although sustainability may be jeopardized by it. According to the US Government Accountability Office, more than 58,000 satellites could be launched by 2030, raising concerns about connected rocket launches' possible influence on the climate and possible safety problems due to reduced visibility. In light of the growing number of launches and private enterprises' efforts to extract extraterrestrial resources, it is imperative to establish strong commercial opportunities for space pollution cleanup. Several satellites and even a few autonomous vehicles are currently scouring planets and the Moon for minerals and water. Though it needs to be strictly regulated, this new space economy has the potential to improve life on Earth.

II. RAPID SPACE COMMERCIALIZATION

This technological advancement is occurring against the backdrop of shifting financing

[1] McKinsey & Company, Can better governance help space lift off?, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/can-better-governance-help-space-lift-off (last visited Apr. 4, 2024)

sources. Government financing accounted for approximately 90% of space R&D expenditures in the early 2000s. Funding for space research and development now comes from commercial sources, according to McKinsey research. Within the next 20 years, government funding may be surpassed by commercial investment if the current momentum continues[2]. The government is mainly welcoming this development, which is leading to new kinds of collaboration, including public-private partnerships. The amount of money the private sector invested in space-related businesses exceeded $10 billion in 2021, marking a record high and a ten-fold rise in only ten years[3]. A greater willingness to take chances has been encouraged by easier access to capital, which has accelerated the advancement of space technology.

In the meantime, space activity is becoming more international. 70% of space expenditures worldwide were financed by the US government ten years ago. Its share is currently less than 50%. Non-US space budgets have surged by more than 130% in the last five years. There are now about 70 national space programs worldwide, reflecting a far more diverse participation in space exploration. In 2021, forty countries sent objects into orbit, which is twice as many as in 2015. Participants from other industries, such as logistics and the automotive sector, have also entered the space sector at the same time. Between 2010 and 2018, the number of space-related businesses that were funded and established annually more than doubled.

Competition has grown as space activity has intensified. For commercial and national security reasons, public and private entities are scrambling to stake claims to limited resources like spectrum and orbits. Space is scarce; in the past 20 years, trackable orbital debris has increased by more than 80%, even before mega-constellations, which are made up of thousands of satellites, started to enter orbit. Furthermore, we now have intricate relationships between numerous countries and businesses in place of the previous bilateral battle between two great space powers.

III. EVOLUTION OF SPACE LAWS

The United Nations (UN) moved swiftly after the first artificial satellite, Sputnik, was launched in 1957. That same year, the UNGA passed a resolution and established an ad hoc committee to monitor space activities for peaceful purposes. UNCOPUOS, the United Nations group on

[2] McKinsey & Company, Space investment shifts from GEO to LEO and now beyond, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/space-investment-shifts-from-geo-to-leo-and-now-beyond (last visited Apr. 4, 2024)
[3] McKinsey & Company, Wall Street to mission control: Can space tourism pay off?, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/wall-street-to-mission-control-can-space-tourism-pay-off (last visited Apr. 4, 2024)

the Peaceful Uses of Outer Space, was modeled after this ad hoc group and was created one year later. International space cooperation and the necessity of exploiting space only for peaceful purposes are recognized in the 1958 UNGA resolution. Another significant UNGA resolution, the Outer Space Declaration (Outer Space Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space), was enacted in 1963 and established several crucial guidelines for the exploration and use of outer space. It was a turning point for early space law legislation. The 1967 Outer Space Treaty (United Nations, 1967) is the first space law treaty, and it is based on this document. The 1968 Rescue Agreement (United Nations, 1968), the 1972 Liability Convention (United Nations, 1972), the 1975 Registration Convention (United Nations, 1976), and the 1979 Moon Agreement (United Nations, 1984) were the four UN-sponsored accords that were to come after this.

The foundation of space law is made up of these five UN space accords. All states have the freedom to freely enter, explore, and utilize space as long as they adhere to the Outer Space Treaty, which defines space as the domain of all humankind (United Nations, 1967, article I(2)(3)). Some basic concepts are now incorporated into customary international law, such as the non-appropriation of space (United Nations, 1967, article II), the peaceful uses of space, and international space cooperation (United Nations, 1967, article III, etc.). These five accords adopt an open approach, permitting private and/or commercial space activities, even though they were signed during the early stages of the space era when sovereign states dominated space activity.

For example, the Outer Space Treaty provides that space activities can be carried out by both governmental and nongovernmental entities (United Nations, 1967, article VI). The state shall be held responsible for activities carried out by nongovernmental entities through such measures as authorization and continuing supervision (United Nations, 1967, article VI). Accordingly, the Outer Space Treaty, though drafted when states were the sole space players, does not preclude the possibility of space commercialization and privatization.

The Rescue Agreement, an extension of the Outer Space Treaty's Article V, focuses on aiding astronauts in accidents, distress, or emergency landings, and ensuring the return of space objects from beyond member states' territories (UNOOSA). Meanwhile, the Liability Convention builds on the Outer Space Treaty's Article VII, establishing absolute liability for damages caused by space objects on Earth or to aircraft, and fault liability for damages

elsewhere, with a dispute resolution mechanism (UNOOSA)[4].

Contrarily, the Moon Agreement, unique among space treaties, addresses potential commercialization but sparked controversy with the concept of the "common heritage of mankind." Despite lesser global adoption, it emphasizes the need for an international framework to regulate Moon resource exploitation (UNOOSA).

IV. GAPS IN THE INTERNATIONAL LEGAL FRAMEWORK

The initial phase of space law culminated with the finalization of the Moon Agreement, marking a period where international space treaties set foundational principles for space endeavors. Following this, from 1980 to 1992, the UN didn't ratify any binding conventions, shifting focus to non-binding resolutions. During this phase, significant UNGA resolutions addressed specific space activities like satellite broadcasting and remote sensing, along with regulating nuclear power use in space.

In the 1990s, national space legislation surged, filling gaps left by the absence of new UN treaties. Countries like Argentina, the USA, Australia, Canada, Finland, France, Germany, Hungary, Indonesia, Japan, New Zealand, the Philippines, the Republic of Korea, the Russian Federation, Slovakia, Sweden, South Africa, Tunisia, Ukraine, the United Kingdom of Great Britain and Northern Ireland, enacted laws to govern their space activities. Simultaneously, the UNGA continued adopting resolutions on international space cooperation and space object registration.

The current trend in space law sees individual states crafting their legislation to stimulate commercial space activities by domestic private enterprises and support government missions. This approach, rather than promoting additional international frameworks, has been adopted by countries like the United States, Luxembourg, the United Arab Emirates (UAE), and Japan, all of which recognize private entity rights to acquire ownership of space resources.

For instance, the United States Commercial Space Launch Competitiveness Act of 2015 grants U.S. citizens engaged in commercial asteroid or space resource recovery ownership rights over the obtained resources, allowing possession, transportation, use, and sale. Similarly, Luxembourg's 2017 Law on the Exploration and Use of Space Resources enables private entities to claim ownership of over-extracted space resources.

[4] United Nations Office for Outer Space Affairs, Legal Principles - United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html (last visited Apr. 4, 2024)

The UAE's National Space Law, effective in December 2019, supports space resource exploitation, requiring permits from the UAE Space Agency. It aims to stimulate investment and private sector involvement in space activities, aligning with the National Space Policy and National Space Strategy 2030[5]. Japan passed a similar law in June 2021, permitting Japanese entities to prospect, extract, and utilize space resources with government permission.

However, these localized laws pose challenges, potentially leading to conflicts across jurisdictions in the crowded outer space environment, contrary to international law's goals of harmonization and cooperation. The tension arises from interpretations of the Outer Space Treaty, particularly Article II, which prohibits national appropriation of outer space. Some argue that private ownership rights are permissible under the Lotus principle, while others view such legislation as violating the treaty.

V. GOVERNANCE SOLUTIONS

To ensure equitable and safe access to space for all stakeholders, leaders recognize the necessity of establishing a comprehensive governance framework. This framework would involve international regulatory bodies, nations, and commercial entities, either through the creation of a dedicated forum or by leveraging existing international standards bodies with broad participation. The regulations put in place would aim to promote responsible space development, ensure safety, and equity, and foster productive activities and advancements.

Given the far-reaching implications of actions in space, there is a consensus among professionals on the critical importance of an effective governance framework. Efforts towards this end have already commenced, including initiatives by bodies like the United Nations Office for Outer Space Affairs Committee on the Peaceful Uses of Outer Space (COPUOS) and the Artemis Accords[6]. However, experts emphasize the need for a more concerted effort by a widely-recognized, multi-stakeholder international forum.

These efforts should prioritize addressing crucial areas such as:

- Encouraging responsible space activities
- Establishing mechanisms for dispute resolution
- Safeguarding against space debris and ensuring sustainable use of space resources

[5] Lucy-Ann McFadden, "Planetary Science." In Oxford Research Encyclopedia of Planetary Science, edited by David A. Rothery. Oxford University Press, 2021.
[6] National Aeronautics and Space Administration. "Artemis Accords." NASA.

- Promoting transparency and accountability in space operations

i. Regulating Conduct in Space

To ensure responsible behavior in space, a comprehensive space governance framework is essential. This framework would establish requirements for ethical conduct in daily space activities and foster compliance through enhanced information sharing and coordination among space actors. Key elements would include promoting a common understanding among states regarding responsible behavior concerning issues like space debris, anti-satellite (ASAT) tests, space traffic management, launch scheduling, and the prevention of space militarization.

Addressing the proliferation of space debris is a top priority due to its significant impact on space operations. Proposed solutions include implementing a "debris removal tax" for companies profiting from space activities, requiring satellite insurance to cover removal costs, updating regulations for de-orbiting spacecraft, and instituting norms like "one up, one down" policies[7]. Additionally, incentivizing debris removal and investing in active remediation technologies are crucial steps.

Restricting or banning certain ASAT tests is deemed necessary to mitigate debris creation and promote responsible behavior. Recently, the US announced the cessation of direct-ascent ASAT missile tests, urging other nations to follow suit. Collaborative efforts among nations are essential to overcome barriers to de-orbiting inactive satellites, as inactive debris poses a significant risk to space operation.

ii. Defining property ownership, access, and usage rights

In the quest for a democratized paradigm for space, achieving clarity regarding ownership of space properties and resources is paramount, according to our respondents. A shared understanding of who holds the right to access and utilize resources like Lagrange points, spectrum, and minerals would benefit all participants[8]. While existing structures such as ITU filings can be leveraged and updated for resources like Spectrum, establishing new international institutions or expanding existing ones may be necessary to clarify rights for other pressured resources.

Effective guardrails and centralized governance are deemed essential for managing ownership,

[7] From "Space Law" to "Space Governance": A Policy-Oriented Perspective on International Law and Outer Space Activities, 64 Harv. Int'l L.J. 385 (2023).
[8] Svetlichnyj, Igor, and Oleksandr Levchenko. "Legal Regulation of Space Activities: Prospects for the Development of International Space Law." Astrophysics and Space Law Journal 4 (2019): 49-63.

access, and usage of contentious resources. This ensures that no single party, company, or nation can monopolize access to these resources, thus promoting equity and preventing dominance in the space domain. By establishing clear ownership frameworks and robust governance mechanisms, the international community can foster a more inclusive and equitable space environment for all stakeholders.

VI. CONCLUSION

The rapid expansion of space commercialization has outpaced the existing international governance regime. While the foundational principles for space operation were established in United Nations treaties from the 1960s and 1970s, they were not designed to address contemporary challenges such as space debris, lunar property rights, and spectrum usage. Moreover, these treaties do not cover extended commercial activities in low Earth orbit (LEO) and beyond, nor do they specify norms for critical areas like Lagrange points. The proliferation of new technologies, applications, and behaviors has strained the current governance regime, with incidents of close encounters between satellites highlighting the need for stronger protocols for collision avoidance. For instance, a recent incident between OneWeb and SpaceX underscored the lack of clear rules governing such encounters[9].

Although the United Nations adopted guidelines for space debris mitigation in 2007 and for the sustainability of space activities in 2019, compliance remains voluntary. Similarly, frameworks issued by industry associations, recommendations from the International Telecommunication Union (ITU), and principles outlined in agreements like the Artemis Accords also rely on voluntary adherence. There is a pressing need to address the gap between space commercialization and governance to effectively tackle challenges such as debris management and spectrum allocation. Enhancing governance frameworks and ensuring broader compliance mechanisms are essential steps towards reconciling the growing commercialization of space with the need for responsible and sustainable space activities.

[9] Henderson, Rebecca, and Sophus A. Reinert. "The Commercial Space Age Is Here." Harvard Business Review (February 2021)