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# The Role of Private Entities in Outer Space Activities

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**ABSTRACT**

Private entities play a significant role in the space industry. Their increasing involvement in outer space activities marks a paradigm shift in space exploration and utilization. Private sector participation has injected unprecedented dynamism into space activities, accelerating technological innovation and reducing costs through competition. Companies like SpaceX and Blue Origin have revolutionized launch capabilities, while others focus on satellite deployment, space tourism, and even asteroid mining. This commercialization has opened new avenues for scientific research, global communication, and economic growth.

The privatisation of space activities raises significant concerns. Private entities, driven by profit, may prioritize commercial interests over scientific advancement or global benefit. There are also concerns about fair access to space resources and the potential for a new form of colonialism. The lack of comprehensive international regulations governing private space activities further complicates liability issues, space debris management, and planetary protection. Balancing the benefits of privatisation with the principles of fair access and peaceful use of outer space remains a critical challenge for the global community in the coming decades. This abstract critically analyses this trend's multifaceted implications, highlighting its transformative potential and inherent risks.

**KEYWORDS**: Private Entities, Outer Space, Privatization, International Law

## 1. Introduction

The space industry is experiencing substantial transformation, moving from a sector mainly governed by government initiatives to one increasingly shaped by private companies.[1]. During the mid-20th century, space exploration was primarily driven by state-funded programs as part of national ambitions. The "Space Race" between the United States and the Soviet Union in this era, where missions like Sputnik, Apollo, and Soyuz had geopolitical power, technological superiority, and scientific advancement[2]. These initiatives laid the foundation for humanity's initial foray into outer space, achieving historic milestones such as the first human landing on the Moon. However, such achievements were marked by substantial costs, bureaucratic inertia, and limited scope for collaborative or commercial ventures.

In recent decades, a paradigm shift has occurred with the advent of private sector involvement in space activities. Several factors, including the maturation of space technology, the rising costs of space missions,

[1] Roger Launius, *NASA: A History of the US Civil Space Program* (Krieger Publishing 2001).
[2] John Logsdon, *The Space Race: The Story of the Competitive Struggle Between the United States and the Soviet Union* (Smithsonian Institution Press 1998).

and growing recognition of the economic potential of outer space, have driven this shift.[3] Private entities such as SpaceX, Blue Origin, and Virgin Galactic have spearheaded this transformation, introducing innovations like reusable rocket systems, satellite constellations for global internet coverage, and even the nascent space tourism industry[4]. These companies have reduced costs and democratized access to space, enabling smaller nations, academic institutions, and private organizations to participate in space exploration and utilization.

The privatization of space has expanded its potential applications beyond traditional goals of scientific research and national security. Today, private companies are leading in areas such as satellite deployment for communication, Earth observation, and navigation; the development of space tourism experiences for civilians; and even the exploration of commercial opportunities like asteroid mining and lunar resource extraction. These advancements represent significant opportunities for economic growth, scientific discovery, and global communication. Moreover, the increased competition among private actors has accelerated innovation, leading to rapid technological advancements that were previously unattainable under government monopolies.

Despite these benefits, the growing involvement of private entities in outer space activities introduces a range of challenges. One key concern is the issue of equitable access to space resources. Outer space, as defined under the **Outer Space Treaty (OST) of 1967**, is considered the "province of all mankind," intended for the benefit of all nations. However, the commercial focus of private companies often prioritizes profit over collective benefit, leading to fears of monopolization of space resources and marginalization of less economically developed countries. Additionally, the management of resources such as lunar minerals and asteroid materials raises legal and ethical questions, particularly regarding ownership and fair distribution.

Environmental sustainability is another pressing issue. The proliferation of private space missions has led to an alarming increase in space debris, which poses significant risks to operational satellites and future missions. The absence of a comprehensive international framework to address debris mitigation further complicates this challenge. Liability for damages caused by space debris, as well as planetary protection against biological contamination during exploration missions, are areas of growing concern.

This paper explores these multifaceted issues by analysing the historical evolution of space exploration, the legal frameworks governing space activities, and the economic and ethical implications of commercialization. It seeks to provide a balanced perspective on the role of private entities, emphasizing the need for regulatory frameworks that ensure fair access, peaceful use, and sustainability in outer space activities. By doing so, this study aims to contribute to the broader discourse on how humanity can navigate this new era of space exploration responsibly and inclusively.

## 2. Historical Context: From Governments to Private Entities

### a. The Government-Led Era

The initial decades of space exploration, spanning the 1950s to the 1990s, were defined by state-led initiatives[5]. This period was dominated by the geopolitical tensions of the Cold War, which saw space as a critical arena for demonstrating national power and technological superiority[6]. The Soviet Union's

[3] Henry Hertzfeld, 'Economic Aspects of Space Commercialization' in Martin Payson (ed), *The New Space Industry* (Johns Hopkins University Press 2015).
[4] Steven Freeland, 'The Role of Private Actors in Space Exploration' (2019) 33 Space and Telecommunications Law 45.
[5] Walter McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Basic Books 1985).
[6] John Lewis Gaddis, *The Cold War: A New History* (Penguin Press 2005).

launch of *Sputnik 1* in 1957 marked the beginning of the Space Age and set the stage for a competitive era of exploration[7]. In response, the United States established NASA in 1958, leading to iconic achievements such as the Apollo program, which culminated in the historic Moon landing in 1969[8].

During this era, space activities were characterized by their focus on national security, scientific exploration, and symbolic achievements. Governments invested heavily in space technologies, with missions like the Soviet *Vostok* and *Luna* programs and the U.S. *Voyager* and *Hubble Space Telescope* projects expanding humanity's understanding of space[9]. However, the immense costs associated with these missions, coupled with the challenges of sustaining political will, limited their long-term feasibility. State agencies operated within the constraints of public funding and bureaucratic oversight, often resulting in slow innovation and high dependency on national budgets[10].

**b. The Rise of Private Entities**

By the late 20th century, a gradual shift toward private sector involvement in space activities began to emerge. Initially, private companies served as contractors, manufacturing equipment and providing services for government agencies. Legislative advancements, such as the U.S. Commercial Space Launch Act of 1984, played a pivotal role in this transition[11]. The Act allowed private firms to offer commercial launch services, marking the first step toward the privatization of space.

The 21st century witnessed the rise of private entities taking on independent roles in space exploration[12]. Companies like SpaceX, Blue Origin, and Rocket Lab moved beyond government contracts to develop their own technologies, including reusable rockets and satellite networks[13]. These advancements revolutionized the industry by reducing costs and enabling more frequent launches. Simultaneously, private ambitions expanded to include commercial space tourism, asteroid mining, and lunar resource extraction, signalling a transformative era for the space sector.

This shift from government dominance to private-sector leadership marked a turning point, unlocking new opportunities while familiarizing complex challenges in regulation and resource management.

## 3. Key Legal Frameworks

The regulation of space exploration and utilisation occurs through international treaties and national laws. These frameworks aim to ensure the peaceful use of outer space, equitable access, and the responsibility of nations for activities conducted under their jurisdiction[14]. However, the increasing involvement of private entities has highlighted gaps and ambiguities in these regulations, necessitating re-evaluation to address contemporary challenges.

**a. The Outer Space Treaty (1967)**

The Outer Space Treaty (OST) is the foundational document of international space law, ratified by over 110 nations. It establishes key principles, including using space for the benefit of all humanity, the prohibition of national claims of sovereignty, and the peaceful exploration and use of outer space. It also

[7] Asif Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945-1974* (NASA History Division 2000).
[8] Roger Launius, *Apollo's Legacy: Perspectives on the Moon Landings* (Smithsonian Books 2019).
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[11] Steven Freeland, 'Interpreting the Outer Space Treaty of 1967' (2017) 41 Journal of Space Law 215
[12] Martin Collins, *Transforming Space: Twenty-First Century Commercial Space Exploration* (Routledge 2018).
[13] Marcia Smith, 'Private Space Companies: A New Era of Space Exploration' (2020) 55 Space Policy 102.
[14] Ram Jakhu, *Governing the Geostationary-Satellite Orbit* (McGill-Queen's University Press 2002).

holds states responsible for all activities conducted in space, whether by government or private entities, and requires state oversight of private operations.

While the OST remains a cornerstone of space governance, its provisions reflect the state-centric context of the 1960s and lack specificity regarding modern developments. For instance, the treaty does not explicitly address private ownership of space resources, creating uncertainty around the legal status of commercial ventures in resource extraction. Similarly, the OST's liability framework, which holds states accountable for damage caused by objects launched from their territory, raises questions about the extent of responsibility for space debris generated by private entities.

**b. Other Treaties and National Legislation**

Subsequent treaties sought to expand on the OST, but their adoption has been limited. The Moon Agreement (1979), for example, attempted to establish a regime for the exploitation of celestial resources, emphasizing their use as the "common heritage of mankind." However, it failed to gain widespread ratification, with major spacefaring nations, including the U.S., Russia, and China, abstaining. Its principles remain largely theoretical and unenforced.

National laws have increasingly filled the regulatory void, often reflecting the interests of spacefaring nations. The U.S. Commercial Space Launch Competitiveness Act (2015), also known as the SPACE Act, grants private companies the right to own resources extracted from celestial bodies. Luxembourg's Space Resources Act (2017) similarly promotes private resource utilization, providing a legal framework for companies to exploit space resources.

These national legislations have sparked debate over their compatibility with international principles, particularly the OST's mandate for space to remain the province of all mankind. Critics argue that unilateral laws risk undermining the cooperative spirit of international treaties and may lead to resource monopolisation. These challenges underscore the need for updated, globally inclusive legal frameworks to address the complexities of private sector participation in outer space.

## 4. Economic Impacts of Privatization

Privatising space activities has fundamentally reshaped the economic landscape of the space industry. With private entities at the forefront, costs have decreased, innovations have accelerated, and new markets have emerged. These developments promise to democratise access to space and unlock vast economic potential, but they also bring challenges in ensuring equitable and sustainable growth.

**a. Cost Reductions and Technological Advancements**

One of the most transformative contributions of private companies to space exploration has been the significant reduction in costs. Historically, space missions were prohibitively expensive, with governments investing billions in single-use rockets and spacecraft[15]. Private firms, however, have disrupted this model by prioritizing cost-efficiency and innovation[16].

SpaceX, a pioneer in this domain, introduced reusable rocket technology with its Falcon 9 and Falcon Heavy systems, drastically reducing the cost per launch[17]. While traditional government-led launches cost upwards of $150 million, SpaceX has achieved similar capabilities for a fraction of that cost, with some

[15] John Logsdon, *Exploring the Unknown: Selected Documents in the History of the US Civil Space Program* (NASA History Division 1996).
[16] Tim Fernholz, *Rocket Billionaires: Elon Musk, Jeff Bezos, and the New Space Race* (Houghton Mifflin Harcourt 2018).
[17] Elon Musk, 'Reusability: The Key to Making Human Life Multi-Planetary' (2017) 33 New Space 112.

launches priced below $60 million[18]. This reduction has opened space access to smaller countries, academic institutions, and private organizations, fostering a more inclusive global space economy.

Additionally, private entities have accelerated technological advancements. Innovations in propulsion, materials science, and miniaturization have improved the efficiency and reliability of space systems. Smaller, cost-effective satellites like CubeSats have become prevalent, enabling new players to enter the space industry[19]. These advancements have also extended the lifespan of satellites and improved their capabilities, offering more value for investment[20].

Cost reductions and technological advancements have not only democratized space access but have also fostered a competitive environment that drives continuous innovation. Governments now collaborate with private companies to leverage their efficiency, as seen in programs like NASA's Commercial Crew Program, which contracts SpaceX and Boeing to transport astronauts to the International Space Station (ISS)[21].

**b. Expanding Applications**

The privatization of space has expanded its applications beyond traditional exploration and satellite deployment, creating new industries and economic opportunities.

- **Global Communications**: Satellite constellations like SpaceX's Starlink and Amazon's Project Kuiper aim to provide high-speed internet connectivity to underserved and remote regions[22]. These initiatives have the potential to bridge the global digital divide, enabling economic and educational growth in developing areas[23].
- **Space Tourism**: Companies such as Blue Origin and Virgin Galactic have pioneered commercial spaceflights, offering suborbital trips to private individuals[24]. Although currently accessible only to affluent customers, the growth of space tourism could eventually make it more affordable and contribute to the broader economy[25].
- **Resource Extraction**: Private firms are exploring the potential for asteroid mining and lunar resource extraction. Resources like rare earth metals, water ice, and helium-3 could revolutionize industries on Earth and support the creation of a sustainable space economy[26]. For instance, water ice can be used for life support and as a component of rocket fuel, enabling deep-space exploration[27].

## 5. Challenges and Risks

The growing involvement of private entities in space activities has brought numerous benefits, but it also raises significant challenges and risks. Issues of monopolization, environmental sustainability, and legal accountability are increasingly critical as the commercialization of space accelerates. Addressing these concerns is essential to ensure that space remains a shared and sustainable domain for all humanity.

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**a. Monopolization and Fair Access**

The rapid rise of private companies in the space industry, particularly dominant players like SpaceX, Blue Origin, and Amazon, has sparked concerns about monopolization[28]. These firms control significant portions of the infrastructure critical to space activities, such as launch systems, satellite constellations, and communication networks. Their dominance may restrict access to space resources and opportunities for smaller nations and organizations, reinforcing global inequalities[29].

For instance, the proliferation of satellite mega constellations, such as SpaceX's Starlink and Amazon's Project Kuiper, raises questions about equitable access to orbital slots and radio frequencies, which are limited resources[30]. Wealthier countries and corporations often secure these resources first, leaving less-developed nations at a disadvantage. This unequal distribution risks perpetuating a form of space colonialism, where access to the benefits of space is reserved for a privileged few[31].

Ensuring fair access to space resources requires robust international collaboration and regulatory mechanisms. Institutions like the International Telecommunication Union (ITU), responsible for allocating orbital slots and frequencies, must adapt to the changing landscape of private sector involvement to maintain equity[32].

**b. Environmental Concerns**

The increasing number of satellites and missions poses a growing threat to the sustainability of space activities[33]. Space debris, resulting from defunct satellites, spent rocket stages, and collisions, is a critical issue. With thousands of satellites launched annually, including mega-constellations, low Earth orbit (LEO) is becoming overcrowded, heightening the risk of collisions and cascading debris events, known as the Kessler Syndrome[34].

The lack of enforceable international regulations exacerbates the problem. While some companies, like SpaceX, have incorporated deorbiting mechanisms into their satellites, many others do not adhere to similar practices. Moreover, existing debris mitigation guidelines, such as those from the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), are non-binding and insufficiently enforced[35].

Addressing environmental concerns requires stricter regulatory frameworks, incentivizing debris removal technologies, and fostering international cooperation to ensure sustainable practices in orbit.

**c. Liability and Accountability**

Under the Outer Space Treaty (OST), states are internationally liable for activities conducted by private entities under their jurisdiction[36]. However, this framework has limitations in addressing contemporary challenges. For example, in cases of transboundary harm, such as collisions involving space debris, the lack of detailed enforcement mechanisms makes accountability ambiguous.

The Liability Convention (1972) supplements the OST by outlining compensation for damage caused by space objects[37]. However, it has been invoked only once, highlighting its limited applicability in resolving

[28] Marcia Smith, 'Market Concentration in Commercial Space Activities' (2020) 56 Space Policy 112.
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[36] Tanja Masson-Zwaan, 'State Liability in International Space Law' (2016) 41 Air and Space Law 345.
[37] Nicolas Mateesco Matte, *Aerospace Law* (Brill 2001).

disputes involving private entities. As the number of private actors increases, the complexity of liability issues grows, requiring updates to international legal frameworks.

Strengthening accountability mechanisms may involve creating arbitration bodies or strengthening the role of the United Nations Office for Outer Space Affairs (UNOOSA) in resolving disputes[38]. Such measures are crucial to addressing the risks posed by privatization while maintaining a secure and equitable space environment.

## 6. Comparative Analysis of National Legislation

The rise of private entities in space activities has led to diverse national legislative approaches, reflecting varying priorities and interpretations of international space law. This section examines the legislative frameworks of the United States, Luxembourg, and Japan, focusing on their impact on the global regulatory landscape.

### a. United States

The United States has been a pioneer in creating a favourable legal environment for private space activities. The U.S. Commercial Space Launch Competitiveness Act (SPACE Act) of 2015 explicitly permits private companies to extract and own resources from celestial bodies, such as asteroids and the Moon[39]. By allowing commercial ownership, the legislation aims to encourage investment in space resource extraction and establish the U.S. as a leader in the emerging space economy[40].

However, the SPACE Act has drawn criticism for potentially conflicting with international law, particularly the Outer Space Treaty (OST) of 1967[41]. While the OST prohibits claims of sovereignty over celestial bodies, it is silent on resource ownership, creating a legal grey area. Critics argue that the SPACE Act undermines the treaty's principle of space as the "province of all mankind," where benefits should be shared equitably[42]. Proponents, however, contend that the legislation aligns with the OST by regulating private activities under U.S. jurisdiction, as required by the treaty[43].

### b. Luxembourg and Japan

Luxembourg has emerged as a hub for space mining enterprises through its Space Resources Act of 2017[44]. This legislation permits companies to own and trade resources extracted from space, similar to the U.S. SPACE Act. By offering financial incentives and a clear legal framework, Luxembourg has attracted several space startups, positioning itself as a leader in the space resource industry[45].

Japan followed suit with its 2021 Space Resources Act, enabling private companies to engage in space mining and own extracted materials[46]. Japan's approach aligns with its broader strategy to promote high-tech industries and international collaboration in space exploration.

### c. Key Trends and Implications

These legislative developments highlight a shift toward national policies that prioritise economic competitiveness over global consensus. While such frameworks foster innovation and private investment,

[38] Steven Freeland, 'Dispute Resolution in International Space Law' (2018) 43 Air and Space Law 167.
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[40] Henry Hertzfeld, 'Cost Dynamics in Commercial Space Activities' (2020) 55 Space Policy 89.
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[44] Gregory Boop, 'Satellite Constellations and Spectrum Allocation' (2020) 46 Telecommunications Law Review 89.
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[46] Tim Fernholz, *Rocket Billionaires: Elon Musk, Jeff Bezos, and the New Space Race* (Houghton Mifflin Harcourt 2018).

they raise concerns about the fragmentation of international space law[47]. The absence of a cohesive global strategy for managing space resources jeopardises the resolution of legal conflicts and worsens inequality in access to space. Collaborative international efforts are needed to reconcile national interests with the principles of equitable access and peaceful use[48].

## 7. Ethical Considerations

The increasing involvement of private entities in outer space activities brings ethical concerns to the forefront, particularly regarding the equitable and sustainable use of space resources. As commercialisation accelerates, these issues require careful attention to ensure that the benefits of space exploration are shared globally and do not exacerbate existing inequalities[49].

### a. Resource Exploitation

Privatising space activities has introduced the potential for a "space race" for valuable resources, such as minerals on asteroids or water on the Moon[50]. This competition, driven by profit motives, risks perpetuating a new form of colonialism where dominant spacefaring nations or corporations monopolize space resources to the detriment of the global community.

While private companies argue that resource extraction can fuel technological advancement and economic growth, critics highlight the ethical obligation to ensure that space remains a domain for the collective benefit of humanity[51]. The Outer Space Treaty (OST) of 1967 emphasizes the principle that space is the "province of all mankind," yet there is no clear framework for distributing the benefits of resource exploitation equitably[52].

International agreements must address this gap by establishing mechanisms to regulate resource extraction, share benefits fairly, and prevent the domination of space by a few powerful actors. Without such measures, the unchecked commercialization of space resources could deepen global disparities.

### b. Equity in Access

Space activities remain largely dominated by developed nations and private corporations while developing nations face significant financial, technological, and infrastructural barriers. This inequity raises ethical concerns about marginalized countries being excluded from the opportunities and benefits of space exploration[53].

Collaborative initiatives such as knowledge-sharing programs, capacity-building partnerships, and inclusive international policies are essential to address this disparity. Platforms like the United Nations Office for Outer Space Affairs (UNOOSA) play a crucial role in ensuring that all nations, regardless of economic or technological status, have fair access to the opportunities offered by space exploration[54].

## 8. Recommendations

The growing involvement of private entities in space activities necessitates robust regulatory and policy responses to ensure that these developments align with international principles of equity, sustainability,

[47] Steven Freeland, 'Dispute Resolution in International Space Law' (2018) 43 Air and Space Law 167.
[48] Steven Freeland, 'The Role of Private Actors in Space Exploration' (2019) 33 Space and Telecommunications Law 45.
[49] Peter Diamandis, 'Democratizing Access to Space' (2018) 33 New Space 45.
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[53] Nicolas Mateesco Matte, *International Space Law* (Brill 2005).
[54] United Nations Office for Outer Space Affairs, *Debris Mitigation Guidelines* (UN Publication 2010).

and peaceful use. Below are key recommendations to address the challenges posed by privatization in outer space.

**a. Develop Comprehensive International Regulations**

The current framework, primarily based on the Outer Space Treaty (OST), lacks provisions to address the complexities of private sector involvement. Modernizing the OST and related treaties is essential to account for issues such as resource exploitation, space debris, and liability for private activities.

New international regulations should:

- Define clear guidelines for owning and utilising space resources, ensuring equitable benefit-sharing.
- Establish a standardized system for managing space debris, with accountability measures for private entities.
- Reinforce the principle of peaceful use while addressing private actors' potential militarization of space.

**b. Promote Public-Private Partnerships**

Governments and private companies must collaborate to balance commercial innovation with societal benefits. Public-private partnerships can:

- Foster joint research and development in sustainable space technology and debris mitigation.
- Ensure that private sector advancements align with national and international priorities, such as scientific exploration and environmental preservation.
- Provide funding for projects that prioritize public interest, such as global communication networks for underserved regions.

**c. Establish an International Space Governance Body**

An independent, multilateral institution should be created to oversee private space activities and enforce compliance with international law. This body could:

- Monitor resource extraction and utilization to prevent monopolization.
- Mediate disputes among nations and private entities.
- Develop and enforce ethical standards for private operations, including environmental stewardship and equitable practices.

**d. Ensure Equitable Access**

To avoid marginalising developing countries, we must create systems that encourage inclusive involvement in space endeavours. These could include:

- Funding programs to support space initiatives in low-income countries.
- Technology-sharing agreements to bridge the gap between advanced and emerging spacefaring nations.
- Capacity-building initiatives to train personnel from underrepresented regions.

By implementing these measures, the international community can ensure that the privatization of space aligns with the broader goals of equity, sustainability, and shared benefit.

## 9. Conclusion

The involvement of private entities has significantly transformed the space industry, bringing innovation, reducing costs, and expanding the horizons of space exploration. Companies like SpaceX, Blue Origin, and others have demonstrated the commercial viability of space activities, unlocking opportunities in global communication, space tourism, and resource extraction. These advancements have spurred economic growth and made space technologies more accessible to smaller nations and organisations.

However, the rapid commercialization of space raises critical concerns. The risk of monopolization, inequitable access to resources, and environmental degradation due to space debris threaten the sustainability of space activities. The absence of comprehensive international regulations tailored to private sector activities exacerbates these challenges, leaving gaps in accountability and governance. Moreover, the ethical implications of privatizing space—a domain historically regarded as the "province of all mankind"—cannot be ignored. Without proper safeguards, there is a danger of replicating colonial patterns, where powerful actors dominate resources and marginalize others.

To address these issues, policymakers and international institutions must take proactive measures. Updating the Outer Space Treaty (OST) and other agreements to reflect contemporary realities is essential. Establishing an international governance body to oversee private activities, developing mechanisms for equitable resource sharing, and ensuring environmental sustainability are crucial steps. Additionally, encouraging public-private partnerships can synchronise commercial innovation with the public good, achieving a balance between economic development and ethical accountability.

In conclusion, while private entities have revolutionized the space sector, their activities must be guided by robust international frameworks to prevent inequalities, environmental harm, and geopolitical tensions. By embracing principles of equity, sustainability, and peaceful use, the global community can ensure that space remains a shared heritage, accessible and beneficial to all of humanity, now and in the future.

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