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**Framing The Responsibility of Public-Private Partnerships (PPPs) on
Space Technology in International Law**

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Abstract

Public-Private Partnerships (PPPs) have gained popularity as a way to use resources and expertise from the private sector to support governmental space activities. In the event of a space-related incident, the division of duties and liabilities between public and private partners may be complicated. Clarifying the division of duties and liabilities between public and private actors is necessary, given the rising participation of private companies in space activities. With the growing involvement of private entities in space activities, there is a need to clarify the allocation of responsibilities and liabilities between public and private actors. Who is held responsible when a private company causes a technological disaster strike? On what basis can the responsibility be made, understood from international law? The research is normative legal research, where the data is collected through a statutory and case approach. The study results show that Public-private partnerships (PPPs) in outer space activities raise complex questions regarding responsibility. Responsibility refers to the Liability Convention on the Outer Space Treaty. The treaty emphasizes that states bear international responsibility for their national activities in outer space, including those conducted by private entities under their jurisdiction. However, the treaty does not explicitly address the specific responsibilities of private actors. Private companies only bear indirect international responsibility. PPPs need to consider the notion of shared responsibility, which acknowledges the contributions of both public and private actors and emphasizes cooperation and transparency.

Keywords: International Law, Public-Private Partnership, Responsibility, Space Technology.

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A. INTRODUCTION

Scientific and technological advances are driving rapid global change. The waves of technological change have driven economic development and social transformation. We are now in the fourth industrial revolution.³ New technologies, for example, the internet, and the potential application of these technologies are rapidly expanding. Some aspects of the development of technology, such as nuclear weapons, fishing activities, biotechnology, stem cells, genetically modified organisms, artificial super intelligence, and the latest in space tourism, are closely linked with social and political concerns.

The exploration and development of outer space have traditionally been the domain of nation-states and intergovernmental organizations.⁴ However, in recent years, private entities have become increasingly involved in space activities, creating a new landscape for the governance of space technology.⁵ In its essence, technology facilitates human beings to meet their needs. The more advanced technology arrives, the more comfortable and adventurous a person's life becomes. One of them is exploration of outer space. Commercialization and privatization of outer space have taken place intensively in the last two decades.⁶ On May 24, 2012 SpaceX's Dragon capsule was launched and, in doing so, became the first commercially built vehicle to berth with and carry cargo to the International Space Station (ISS).⁷ It successfully completed its mission and returned to the Pacific Ocean on May 31, 2012.⁸ In 2021, the VSS Unity

Galactic spacecraft fulfilled Richard Branson's dream of embarking on space travel.⁹ The New Shepard vehicle developed by Blue Origin successfully launched Bezos into space, and so he enjoyed his space tourism.¹⁰ The global space tourism market size was valued at USD 695.1 million in 2022. It is expected to expand at a compound annual growth rate (CAGR) Of 40.2 % from 2023 to 2030.¹¹ The phenomenon has placed non-governmental entities as the main actors in the exploration of outer space.¹² The Outer Space law does not explicitly mention the term "commercialization," but it does not mean that the exploration of outer space is not allowed for commercial purposes.¹³ Rising advancements in technology, the growing inclination of adventure travelers, and increased focus on research and development activities by government and private research organizations are some of the factors fueling the growth of the market.¹⁴

Public-private partnerships (PPPs) have emerged as a key model for collaboration between public and private entities in the space sector.¹⁵ SpaceX, as one of the companies in the U.S., is revolutionizing human operations in outer space by developing groundbreaking new space technologies and by crafting ambitious plans for the future of human activity in space.

³ Denise Rotatori, Eun Jeong Lee, and Sheryl Sleeva, "The Evolution of the Workforce during the Fourth Industrial Revolution," *Human Resource Development International*, Vol. 24, No. 1 (2021), at 92–103.

⁴ Clelia Iacomino, "Introduction," in *SpringerBriefs in Applied Sciences and Technology*, 2019.

⁵ Peter Martinez, "Development of an International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities," *Space Policy*, 2018.

⁶ Pawel Frankowski, "Outer Space and Private Companies," *Politeja Journal*, Vol. 5, No. 50 (2017), at 135.

⁷ Elizabeth Howell, "SpaceX's Dragon: First Private Spacecraft to Reach the Space Station," 2020.

⁸ *Ibid.*

⁹ Michael Sheetz, "Richard Branson Reaches Space on Virgin Galactic Flight", 2021, <https://www.cnn.com/2021/07/11/richard-branson-reaches-space-on-virgin-galactic-flight.html>, accessed 3 May 2023.

¹⁰ Paul Ricon, "Jeff Bezos Launches to Space aboard New Shepard Rocket Ship", 2021, <https://www.bbc.com/news/science-environment-57849364>, accessed 3 May 2023.

¹¹ See Research and Market, "Tourism Market Size, Share & Trends Analysis Report by Type (Orbital, Sub-orbital), By End Use (Government, Commercial), By Region, And Segment Forecasts, 2023 – 2030", <https://www.researchandmarkets.com/reports/5644945/global-space-tourism-market-size-share-and-trends>, accessed 1 May 2023.

¹² Neni Ruheni, "Direct International Responsibility of Non-Governmental Entities in the Utilization of Outer Space", *Padjajaran Jurnal Ilmu Hukum*, Vol. 7, No. 1 (2020), at 103.

¹³ *Ibid.*

¹⁴ Research and Markets, *supra* note 11.

¹⁵ Karen L. Jones, "Public-Private Partnership: Stimulating Innovation in the Space Sector", *The Aerospace Corporation*, (2018) at 3-4.

SpaceX has launched numerous cargo payloads and astronauts to the International Space Station for the National Aeronautics and Space Administration (NASA).¹⁶ SpaceX launched three rich businessmen and their astronauts to the International Space Station in April 2022. It was SpaceX's first private charter flight to the orbiting lab after two years of carrying astronauts there for NASA.¹⁷ The three businessmen were an American, Canadian, and Israeli who ran investment, real estate, and other companies. They're paying \$55 million apiece for the rocket ride and accommodations, and all meals included.¹⁸ The number of space tourism activities will continue to grow and skyrocket in the coming years. The growth of space tourism done by spacefaring companies in the following years will likely create legal problems in the case of damage.

While PPPs offer numerous benefits, such as innovation, efficiency, and cost-effectiveness, they also raise complex questions regarding responsibility and liability. Technological or man-made hazards can happen in space activities. These are examples of space technological accidents: the Apollo 12 accident in 1969, the Challenger accident in 1986, the Mir-18 accident in 1995, the Space Shuttle Columbia incident in 2003, the ISS Expedition 36 accident in 2013, the Virgin Galactic accident in 2014, and the SpaceX explosion in 2016.¹⁹

The responsibility of PPPs in space activities is an issue that has received considerable attention in recent years, both from policymakers and legal scholars.²⁰ The

allocation of responsibilities and liabilities between public and private entities is a crucial aspect of ensuring the responsible and sustainable use of space technology.²¹ This is particularly important as the number of private entities engaged in space activities continues to grow, raising questions about the extent of their legal obligations and responsibilities. The bigger question emerges as now the trend of using space technology becomes more commercial and it is run by private companies. Who is held responsible when a technological disaster strikes? Could private companies have direct international responsibility under International Law?

International space law provides the framework for addressing the legal aspects of PPPs' responsibilities in space activities. The Outer Space Treaty, which forms the cornerstone of international space law, sets out the fundamental principles governing the exploration and use of outer space.²² While the treaty places primary responsibility on states for their national activities in outer space, it does not explicitly address the specific responsibilities of private entities.

The systematics of this article is as follows: First, this article will explain PPPs on space technology in international law, including the role of PPPs in space technology and international regulations on the utilization of technology in outer space activities. Second, the approaches to framing responsibility in PPPs on space technology in international law, such as the use of the shared responsibility models, will be explained, including the explanation of the extension of the state responsibility and the shared responsibility model. Third, this section will give a conclusion that PPPs' responsibilities must be clearly defined.

¹⁶ See Reuters, "SpaceX to Raise \$750 Million At \$137 Billion Valuation – CNBC", <https://www.reuters.com/markets/deals/spacex-raise-750-million-137-billion-valuation-cnbc-2023-01-03/>, accessed 1 May 2023.

¹⁷ See The Associated Press, "3 visitors heading to the space station are paying \$55M each, all meals included", 2022, <https://www.npr.org/2022/04/08/1091661900/spacex-space-station-launch-axiom>, accessed 1 May 2023.

¹⁸ *Ibid.*

¹⁹ JSC SMA Flight Safety Office, "Significant Incidents & Close Calls in Human", <https://sma.nasa.gov/SignificantIncidents/>, accessed 1 April 2023.

²⁰ Masafumi Hashimoto, "The Responsibility of PPPs In Space Activities is an Issue that Has Received

Considerable Attention In Recent Years, Both From Policymakers and Legal Scholars", 2009, at 10.

²¹ M. Palmroth, et.al, "Toward Sustainable Use of Space: Economic, Technological, and Legal Perspectives", *Space Policy Journal*, Vol. 57, (2021) at 11-14.

²² Fengna Xu, Jinyuan Su, Miqdad Mehdi, "A Re-Examination of Fundamental Principles of International Space Law at the Dawn of Space Mining", *Journal Space Law*, Vol. 44, No. 1 (2020), at 1.

B. PUBLIC-PRIVATE PARTNERSHIPS ON SPACE TECHNOLOGY IN INTERNATIONAL LAW

1. Role of Public-Private Partnership in Space Technology

Space exploration and technology have traditionally been the domain of governments and state-funded agencies.²³ However, in recent years, there has been a significant shift towards the involvement of private entities in space activities. This shift has given rise to the emergence of public-private partnerships (PPPs) in the field of space technology. PPPs are collaborative arrangements between governments and private entities aimed at achieving a common goal through the sharing of resources, risks, and responsibilities.²⁴ These partnerships, which bring together the expertise, resources, and capabilities of both public and private sectors, play a crucial role in shaping the future of space exploration and utilization.²⁵ PPPs have been increasingly used in commercial outer space activities to leverage public and private resources, reduce costs, and promote innovation.²⁶

PPPs in commercial outer space activities involve a wide range of activities, such as the development of new launch systems, satellite technology, and space tourism.²⁷ For example, NASA has established partnerships with private companies, such as SpaceX and Boeing, to develop and launch spacecraft to the International Space Station.²⁸ PPPs in commercial outer space activities can take various forms, such as contracts, grants, joint ventures, and equity investments.²⁹ Governments can gain from private sector

innovation and investment, while private enterprises can access government funds, resources, and knowledge through these collaborations. PPPs are used in space activities for a number of reasons:

1. Cost sharing: Space infrastructure and technology development need significant investments that may be outside the scope of any one actor. Governments can share the costs and hazards of space activities by working with private enterprises, which can make space exploration and use more inexpensive and sustainable.³⁰
2. Innovation: Private companies frequently have access to state-of-the-art resources, knowledge, and creativity that can hasten the advancement of space technologies and applications. Governments can benefit from this knowledge and introduce fresh perspectives and methods to space activities by collaborating with commercial firms. Often, they have access to cutting-edge technology, expertise, and innovation that can accelerate the development of space technologies and applications.³¹
3. Efficiency: Due to their commercial orientation, private companies might be able to operate more effectively and adaptably than governmental organizations. Governments can profit from this efficiency and lessen administrative barriers to space operations by collaborating with commercial firms.³²
4. Access to capital: Compared to government organizations, private companies may have easier access to capital markets and funding sources.

²³ Clelia Iacomino, *supra* note 4.

²⁴ Md. Abu Rashed, "Considerable Issues for Sustainable Public-Private Partnership (PPP) Project", 2011.

²⁵ Karen L. Jones, *supra* note 15.

²⁶ *Ibid.*

²⁷ European Space Policy Institute, "The Rise of Private Actors in the Space Sector", Executive Summary, 2017: 1, <https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-report-The-rise-of-private-actors-Executive-Summary-1.pdf>, accessed 1 April 2023.

²⁸ Christian Davenport, "NASA Looks to Private Sector for Successor to the International Space Station", 2022, <https://www.wilsoncenter.org/article/nasa-looks-private-sector-successor-international-space-station>, accessed 1 April 2023.

²⁹ Karen L. Jones, *supra* note 15.

³⁰ The World Bank, "Government Objectives: Benefits and Risks of PPPs", 2020, <https://ppp.worldbank.org/public-private-partnership/overview/ppp-objectives>, accessed 5 April 2023.

³¹ ISS National Laboratory, "Public-Private Partnerships in Space", <https://www.issnationallab.org/research-on-the-iss/public-private-partnerships-in-space/>, accessed 5 April 2023.

³² *Ibid.*

Governments can access this funding and more efficiently finance space programs by collaborating with commercial firms.³³

5. Shared benefits: Governments can more equitably distribute the economic, scientific, and social benefits of space operations by collaborating with private companies. Government assistance, such as providing private businesses with access to government data, infrastructure, and regulatory frameworks, may also be advantageous.³⁴

In general, the use of public-private partnerships in space activities provides a mechanism to combine the advantages and assets of the public and private sectors and to advance ethical and sustainable space exploration and usage. However, PPPs in commercial outer space activities also pose challenges and risks, such as the allocation of risks and liabilities, intellectual property rights, and regulatory compliance. For example, there may be disagreements between the government and private companies over the ownership and control of space assets or over the extent of liability in case of accidents or damage caused by space activities. To address these challenges, governments and private companies can establish clear legal frameworks and agreements that define the roles, responsibilities, and obligations of each party, as well as the conditions for the transfer of technology and intellectual property rights. Governments can also establish regulatory frameworks that promote safety, sustainability, and international cooperation in commercial outer space activities.

Based on that explanation, we know that the private sector's growing involvement in space technology has brought about significant changes in the space industry. The commercialization of space, technological advancements, cost reductions,

entrepreneurial spirit, and public-private partnerships have collectively paved the way for private entities to contribute to space exploration, satellite development, and other space-related activities. The increasing collaboration between the private and public sectors holds the promise of unlocking new frontiers in space and driving innovation for the benefit of humanity.

2. International Regulations on Utilization of Technology in Outer Space Activities

a. The Outer Space Treaty

International regulations on the utilization of technology in outer space activities refer to the various agreements, treaties, and guidelines that govern the peaceful exploration and use of outer space. The primary aim of these regulations is to ensure that space activities are conducted in a safe, responsible, and sustainable manner and that all nations have equal access to the benefits of space technology.

The Outer Space Treaty, formally known as 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 an international treaty that serves as the cornerstone of space law.³⁵ It was adopted by the United Nations General Assembly on January 27, 1967, and entered into force on October 10, 1967.³⁶ The Outer Space Treaty has been ratified by over 110 countries, making it one of the most widely accepted treaties in the field of international law.³⁷

The key principles of the Outer Space Treaty are aimed at ensuring the peaceful and cooperative use of outer space while

³³ Center for Space Policy and Strategy, "Public-Private Partnership in Space", 2018 <https://csp.s.aerospace.org/papers/public-private-partnerships-space>, accessed 30 April 2023.

³⁴ *Ibid.*

³⁵ The United Nations Office for Outer Space Affairs, "The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>, accessed 30 April 2023.

³⁶ *Ibid.*

³⁷ Arms Control Association, "The Outer Space Treaty at a Glance", <https://www.armscontrol.org/factsheets/outerspace>, accessed 30 April 2023.

preventing its weaponization and territorial appropriation. Some of the important provisions of the treaty include³⁸:

- a. Exploration and Use of Outer Space: Article I of the Outer Space Treaty recognizes the freedom of all states to explore and use outer space for peaceful purposes. It promotes international cooperation and the exchange of scientific information and personnel among states.
- b. Prohibition of National Appropriation: Article II, the Outer Space Treaty Outer space, states that outer space, including the Moon and other celestial bodies, is declared as the "province of all mankind." No state can claim sovereignty over any part of outer space, and it is prohibited to establish territorial claims or exclusive rights of ownership.
- c. Non-Weaponization of Outer Space: Article IV states that The treaty prohibits the placement of nuclear weapons or any other weapons of mass destruction in outer space. It also prohibits the use of military bases, installations, and fortifications on celestial bodies.
- d. Peaceful Purposes and International Law: Outer space activities must be conducted for peaceful purposes in accordance with international law. States bear international responsibility for their national activities in space, whether carried out by governmental or non-governmental entities.
- e. Responsibility and Liability: The treaty holds governments accountable for their personnel's behavior and their space activities, according to Articles

VI and VII. States are responsible for any harm their spacecraft may do and are required to pay damages as a result of their actions.

- f. International Cooperation: The importance of international cooperation in the exploration and utilization of space is emphasized by the treaty, according to Article IX. States are urged to share their scientific findings and work together to advance space technology for everyone's benefit.

The Outer Space Treaty served as the basis for future international conventions and agreements pertaining to space law, including the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space. It continues to serve as the primary legal framework for space activities, promoting peaceful cooperation, preventing conflicts, and ensuring the responsible and sustainable exploration and use of outer space for the benefit of humanity.

b. Other Relevant International Agreements on Space Activities

In addition to the Outer Space Treaty, there are several other relevant international agreements and conventions that govern space activities. These agreements address specific aspects of space law and provide additional guidelines and regulations for the exploration and use of outer space. Some of the notable international agreements on space activities include:

- a. Rescue Agreement:

The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, adopted in 1968, establishes the obligation of states to promptly assist and rescue astronauts in distress, as well as facilitate the

³⁸ See The United Nations Office for Outer Space Affairs, "The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>, accessed 30 April 2023.

return of astronauts and space objects to their country of origin.³⁹

b. Liability Convention:

The Convention on International Liability for Damage Caused by Space Objects, adopted in 1972, addresses the issue of liability for damage caused by space objects. It establishes the liability of launching states for damages caused on Earth or to other space objects and sets out the principles and procedures for compensation.⁴⁰

c. Registration Convention:

According to the Convention on Registration of Objects Launched into Outer Space, adopted in 1975, governments are required to register their spacecraft with the UN. Registration increases transparency and makes it easier to determine who is responsible for space operations by providing details about the ownership, trajectory, and characteristics of space objects.⁴¹

d. Moon Agreement:

In 1979, The Agreement on the Activities of States on the Moon and Other Celestial Bodies created a framework for using and defending the Moon and other celestial bodies. It highlights the shared legacy of humanity, forbids resource extraction without a global agreement, and encourages collaboration in scientific research and the nonviolent study of celestial bodies.⁴²

e. Space Debris Mitigation Guidelines:

The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS),

which adopted the space debris mitigation guidelines in 2007, offers suggestions and best practices for space debris reduction. These principles are meant to reduce the production of space debris, encourage safe and responsible space operations, and urge space-faring governments to implement debris mitigation techniques.⁴³

f. Telecommunications and Frequency Coordination:

Coordination and management of the use of radio frequencies and orbital slots for satellite communications are key tasks performed by the International Telecommunication Union (ITU). International collaboration in telecommunications is promoted by the ITU's Radio Regulations, which ensure effective use of the radio frequency spectrum and orbital resources while preventing detrimental interference.⁴⁴

3. The State Responsibility for National Activities in Outer Space

State responsibility in international law refers to the legal obligation of states to comply with their international legal obligations and the legal consequences that arise when a state breaches those obligations. The International Law Commission's Draft Articles on State Responsibility governed the rules and principles of state responsibility (ILC Draft). Under Article 2 ILC Draft, a state may be held responsible for an internationally wrongful act if the act is attributable to the state and constitutes a breach of an international legal obligation.⁴⁵

The act must also cause harm to another state or to the international community as a whole. Besides that, Article 5 the Declaration of Legal Principles Governing

³⁹ See The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/rescueagreement.html>, accessed 1 May 2023.

⁴⁰ See The Convention on International Liability for Damage Caused by Space Objects, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html>, accessed 1 May 2023.

⁴¹ See The Convention on Registration of Objects Launched into Outer Space, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html>, accessed 1 May 2023.

⁴² See The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html>, accessed 1 May 2023.

⁴³ See *The Space Debris Mitigation Guidelines*, https://www.unoosa.org/pdf/publications/st_space_49E.pdf, accessed 5 April 2023.

⁴⁴ The International Telecommunication Union, "Welcome to ITU-R", <https://www.itu.int/en/ITU-R/information/Pages/default.aspx>, accessed 5 May 2023.

⁴⁵ *Ibid* and see also Alain Pellet, *The Law Of International Responsibility Oxford Commentaries On International Law*, in James Crawford, Alain Pellet & Simon Olleson Eds., Oxford, 2010.

the Activities of States in the Exploration and Uses of Outer Space, adopted by General Assembly Resolution 1962 (XV111) of 13 December 1963, also states that:

States bear international responsibility for national activities in outer space, whether carried on by governmental agencies or by non-governmental entities and for assuring that national activities are carried on in conformity with the principles set forth in the present Declaration. The activities of non-governmental entities in outer space shall require authorization and continuing supervision by the state concerned. When activities are carried out in outer space by an international organization, responsibility for compliance with the principles set forth in this Declaration shall be borne by the international organization and by the States participating in it.⁴⁶

The legal consequences of state responsibility may include reparations, compensation, or other forms of restitution for the harm caused by the state's actions.⁴⁷ In some cases, other states or international organizations may take measures to ensure that the responsible state complies with its legal obligations or to prevent similar breaches of international law from occurring in the future. State responsibility is an important mechanism for promoting compliance with international legal rules and ensuring that states are held accountable for their actions in the international community.⁴⁸

It helps to maintain the integrity and stability of the international legal system by ensuring that states are held responsible for their wrongful conduct and providing a means for redressing any harm caused by that conduct.

Direct state responsibility and indirect state responsibility are the two subcategories of state liability under international law.⁴⁹ Direct state responsibility arises when a state commits an internationally wrongful act, either through its own actions or omissions.⁵⁰ This situation comprises instances where a state disobeys its commitments under international law or violates a treaty, customary international law, or both. For example, if a state launches a military attack on another state in violation of the United Nations Charter, it would be directly responsible for the resulting harm caused.

On the other hand, indirect state responsibility arises when a state is held responsible for the actions of non-state actors or entities within its jurisdiction.⁵¹ This responsibility may include situations where a state fails to prevent or punish the actions of private individuals or groups who engage in conduct that violates international law.⁵² For example, if a state fails to take action to prevent a private company from polluting a river that flows into another state, it may be held indirectly responsible for the harm caused by the pollution. The state's responsibility to protect other states and citizens from any actions; the state has an obligation to use due diligence process in the application of international standards to prevent, resist, and cease any violations of the rights of states, including the rights of its citizen, carried out within jurisdiction, and

⁴⁶ See the *Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space*, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html>, accessed 5 May 2023.

⁴⁷ Dinah Shelton, "Reparation in the Law of State Responsibility", *Book Remedies in International Human Rights Law*, 2nd eds., 2006, at 55.

⁴⁸ Gonzalo Sanchez de Tagle, "The Objective International Responsibility of States in the Inter-American Human Rights System", *Mexican Law Review* Vol. 7, No. 2 (2015).

⁴⁹ IRALR, "State Responsibility in International Law", *Indian Review of Advanced Legal Research*, 2021, <https://www.iralr.in/post/state-responsibility-in-international-law>, accessed 5 May 2023.

⁵⁰ Neni Ruhaeni, *supra* note 12 at 107.

⁵¹ Yearbook ILC 1973-II, at 176, Document A/9010/Rev.1, chap. II, sect. B, par. 11. Similar: Eight Report Ago (1979), especially p. 4 onwards.

⁵² Erik Kok, "Indirect Responsibility in the Contemporary Law of State Responsibility", *Prufrock Publishing, the Netherlands*, 2018, at 28, <https://pure.uva.nl/ws/files/21933307/Thesis.pdf>, accessed 30 April 2023.

done by anyone who acts in the capacity as state officials.⁵³

Both direct and indirect state responsibility are essential mechanisms for promoting compliance with international legal obligations and ensuring that states are held accountable for their actions in the international community. However, the determination of state responsibility in each case will depend on the specific facts and circumstances involved, as well as the applicable rules and principles of international law.

State responsibility for national activities in outer space refers to the legal obligations and liabilities that states assume for the actions and conduct of their government agencies, entities, and nationals in space.⁵⁴ States are held accountable for their space activities under international space law as sovereign entities.⁵⁵ Article VI the Outer Space states that States have a duty to authorize and supervise their national activities in outer space.⁵⁶

The notion of due diligence is reflected in state responsibility for national actions in space, which calls for governments to take every precautionary measure possible to avoid harm and to uphold their commitments to international agreements. To encourage the responsible and sustainable use of space, it highlights the necessity of solid national regulatory frameworks, monitoring systems, and international collaboration. States contribute to the peaceful and equitable development of space operations and the preservation of outer space as a common resource for the advantage of current and future generations by adhering to their commitments.

4. The Liability Convention and Its Implication in Space Technology

An international agreement that covers the topic of liability for damage brought on by space objects is the Liability Convention, commonly known as the Convention on International Liability for Damage Caused by Space Objects. Adopted by the General Assembly in its Resolution 2777 (XXVI) in September 1972,⁵⁷ The convention provides a legal framework for determining the liability of launching states for damages caused on Earth or to other space objects. The Liability Convention has several implications in the field of space technology:

a. Liability of Launching States:

The agreement lays forth the idea of absolute obligation for launching states, expanding on Article 7 of the Outer Space Treaty. It holds the state liable for any harm brought on by its spacecraft, whether that harm occurs in space or on Earth. This implies that a launching state is responsible for damages even if they were accidental or the product of non-negligent behavior.⁵⁸

b. Scope of Liability:

Damage to people, property, aircraft, and other space objects is one of the many types of damages that are covered under the Liability Convention. It applies to both government and non-governmental entities involved in space activities.⁵⁹

⁵³ *Ibid.*

⁵⁴ Bin Cheng, "International Responsibility and Liability of States for National Activities in Outer Space, Especially by Non-governmental Entities", 1997, at 621-622.

⁵⁵ Riza Amelia, "State Obligations related to the Launch of Objects into Outer Space Under International Law", *Lampung Journal of International Law*, Vol. 2, No. 2 (2020), at 80.

⁵⁶ *Ibid.* at 82.

⁵⁷ See the *Liability Convention*, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html>, accessed 5 April 2023.

⁵⁸ Trevor Kehr, "Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space", *Chicago Journal of International Law*, Vol. 20, No. 1 (2019) at 178-179.

⁵⁹ Carl Q. Christol, "International Liability for Damage Caused by Space Objects", *The American Journal of International Law*, Vol 74, No. 2 (1980) at 353.

c. Cross-Jurisdictional Liability:

The convention addresses the issue of liability in cases where damage occurs in the territory of another state. It ensures that the state where the damage occurs has the right to seek compensation from the launching state, regardless of whether the damage was caused on land, in airspace, or on the high seas.⁶⁰ In the *Corfu Channel* case, the International Court of Justice held that every state is obliged “not to allow knowingly its territory to be used for acts contrary to the rights of other states.”⁶¹ The same principle was also founded in the earlier Trail Smelter arbitration, which was stated coupled with the duty to pay monetary damages for identified harm to property.⁶²

d. Limitations and Exemptions:

The convention allows for certain limitations on liability. Launching states are not liable for damage caused by their space objects if the injury resulted from an act of war, military operations, or an unforeseeable event of nature.

e. Compensation and Claims:

The injured party has a right to claim compensation for material damages, such as property damage, and non-material damages, such as loss of life or personal injury.⁶³ Article IX Liability Convention states that a claim for compensation submitted by the claimant state to the launching country is carried out through the diplomatic channel.⁶⁴

f. Insurance and Financial Responsibility:

The convention encourages launching states to maintain insurance or other financial mechanisms to cover their liability for space activities. The International Law Association later issued the Draft Model Law of the National Space Legislation, also known as the ILA Model Law, which governs insurance coverage for third parties in addition to the five international space law treaties.⁶⁵ The state will only allow a space object launch if the launch entities can demonstrate their financial stability and secure third-party liability insurance.⁶⁶

The Liability Convention is a crucial tool for governing the liability issues of space technology. It promotes accountability and ensures that launching states bear the responsibility for the consequences of their space activities. By establishing a clear framework for liability and compensation, the convention contributes to the safe and responsible development of space technology, encourages the adoption of risk mitigation measures, and protects the interests of states and individuals affected by space-related damages.

In the event of a space technological disaster, responsibility for the damage caused may be attributed to a variety of parties depending on the specific circumstances of the incident. Generally speaking, responsibility may be attributed to the following:

- a. The state that authorized and supervised the space activity: Under international space law, states are responsible for their

⁶⁰ *Ibid.*

⁶¹ *Ibid* and see also 1949 ICJ Rep. 4, 22, reprinted in 43 AJIL 558.

⁶² *Ibid.*

⁶³ Riza Amalia, *supra* note 55, at 83-84.

⁶⁴ *Ibid.*

⁶⁵ Garry Gumelar Pratama and Nadhifathur Rochmah Ruswandi, “Space Insurance for Small Satellite Launch and Operation in the Setting of Indonesian Law”, *Transnational Business Law Journal*, Vol 2, No. 1 (2021), at 74.

⁶⁶ *Ibid.*

space activities and must authorize and supervise the activities of private entities such as companies. If a space technological disaster occurs as a result of a failure in the state's authorization or supervision process, the state may be held responsible.

- b. If a space technological disaster is caused by a private company, that company may be held responsible for the damage it causes. However, the state that authorized and supervised the activities of the private company may also bear responsibility under international law. Under the Outer Space Treaty of 1967, states are responsible for their space activities, whether carried out by governmental or non-governmental entities. Article VI of the treaty requires that the activities of non-governmental entities in outer space, including private companies, require authorization and continuing supervision by the appropriate state. If a private company causes a space technological disaster, the state that authorized and supervised its activities may also be held responsible for any resulting damage. In addition, the Liability Convention of 1972 establishes rules governing the liability of states for damage caused by their space activities. Article II of the convention provides that a launching state is absolutely liable for damage caused by its space objects on the surface of the Earth or to aircraft in flight. If a private company launches a space object with the authorization and supervision of a state, that state may be held liable for any resulting damage caused by the space object. Therefore, if a space technological disaster is caused by a private company, both the company and the state that authorized and

supervised its activities may be held responsible for any resulting damage.

Unfortunately, Non-governmental entities (private companies) only bear indirect international responsibility. It is important for states to ensure that they properly authorize and supervise the activities of private companies to prevent such disasters from occurring and to fulfill their obligations under international space law. Direct International Responsibility of private companies in Outer Space Activities can be possible if private companies are recognized as a subject of international law. The assignment of private companies as the subjects of international law should not mean that private companies have similar rights and obligations to other subjects of international law.

- c. Other states or international organizations affected by the disaster: If a space technological disaster (accident) causes damage to the territory or nationals of another state, that state may hold the responsible party accountable for the damage. Similarly, if the disaster causes harm to the environment or has other international implications, international organizations may become involved in attributing responsibility for the damage caused.

C. APPROACHES TO FRAMING RESPONSIBILITY IN PUBLIC-PRIVATE PARTNERSHIPS ON SPACE TECHNOLOGY IN INTERNATIONAL LAW

With the increasing involvement of private entities in space technology and exploration, defining and allocating responsibilities within the framework of public-private partnerships becomes crucial. Clear and well-defined responsibilities ensure

effective governance, accountability, and the responsible and sustainable use of space technology. The importance of defining PPPs' responsibilities in space technology can be understood from several perspectives:

a. Legal Clarity and Compliance:

International space law, primarily governed by the Outer Space Treaty and other relevant conventions, sets forth the legal framework for space activities.⁶⁷ By clearly delineating the responsibilities of public and private actors, the legal obligations of each party can be established, ensuring adherence to international norms and regulations.

b. Liability and Risk Mitigation:

Space activities inherently involve risks, such as satellite collisions, space debris, and environmental impact. Articles VI and VII the Outer Space Treaty 1967 consider the responsibility and liability of the states in the space domain.⁶⁸ Defining PPPs' responsibilities includes addressing liability issues and establishing mechanisms for risk mitigation.⁶⁹ Clear allocation of liabilities ensures that parties are accountable for their actions and can be held responsible in case of accidents, damages, or environmental harm.

c. Resource Allocation and Efficiency

PPPs' responsibilities play a vital role in efficient resource allocation. It is possible to more efficiently manage resources, such as funds, infrastructure, and technical experience, by clearly outlining the roles and responsibilities of public and private institutions.⁷⁰

d. Collaboration and Cooperation

By clearly defining PPP responsibility, the public and private sectors can work together more effectively.⁷¹ PPPs can function in a coordinated manner, utilizing the skills and knowledge of each sector by setting clear expectations and norms.

e. Stakeholder Engagement and Transparency

Clearly defined PPP responsibilities promote stakeholder engagement and transparency.⁷² When responsibilities are clearly outlined, stakeholders, including governments, private companies, and the general public, can better understand the roles and contributions of each party.

f. Long-term Sustainability

Defining PPPs' responsibilities is crucial for ensuring the long-term sustainability of space activities.⁷³ Space is a finite resource, and responsible utilization requires careful planning and management. By allocating responsibilities for space debris mitigation, orbital slot coordination, and sustainable satellite operations, PPPs can contribute to the preservation of the space environment, minimizing the negative impact on future space activities and exploration.

g. Innovation and Economic Growth

Clear PPP responsibilities foster an environment conducive to innovation and economic growth.⁷⁴ By establishing a predictable and stable framework, private entities are

⁶⁷ Francis Lyall and Paul B Larsen, "Space Law: a Treatise", *Adelaide Law Review*, Vol 39, (2018) at 457-459.

⁶⁸ *Ibid*, at 461.

⁶⁹ Masafumi Hashimoto, *supra* note 20.

⁷⁰ Asian Development Bank, "Public Private Partnership", Handbook, 1, <https://www.adb.org/sites/default/files/institutional-document/31484/public-private-partnership.pdf>, accessed 30 April 2023.

⁷¹ *Ibid*.

⁷² The World Bank, "Stakeholder Communication and Engagement", <https://ppp.worldbank.org/public-private-partnership/stakeholder-communication-and-engagement>, accessed 30 April 2023.

⁷³ Yunita Permatasari, "The Urgency of Guidelines for the Long-term Sustainability of Outer Space Activities for Indonesia", *Global Strategis-Cakra Studi Global Strategis* <https://doi.org/10.20473/jgs.13.2.2019.63-74>, accessed 30 April 2023.

⁷⁴ Nunzia Carbonara and Roberta Pellegrino, "The Role of Public Private Partnerships in Fostering Innovation", *Construction Management and Economics*, Vol 38, No. 10 (2019), at 1-17.

encouraged to invest in space technology development, research, and commercial ventures.

When framing responsibility in Public-Private Partnerships (PPPs) on space technology, several approaches can be considered to ensure effective governance, accountability, and the responsible use of resources. States are responsible for the public activities carried out by nongovernmental entities. It can disrupt the law and justice when an innocent state should be liable for damages caused by the launch of space objects on international territory by a national or multinational corporation acting on behalf of the state to deceive the law. These approaches help delineate the roles, obligations, and liabilities of each party involved in the partnership. Here are some key approaches to framing responsibility in PPPs on space technology:

1. Clear Definition of Roles and Responsibilities:

The obligations of the public and private parties in a PPP must be clearly defined. It is crucial that all parties engaged in space activities take the necessary precautions to avert disasters and uphold their legal commitments to protect people, property, and the environment.

2. Aligned Objectives and Performance Metrics:

In order to represent the partnership's common objectives and expected results, the PPPs should define congruent objectives and performance measures.⁷⁵

3. Risk Assessment and Mitigation:

A comprehensive risk assessment should be conducted to identify potential risks and uncertainties associated with the PPPs.⁷⁶

4. Legal and Regulatory Framework:

A clear legal and regulatory framework that oversees space activities should be

used to operate the PPPs.⁷⁷ Regarding space exploration, satellite operations, and data protection, this entails adhering to international treaties, national laws, and regulations.

5. Resource Allocation and Financial Responsibility:

The PPPs should clearly define the allocation of resources, including funding, facilities, and intellectual property rights.⁷⁸

6. Monitoring, Evaluation, and Accountability Mechanisms:

Effective monitoring, evaluation, and accountability mechanisms should be established to assess the performance of the PPPs and ensure compliance with agreed-upon responsibilities.⁷⁹

7. Communication and Stakeholder Engagement:

The PPPs should prioritize effective communication and stakeholder engagement. This entails interaction with pertinent stakeholders, such as governmental organizations, scientific communities, business representatives, and the general public, as well as frequent and open communication among the partners.

Using these strategies, PPPs on space technology can create a solid foundation for accountability, assuring successful stakeholder involvement, risk management, compliance, and collaboration. It makes it easier to accomplish shared objectives and encourages space technology's ethical and sustainable advancement.

⁷⁵ Karen L. Jones, "Public-Private Partnership: Considerations for the New Space Age", *The New Space Age: Beyond Global Order*, Fall 2021, Perry world House, https://global.upenn.edu/sites/default/files/perry-world-house/Jones_SpaceWorkshop.pdf, accessed 20 April 2023.

⁷⁶ *Ibid.*

⁷⁷ Wahyu Kurniawan, et.al, "The Role of Law in Public Private Partnership: Indonesia", *Journal of Management Information and Decision Science*, Vol 24, No. 6 (2021), at 6.

⁷⁸ United Nations Commission on International Trade Law, "Legislative Guide on Public Private Partnership", 2020, at 16-18, https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/19-10872_ebook_final.pdf, accessed 2 May 2023.

⁷⁹ Temulin Batjargal and Mengzhong Zhang, "Review of Key Challenges in Public-Private Partnership Implementation", *Journal of Infrastructure, Policy and Development*, Vo 5, No. 2 (2021), at 6.

1. Extension of State Responsibility

The extension of state responsibility in the framework of PPPs on space technology involves the assignment of specific duties to the participating government or state institution. While the private sector contributes its knowledge, capital, and inventiveness to the partnership, the government plays a crucial role in guaranteeing adherence to legal responsibilities, protecting the interests of the general public, and upholding overall responsibility. Following are some state responsibility facets that might be expanded in PPPs for space technologies.:

1. **Compliance with International Law**
The government is accountable for ensuring that the PPPs' private partner's operations adhere to applicable international laws and treaties. These agreements set forth space exploration, use, and liability rules. States are obligated to adhere to and enforce the responsibilities outlined in these treaties as party parties, even when participating in PPPs.
2. **Regulatory Oversight**
Even in the context of PPPs, the government is responsible for creating and upholding the regulatory frameworks and standards that regulate space activities. Through regulatory oversight, the government ensures that the private partner's actions comply with local, state, federal, and international laws, safeguarding the public interest and reducing risks.
3. **Safety and Security**
The use of space technology has an impact on sovereignty and national security. Governments have a responsibility to defend national security interests and make sure that PPPs related space activities do not jeopardize national security. By extending state responsibility, governments can continue to exercise monitoring, control, and

decision-making power over key components of space technology that have an influence on national security.

4. **Liability and Compensation**
Governments have the inherent authority and regulatory power to oversee and regulate space activities within their jurisdiction. This authority extends to PPPs, where the government acts as a regulatory body to enforce compliance with legal and safety standards. Through regulatory oversight, the government ensures that the private partner's actions align with national and international regulations, protecting the public interest and mitigating risks.
5. **Public Interest and Ethical Considerations**
The government must protect the public interest and ensure that the PPP aligns with more general societal goals. Space activities significantly impact citizen welfare, environmental sustainability, and national security.
6. **Long-term Sustainability**
The government is essential in fostering the PPP's long-term viability of space activities.
7. **Compliance with National Laws**
PPPs on space technology must comply with national laws and regulations. Governments have the authority to establish and enforce these laws, ensuring that the activities of the private partner align with national legal requirements.

While the private sector brings innovation, expertise, and efficiency to PPPs on space technology, the extension of state responsibility helps maintain overall governance, compliance, and accountability.

2. Shared Responsibility Model

A non-governmental entity in space is defined as an entity not established by and does not act on behalf of the respective government. A non-governmental entity is a private company operating a space-port

launch, communications satellite, and investment. The involvement of private companies in outer space activities is becoming increasingly relevant due to the growth of the space industry and the privatization of space exploration. Private companies have the financial resources, technical expertise, and innovative capacity to play an essential role in space activities, such as satellite launches, space tourism, and resource extraction.

Private Companies involved in outer space activities are subject to international law, including the Outer Space Treaty of 1967 and other international agreements that govern the exploration and use of outer space. These agreements recognize the responsibility of states to ensure that their activities in outer space are carried out in accordance with international law and that they are liable for any damage caused by their space objects.

National laws and regulations, such as those governing space launches and the regulation of space activities by national space agencies, also apply to private companies. For instance, the Commercial Space Launch Act was formed in the US, which controls the launch and reentry of commercial spacecraft and necessitates that businesses get permits from the Federal Aviation Administration.

The public actions carried out by non-governmental organizations are the responsibility of the state. When a national or multinational firm acts on behalf of the state to confuse the law by launching space objects on international territory, this can constitute a disruption to the rule of law and justice. It is crucial to understand that numerous parties may sometimes share blame for a space technology disaster. For instance, it may be determined that the state and the private business engaged in a space operation are both accountable for a disaster brought on by a flaw in their authorization and oversight procedures.

Shared responsibility is an important concept in international space law and may play a role in determining liability for an outer space disaster caused by a private company. It

is important for all parties involved in space activities to take appropriate measures to prevent disasters from occurring and to fulfill their obligations under international law to prevent harm to people, property, and the environment. Attributing responsibility for a space technological disaster is a complex process that requires a thorough investigation of the incident and an assessment of the legal and factual circumstances surrounding the incident. Shared responsibility in international law is the sharing of international responsibilities among multiple actors who contribute to injury to third parties. Principle 1 The Guiding Principles on Shared Responsibility in International Law (at a side event of the Sixth (Legal) Committee of the United Nations (UN) General Assembly on 1 November 2019) stated that,

Use of terms for purposes of the present Guiding Principles: (a) 'international person' means a state or international organization; (b) 'person' means an international actor, including an international person."⁸⁰

The principles are without prejudice to the possibility that other actors, such as individuals or other non-state actors, bear international obligations and share responsibility in certain circumstances.

Andre Nolkaemper and Dov Jacobs provide indicators of Shared Responsibility in International law:

1. First, the concept of shared responsibility refers to the responsibility of multiple actors. These actors obviously include states and international organizations but may also include other actors such as multinational corporations and individuals.

⁸⁰ Andre Nolkaemper, "Guiding Principles on Shared Responsibility in International Law", *European Journal of International Law*, Vol 31, No. 1 (2020), at 16.

2. Second, the term refers to the responsibility of multiple actors for their contribution to a single harmful outcome. Such an outcome may take a variety of forms, including material or nonmaterial damage to third parties. As we will further explain below, on this point, we distance ourselves from the concept used by the JLC, which opted for a narrower approach.
3. Third, the term shared responsibility *strictu sensu* refers to situations where the contributions of each individual cannot be attributed to them based on causation.
4. The fourth defining feature of shared responsibility in this broad sense is that the responsibility of two or more actors for their contribution to a particular outcome is distributed to them separately rather than resting on them collectively.⁸¹

The shared responsibility model in PPPs on space technology recognizes that the challenges and benefits of space activities are best addressed through collaboration and joint accountability. By leveraging the strengths and resources of both the public and private sectors, the shared responsibility model promotes effective governance, sustainable development, and responsible use of space technology to benefit society.

In comparing these approaches, it is evident that shared responsibility and extension of state responsibility are not

mutually exclusive. Both methods recognize the need for collaboration, regulatory compliance, and risk management. Shared responsibility emphasizes the partnership between public and private entities while extending state responsibility underscores the government's ongoing role in regulating and protecting the public interest. The choice of approach may depend on various factors, including the specific context, legal frameworks, and policy objectives. A balanced approach combining shared responsibility with the extension of state responsibility can lead to effective governance, responsible conduct, and realizing the benefits of space activity while ensuring the protection of public interest and safety.

3. Case of PPPs' Responsibility on Space Tourism and Passenger Safety

The tragic event involving the Virgin Galactic spacecraft SpaceShipTwo during a test flight in 2014 is one case in point demonstrating the significance of PPPs' responsibilities in space tourism and passenger safety.⁸² In this case, Virgin Galactic, a private company, entered into a PPP with various public entities, including NASA and the Federal Aviation Administration (FAA), to develop and operate commercial space tourism flights.⁸³

After the disaster, both the private partner, Virgin Galactic, and the public partners engaged came under more criticism for their roles in the tragedy. After conducting a thorough examination, the National Transportation Safety Board (NTSB) found crucial issues such as insufficient oversight, insufficient training, and insufficient safety

⁸¹ Andre Nolkaemper and Dov Jacobs, "Shared Responsibility in International Law: A Conceptual Framework", *Michigan Journal of International Law*, Vol 34, No. 2 (2013), at 366-367.

⁸² BBC, "Virgin Galactic Spacecraft Crash Kills Pilot", 2014, <https://www.bbc.com/news/world-us-canada-29857182>, accessed 1 March 2023.

⁸³ BBC, "Virgin Galactic Signs Spaceflight deal with US Authority", 2014, <https://www.bbc.com/news/business-27628476>, 1 March 2023, and see also Bharat Madan and Daphne halkias, "Virgin Galactic's NASA Partnership and Space Tourism-A Teaching Case", *Ecole des Ponts Business School*, 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3820623, accessed 1 March 2023.

precautions.⁸⁴ This situation demonstrated the necessity for improved regulatory monitoring and distinct roles in PPPs for space tourism. The tragedy caused the FAA to examine and improve its rules and licensing requirements for commercial space launches, putting a greater emphasis on safety and risk mitigation.

Following the disaster, Virgin Galactic made considerable adjustments to its safety procedures, design procedures, and crew training.⁸⁵ Along with other private space tourism companies, the company saw the need to work closely with regulatory bodies to guarantee adherence to safety guidelines and industry best practices.⁸⁶ The company is working in close collaboration with the Federal Aviation Administration (FAA) to ensure that its products meet stringent safety standards. In addition, Virgin Galactic is actively engaging with the United Nations Office for Outer Space Affairs (UNOOSA) to ensure that its space tourism services are in compliance with international law. This instance highlights the fact that private partners and regulatory bodies share responsibilities for safeguarding the security of tourists engaging in space travel.⁸⁷

Overall, this case serves as a reminder that PPPs in space tourism must prioritize safety, adhere to robust regulatory frameworks, and continuously assess and improve their operations to safeguard passengers. It highlights the critical role of both public and private partners in upholding their responsibilities and working together to create a safe and sustainable environment for space tourism.

D. CONCLUSION

The growing involvement of the private sector in space technology brings forth opportunities for innovation, efficiency, and resource mobilization. However, it also necessitates careful attention to the allocation of responsibilities, compliance with legal frameworks, and the protection of public interest. The Outer Space Treaty serves as a foundational instrument that outlines the general principles guiding space activities, including the responsibility of states for national activities in outer space. Furthermore, other relevant international agreements, such as the Liability Convention, play a crucial role in addressing liability and compensation issues in space technology ventures. These agreements support the development of a responsibility framework and guarantee that the risks and repercussions that may be connected to space operations are adequately addressed.

For efficient governance, risk management, and resource allocation in space technology, PPP responsibilities must be clearly defined. Roles are clearly defined, goals are congruent, and performance measures are established, enabling coordinated collaboration and guaranteeing that the partnership's actions are focused on shared objectives. Furthermore, effective monitoring, evaluating, and accountability procedures offer a way to gauge the partnership's development and hold each party accountable for their deeds. Legal justifications, such as compliance with international law, public interest protection, regulatory authority, liability and compensation considerations, national security issues, and adherence to national laws, support the extension of state responsibilities in PPPs. The shared responsibility approach emphasizes strategy alignment, complementary expertise, risk sharing, ongoing communication, and recognizing the collaborative character of PPPs.

⁸⁴ National Transportation "Safety Board, In-Flight Breakup During Test Flight Scaled Composites Spaceship Two, *Aerospace Accident Report*, 2014, <https://www.nts.gov/investigations/AccidentReports/Reports/AAR1502.pdf>, accessed 1 March 2023.

⁸⁵ TS2, "Virgin Galactic's Efforts to Improve Space Tourism safety Standards", 2023, <https://ts2.space/en/virgin-galactics-efforts-to-improve-space-tourism-safety-standards/>, accessed 5 May 2023.

⁸⁶ Martin Frackiewcs, "Virgin Galactic's Role in Space Tourism Regulation", TS2, 2023, <https://ts2.space/en/virgin-galactics-role-in-space-tourism-regulation/>, 1 March 2023.

⁸⁷ *Ibid.*

REFERENCES

Books

Amiruddin, Pengantar Metode Penelitian Hukum, Jakarta: Raja Grafindo Press, 2004.

Asian Development Bank, "Public Private Partnership", Handbook, 1, <https://www.adb.org/sites/default/files/institutional-document/31484/public-private-partnership.pdf>.

Marzuki, Peter Mahmud. *Penelitian Hukum*. Jakarta: Kencana. 2005.

Pellet, Alain. *The Law Of International Responsibility Oxford Commentaries On International Law*, Oxford, 2010.

Shelton, Dinah, "Reparation in the Law of State Responsibility", *Book Remedies in International Human Rights Law* (2nd edn), 2006.

Soekanto, Soerjono and Mamuji, Sri. *Metode Penelitian Normatif*. Jakarta: Rajawali, 1995.

Suggono, Bambang. *Metodologi Penelitian Hukum : Suatu Pengantar*, cet.5, Jakarta: PT Raja Grafindo Persada, 2003.

Other Documents

Amelia, Riza. "State Obligations related to the Launch of Objects into Outer Space Under International Law". *Lampung Journal of International Law* Vol. 2, No. 2 2020

Arms Control Association, "The Outer Space Treaty at a Glance", <https://www.armscontrol.org/factsheets/outerspace>.

Batjargal, Temulin and Zhang, Mengzhong. "Review of Key Challenges in Public-Private Partnership Implementation". *Journal of Infrastructure, Policy and Development*. Vol 5. No. 2. 2021.

BBC, "Virgin Galactic Signs Spaceflight deal with US Authority", 2014, <https://www.bbc.com/news/business-27628476>, 1 March 2023, and see also Bharat Madan and Daphne Halkias, "Virgin Galactic's NASA Partnership and Space Tourism-A Teaching Case", *Ecole des Ponts Business School*, 2020,

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3820623, accessed 1 March 2023.

BBC, "Virgin Galactic Spacecraft Crash Kills Pilot", 2014, <https://www.bbc.com/news/world-us-canada-29857182>, accessed 1 March 2023.

Carbonara, Nunzia and Pellegrino, Roberta, "the Role of Public Private Partnerships in Fostering Innovation, *Construction Management and Economics*. Vol 38, No. 10. 2019.

Center for Space Policy and Strategy. "Public-Private Partnership in Space". 2018

<https://csps.aerospace.org/papers/public-private-partnerships-space>.

Cheng, Bin, "International Responsibility and Liability of States for National Activities in Outer Space, Especially by Non-governmental Entities". 1997.

Christol, Carl Q. "International Liability for Damage Caused by Space Objects". *The American Journal of International Law* Vol 74, No. 2. 1980.

Davenport, Christian. "NASA Looks to Private Sector for Successor to the International Space Station". 2022. <https://www.wilsoncenter.org/article/nasa-looks-private-sector-successor-international-space-station>.

de Tagle, Gonzalo Sanchez. "The Objective International Responsibility of States in the Inter-American Human Rights System". *Mexican Law Review*. Vol 7. No. 2. 2015.

European Space Policy Institute. "The Rise of Private Actors in the Space Sector", Executive Summary. 2017. <https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-report-The-rise-of-private-actors-Executive-Summary-1.pdf>, accessed 1 April 2023.

Ferreira-Synman, Anel. "The environmental responsibility of states for space debris and the implications for developing countries in Africa". *The Comparative and International Law Journal of Southern Africa*. Vol 46, No. 1. 2013.

- Frackiewicz, Martin. "Virgin Galactic's Role in Space Tourism Regulation". TS2. 2023. <https://ts2.space/en/virgin-galactics-role-in-space-tourism-regulation/>, 1 March 2023.
- Frankowski, Pawel, "Outer Space and Private Companies". *Politeja Journal*. Vol 5. No. 50. 2017.
- Hashimoto, Masafumi. "The responsibility of PPPs in space activities is an issue that has received considerable attention in recent years, both from policymakers and legal scholars". 2009. <https://dspace.mit.edu/bitstream/handle/1721.1/52751/501191812-MIT.pdf?sequence=2&isAllowed=y>.
- Howell, Elizabeth. "SpaceX's Dragon: First Private Spacecraft to Reach the Space Station". 2020.
- IRALR. "State Responsibility in International Law". *Indian Review of Advanced Legal Research*. 2021. <https://www.iralr.in/post/state-responsibility-in-international-law>.
- ISS National Laboratory, "Public Private Partnerships in Space", <https://www.issnationallab.org/research-on-the-iss/public-private-partnerships-in-space/>,
- Jones, Karen L., "Public-Private Partnership: Considerations for the New Space Age". *The New Space Age: Beyond Global Order*. Fall 2021. Perry world House. https://global.upenn.edu/sites/default/files/perry-world-house/Jones_SpaceWorkshop.pdf, accessed 20 April 2023.
- Jones, Karen L., "Public-Private Partnership: Stimulating Innovation in the Space Sector". *The Aerospace Corporation*. 2018. https://aerospace.org/sites/default/files/2018-06/Partnerships_Rev_5-4-18.pdf.
- JSC SMA Flight Safety Office. "Significant Incidents & Close Calls in Human". <https://sma.nasa.gov/SignificantIncidents/>. accessed 1 April 2023.
- Kehrer, Trevor. "Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space". *Chicago Journal of International Law*. Vol 20. No. 1. 2019.
- Kok, Erik, "Indirect Responsibility in the Contemporary Law of State Responsibility". *Prufrock Publishing*. the Netherlands. 2018. <https://pure.uva.nl/ws/files/21933307/Thesis.pdf>.
- Kurniawan, Wahyu, et.all. "The Role of Law in Public Private Partnership: Indonesia". *Journal of Management Information and Decision Science*. Vol 24. No. 6. 2021.
- Lyall, Francis and Larsen, Paul B. "Space Law: a Treatise". *Adelaide Law Review*. Vol 39. 2018. https://law.adelaide.edu.au/system/files/media/documents/2019-03/ALR_39%282%29_08_Lisk.pdf.
- Martinez, Peter. "Development of an International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities." *Space Policy*. 2018. <https://doi.org/10.1016/j.spacepol.2018.01.002>.
- Nolkaemper, Andre and Jacobs, Dov. "Shared Responsibility in International Law: A Conceptual Framework". *Michigan Journal of International Law*. Vol 34. No. 2. 2013.
- Nolkaemper, Andre, "Guiding Principles on Shared Responsibility in International Law", *European Journal of International Law*. Vol 31, No. 1. 2020.
- Palmroth, M., et.all, "Toward Sustainable Use of Space: Economic, Technological, and Legal Perspectives". *Space Policy Journal* 57, (2021): 11-14.
- Permatasari, Yunita, "The Urgency of Guidelines for the Long-term Sustainability of Outer Space Activities for Indonesia". *Global Strategis-Cakra Studi Global Strategis*.
- Pratama, Garry Gumelar and Ruswandi, Nadhifathur Rochmah, "Space Insurance for Small Satellite Launch and Operation in the Setting of Indonesian Law". *Transnational Business Law Journal* Vol. 2, No. 1. 2021.
- Rashed, Md. Abu, "Considerable Issues for Sustainable Public-Private Partnerships

- (PPP) Project, 2011, <https://osf.io/h9gw4/download>.
- Research and Market, "Tourism Market Size, Share & Trends Analysis Report by Type (Orbital, Sub-orbital), By End Use (Government, Commercial), By Region, And Segment Forecasts, 2023 – 2030". <https://www.researchandmarkets.com/reports/5644945/global-space-tourism-market-size-share-and-trends>, accessed 1 May 2023.
- Reuters, "SpaceX to Raise \$750 Million At \$137 Billion Valuation – CNBC". <https://www.reuters.com/markets/deals/spacex-raise-750-million-137-billion-valuation-cnbc-2023-01-03/>. accessed 1 May 2023.
- Ricon, Paul. "Jeff Bezos Launches to Space aboard New Shepard Rocket Ship". 2021, <https://www.bbc.com/news/science-environment-57849364>, accessed 3 May 2023.
- Rotatori, Denise, Lee, Eun Jeong, and Sleeva, Sheryl. "The Evolution of the Workforce during the Fourth Industrial Revolution," *Human Resource Development International* Vol 24, No. 1 2021.
- Ruheni, Neni. "Direct International Responsibility of Non-Governmental Entities in the Utilization of Outer Space". *Padjajaran Jurnal Ilmu Hukum* Vol 7, No. 1. 2020.
- Sheetz, Michael. "Richard Branson Reaches Space on Virgin Galactic Flight". 2021. <https://www.cnbc.com/2021/07/11/richard-branson-reaches-space-on-virgin-galactic-flight.html>. accessed 3 May 2023.
- The Associated Press. "3 visitors heading to the space station are paying \$55M each, all meals included". 2022. <https://www.npr.org/2022/04/08/1091661900/spacex-space-station-launch-axiom>, accessed 1 may 2023.
- The International Telecommunication Union. "Welcome to ITU-R". <https://www.itu.int/en/ITU-R/informati> [on/Pages/default.aspx](https://www.itu.int/en/ITU-R/informati), accessed 5 May 2023.
- The National Transportation "Safety Board, In-Flight Breakup During Test Flight Scaled Composites Spaceship Two, *Aerospace Accident Report*", 2014. <https://www.nts.gov/investigations/AccidentReports/Reports/AAR1502.pdf>, accessed 1 March 2023.
- The Space Debris Mitigation Guidelines, https://www.unoosa.org/pdf/publications/st_space_49E.pdf.
- The World Bank. "Government Objectives: Benefits and Risks of PPPs". 2020. <https://ppp.worldbank.org/public-private-partnership/overview/ppp-objectives>
- The World Bank. "Stakeholder Communication and Engagement". <https://ppp.worldbank.org/public-private-partnership/stakeholder-communication-and-engagement>
- TS2. "Virgin Galactic's Efforts to Improve Space Tourism Safety Standards' ". 2023. <https://ts2.space/en/virgin-galactics-efforts-to-improve-space-tourism-safety-standards/>. accessed 5 May 2023.
- Legal Documents**
- The 1949 ICJ Rep. 4, 22, reprinted in 43 AJIL 558.
- The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html>.
- The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/rescueagreement.html>.
- The Convention on International Liability for Damage Caused by Space Objects, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html>.
- The Convention on Registration of Objects Launched into Outer Space,

<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html>.

The Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html>, accessed 5 May 2023.

The United Nations Commission on International Trade Law. "Legislative Guide on Public Private Partnership". 2020. https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/19-10872_ebook_final.pdf. accessed 2 May 2023.

The United Nations Office for Outer Space Affairs, "the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspace treaty.html>.

The United Nations Office for Outer Space Affairs. "The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies". <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspace treaty.html>.

The Yearbook ILC 1973-II, p. 176, document A/9010/Rev.1, chap. II, sect. B, par. 11. Similar: Eight Report Ago (1979), especially p. 4 onwards.