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WHITE BLACK LEGAL is an open access, peer-reviewed and refereed journal providededicated to express views on topical legal issues, thereby generating a cross current of ideas on emerging matters. This platform shall also ignite the initiative and desire of young law students to contribute in the field of law. The erudite response of legal luminaries shall be solicited to enable readers to explore challenges that lie before law makers, lawyers and the society at large, in the event of the ever changing social, economic and technological scenario.

With this thought, we hereby present to you

# **SPACE DEBRIS: INTERNATIONAL AND INDIAN ENVIRONMENTAL LAW PERSPECTIVES**

AUTHORED BY - SATYA VRAT PANDEY

## **ABSTRACT**

Space debris from satellites, rocket stages, and other objects disrupts Earth's orbit and harms the ecology. This article examines India and other nations' complex space debris management laws and their environmental impacts. The main international space treaty is the 1967 Outer Space Treaty. States are obligated under Articles VI and IX to take measures to prevent harmful debris and to accept international responsibility for their actions in space. These commitments remain crucial despite the agreement's focus on peaceful usage and the non-appropriation of space. The UN Committee for the Peaceful Uses of Outer Space<sup>1</sup> and the Inter-Agency Space Debris Coordination Committee<sup>2</sup> have produced additional rules and best practices to address space debris as the treaty does not. National rules and strategies based on these non-binding principles reduce space debris concerns in spacefaring nations. The 2017 Space Activities Act is essential for regulating space operations and controlling space debris in India. To ensure the long-term viability and security of its space missions and facilities, ISRO strictly follows these rules. ISRO monitors space debris and satellite collisions and promotes sustainable satellite design, launch, and disposal.<sup>3</sup> Space debris damages Earth and space. Also, Satellite collisions and space junk might threaten future operations. Major debris bits that fall to Earth endanger people and property, requiring strict control and supervision. Space debris control requires a worldwide legal framework that incorporates technical innovation, cooperative governance, and environmental concerns.

**Key Words:** Space debris, Environment, ISRO, junk, international, satellite

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<sup>1</sup> Claudio Portelli, *UN COPUOS Space Debris Guidelines*, RESEARCHGATE, ( June 22, 2024, 4:00 PM), [https://www.researchgate.net/publication/241410782\\_UN\\_COPUOS\\_Space\\_Debris\\_Guidelines](https://www.researchgate.net/publication/241410782_UN_COPUOS_Space_Debris_Guidelines)

<sup>2</sup> NASA, <https://orbitaldebris.jsc.nasa.gov/library/iadc-space-debris-guidelines-revision-2.pdf> (last visited 22 June , 2024).

<sup>3</sup> V. Adimurthy and A.S. Ganeshan, *Space Debris Mitigation Measures in India*, RESEARCHGATE, (June 22, 2024,10:00PM), [https://www.researchgate.net/publication/223028718\\_Space\\_debris\\_mitigation\\_measures\\_in\\_India](https://www.researchgate.net/publication/223028718_Space_debris_mitigation_measures_in_India).

# INTRODUCTION

Space debris, often known as space rubbish or space junk, refers to non-functional human-made objects orbiting the Earth.<sup>4</sup> These things include expended rocket stages, inactive satellites, and debris resulting from collisions, explosions, or disintegration in orbit. Both Earth-based and space activities are subject to significant safety and environmental concerns in relation to this problem. To tackle the issue of space debris, individuals must traverse a complex network of international treaties, agreements, national laws, and suggestions. This article focuses on the international legal framework governing space debris, with a specific emphasis on global views and the Indian context. It analyses the environmental impact of space debris and explores the regulatory approaches used to address this issue. Space debris, commonly referred to as space junk, presents a significant hazard to both the environment and operations in Earth's orbit. This issue poses challenges for spacefaring nations as well as the global community as a whole. The composition of space debris consists of discarded satellites, expended rocket stages, and fragments resulting from collisions and explosions. To address the issue of space debris, a comprehensive legal framework comprising international treaties, agreements, recommendations, and national rules is required.<sup>5</sup> The evolving international legal framework concerning space debris, with an emphasis on global viewpoints and the specific context of India. It sheds light on environmental considerations and regulatory actions in this field

## GLOBAL LEGAL FRAMEWORK

### The Outer Space Treaty of 1967

The Outer Space Treaty<sup>6</sup> (OST) serves as the fundamental framework for international space law, providing essential regulations for space-related activities. According to Article VI, states are accountable for their actions in outer space, even if carried out by non-governmental enterprises. Additionally, Article VIII states that states must inform the United Nations and the international community about the details, behaviour, and outcomes of their space operations.<sup>7</sup> Article IX mandates

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<sup>4</sup>Erik Gregersen, *space debris*, BRITANNICA, (June 23, 2024, 8:00 PM), <https://www.britannica.com/technology/space-debris>.

<sup>5</sup> Rada Popova and Volker Schaus, *The Legal Framework for Space Debris Remediation as a Tool for Sustainability in Outer Space*, 5, *Aerospace*, 1, 4 (2018).

<sup>6</sup>UNITED NATIONS OFFICE FOR OUTER SPACE ACTIVITIES, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html> (last visited June 23, 2024).

<sup>7</sup>UNITED NATIONS OFFICE FOR OUTER SPACE ACTIVITIES, <https://www.unoosa.org/pdf/publications/STSPACE11E.pdf> (last visited June 24, 2024).



that state parties take measures to avoid detrimental pollution of outer space and celestial objects.<sup>8</sup> Notwithstanding these principles, the Outer Space Treaty (OST) does not contain specific provisions addressing the reduction and removal of space debris.

## SPACE DEBRIS MITIGATION GUIDELINES

Various worldwide parties and organisations have formulated suggestions and optimal methods to address the increasing danger presented by space debris. The UN Committee on the Peaceful Uses of Outer Space (COPUOS) has produced proposals on reducing space debris, which include spacecraft design, post-mission disposal, and debris avoidance measures.<sup>9</sup> The Committee for the Coordination of Inter-Agency Space Debris (IADC) is an organisation that oversees the management of space debris across many agencies.<sup>10</sup> The International Astronautical Development Consortium (IADC) including global space organisations, establishes technical standards and recommendations for space operations and the mitigation of space debris. While these ideas lack legal binding, they can serve as a basis for spacefaring nations to develop national laws and policies to effectively address the issue of space debris.\

## LIABILITY AND COMPENSATION

Complementing the Space Treaty are the Liability Convention<sup>11</sup> (1972) and the Registration Convention<sup>12</sup> (1976), both of which address the problem of culpability for harm caused by space objects and the obligation to formally register them with a central authority, respectively. Both of these conventions were signed in 1972 and 1976, respectively. Due to the fact that collisions between space objects have the potential to inflict severe damage to satellites and other space assets, liability clauses are an essential component in the process of dealing with space debris. Components consisting rules for the distribution of responsibility for damages caused by space objects are established by the Liability Convention. These rules apply regardless of whether the space objects are located inside or

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<sup>8</sup> N. Jasentuliyana, *Space Debris and International Law*, 26, *Journal of space law*, 101, 139 (1998), <https://airandspace.law.olemiss.edu/pdfs/jsl-26-2.pdf>.

<sup>9</sup> NASA, <https://orbitaldebris.jsc.nasa.gov/mitigation/> (last visited June 25, 2024).

<sup>10</sup> WIKIPEDIA, [https://en.wikipedia.org/wiki/Inter-Agency\\_Space\\_Debris\\_Coordination\\_Committee](https://en.wikipedia.org/wiki/Inter-Agency_Space_Debris_Coordination_Committee) (last visited June 25, 2024).

<sup>11</sup> UNITED NATIONS OFFICE FOR OUTER SPACE ACTIVITIES, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html> (last visited, 25, 2024).

<sup>12</sup> UNITED NATIONS OFFICE FOR OUTER SPACE ACTIVITIES, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html> (last visited June 26, 2024).

outside of the atmosphere of Earth. In accordance with the Registration Convention, states are obligated to keep a record of all space objects that have been launched into orbit and to promptly transmit information on these things. When it comes to evaluating culpability and responsibility for damages caused by encounters with space debris, these guidelines are absolutely essential with regard to the matter

## **LEGAL FRAMEWORK IN INDIA**

India, a nation seeing significant growth in its space sector, has established a regulatory framework to govern space operations and address the issue of space debris. The Space Activities Act of 2017 is a legislation in India that regulates space-related activities.<sup>13</sup> It covers measures to mitigate space trash and establishes responsibility for any damage caused by space objects. The Indian Space Research Organisation (ISRO) follows international standards in executing regulations for space debris reduction.<sup>14</sup> India's policy focuses on enhancing its domestic space capabilities while prioritising responsible space activities and adherence to international norms.

## **MITIGATION EFFORTS AND INDIAN SPACE DEBRIS**

India's space programme, overseen by ISRO, has made substantial endeavours to diminish space debris. Specifically, ISRO operates a facility dedicated to monitoring and mitigating space debris, as well as assessing the risks of collisions involving Indian satellites. Sustainable Space Activities: Emphasises the use of environmentally sustainable approaches in the design, launch, and disposal of satellites once they are no longer usable. India's commitment to mitigating space debris aligns with global efforts while addressing specific regional challenges and opportunities. Various international space organisations and organisations have established regulations and guidelines to mitigate space debris and handle the associated environmental problems. These acts encompass tasks such as constructing spacecraft specifically for the purpose of disposing them at the end of their lives, advancing technology to actively remove debris, and executing manoeuvres to prevent collisions. In order to reduce the likelihood of mishaps, there are currently ongoing initiatives to improve space situational awareness and debris monitoring. Outside the confines of space, space debris, which refers to the remnants of human-made objects around the Earth, presents a significant environmental hazard.

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<sup>13</sup> Aswathi Pacha, *What is the Space Activities Bill, 2017*, THE HINDU, (June 25, 2024, 11:00PM).

<sup>14</sup> ISRO, <https://www.isro.gov.in/SSA.html> (last visited June 26, 2024, 1:00 PM).

The environmental consequences of space debris can have detrimental repercussions not only on satellite operations and space missions but also on human activities and terrestrial ecosystems. Environmental laws and regulations are crucial for mitigating these threats and ensuring adherence to standards.

## ***ENVIRONMENTAL IMPACT OF SPACE DEBRIS***

*Space debris causes severe environmental dangers both in space and on Earth:*

- ***Collision and Fragmentation:*** *Space debris increases the likelihood of collisions with operational satellites, which can trigger a series of events leading to the creation of more junk. This phenomenon is known as the Kessler syndrome.<sup>15</sup> The Kessler syndrome refers to a situation in low Earth orbit (LEO) where the density of objects is so high that collisions between objects generate more debris, hence increasing the likelihood of further collisions. The cascading impact of this phenomenon may render some orbital altitudes unsuitable for future space missions and satellite launches, therefore restricting our ability to effectively explore and utilise space.*
- ***Risk to Space Infrastructure:*** *The existing space infrastructure, including weather satellites, communication satellites, and Earth observation satellites, is directly endangered by space debris. These satellites play a crucial role in facilitating global communication networks, monitoring the environment, predicting meteorological conditions, and managing disasters. If a collision occurs with space debris, these satellites might be damaged or become dysfunctional, which would undermine their capacity to carry out crucial functions and gather necessary data for managing environmental emergencies, monitoring climate change, and comprehending natural catastrophes.*
- ***Danger to Human operations on Earth:*** *In addition to its harmful effects on space infrastructure, space debris presents a danger to human operations on Earth. Significant fragments of space debris have the ability to endure and make contact with the Earth's atmosphere and surface, even in the face of the extreme heat generated during re-entry. Although the majority of debris is incinerated after re-entry, bigger bits might potentially endanger inhabited regions. While the probability of a space debris particle causing harm to*

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<sup>15</sup> Mariappan A and Crassidis JL, *Kessler's Syndrome: A Challenge to Humanity*, FRONTIERS, (June 26, 2024, 3:05 PM), <https://www.frontiersin.org/journals/space-technologies/articles/10.3389/frspt.2023.1309940/full>

*individuals or property on Earth is minimal, the possible ramifications emphasise the necessity for efficient management and monitoring of debris.*

- **Issues with Long-Term Sustainability:** The proliferation of space debris gives rise to apprehensions regarding the enduring viability of space endeavours. As the number of satellites and space missions increases, the probability of collisions and the amount of debris they generate also increase. This cycle has the potential to complicate debris control and impede our ability to undertake more space missions and explore uncharted territories.

## **CHALLENGES AND FUTURE DIRECTIONS**

*The growth of little satellites and large-scale constellations poses novel challenges in managing space debris:*

- **Regulatory Deficiencies:** *The current legal framework may not adequately cover the extent and intricacy of debris resulting from extensive satellite constellations.*
- **Technological Innovations:** *Despite the emergence of new regulatory challenges, advancements in satellite technology and orbital manoeuvring capabilities provide potential solutions.*

*The challenge faced by the international community is to update and synchronise legal frameworks to effectively address the evolving risks presented by space debris.*

- **Normative Evolution:** *In order to enhance efforts to reduce and clean up space debris, there is a consideration of new international accords or changes to existing treaties.*
- **Enhanced transparency and collaboration:** *In order to bolster space situational awareness and mitigate collision risks, it is imperative to foster increased international exchange of information and collaboration.*

## **CONCLUSION**

Space debris is a significant operational and environmental hazard for the international space community. To tackle this issue, a comprehensive approach that combines international agreements, domestic legislation, technological advancements, and collaborative initiatives is required. ISRO's proactive measures and adherence to international rules indicate India's dedication to responsible space management. In the future, it is essential to prioritise communication and collaboration in order to establish effective legal frameworks and technical solutions that ensure the long-term sustainability

of space activities for future generations and it will be essential to ensure ongoing communication and collaboration between nations involved in space exploration. This is crucial in order to develop effective solutions and ensure the sustainability of space activities for future generations. To ensure the benefits of space exploration and utilisation while mitigating the risks of debris accumulation, the international community can employ a combination of environmental legislation and space debris management techniques to safeguard Earth and space ecosystems. Space debris, the remnants of human-made objects in Earth's orbit, poses significant operational and environmental challenges for space missions. Space trash consists of discarded rocket stages, abandoned satellites, and debris resulting from collisions. It presents a peril to space expeditions, functioning satellites, and even activities conducted on the ground. An all-encompassing legal framework consisting of international agreements, treaties, recommendations, and national regulations is essential to tackle this matter. This discussion focuses on the ever-changing global legal landscape of space debris, with a special emphasis on the environmental consequences and regulatory approaches, both on a global scale and specifically within the context of Indian law.

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