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RESPONSIBILITY OF THE SATELLITE OWNER STATE THAT BECOMES WASTE IN SPACE UNDER THE 1967 SPACE TREATY

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Abstract: *Space exploration and utilization have increased significantly as more satellites have been launched into Earth orbit. The impact of these activities is the emergence of space debris which has the potential to cause collisions in orbit between space objects, especially between inactive satellites (space debris) and active satellites belonging to other countries that cause losses, with active satellites and trigger Kessler Syndrome. This study aims to analyze the legal status and responsibility of the satellite owner country that has become space junk under the 1967 Space Treaty. This research uses a type of normative juridical research with a legislative approach and a conceptual approach. The results show that although the 1967 Space Treaty does not explicitly regulate space junk, it is still categorized as a space object that falls under the jurisdiction of the launching country under Article VIII. State liability is regulated in Article VI, while liability for damages is regulated in Article VII which is then further regulated in the Liability Convention 1972 with the principle of fault-based liability for losses in space. However, the application of the principle of error is difficult to prove, creating a legal vacuum related to liability for space debris collisions and regulations regarding active space debris cleaning.*

Keywords: *State Responsibility, Space Junk, Space Objects, Space Treaty 1967, Space Law.*

INTRODUCTION

Space launch activities since the *Sputnik 1* era in 1957 have opened a new chapter in human civilization. Space, especially Low *Earth Orbit* (LEO) and Geostationary *Orbit* (GEO), has now become the lifeblood of global telecommunications infrastructure, navigation, meteorological observation, and military interests of national defense. However, the massive

commercialization and privatization of space today presents a very serious negative externality for the sustainability of the space environment itself[1].

Each man-made satellite launched has a limited operational life (service life). When a satellite runs out of thrust, suffers a systemic malfunction, or has completed its mission, it does not necessarily fall to earth or disappear. These objects remain orbiting the earth as inanimate objects that can no longer be controlled. In astronomical terminology and the laws of space planning, a decommissioned satellite and its launcher rocket debris are classified as *space debris* or *orbital debris*.[2]

According to data released by the *European Space Agency* (ESA) and *the National Aeronautics and Space Administration* (NASA), there are currently millions of space junk particles orbiting the earth at speeds of up to 28,000 kilometers per hour. At this kinetic speed, even a metal chip the size of a marble has a destructive power equivalent to a grenade explosion if it collides with an operational satellite or the *International Space Station* (ISS). This condition gave birth to a threat that Donald Kessler theoretically predicted in 1978, known as Kessler Syndrome. This syndrome predicts a scenario in which the density of objects in low Earth orbit reaches a critical point, so that one collision will produce a domino effect in the form of a series of collisions that produce thousands of new debris, and ultimately make the Earth's orbit covered by a belt of metal junk that makes future space exploration impossible.[3]

In this study, what is meant by a collision is a collision *in outer space*, especially a collision between a space object in the form of an active satellite and an inactive satellite or space debris (*space debris*) that is in the earth's orbit and results in damage or loss to space objects belonging to other countries. The collision includes not only a direct impact between two satellites, but also a collision between the satellite and debris from a space object such as rocket parts, metal fragments, or satellite components that are no longer functioning.[4] In international space law, these collisions in space are important because they determine the state liability regime based on the 1967 Space Treaty and the 1972 Liability Convention, especially regarding the application of *the principle of fault-based liability* for losses incurred in space.

From the perspective of international law, all activities in space are subject to the regime of *international space law*, the main foundation of which is laid by the *Treaty on Principles*

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[1] Houle, C. (2024). Preventing the next global crisis: Addressing the urgent need for space debris removal. California Law Review, 112(1), 345–412.

[2] Steele, S. M. (2022). Space debris: A basis for actively removing objects under an international legal order. American Journal of Aerospace Engineering, 8(2), 45–60. https://doi.org/10.11648/j.ajae.20210802.11

[3] NASA Estimates There Are 0.5 Million George Putic Space Debris - https://www.voaindonesia.com/a/nasa-perkirakan-ada-setengah-juta-sampah-antariksa/1945202.html

[4] Edward M.L. Panjaitan and Sandy Tanggono, "International Liability for Losses from Satellite Collisions in Space Caused by Deorbit," *Journal Justiciabellen* 5, no. 1 (January 2025): 30–46, https://jurnal.unsur.ac.id/index.php/JJ

Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967 (hereinafter referred to *as the 1967 Space* Treaty). This treaty is often dubbed the *Magna Carta* of space because it contains fundamental principles, such as the principle of freedom of exploration, the principle of *non-appropriation principle*, and the principle of the use of space for peaceful purposes.[5]

However, when the *1967 Space Treaty* was formulated in the midst of the Cold War, the main focus of the international community was on preventing a nuclear arms race in space, not on the issue of the orbital environment. Therefore, the *1967 Space Treaty* is epistemologically lagging behind in terms of specific arrangements regarding the definition, mitigation, and responsibility for "space junk". The nomenclature known in the treaty is simply "space bodies".[6]

This paper is intended to examine and analyze analytically the legal construction of the responsibility of the satellite owner state that has changed its status to space junk. The analysis focused on dissecting Articles VI, VII, VIII and IX of the *1967 Space Treaty* to test the extent to which this classical instrument is able to answer the legal challenges of modern space collision disputes, as well as dissect the evidentiary impasse due to the application *of the fault based liability* principle in space.

In international space law, the determination of ownership and jurisdiction over a satellite or space object is not determined by the flag of a country as on a ship or aircraft, but rather through a space object registration mechanism. The legal norms in this regard are regulated in Article VIII of the 1967 Space Treaty which states that the country that registers the space object retains jurisdiction and control over the object while it is in space. This provision was later clarified in the *1975 Convention on Registration of Objects Launched into Outer Space* which required each launching country to register its launched space objects in the national register and report it to the Secretary-General of the United Nations. Through such a registration mechanism, a space object can under international law be identified as belonging to or under the jurisdiction of a particular country.[7]

In contrast to the law of the sea and the law of the air which use the *flag state principle* or the principle of floating island to determine jurisdiction over ships and aircraft, space law uses

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[5] United Nations General Assembly, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, Resolution 2222 (XXI), 1966, https://www.unoosa.org/oosa/oosadoc/data/resolutions/1966/general_assembly_21st_session/res_2222_xxi.html

[6] Radi, Y. (2023). Clearing up the space junk: On the flaws and potential of international space law to tackle the space debris problem. ESIL Reflections, 12(2), 1–10. https://esil-sedi.eu/esil-reflection-clearing-up-the-space-junk-on-the-flaws-and-potential-of-international-space-law-to-tackle-the-space-debris-problem/

[7] Noo, Dimitri Anggrea. "State Responsibilities Under the 1967 Space Treaty for Commercial Activities in Outer Space." Accessed file:///Users/user/Downloads/18881-1-36025-1-10-20160218.pdf.

the principles of launching *state and state of registry* as the basis for attribution of ownership and legal responsibility.[8] Thus, proving that a satellite belongs to a country is done through international registration data and launch identification, not through physical symbols such as the country's flag. However, in practice, this proof can be difficult if the cause of loss is a small fragment of space junk that can no longer be identified from the country, thus causing legal problems in determining state responsibility. The problem of attribution of ownership of space objects is one of the weaknesses in the current international space law regime.

PROBLEM FORMULATION

1. What is the construction of the legal status of inactive satellites (space debris) based on Article VIII of the 1967 Space Treaty?
2. What is State Responsibility Based on Article VI of the 1967 Space Treaty?

RESEARCH METHODS

This research is a normative legal research that places law as a building of a system of interconnected norms, principles, and rules. The research approach used is a statute *approach* that focuses on the study of international treaty instruments, especially the *1967 Space Treaty* and *the Convention on International Liability for Damage Caused by Space Objects* (1972). In addition, a conceptual approach is used to analyze the doctrines of *state responsibility* and *liability* in international law.

Primary legal materials include the official text of the international convention on space. Secondary legal materials are sourced from international legal literature, academic journals, reports *of the United Nations Committee on the Peaceful Uses of Outer Space* (UNCOPUOS), and the views of leading scholars (doctrine). The data was analyzed prescriptive-analytically using deductive logic, which is drawing conclusions from the general principles and norms of space law to be applied to the specific problem of inactive satellites that become space junk.

DISCUSSION

1. Construction of the Legal Status of Inactive Satellites (Space Junk) Based on Article VIII of the 1967 Space Treaty

The first starting point in formulating legal responsibility is to occupy the ontological and juridical status of space junk itself. Empirically, when a satellite can no longer be controlled due to running out of fuel (*propellant*) or malfunction of the telemetry function, the satellite switches to pure waste. However, the *1967 Space Treaty* instrument does not contain a definition of "*space debris*" at all. The convention only recognizes the term "*space object*".[9]

The absence of this definition is overcome through an extensive and systematic interpretation of Article VIII *of the 1967 Space Treaty* which is read together with Article I letter (d) *of the 1972 Liability Convention*. The provision states that the term space object includes the components that make up the object, its launch vehicle, and the parts of the launch vehicle.

Based on the expansion of the definition, space law experts such as Bin Cheng and Frans von der Dunk agree that the operational function of an object in space does not affect or abolish

[8] Ida Bagus Rahmadi Supancana, *Basic Concepts of International Law and International Space Law* (Jakarta: Atma Jaya Catholic University of Indonesia Publisher, 2020), p. 37.

[9] Mahoney, A. (2022). It's raining rockets: Heightening state liability for space pollution. Chicago Journal of International Law, 23(1), 1–45. https://cjil.uchicago.edu/print-archive/its-raining-rockets-heightening-state-liability-space-pollution

its legal status. In other words, operational satellites worth trillions of rupiah or pieces of dead metal left over from satellites that are completely useless, de *jure* have the equivalent legal status as "space objects".

The affirmation of this status has crucial juridical implications when linked to the principle of perpetual jurisdiction in Article VIII of the *1967 Space* Treaty. Article VIII underlines that:

> *"A State Party to the Treaty on which a space object is launched shall have jurisdiction and control over the object, and over any personnel thereon, while in space or on a celestial body. Ownership of space objects... unchanged as a result of its passage through space..."*

This legal construction of Article VIII gave birth to what is called the doctrine of perpetual possession and retention of absolute jurisdiction. This confirms that international space law does not recognize the concept *of res derelicta* (objects that are abandoned and lose their owners). Although the launching country (e.g. the United States or Russia) has *de facto* turned off its satellite instruments, abandoned them in orbit, and no longer uses them, de *jure* the dead satellite and any of its bolts and metal fragments remain the legal property of the registrant country. Ownership, jurisdiction, and control rights will never expire. Therefore, the satellite owner state cannot legally wash its hands or relinquish responsibility for disasters caused by the "wreckage" of its satellites in the future.[10]

2. *State Responsibility* Based on Article VI of the 1967 Space Treaty

In general international law, a state is only responsible for the actions of its own state apparatus or agents. However, the *1967 Space Treaty* made a radical breakthrough that deviated from the principle of common international law.

The fundamental responsibility of a state for all activities in space is affirmed in Article VI of the *1967 Space Treaty*, which reads:

> *"States Parties to the Treaty shall assume international responsibility for national activities in outer space, ... regardless of whether these activities are carried out by government agencies or by non-governmental entities..."*

This provision is the basis for imposing public responsibilities that are very essential today. Recent developments show that satellite launches are no longer dominated by state agencies such as NASA or Roscosmos, but rather by giant private companies such as *SpaceX, Blue Origin, and OneWeb.* When SpaceX launches thousands of Starlink satellites into orbit, those private satellites will eventually become space junk when their lifespan (about five years) is up.[11]

Based on the analysis of Article VI, the country in which the private company is domiciled or launched (in this case the United States) cannot avoid liability on the grounds that it is purely a civil act of a private company. The law of space stipulates direct *attribution*. The state is required to authorize and *continue supervision* of private satellites under its jurisdiction. If the private satellite turns into garbage that endangers the orbital trajectory of another country, then the one who will be sued in front of the international forum is not the board of directors of the private company, but the launching country. State Responsibility is inherent, inherent in it uninterrupted

[10] Byers, M., & Boley, A. (2023). Who owns outer space? International law, astrophysics, and the sustainable development of space. Cambridge University Press. https://doi.org/10.1017/9781108597135

[11] Hobe, S. (Ed.). (2023). Space law (2nd ed.). Hart Publishing/Nomos.

from launch, orbit, death of the satellite, until finally the object is destroyed and burned in the atmosphere.[12]

If Article VI talks about the moral obligation and general responsibility of a state for its activities, then Article VII speaks specifically about the obligation to pay financial compensation for the damage caused. Article VII *of the 1967 Space Treaty* outlines that any country that launches or attempts to launch an object into space, as well as a country whose territory is used to launch the object, directly bears the obligation of compensation for damage to the other party. The provisions of Article VII are very general and are subsequently executed and detailed through a derivative legal instrument that is *lex specialis*, namely *the Liability Convention 1972*. A legal analysis of the *1972 Liability Convention* reveals the existence of a two-pronged liability regime (jurisdictional dichotomy) that relies heavily on *locus delicti* (the place where the loss occurs):

A. Absolute *Liability* on the Earth's Surface and Airspace

Article II *of the Liability Convention* states that the launching country is absolutely responsible for the payment of compensation if a satellite (or its space debris debris) falls and damages the surface of the earth or the aircraft in flight. This absolute *liability is* in line with the principle of *strict liability* which does not require the victim country to prove the existence of "*fault*" or malicious intent (*mens rea*) from the launching country. The empirical fact that the satellite debris of country A fell on a building in country B is sufficient to oblige country A to pay all damages unconditionally.[13]

A classic example of the application of this principle is the crash of the Soviet Union's Kosmos 954 nuclear-powered satellite over Canadian territory in 1978. The Soviet Union was legally obliged to pay financial compensation for the cost of cleaning up radioactive waste without the need to prove whether the satellite crash was intentional or the result of negligence of Soviet technicians.[14]

B. *Fault-Based Liability* in Space

The sharpest and most crucial legal problem occurs when an accident occurs in space, namely in a vacuum orbital trajectory. Article III *of the Liability Convention* affirms that:

> *"In the event of damage inflicted anywhere other than the earth's surface on a space object belonging to a single launching nation... by a space object belonging to another launching country, the latter shall only be liable if such loss is the result of his fault or the fault of the person responsible for it."*

Article III applies the principle of responsibility based on fault. This is where the anomaly and *legal loophole* lies in prosecuting the country that owns space junk.[15]

To understand this impasse, the case of the satellite collision between Iridium 33 (an active communications satellite belonging to the United States) and Kosmos 2251 (a Russian military satellite that has been dead for many years and has the status of space junk) in 2009 is a

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[12] Blount, P. J., & Hofmann, M. (Eds.). (2023). Space law in a networked world (Studies in Space Law, Vol. 19). Brill Nijhoff. https://doi.org/10.1163/9789004527270

[13] Muñoz-Patchen, C. (2021). Regulating the space commons: Treating space debris as abandoned property in violation of the Outer Space Treaty. Chicago Journal of International Law, 19(1), 233–259. https://cjil.uchicago.edu/print-archive/regulating-space-commons-treating-space-debris-abandoned-property-violation-outer

[14] Absal Bachtiar, "Kosmos 954, a Nuclear Satellite That Fell from Space," *Kumparan*, May 13, 2020, https://kumparan.com/absal-bachtiar/kosmos-954-satelit-nuklir-yang-jatuh-dari-luar-angkasa-1tPBQ8zLeP1/4

[15] Srour, L. (2022, March 14). Who is going to take out the trash? Addressing space debris under international law. Public International Law & Policy Group. https://www.publicinternationallawandpolicygroup.org/lawyering-justice-blog/2022/3/14/who-is-going-to-take-out-the-trash-addressing-space-debris-under-international-law

perfect precedent. The kinetic collision destroyed both satellites and produced thousands of new debris (*Kessler Syndrome in action*).[16]

Normatively, to obtain compensation, the United States must prove the existence of an element of "wrong" (negligence or deliberate law/*culpa* or *dolus*) on the part of Russia as the owner of the dead satellite. Doctrinal analysis of proof of error in space faces almost impenetrable empirical obstacles:[17] Proving error in the case of collisions caused by space junk faces various legal and technical difficulties. First, satellites that are no longer inactive cannot be maneuvered because they no longer have fuel or control systems, so their movements fully follow the laws of physics and gravity, making it difficult to attribute negligence on the part of the country that owns the satellite. Second, until now there has been no *internationally binding space traffic management* system as in the law of the sea or air law which has rules of navigation and right of passage, so there is no standard of prudence that can be used as a basis to prove that a country has been negligent in controlling its space objects. Third, in many cases the damage in space is caused by small fragments of space junk that are very difficult to trace the country of origin, even though the identification of ownership is an important condition for determining the country of responsibility under the 1975 Registration Convention, so that without such identification the attribution of state liability becomes very difficult to do

As a result of *this irrational* burden of proof, the *fault-based liability regime* in Article VII *of the Space Treaty* and Article III *of the Liability Convention* is practically paralyzed in dealing with disputes due to space debris.

In addition to the compensation mechanism, the responsibility of the satellite owner state must also be reviewed from the perspective of space environmental law. *The 1967 Space Treaty* alludes to this aspect of environmental protection in Article IX, which mandates that space exploration activities must be guided by the principles of cooperation, mutual assistance, and due *regard* to the interests of other parties. More specifically, Article IX orders states to conduct space studies in such a way as to avoid *harmful contamination* and to avoid adverse changes to the Earth's environment.[18]

The question that arises is, can the abandonment of dead satellites in orbit and the formation of space debris clouds qualify as violations of the obligation to avoid "harmful contamination" and "*potentially harmful interference*"?

Textually, the phrase "harmful contamination" at the time of the drafting of the treaty in the 1960s referred to scientists' fears of extraterrestrial biological contamination (bringing earth microbes to the moon or vice versa) and nuclear radiation pollution. Lawmakers in no way envisioned kinetic pollution in the form of mechanical waste.

However, through teleological interpretation (interpretation based on the legal purpose of environmental conservation), the actions of states that allow commercial satellites to die in a row on a very congested orbital trajectory have clearly ignored the principle *of due regard* (due consideration of the right of another country to pass safely). Referring to the renewal of these principles recommended by the *Inter-Agency Space Debris Coordination Committee* (IADC) and the UNCOPUOS guidelines on Space Debris Mitigation, the deliberate creation of space debris (e.g. through the test of satellite-destroying missiles/ASAT) constitutes a naked violation of the spirit

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[16] Muchamad Zaid Wahyudi, "Two Large Blocks of Space Debris Almost Collid," *Kompas.id*, October 16, 2020, https://www.kompas.id/artikel/dua-bongkah-besar-sampah-antariksa-nyaris-bertabrakan

[17] Christian Tomuschat, "International Law: Ensuring the Survival of Mankind on the Eve of a New Century," in *The Hague Academy Collected Courses Online*, https://referenceworks.brill.com/display/entries/HACO/A9789041114884-01.xml

[18] Sapre, A. A., et al. (2025). Space debris: Legal challenges toward a sustainable space environment. New Space. Advance online publication. https://doi.org/10.1177/21680256251391127

of environmental preservation in Article IX. Countries conducting ASAT tests have blindly undermined space safety governance.[19]

Realizing that *the liability* rules in space law are ineffective and that Earth's orbit is increasingly critical, modern technology has put forward proposals to carry out Active *Debris Removal* (ADR). This proposal involves sending a capture vehicle armed with a net, laser or magnetic harpoon to catch a dead satellite and deliberately burn it in the Earth's atmosphere (de forced orbit).[20]

However, this environmental rescue initiative is actually hindered by a thick fence of legal dogma born from the *1967 Space Treaty* itself. As analyzed in subchapter 3.1, Article VIII ensures that dead satellites remain the property and are under the absolute jurisdiction of the launching country. International law does not recognize the concept of taking over waste in space without permission.

If the European Space Agency (ESA) detects a dead Russian satellite that poses a serious danger to orbit, ESA does not have the unilateral legal authority to capture and destroy the Russian satellite. Touching, capturing, or deflecting the trajectory of another country's satellite (even if it has been a dead wreck for three decades) without a prescriptively valid permit is classified as a violation of property sovereignty, an act of mechanical aggression, and can trigger high-level international diplomacy incidents. An abandoned military dead satellite remains viewed as a state secret by its owner, and they will never allow foreign technology to touch it to be evacuated.[21]

The legal construction *of the 1967 Space Treaty* in this context turned into a double-edged sword. On the one hand, perpetual jurisdiction is aimed at keeping the state from running away from responsibility. But on the other hand, this perpetual possession makes space junk immune to unilateral intervention and evacuation efforts by the international community. This legally preserves the Kessler Syndrome, in which past legal regimes hold back the progress of future operational governance.[22]

The 1967 Space Treaty and other space law conventions do not explicitly use the term space debris, but implicitly their existence is included in the term space object. Article VIII of the 1967 Space Treaty states that the registrant state retains jurisdiction and control over the space object it launches while in space, regardless of whether it is still functioning or inactive. In addition, the 1972 Liability Convention defines space objects including their components and parts, which can include satellite debris or rockets that become space junk. Thus, although not strictly regulated, implicitly international space law has implicitly covered space junk as part of a space object.

State responsibilities in space law are set out in Article VI and Article VII of the 1967 Space Treaty and the 1972 Liability Convention. If space junk or an inactive satellite belonging to a country collides with an active satellite belonging to another country in space, then the applicable liability is fault-based liability as stipulated in Article III of the Liability Convention 1972. This means that the aggrieved country must prove the fault of the country that owns the satellite. The form of liability that can be imposed is generally in the form of compensation or compensation

[19] Hunter, D., & McKemey, Q. (2025). Advancements in space law: Satellite communications industry regulations and obligations for orbital debris mitigation. International Journal of Legal Information, 53(1), 1–30. https://doi.org/10.1017/jli.2025.5

[20] Lyall, F., & Larsen, P. B. (2025). Space law: A treatise (3rd ed.). Routledge.

[21] Robert Jan van Pelt, "The Van Pelt Report," *Holocaust Denial on Trial*, accessed [date access], https://www.hdot.org/van-pelt-report/

[22] Masson-Zwaan, T. L., & Hofmann, M. (2025). Introduction to space law (5th ed.). Wolters Kluwer.

for the damage caused, not criminal fines, because the space law regime is within the realm of public international law that emphasizes compensation and reparations.

If a country is suspected of making mistakes related to space debris that cause losses, the settlement is carried out through the international claims mechanism as stipulated in the 1972 Liability Convention, namely through diplomatic channels, negotiations, or the establishment of a Claims Commission if the parties do not reach an agreement. A country accused of being guilty can defend itself by proving that the loss was not due to its fault or was beyond its control, for example because the satellite is out of control or due to natural orbital factors. This shows that proving error in the case of a collision in space is very difficult to do.[23]

The state responsibility discussed in this study is not only limited to liability when space junk causes damage or collision with an active satellite belonging to another country, but also includes state responsibility for satellites that are already inactive and left to become space junk in Earth orbit. Thus, this study discusses the responsibility of the state both in the context of losses due to satellite collisions in space and the responsibility of the state in managing, controlling, and preventing the formation of space debris from its satellite launch activities.[24]

CONCLUSION

Based on the overall normative and conceptual analysis above, this study formulates the following sharp legal conclusions. First, in the construction of the *1967 Space Treaty*, the term "space junk" or inactive satellites does not have a different legal status from optimally functioning satellites. Both are equally classified as "*space objects*" that are subject entirely to the jurisdiction, control, and retention of absolute ownership of the launching country under Article VIII. There is no recognition of the doctrine of abandoned finds in space.

Second, the state bears permanent moral and political responsibility for the activities of its satellite launches, without dichotomizing the role of government agencies and private industry, as mandated by Article VI. However, the application of civil liability for the payment of compensation due to space collisions in orbit presents a legal vacuum due to the impasse of proof. Article VII of the *1967 Space Treaty*, which is married to Article III *of the 1972 Liability Convention*, requires proof of the existence of an element of "*fault-based liability*". Proving fault for the failure of the maneuver of a lifeless satellite wreckage moving passively in a vacuum is an empirical impossibility for the reporting country.

Third, the *1967 Space Treaty* has not facilitated the urgent need for decontamination of the orbital environment. The protection of perpetual property rights over satellite wrecks actually locks the steps of the international community in carrying out *Active Debris Removal* (ADR), because the state is not allowed to evacuate foreign waste without the intervention of state permits. This requires a revolutionary step in the form of the ratification of additional protocols or new conventions on space debris mitigation, which govern the relinquishment of ownership of dead satellites and transform the regime of proof of error into a universal absolute responsibility to safeguard the continuity of humanity's space exploration in the future.

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[23] Tiara Noor Pratiwi, "The Responsibility of the Launching State for Space Debris (Study on the Collision Incident of China's Space Debris with a Russian Satellite)" (Thesis, Faculty of Law, Universitas Brawijaya, 2014), https://media.neliti.com/media/publications/35241-ID-tanggung-jawab-negara-peluncur-terhadap-sampah-angkasa-space-debris-studi-terhad.pd

[24] Nurul Adzkia et al., "Legal and Security Challenges in Mitigation of Unidentified Space Debris: Threats to Space Missions and Astronaut Safety," Indonesian Journal of Law and Justice 2, no. 4 (2025): 1–15, https://journal.pubmedia.id/index.php/lawjustice

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