

Responsibilities and Legal Concerns in the Governance of Active Space Debris Removal

Jie Long and Chuying Huang***

Abstract

The mitigation of space debris presents an urgent challenge for the sustainable development of outer space, and active removal is widely acknowledged as the most effective measure for its eradication. Following the fundamental principles of space law, both nations facing threats from identifiable foreign space debris and those possessing capabilities have the right to engage in active removal operations. However, such actions are subject to stringent legal obligations towards the country responsible for registering the debris unless authorized by the United Nations, accompanied by an agreement on jurisdiction transfer, or justified by emergency circumstances. To ensure equitable allocation of liability, the international community must establish a mechanism for sharing responsibility and cross-waiver agreements among relevant countries. Additionally, exploring potential funding sources, involving non-governmental entities in cost-sharing efforts, and promoting commercial recycling initiatives can potentially facilitate active removal.

Keywords: Active removal; Statutory obligation; Responsibility for internationally wrongful acts; Liability-sharing mechanism.

Confronted with an excessive volume of space debris that imposes a substantial burden on limited orbital resources, addressing this issue within the legal framework established by the five conventions on space law, as well as through adherence to guidelines set forth by IADC and COPUOS Space Debris Mitigation Guidelines becomes imperative to enable efficient facilitation of active removal operations. In cases where a non-registering state undertakes such activities, careful examination is required concerning their legality while ensuring compliance with stringent obligations and liability for any resulting damages. Introducing more diverse regulations

* Assistant Professor, Institute of Space Policy and Law, Law School, Shenzhen University, China. Corresponding author. Email address: longjie@szu.edu.cn (J. Long).

** Research Assistant, Institute of Space Policy and Law, Law School, Shenzhen University, China.

encompassing mutual assistance, exemption provisions along guarantees would effectively clarify rights granted as well as limitations imposed while offering appropriate remedies associated with active space debris removal.

1. Active Removal Technology and Its Legal Basis

Space debris, encompassing spent rocket stages, defunct satellites, discarded objects from space missions, and fragments resulting from space collisions, constitutes the primary source of pollution in the space environment.¹ Presently, the space debris monitoring network actively tracks and catalogs over 28,000 pieces of debris. The cumulative mass of man-made objects in near-Earth orbit exceeds 9,200 tons.² This proliferation of space debris poses significant threats to human activities in outer space by compromising payload operation safety and spacecraft maneuverability while also potentially generating terrestrial impacts that endanger Earth's environment and human lives.

Space debris mitigation technology in China has undergone an evolution from a hierarchical approach based on debris size to encompassing three distinct categories: orbital avoidance, debris protection, and environmental control. This framework is consistent with the technical measures delineated by both the Inter-Agency Space Debris Coordination Committee (IADC) and the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), which have established guidelines for space debris mitigation. Within these categories, active removal technology emerges as particularly efficacious; nevertheless, its successful implementation requires not only technical expertise but also substantial economic support for tasks including debris destruction, orbit alteration, and material reuse. Regrettably, only a limited number of nations possess comprehensive capabilities for active removal.

Firstly, under Article 9 of the Outer Space Treaty, the principle of environmental protection necessitates that activities conducted in outer space refrain from causing damage or pollution to celestial bodies and outer space externally. Additionally, it is crucial to prevent internal contamination upon re-entry into Earth's environment. The definition of "harmful contamination" encompasses stringent control over contamination generation during activities and the treatment of existing contamination, with a focus on safeguarding intergenerational interests comprehensively. Consequently, addressing the prevailing issue of space debris retention

1 Xiangmin Xu and Yan Wang, "Utilization of Outer Space Resources and Improvement of the Legal System for the Protection of Outer Space Environment", (2007) 4 *China Population-Resources and Environment* 112.

2 Tang Jingshi and Cheng Haowen, "The Origin, Status and Development of the Space Debris Problem", (2021) *Physics*, Vol. 5, No. 5, 319.

becomes an essential obligation for nations engaged in space exploration. Only by effectively removing hazardous pollution can countries fundamentally establish usable orbital conditions for subsequent space endeavors. This indirectly grants countries legitimate authority to take action against debris.

Moreover, the principle of common interest enshrined in Article 1 of the Outer Space Treaty necessitates that the exploration and utilization of outer space be conducted for the collective benefit of all States, ensuring positive contributions to humanity while avoiding any detrimental impact on other nations' interests. This implies that States should prioritize substantive equality in their objectives and rights concerning outer space activities, whereby pioneers and current actors bear an obligation and responsibility to ensure equal opportunities for future generations, encompassing resource sustainability, orbital safety, and crucially addressing space debris removal as a fundamental prerequisite. Consequently, nations possessing debris removal capabilities possess the right to take action as creators of such debris; they must assume both the duty and responsibility to safeguard mankind's common interests while upholding equality within outer space endeavors.

Ultimately, both the Outer Space Declaration and Article 3 of the Outer Space Treaty stipulate that space activities should be conducted with the primary objective of fostering international cooperation and understanding.³ However, in situations where the issue of space debris escalates into a pressing crisis or significantly impacts community interests, it disrupts the established legal relationship between the state responsible for removal and the state registering the object. Failure on the part of the obligated state to promptly seek cooperation and take peaceful measures not only results in environmental pollution or spacecraft damage but also subjects them to scrutiny regarding their obligation to cooperate. Consequently, establishing legitimacy for the right to removal hinges upon satisfying principles of cooperation and mutual assistance as an essential prerequisite for advancing removal efforts.

2. International Obligations and Exemptions

While space debris is generally recognized as “non-functional” within the international community, it is still classified as a space object. The International Academy of Astronautics emphasized in its Cosmic Study on Space Traffic Management that there is no legal distinction between

3 Steele S M, “Can International Law Provide a Basis for Actively Removing Space Debris?”, 2020, 27.

operational spacecraft and non-functional space debris.⁴ According to Article 8 of the Outer Space Treaty (OST), States retaining jurisdiction over registered objects also maintain control over traceable space debris generated by them. This implies that the State of registry possesses the right to operate its space object and expects other States not to interfere with its jurisdiction or day-to-day management. Consequently, any removal of space debris by one State from another would be considered a direct infringement upon the property rights of the latter State, thereby necessitating compliance with international legal obligations such as notification, consultation, due regard or due diligence, and information sharing.

Active removal operations serve the global public interest. In situations where states with obligations are inadequate or face coercive impediments from registry states, or when space debris reaches a critical mass in emergency scenarios, remedies such as United Nations authorizations, agreements on jurisdiction transfer between states, and invoking the necessity of emergency can be utilized to prevent wrongfulness.

2.1. Authorised by the United Nations

The mitigation of space debris is not solely the responsibility of individual states or a matter to be resolved through bilateral or multilateral agreements. It is also a collective concern for the international community within the framework of global environmental governance and falls under the jurisdiction of public international law, specifically that of the United Nations. In situations where the density or location of space debris poses a threat to orbital security, in accordance with Articles 25, 39, 48, and 103 of the United Nations Charter, it is within the authority of the UN Security Council to determine if there exists a threat to peace and designate member states responsible for taking measures to restore outer space security. These designated clean-up obligations are considered high priority and binding on concerned member states. Failure by any member state to comply with these resolutions may result in coercive actions taken by the Council. Consequently, while authorization from the United Nations grants immunity from liability between removal states and registry states, any damages caused during removal operations outside the scope defined by such resolutions would render removal states liable.

2.2. Interstate Jurisdictional Transfer Agreement

According to Article 2 of the Registration Convention, the authority to register space objects is exclusively granted to the launching State. However, given the increasing diversification of space subjects and activities, it may

4 International Academy of Astronautics, Cosmic Study on Space Traffic Management (IAA, 2006, p.40), <https://iaaweb.org/iaa/Studies/spacetraffic.pdf>, accessed 2 August 2023.

become necessary to invoke customary international law principles that favor third States. This would enable States to enter into agreements granting rights to a third State, thereby allowing them to take action per such provisions. This approach finds support in international jurisprudence and State practice, as demonstrated by the Netherlands' transfer of registered satellites. Consequently, in active removal activities, jurisdiction, and control over space debris can be transferred from the State of registry through a legitimate bilateral agreement with the responsible removal State. Such an arrangement liberates the removal country from certain conduct restrictions based on mutual consent and facilitates lawful actions.

2.3. Invoke the Necessity of Emergency

Under Article 25 of the Draft on Responsibility of States for Internationally Wrongful Acts, a State may invoke necessity as a lawful justification for its actions in urgent situations, provided that: 1) such acts are the exclusive means by which the State can safeguard an essential interest against a serious and imminent threat; and 2) they do not significantly undermine any essential interest of the obligee State or the international community, while said obligee State has failed to fulfill its corresponding international obligation thereby excluding necessity, or contribute towards alleviating the state of necessity. A potentially affected State is entitled to rely on necessity as a legitimate basis for undertaking necessary measures.

Accordingly, a country may invoke the necessity to actively remove space debris from another State. However, this action should only be carried out when there is a serious threat to its essential interests and to neutralize that threat. The assessment of removal technology must consider it as the "sole means" to safeguard the interests of that State. Additionally, this act must not violate the essential interests of States other than the State of registration and the removal State or cause an urgent situation. While invoking necessity may exempt an action from wrongfulness in an emergency, any unlawful act beyond the scope of "essential interests" would still incur responsibility for an internationally wrongful act. Third States would also have the entitlement to claim compensation from the removal State for damage caused to space objects belonging to third States other than those related to accidental incidents during such actions.

3. The Responsibility and Liability of Debris' Active Removal

In the case of a State's activities for the removal of space debris from another State, two potential subjects may be subject to wrongful acts or damage caused by the removing State: namely, the State of registry and third parties other than the State of registry. Different responsibility regimes would apply to each subject.

3.1. Application of Responsibility for Internationally Wrongful Acts

Although international treaties and customary international law do not explicitly prohibit the active removal of space debris, certain actions would constitute serious violations of international rules and are contrary to the common interests of mankind. These include employing removal techniques that fail to meet national safety standards resulting in the release of biochemical substances, spread of nuclear radiation, or generation of additional debris; intentionally obstructing or delaying debris removal activities that worsen contamination in the space environment; using force in violation of the Charter of the United Nations and five conventions on space law; or engaging in offensive military activities under the guise of removal efforts. In such cases, countries should be held accountable for internationally wrongful acts and subjected to more severe penalties.

The responsibility for an internationally wrongful act is contingent upon the presence of fault, whereby a State that fails to fulfill its international obligations bears culpability for the damage caused by another State.⁵ In scenarios involving active removal, the removing State demonstrates its fault in distinct manners towards both the registering State and third parties. Firstly, before removal, if the removing State neglects its duty to engage in consultation with the registering State and proceeds with active removal without consent or authorization from either party or notification to the registering State, it constitutes an internationally wrongful act. Secondly, during the actual removal process, if the removing state fails to exercise due diligence towards the registering State and intentionally conducts removal operations using faulty technology or beyond what was agreed upon by consent and agreement of the registering state – resulting in unintended damage to space debris – it incurs liability for a wrongful act. Conversely, a removing state also assumes responsibility for internationally wrongful acts when conducting space debris removal operations that cause harm to third-party space objects. If such actions involve clear violations of international law against states other than those involved in registration; deliberate non-compliance with due diligence obligations; refusal to adhere to information-sharing responsibilities; intentional exceeding of United Nations authorizations; or intentional concealment and failure to report potentially hazardous situations – then they are accountable for any ensuing damages.

5 Corfu Channel (UK v. Albania) (Assessment of the amount of compensation due from the People's Republic of Albania to the United Kingdom of Great Britain and Northern Ireland), (1949) I.C.J. Reports, 3-43; see also the commentary on the present draft article. Corfu Channel (UK v. Albania) (Assessment of the amount of compensation due from the People's Republic of Albania to the United Kingdom of Great Britain and Northern Ireland), (1949) I.C.J., Dec. 15, 244-251.

3.2. Application of Liability for Damages

The principle of negligence is applied in international liability, where the categories of consequences serve as a criterion for damage resulting from unprohibited acts. Strict liability should be adhered to in cases of damage occurring to the ground surface and aircraft in flight, while negligence should be followed when other objects are damaged, with the corresponding assumption of liability for damages. Liability for damages is determined based on the presence of factual harm, negligent actions, and a proximate causal relationship between the action and the damage.

In cases involving active removal activities, regulations regarding liability differ concerning damage caused by both the State of registration and third parties. Firstly, when there is no deliberate wrongdoing on behalf of the removal state towards the State of registration, it is deemed a lawful action with both parties being exempt from mutual liability for damages. Secondly, under specific circumstances where unintentional harm occurs to a third party without any intended actions targeting them directly, liability for damages may apply if it can be proven that while fulfilling its international obligations to prevent such harm, inadvertence or negligence on the part of the removal state resulted in a causal link between their actions and incurred damage. Conversely, if there is no fault on the part of the removal state and insufficient proximate causation exists between their actions and subsequent damage caused by force majeure or other extra-intentional factors or due to lack of negligence on their part, they may be exempt from liability towards third parties.

The determination and assessment of liability compensability necessitates the inclusion of mechanical characteristics on space-based loads as an additional factor. An examination of article 49 in the ARS reveals that “reversibility” constitutes an additional constituent element in determining legality.⁶ Countermeasures that are temporary and provisional in nature, aimed at restoring the lawful situation between the injured state and responsible state while safeguarding the fundamental interests of both parties and the international community, fulfill the criterion of “reversibility” and thereby exclude liability. As per Article 22 of ARS,⁷ countermeasures preclude wrongfulness for acts committed by a state. However, according to Article 7

6 ARS, Art 49, Countermeasures are limited to the non—performance for the time being of international obligations of the State taking the measures towards the responsible State. Countermeasures shall, as far as possible, be taken in such a way as to permit the resumption of performance of the obligations in question.

7 ARS, Art 22, The wrongfulness of an act of a State not in conformity with an international obligation towards another State is precluded. The wrongfulness of an act of a State not in conformity with an international obligation towards another State is precluded if and to the extent that the act constitutes a countermeasure taken against the latter State in accordance with chapter II of Part Three.

of OST and Articles 2 and 3 of LIAB, a state remains liable for damages caused by its conduct not prohibited under international law. Concerning international public interest activities such as active removal of space debris, considering Article 49's concept of "reversibility," if damage aims to restore legality between states involved while safeguarding their fundamental interests along with those of the international community, and if such damage is naturally recoverable or repairable based on its mechanical properties (e.g., temporary dizziness caused by lasers), then either no liability would be attributed to the author state or mitigation thereof could be considered.

If the damage caused by active removal is not of a temporary or transitory nature and constitutes an unintentional "new situation," State responsibility arising from the wrongful act may be excluded. However, the injured state may still claim consequential damages related to labor costs beyond natural recovery. The determination of liability for such consequential damages would require a stringent proximate cause test. The removal state would not be held liable for damages if it did not constitute a proximate cause.

4. Suggestions on Implementation Mechanism for Active Removal Responsibilities

4.1. Liability-Sharing Mechanism for Compensation

In accordance with Article 9 of the Outer Space Treaty, which emphasizes cooperation and mutual assistance, active removal activities are primarily carried out through bilateral agreements between the state responsible for removal and the state overseeing the registry. These agreements are initiated by signing jurisdiction transfer agreements, followed by consultations to establish clear competence boundaries. Actions falling within the agreed scope are considered lawful while exceeding such scope would result in state responsibility.

A new model of shared responsibility between the parties is imperative. On one hand, the removal state should approach the registry state prior to removal to negotiate a proportionate share of responsibility for any damage arising during the operation. This would be established through an agreed procedure and documented in writing. In case of any damage, both parties would reimburse their respective proportionate shares of responsibility. The injured state may initially claim compensation from each involved state and subsequently seek internal recovery from other states based on proportional liability. On the other hand, if damage occurs outside the agreement during the operation, the removal state is authorized to make a supplementary request to engage in negotiations with the registry state regarding their respective proportions of responsibility for such damages. These negotiations should follow a pre-consultation process and adhere to specified forms, aiming to promptly compensate any injured third party as soon as possible.

However, the removal state needs to demonstrate that such damages were not caused by its unlawful acts or faults but rather by intervening factors or natural force majeure conditions. In this scenario, consultations and compensations should be carried out expeditiously without deliberate delays which could constitute an internationally wrongful act for which they are accountable. If disputes arise during these consultations, seeking intervention from either the United Nations or a third-party dispute settlement organization becomes necessary.

4.2. Disclaimer Agreements between Relevant Countries

Within the current legal framework, states hold distinct prerogatives in managing liability risks through collaborative arrangements. As stipulated in Article 16 of the Intergovernmental Agreement on the International Space Station, a reciprocal exemption from liability is established among partnering nations and their affiliated entities concerning damages resulting from activities associated with constructing and utilizing the International Space Station. Consequently, no claims may be pursued against fellow partners or their affiliates – encompassing contractors/subcontractors across all tiers – nor against users/customers at any level; this also extends to contractors/subcontractors engaged by said users/customers.

Therefore, this article advocates and calls for the establishment of specific waiver agreements at the United Nations level between relevant countries to facilitate active debris removal. It is possible to formalize a mutual reduction of liability for damages resulting from all legitimate removal activities associated with launch, capture, recovery, and propulsion operations through a comprehensive agreement involving partners and entities possessing or requiring knowledge about such operations. This waiver has the potential to include all collaborating launching states that have the right to register debris, states possessing capabilities for removal, states engaged in emergency removal under extraordinary circumstances, as well as potential victims having space objects located near debris. Participating states or other relevant entities joining this agreement will be prohibited from making claims against their partners or associated entities for damages resulting from lawful actions. By utilizing contractual principles grounded in voluntary consent and self-responsibility, this approach can effectively mitigate unwarranted claims and remedies.

4.3. Establish an International Fund for Debris Removal

To enhance the efficiency of active debris removal, an international treaty could establish a dedicated fund for debris mitigation and removal, overseen by COPUOS. This would require space-faring nations to contribute to the fund upon joining a space law-related treaty and create an international organization within the treaty responsible for managing the fund's collection and distribution of revenues. The funds collected would be allocated towards both debris removal efforts and compensatory measures to facilitate effective mitigation

activities. National contributions should be calculated proportionally based on their current orbital debris inventory.⁸ Additionally, integrating total risk creation with total removal contribution presents the only equitable and efficacious solution to address the challenge posed by space debris.⁹ In case of collisions between space objects, states would assume not only their national liability but also be obliged to make additional contributions to the debris removal fund commensurate with the amount of generated debris. Such a mechanism would impose significant financial obligations on states generating substantial amounts of space debris while simultaneously providing adequate financial support through a flexible remedial outlet.

4.4. Leveraging the Sponsorship Role of Non-Governmental Entities

In the context of state practice and debris removal studies, the implementation of a guarantee system is considered as an ultimate measure due to the unpredictable and non-excludable risk associated with damages, similar to national guarantee funds established in various countries for road transportation. This approach allows states to allocate a specific additional economic cost for national removal operations as a voluntary guarantee, which can be borne by private entities. Adopting this option, alleviates the financial burden solely carried by the state while facilitating private entities' involvement in sharing responsibility with the state, thereby safeguarding the confidentiality of outer space activities.

However, the establishment of a security regime necessitates the implementation of a licensing regime involving private entities. The inclusion of private subjects introduces an element of uncertainty and unknowns, thereby requiring the adoption of a universally accepted and recognized system for access among states. This process entails careful deliberation and determination of the essential core elements for licensing. Currently, only eight states have successfully implemented a similar authorization system for security purposes: the United States, Norway, Sweden, United Kingdom, Russian Federation, South Africa, Australia, and Ukraine. The legality of the entire sponsorship program and the legal considerations regarding access factors present significant research challenges.

In the case of private entities providing financial guarantees for debris removal, these entities pledge their assets based on specific commercial

8 Imburgia J S, "Space debris and its threat to national security: a proposal for a binding international agreement to clean up the junk", (2011) 44 Vand. J. Transnat'l L., 2011, 589, 630.

9 Mark J. Sundahl, Note, "Unidentified Orbital Debris: The Case for a Market-Share Liability Regime", (2000) 24 HASTINGS INT'L & COMP. L. REV. 125, 138 (noting that increased space activity may bring about the Kessler effect); Carl Hoffman, Battlefield Space, POPULAR MECHANICS, July 2007, 76, (using the Kessler Syndrome to describe the space where China had decided to blow up one of its own satellites).

contracts or consensual agreements, and the return of the pledged assets can take various forms. With the gradual opening up of scientific research in space technology to private actors, except for cases involving state military secrets or compulsory nationalization, private actors can contribute to specific studies in certain technical fields to achieve more accurate and advanced technical outcomes. Therefore, private actors possess inherent advantages in processing and recycling space debris. It is recommended that both the encumbered removal state and the private entities implementing the guarantee may agree to transfer ownership of space debris after its removal through agreement or other forms of consensual confirmation, including contracts and written offers. This model fosters a closer alignment of interests between the state and private entities while facilitating an efficient flow of funds and debris removal operations. However, different ownership attributions and varying levels of information confidentiality associated with the debris would be subject to distinct liability reviews.

5. Concluding Remarks

It is crucial to address the issue of space debris to ensure sustainable development of the orbital environment. Overcoming obstacles in the liability regime for the active removal of space debris by one state on behalf of others is imperative. The legal basis for proactive removal operations can be invoked through principles such as environmental protection, common interest, cooperation, and mutual assistance within existing international legal frameworks. In cases where the registry state retains jurisdiction and control, the removal state should strictly adhere to obligations regarding consultation, notification, due diligence, and information-sharing unless authorized by the United Nations or through an interstate jurisdictional transfer agreement or invoking emergency necessity. The liability regime for outer space offers ample room for expansion with its center around the Liability Convention. Proportional sharing of liability can be achieved through pre- and post-agreements between the removal state and registry state to safeguard compensation claims from affected third parties. Drawing inspiration from the exemption scheme outlined in the Intergovernmental Agreement on International Space Station (ISS), responsibility for removal could be placed in the public domain to relieve unnecessary burden on the removal state. Enforcing liability mechanisms can primarily rely on an international fund dedicated to debris removal while enhancing funds flow towards active removal efforts and facilitating the recycling of debris materials by introducing non-government entities and implementing a guarantee system. With modernized liability regimes in place, countries possessing capabilities for active debris removal could transition from preparatory measures to actively engaging in such endeavors.