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**General exchange of information and views on legal mechanisms relating to  
space debris mitigation and remediation measures, taking into account the work  
of the Scientific and Technical Subcommittee**

**Space Debris Mitigation and Remediation: Policy and Legal  
Challenges**

**Conference room paper by the National Space Society**

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## **Space Debris Mitigation and Remediation: Policy and Legal Challenges**

### **1. Introduction**

Space debris removal is the ability to retrieve objects in space and remove them from orbit. It is challenging for several reasons including technical, legal/regulatory, political, and economic. The issue of space debris spans all nations since space is without borders. Though minimal action has been taken thus far in debris removal, a 1978 paper by Donald J. Kessler and Burton Cour-Palais spawned decades of work characterizing debris in space, including their number, types, and orbits, as well as the creation of voluntary debris mitigation standards that have gained worldwide endorsement. Mitigating new space debris will only slow the acceleration of the degradation of the space environment. To remediate the environment, positive steps are required including active debris removal (ADR). The recent introduction of new space actors and corresponding increase in space operations has raised the profile of the concept of space sustainability. ADR is an important element to ensuring that the orbital space environment remains viable.

### **2. Background**

National actors have individually acted in a way that is a classic “tragedy of the commons” situation with the outer space environment where using up a resource makes rational sense to the individual actor at the expense of all other actors. This has had the effect of leading States to approach the problem passively rather than actively (Carns, 2017). These passive efforts that States have taken have primarily focused on monitoring the problem and mitigating the creation of future space debris which, alone, is unlikely to solve the debris problem. Some States have chosen to incorporate space debris mitigation principles into their domestic law. However these laws only address the creation of additional space debris meaning that little to no law has been created mandating the removal of existing debris (Carns).

### **3. Current International Space Debris Guidelines**

States have attempted to influence other national actors to act according to a consensus regime with proposals for international non-binding agreements and codes of conduct in space. However these principles are soft law and have no enforcement mechanisms (Carns, 2017). International guidelines have been developed for the use of near-Earth space which emphasize the need to take measures to reduce the production of new space debris during launch, operations, and disposal. In 2010, the United Nations Office for Outer Space Affairs issued space debris mitigation guidelines that suggest that operators should limit debris released during operations, minimize the potential for breakup during operational phases, limit the probability of accidental collision in orbit, minimize potential for post-mission breakups resulting from stored energy, avoid intentional destruction and other harmful activities, and limit the long-term presence and interference of spacecraft and launch vehicle orbital stages (United Nations Office for Outer Space Affairs, 2010). However these guidelines are purely voluntary, with no

enforcement mechanism and do not support the creation of a debris removal market. Adilov et al. (2015) states that given that at least some of the guidelines impose direct costs on actors but confer only indirect benefits, the marginal costs of compliance will exceed marginal benefits meaning that it will not be individually rational for operators to voluntarily undertake at least some of the costs of mitigation. Sullivan & Ben-Itzhak (2023) assert that voluntary mitigation compliance is insufficient to address the orbital debris issue and is not likely to stabilize its population growth. Only strong national or international regulation can correct this market failure.

#### **4. International Law Considerations**

The provisions of treaties regulating conduct of States in outer space has raised unnecessary roadblocks for the removal of the bulk of dangerous space debris (Carns, 2017). Historical precedent states that material belonging to a State in space is owned by that State in perpetuity and that consent would be required if a third-party removed the material from the space environment (Carns). States retain sovereignty over derelict objects. A state cannot unilaterally remove another State's debris without the consent of the second State.

Attempting ADR operations presents multiple risks. If any damage is caused to a third party during the remediation operation, the launching state of the company carrying out the ADR will be held liable and be required to pay compensation to the claimant state (Emanuelli et al., 2014). ADR operations are risky because of the crowded space environment, lack of space situational awareness, and lack of space traffic management capabilities (Emanuelli et al.).

Regarding legal questions surrounding active space debris removal, there is perhaps no issue more important than the issue of ownership. Carns (2017) states that the five space treaties and subsequent declarations do not provide any definitive definition or explanation of space debris. Consequently, a custom has evolved that treats all artificial material in space as "space objects." The distinction between space objects and space debris is significant because it determines ownership in space. If redefining a space object as space debris would classify the object as abandoned, then removal without consent would be straightforward since there would be no owner from whom to seek consent. For now, the status of international law is that defining an item as a space object or space debris does not change its ownership status. Regardless of whether a piece of debris is useful, functioning, or otherwise, it is still owned by some entity in perpetuity. Neither the Outer Space Treaty nor the Registration Convention provide any mechanism for detaching a state from ownership over an object on a registry. Because of this, ownership in perpetuity is assured (Carns). This means that if the origin of the debris is known, legally only the launching state can remove the debris from orbit and thus, unless explicit legal consent is given to another entity to remove the debris, the right of ownership by salvage may not be claimed (May, 2021).

Continued ownership interest in larger objects is understandable based on issues such as residual value or proprietary technology (Carns). Whichever entity retains jurisdiction over a space object can assert the privileges associated with that space object but also assume any associated obligations with the object (Carns).

Beyond ownership questions, there is also the question of transferring certain aspects of ownership to another. If transferring ownership of a space object, the registering state still holds many obligations (Carns, 2017). In addition, there are often multiple launching States involved in a space object and consent for transferring ownership may need to come from multiple States with diverse and disparate interests (Carns). There is currently no provision in international law for the abandonment of a space object. Launching States keep their obligations to their space objects in perpetuity. The establishment of an abandonment mechanism or standard would assist in ADR since abandoned property could be removed, reused, or recycled without permission.

There are difficulties associated with identifying ownership of a space object, and thus determining fault, which present significant hurdles for liability (Carns, 2017). This creates a risk-benefit analysis which favors high benefits in the form of profiting from space operations, and low risk because the operator is only accountable for damage in space if both fault can be proven and definitive identification of the origin of the space debris can be made. This results in favor of taking the risks of creating space debris over incurring the expense of trying to prevent it (Carns).

Contant-Jorgenson et al. (2006) asserts that the world community should come to a consensus on whether space debris are space objects in the sense used in space treaties with the goal of a legal recognition of the difference between valuable space assets and space debris that have no value. International protocols should be developed stating what provisions of the space treaties apply to valuable spacecraft and which provisions apply to space debris and under what conditions space debris may be removed or re-orbited in order to prevent collisions or close encounters with valuable spacecraft (Contant-Jorgenson et al.).

## 5. Conclusion

The issue of space debris and what to do about it is becoming more critical due to the large number of cubesats and the arrival of satellite megaconstellations changing the magnitude of the problem. The increase in space activities will inevitably change the rules governing space as actors seek to secure safe operations for their assets in orbital space. To ensure a sustainable space environment, continued research, policy development, and technological innovation must be brought to bear. Current technology for on-orbit servicing and debris removal is in its early stages and still immature. Not only do spacefaring nations that have debris in orbit from legacy operations have an ethical responsibility to clean the space environment, but it is in their best interests to ensure the sustainability of the environment since their economies and militaries are so highly dependent on the use of space.

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