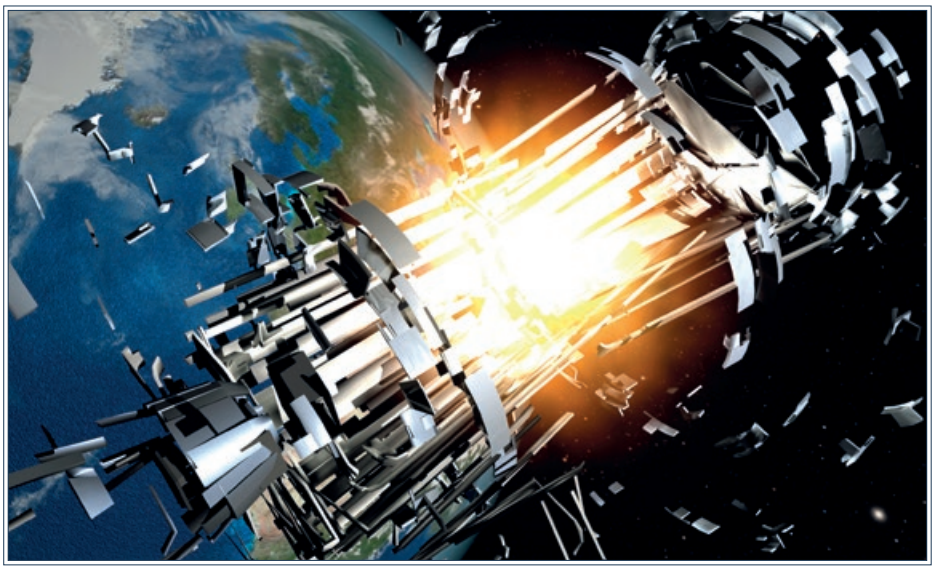
By Michael J. Listner

Legal Issues of Space Debris Remediation

Almost 60 years of space activities have left a self-perpetuating debris environment that threatens to render the outer space environment useless, particularly in low-Earth orbit. Space debris ranges in size from infinitesimal fragments to intact satellites, rocket bodies, objects from extravehicular activities, and fragments from exploded rocket bodies and collisions.

Space debris can be addressed through mitigation and remediation. Mitigation includes practices such as limiting the number of objects released during normal operations, reducing long term presence of an object in orbit after end-of-life, and releasing of stored energy through passivation. Measures like these are recommended in the Space Debris Mitigation Guidelines promulgated by the United Nations (UN), which are non-binding upon member states of the UN and implemented as mandatory requirements by a few of the space-faring nations only. Remediation includes methodologies for removal of existing space debris, a topic that is that in its infancy and facing substantial technical, financial, political, and legal hurdles.



Artist's conception of rocket body explosion, an issue that can be prevented through intentional release of stored energy (passivation), one of the mitigation measures recommended by the UN. – Credits: ESA

The Legal Framework

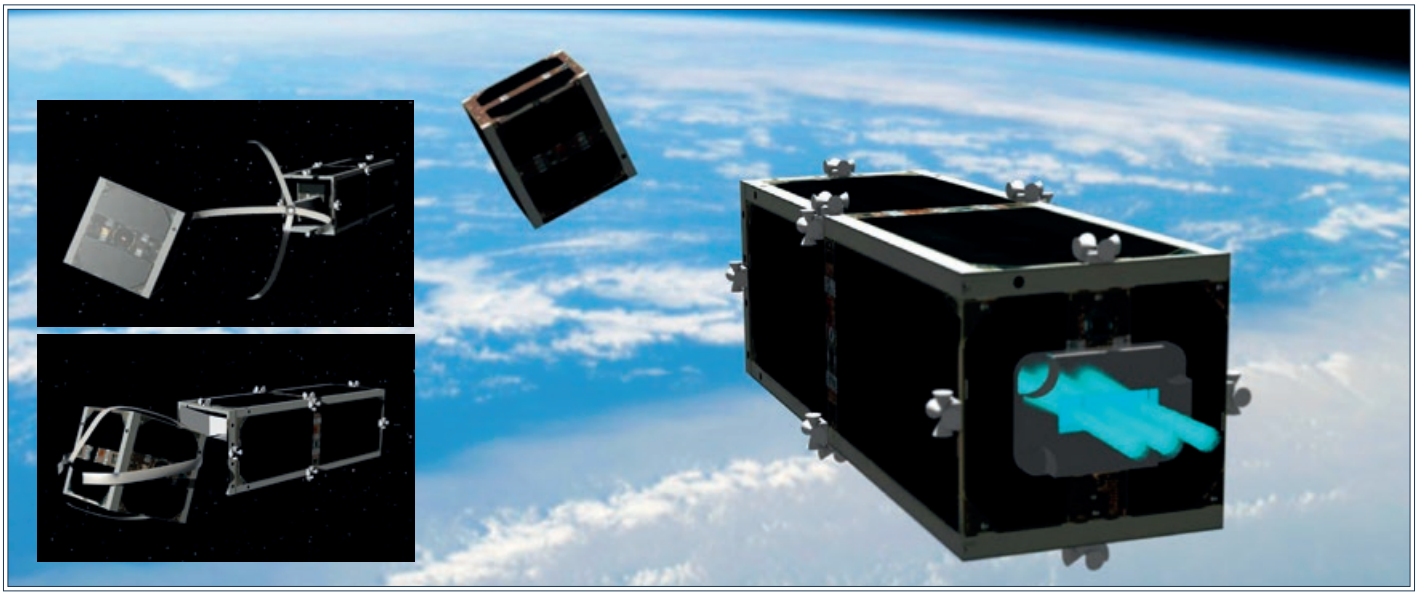
The issue surrounding cleanup of orbital space debris is rooted in Article VIII of the Outer Space Treaty (OST) where space objects, including non-functioning satellites, continue to belong to the country or countries that launched them. There is no right of salvage in space law, so even though a satellite may not be functioning it does not mean that it has legally been abandoned by the launching state. This is further complicated by the fact that international space law deems fragments and components of space objects as individual space objects in and of themselves, thereby requiring identification to determine the owner and either individual or blanket consent to remove such objects from orbit.

Besides ownership, there are licensing and compliance with International Traffic in Arms Regulations (ITAR) issues. Removal methodologies of intact derelict satellites may include the use of mechanisms that rendezvous with, attach to, and physically move a derelict from a stable orbit into either a graveyard orbit where it will not interfere with other space objects or into a less stable orbit, ensuring destructive reentry within a short period of time. Such methodologies require an intimate knowledge of the spacecraft, possibly triggering ITAR in the case of space objects belonging to the United States. ITAR issues could also arise if a derelict satellite registered to the United States is slated for removal by a foreign government, especially if this operation involves exporting spacecraft-related technical data outside the US. Before such exporting and subsequent satellite disposal could take place, licenses or other waivers would be required to address these issues.

> "Removal requires an intimate knowledge of the spacecraft, possibly triggering ITAR"

Disclosure of sufficient technical details regarding a derelict spacecraft could implicate intellectual property, including confidential and proprietary technical information as well as patents. Licensing, confidentiality, and nondisclosure agreements between the owners and former operators of the derelict satellites would have to be negotiated in order to protect the rights of the owners.

The issue of liability is also very relevant. Removal of space debris presents a risk, regardless of whether non-governmental or governmental organizations are performing the activity. Article VI of the OST requires that the country under whose jurisdiction that organization falls retain responsibility for their activities and any accidents incurred during their activities. The Liability Convention takes the issue of liability a step beyond Article VII of the OST, envisioning an event where a space object causes damage someplace other than the surface of the Earth, ▸▸



Artist's conception of CleanSpace One, a debris removal cubesat mission. – Credits: Swiss Federal Institute for Technology

including outer space or another celestial body, and applies a fault standard which apportions responsibility based on the culpability of the actors involved.

A Definition of Space Debris

Another troublesome issue of space debris is finding a suitable legal definition. The term "space debris" is commonly used to describe both the veritable junkyard of expended space objects in orbit and naturally occurring objects such as asteroids and meteors. There have been proposals in the context of legally binding treaties and liability for space debris, but an acceptable legal definition for space debris is still missing.

While proposed definitions of space debris focus on the current problem of responsibility and liability for damages caused by them, they do not create a solution in terms of remediation. A strictly legal approach in the form of a treaty focused at the UN level has little chance of being implemented any time soon given the competing geopolitical interests of the various nations who make up the UN and the Committee on the Peaceful Uses of Outer Space (COPUOS).

A more practical approach to remediation of space debris is to apply a quasi-legal definition that directly addresses the problem of ownership. As mentioned above, one the primary issues of space debris removal is the absence of salvage rights because of the ownership issues related to Article VIII of the OST. To that end, a quasi-legal definition of space debris taking into account the economic value, historical value, and national security value of a space object would focus the impetus of space debris more on whether a space object should be expressly abandoned and disposed of than on liability.

Provisions of the Liability Convention and the Registration Convention incorporated into to a quasi-legal definition of space debris would bolster current international law and resolve issues of ownership and liability, especially in the context of the definition of "space object," which is similarly defined by both treaties. While there is debate about the definition of "space object" in the context of both treaties, the use of the term and a similar definition in the domestic space laws of some nations makes the case that the term as defined has customary legal precedent.

Historical Precedents and Future of Removal

A final legal hurdle that must be addressed is the legal act of removing space debris, which does not have sufficient precedent. The retrieval of a space object belonging to another nation, however, is not entirely without precedent. In February 1984, the commercial satellite Palapa B2, launched for the Indonesian government on Space Shuttle mission STS-41B, failed to reach geosynchronous orbit due to a malfunction of its perigee motor stage. While it was circling the Earth in a useless orbit, the satellite was purchased by Sattel Technologies of California from the insurance group that covered the loss. Sattel subsequently contracted NASA to retrieve the satellite, which it did in 1984. The satellite, renamed Palapa B2-R, was successfully re-launched in April 1990. After the re-launch, title of the satellite was transferred back to Indonesia.

> "The primary issue of space debris removal is the absence of salvage rights"

To cement the debris removal concept in the current legal and policy environment more precedents are needed. The Swiss debris removal proposed mission CleanSpace One, slated to remove a Swiss cubesat for this very reason, may in the future provide the precedent to cement a customary rule allowing a nation to perform active removal of both their own and other nation's space debris, creating a legal and policy impact similar to those of Sputnik-1 on the issue of free access and navigation of outer space.

The issue of space debris removal is an unconventional one, still in its infancy, with unprecedented legal and policy implications. The solution will likewise require a clear legal definition of the problem, and will require unconventional means to achieve it.