



# Active Space Debris Removal: When Consent Is Not an Option

By Melissa Kemper Force

**W**e are all dependent on space resources in one way or another. That dependency has been increasing for over half a century, even though the extent of our reliance has only become apparent to the general population in the new millennium. The 2015 *Space Report*, published by the Space Foundation, reported that from 2005 through 2014, the global space economy nearly doubled, generating \$330 billion in 2014.<sup>1</sup>

We rely on satellites for national security and everyday conveniences. A loss of communication, television, meteorological, remote sensing, GPS, or reconnaissance satellites would have profound consequences because there is virtually no facet of modern life that is not enabled by some satellite in space, which makes their vulnerability to damage or destruction by space debris a serious threat.

This article describes the phenomenon of space debris and the challenges involved in its removal or mitigation. Next, the article examines the framework of international space law pertaining to space debris and posits that interpretation of existing space treaty law may provide a legally valid and pragmatic means of addressing the problem of debris removal and the disconnect that generally exists between the responsibility for placing items in space versus removing them.

## What Qualifies as Space Debris?

Since AT&T and Intelsat placed the first commercial satellites in orbit in the early 1960s, the world has launched about 6,600 satellites. Most of them, working or not, are still orbiting in space. Of the 300,000 objects currently being tracked, only 1,265 provide service; all of the others are uncontrolled and uncontrollable debris.

Historically, spontaneous explosions of rocket stages containing leftover propellant were responsible for creating most of the new debris in space. More recently, as the volume of debris has increased, collisions among objects are becoming more frequent. Two events—in 2007, when China destroyed its own weather satellite, and in 2009, when a Russian spy satellite collided with an American communications satellite—illustrate the problem. Fallout from these two incidents alone produced an additional 5,000 objects, each of which may cause new collisions, thereby creating a chain reaction of collisions known as “the Kessler syndrome,” generating constantly

moving minefields of debris in the most popular orbits.<sup>2</sup>

The population of space debris is comprised of more than just fragments scattered from old collisions, explosions, and launch separations. It includes whole satellites that stopped working years, even decades, ago. Without any means of control, but considerable orbital velocity, these large objects pose a risk of crashing into each other or operational satellites. As more debris collisions occur, the riskier and more expensive it will become to ensure the continuity of space services on which we rely.

## Space Debris Mitigation

In the 1980s, perceptive legal minds began asking the hard questions,<sup>3</sup> but only in the 1990s did international law and policy begin to address the issue. Ultimately, the Inter-Agency Space Debris Coordination Committee (IADC)<sup>4</sup> worked to promulgate international guidelines to minimize the production of debris, which were subsequently adopted (in varied form) by the U.N. Committee on the Peaceful Uses of Outer Space (UNCOPUOS) in 2007 as “Space Debris Mitigation Guidelines.”<sup>5</sup>

## Active Debris Removal (ADR)

The danger posed by accumulated debris fields, and the need to take positive action to not only slow their propagation but to reverse it, is so well known that we have coined a phrase and an acronym—active debris removal (ADR)—to describe it. ADR encompasses the process, technology, and strategy to remove an immediate threat posed by a defunct satellite, a rocket body, or some other large piece of debris by nudging it into a safer orbit or forcing it to prematurely reenter the atmosphere.<sup>6</sup>

Mitigation measures alone are not sufficient to constrain the space debris population.<sup>7</sup> Thus, the emphasis has shifted to *removing* large objects that travel in congested orbits.<sup>8</sup> The European Space Agency has recommended ADR in low Earth orbit (LEO) as soon as possible,<sup>9</sup> and a NASA study concluded that ADR of

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large debris over the next 200 years, at the removal rate of one to five objects per year beginning in 2020, would stabilize the LEO population.<sup>10</sup> Other studies recommend an even faster rate of removal.<sup>11</sup>

The challenges to develop technical, financial, and operational capabilities required to actively remove an old satellite and prevent its collision with working satellites in its path are formidable and have only recently approached the point of serious discussion. But the *legal* barriers are even more daunting because they risk preventing any active cleanup of space, even if all other obstacles are overcome, by chilling any prospective funding with the prospect of unknown regulatory hindrances.

### The International Space Law Framework

No country, organization, company, or individual may participate in a space endeavor unless it complies with the rules of international law. These rules are comprised primarily of five space treaties negotiated in the United Nations in the 1960s and 1970s, supplemented by customary international law. The treaties provide the definitive legal framework of the outer space regime. Of the five treaties that govern human actions in outer space, the most fundamental is the Outer Space Treaty.<sup>12</sup>

The treaties were drafted and negotiated at a time in history when the contest for military superiority between two major spacefaring states was the dominant concern. All states agreed that no *area* in space would be subject to a claim of ownership by anyone. But ownership of *objects* in space was another matter. Ultimately, tensions on both sides were assuaged with mutual assurances that neither would interfere with the other's spacecraft and that each would retain its ownership rights. Perpetual ownership of space objects was the natural corollary of that bargain; the resulting constraints on future commercial interests did not receive much scrutiny.

### The Problem with Nonconsensual Use of ADR

ADR obtained by negotiated consent, with terms of payment, liability, and risk-shifting mechanisms agreed upon, presents no real legal issues. It is only when the owner of a hazardous nonfunctioning satellite withholds its consent or cannot be identified that legal challenges arise.<sup>13</sup> Nonconsensual ADR presents a dilemma because international law does not prioritize among the opposing interests of the owner (including its budgetary constraints, potential collateral liability, and dual-use national security concerns) and those of other users of the orbit who require the orderly and productive use of the orbit without risk of collision.

The legal problem for ADR arises when, in the absence of explicit consent, any state or entity needs to protect its spacecraft from an impending collision by diverting another state's debris. There has never yet

been a need to employ such a tactic—happily, because there is no technical or financial means to do so and no geopolitical will to endorse it. However, the continued proliferation of satellites in a limited number of preferred orbits, coupled with the potential for cascades of future collisions, will force us to consider the use of ADR as part of a larger policy to maintain a safe and sustainable space environment. To that end, we must overcome the argument that removal of dangerous debris requires the owner's explicit consent or, alternatively, abandonment of the object (which is impossible under the current space regime).<sup>14</sup>

The implication of the rule of perpetual ownership is that, once launched, the owner's property rights in the object confer absolute authority over that object in perpetuity, even after it ceases operation and the owner loses functional control over it. Although there are a number of interrelated legal issues that pose an impediment to ADR, it is this eternal fidelity to the superiority of ownership rights that prevents threatened users from using ADR to ameliorate the danger posed by hazardous space objects when their owners are unidentifiable or uncooperative.

### Interpretation of the Outer Space Treaty

The Outer Space Treaty could be construed to require a state of registry to retain control over any object launched into outer space, such that permitting a nonfunctional satellite to remain in orbit would violate that obligation.<sup>15</sup> But the *travaux préparatoires* of the treaty, discussions in the United Nations, and even the U.S. Senate hearings to ratify the treaty never considered orbital debris in this context (not that this should preclude such an interpretation). In the 1960s, the only recognized threat that other satellites could pose was radio interference.

There is no provision in the treaty that explicitly defines ownership of a space object as interminable; Article VIII of the treaty merely provides that ownership is "not affected" by an object's presence in space.<sup>16</sup> Propositions to curtail a state's sovereignty—including challenges to its absolute control over dead satellites—have generally been avoided by politically sensitive diplomats and consensus-driven space lawyers. Thus, the legal and policy concerns of ADR have languished because the inertial force of conducting space activities as if there were no duty to remove debris is much stronger than the will to muster political support to make spacefaring states accountable for that debris. For example, despite the relative success of the mitigation guidelines, about half of all satellites in orbit are not properly deorbited at the end of their lives<sup>17</sup> because the guidelines are entirely voluntary; efforts to make them mandatory have been consistently resisted.

Considering the difficulties of perpetual ownership and the appeal of the less risky alternative of just doing nothing, it is tempting to dismiss the invocation of

international space law to support ADR activities. However, a solution to the legal conundrum may be found in nothing more obvious than treaty interpretation.

### Addressing the Problem of Unbounded “Use” of Space

An interpretation of what *use* states are permitted to make of space should support the treaty’s proscription of nonappropriation.<sup>18</sup> There are no temporal limits on occupying any area of space for any given use. Currently, the undefined term “use” has assumed such an all-embracing reach that almost anything short of outright hostility may qualify as a legitimate “use” of space. The result is that even an object with no purpose or function other than “being” can possess an orbit indefinitely as long as it merely occupies the space.<sup>19</sup> This understanding of “use” results in no qualitative difference between occupation for the purpose of some nebulous “use” and forbidden national appropriation because the identical result is produced in both instances: preclusion of all other states from enjoying that area indefinitely.<sup>20</sup>

Interpretation of the treaty language to limit “use” in a constructive way could outlaw such eternal occupation of orbits or territory (which is essentially ownership in all but name). Such an interpretation is supported by analogues in the International Telecommunication Union (ITU), which implicitly recognizes that active “use” of an orbital position in a congested frequency spectrum is a predicate to a state’s right to occupy it.

The ITU incorporates a “bring into use” requirement for satellite frequencies, reducing the nebulous concept of “use” to practical applications that aid in the interpretation of Article I of the Outer Space Treaty. The “use” requirement derives from the key ITU determination that “radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically.”<sup>21</sup> The ITU regime provides insight into how and why the mere occupation of an orbit is not the kind of use “carried out for the benefit and in the interests of all countries” granted by the Outer Space Treaty, especially when its sole effect is to keep others from using a limited natural resource.

### Addressing the Problem of Perpetual Ownership

A second focus of treaty interpretation must address the problem of perpetual ownership. As discussed above, noninterference with another’s property rights in an object is currently inviolate because the only justifiable grounds for interference are either very vague (e.g., the use is not “peaceful”) or extremely limited (e.g., “objects carrying nuclear weapons or any other kinds of weapons of mass destruction”). But comparisons to national regimes that mandate action to keep the highway system clear of debris may

be useful to demonstrate that ownership rights in an object do not confer *absolute* protection in situations where the object’s activity is inconsistent with the “due regard” policies underlying space law.

For example, the U.S. Federal Highway Administration systematically coordinates a national program focused on the efficient clearing of traffic incidents from highways and “authority removal” laws allowing removal of vehicles from the roads without fear of liability claims from their owners. If the car is not being “used” on the highway, it will be removed—with or without the owner’s consent—for the greater safety of the traveling public and regardless of any ownership rights. Employment of such analogues can demonstrate why the bundle of rights that accompany ownership of uncontrolled space debris can and should be curtailed when social policy dictates (as when, for example, a sustainable and safe space traffic system must be maintained for the benefit of all spacefaring states).

Space law currently provides little guidance to define the types of conduct that cause prohibited harm. However, generally accepted international standards may be imported from customary international environmental law, which recognizes the obligation of states to ensure that activities within their jurisdiction and control respect the environment of other states and areas beyond national control.<sup>22</sup>

The duty not to cause significant transboundary environmental harm is not absolute; there is an international due diligence standard, which is generally considered to be appropriate and proportional to the degree of risk of transboundary harm in the particular instance.<sup>23</sup> That standard could apply to a state that permits its space object to cause hazards to navigation of other space users in affected orbits, so that it is vulnerable to a claim of violating generally accepted international rules if it fails to take steps “appropriate and proportional to the degree of risk” to abrogate or ameliorate the danger—establishing a concrete standard to measure “negligent” conduct in space.<sup>24</sup>

### Conclusion

Scientists have warned for decades that ADR will eventually be necessary, but current interpretations of international space law provide no support or incentive for its use. The necessary space law provisions exist, but their ambiguous interpretation affords the owners of hazardous space debris unjustifiably broad control and discretion to defer indefinitely any action to curtail that danger. Adoption of an interpretation of the treaty language consistent with the original intent of the international community and in a way that addresses the law and policy issues exposed by ADR could offer a solution. Making law by treaty interpretation would require no treaty adoption or amendment and could provide the impetus for adoption of ADR policies on a domestic or national level. At the very

least, widespread recognition of this interpretation of space law could contribute to the formation of customary international law supporting the use of ADR.

## Endnotes

1. SPACE FOUND., THE SPACE REPORT 2015: THE AUTHORITY GUIDE TO GLOBAL SPACE ACTIVITY 2 (2015), [https://www.spacefoundation.org/sites/default/files/downloads/The\\_Space\\_Report\\_2015\\_Overview\\_TOC\\_Exhibits.pdf](https://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2015_Overview_TOC_Exhibits.pdf).

2. See Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYSICAL RES. 2637 (1978).

3. See, e.g., HOWARD A. BAKER, SPACE DEBRIS: LEGAL AND POLICY IMPLICATIONS (1989).

4. The IADC is an international body comprised of the world's elite space agencies, including NASA, Roscosmos (Russia), JAXA (Japan), ESA (Europe), ISRO (India), CNSA (China), CSA (Canada), SSAU (Ukraine), and other major European agencies, formed to harmonize their efforts to address orbital debris.

5. The U.N. General Assembly endorsed the Space Debris Mitigation Guidelines, available at <http://www.iadc-online.org/index.cgi?item=documents>, in Resolution 62/217 on December 22, 2007.

6. Comm. on the Peaceful Uses of Outer Space, Scientific & Technical Subcomm., 49th Sess., *Active Debris Removal—An Essential Mechanism for Ensuring the Safety and Sustainability of Outer Space: Rep. of the Int'l Interdisciplinary Congress on Space Debris Remediation and On-Orbit Satellite Servicing*, U.N. Doc. A/AC.105/C.1/2012/CRP.16 (Jan. 27, 2012) [hereinafter *IICSD 2012 Report*].

7. See *Key Findings from the 5th European Conference on Space Debris*, EUR. SPACE AGENCY (Apr. 2, 2009), [http://www.esa.int/Our\\_Activities/Operations/Key\\_findings\\_from\\_the\\_5th\\_European\\_Conference\\_on\\_Space\\_Debris](http://www.esa.int/Our_Activities/Operations/Key_findings_from_the_5th_European_Conference_on_Space_Debris); see also Joseph S. Imburgia, *Space Debris and Its Threat to National Security: A Proposal for a Binding International Agreement to Clean Up the Junk*, 44 VAND. J. TRANSNAT'L L. 589 (2011); J.-C. Liou & Nicholas L. Johnson, *Risks in Space from Orbiting Debris*, 311 SCI. 340 (2006).

8. See James E. Dunstan & Bob Werb, *Legal and Economic Implications of Orbital Debris Removal: Comments of the Space Frontier Foundation in Response to DARPA Orbital Debris Removal (ODR) Request for Information for Tactical Technology Office (TTO), Defense Advanced Research Projects Agency (DARPA)* (Solicitation No. DARPA-SN-09-68, Oct. 30, 2009), <http://www.scribd.com/doc/23379988/Legal-and-Economics-Implications-of-Orbital-Debris-Removal>.

9. Heiner Klinkrad & Nicholas L. Johnson, *Space Debris Environment Remediation Concepts*, Paper Presented at the NASA-DARPA International Conference on Orbital Debris Removal, Chantilly, Va. (Dec. 8–10, 2009).

10. See Megan Ansdell, *Active Space Debris Removal: Needs, Implications and Recommendations for Today's Geopolitical Environment*, 21 PRINCETON JPIA 7 (2010) (citing J.-C. Liou & Nicholas L. Johnson, *A Sensitivity Study of the Effectiveness of Active Debris Removal in LEO*, Paper No.

IAC-07-A6.3.05 Presented at the 58th International Astronautical Congress, Hyderabad, India 6 (Sept. 21–28, 2007)).

11. See, e.g., *IICSD 2012 Report*, *supra* note 6, at 21 (“The focus of [ADR] should . . . be on removal of larger objects capable of causing catastrophic collisions and massive fragmentations in space. . . . [Given certain realistic parameters], there will be the need to remove 9.1 objects per year from LEO by means of [ADR] in order to achieve the threshold of stability within the 200 year timeframe.”).

12. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter *Outer Space Treaty*]. The other four treaties are the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119; the Convention on International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187; the Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 1023 U.N.T.S. 15; and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 3.

13. See Melissa K. Force, *Legal Implications of Debris Removal: Clean Space One under Investigation*, in 2012 PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 727 (2013).

14. Even “by renouncing rights of ownership the state is not released from those obligations which rest upon it as the result of launching the object or from further consequences thereof” (i.e., liability). MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 73 (1972).

15. See James E. Dunstan, *Space Trash: Lessons Learned (and Ignored) from Space Law and Government*, 39 J. SPACE L. 23 (2013).

16. *Outer Space Treaty*, *supra* note 12, at art. VIII (“A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth.”).

17. See Comm. on the Peaceful Uses of Outer Space, Scientific & Technical Subcomm., 48th Sess., *Towards Long-Term Sustainability of Space Activities: Overcoming the Challenges of Space Debris: Rep. of the Int'l Interdisciplinary Congress on Space Debris*, U.N. Doc. A/AC.105/C.1/2011/CRP.14, at 42 (Feb. 3, 2011).

18. *Outer Space Treaty*, *supra* note 12, at art. II (“Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”).

19. See *id.* at art. I (“The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all

countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.”).

20. The fact that the indefinite “use” and occupation is performed by a nongovernmental entity is irrelevant, because all nongovernmental actors are required to be supervised and authorized by a state, thus making it a “national” activity. *See id.* at art. VI (“States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.”).

21. *See Const. of the Int’l Telecomm. Union art. 44, in COLLECTION OF THE BASIC TEXTS OF THE INTERNATIONAL TELECOMMUNICATION UNION ADOPTED BY THE PLENIPOTENTIARY CONFERENCE 3 (2011); see also Constitution and Convention, ITU, <http://www.itu.int/en/history/Pages/ConstitutionAndConvention.aspx> (last visited Aug. 22, 2016). Article 44(2) of the ITU Constitution provides: “In using*

frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.” Thus, any orbit associated with the use of the radio-frequency spectrum is a limited natural resource, including LEOs.

22. *Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶¶ 29–30 (July 8). The International Court of Justice (ICJ) reaffirmed this statement in Gabčíkovo-Nagymaros Project (Hung./Slovk.), Judgment, 1997 I.C.J. 7, ¶ 53 (Sept. 25), and again in Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. 14, ¶ 193 (Apr. 20).*

23. *See Draft Articles on Prevention of Transboundary Harm from Hazardous Activities art. 3, ¶ 11, in Report of the International Law Commission on the Work of Its Fifty-Third Session, 56 U.N. GAOR Supp. No. 10, at 370, U.N. Doc. A/56/10 (2001), reprinted in [2001] 2 Y.B. Int’l L. Comm’n 144. The ICJ has recently applied the due diligence requirement to transboundary pollution in the Pulp Mills case, supra note 22.*

24. *See Melissa K. Force, When the Nature and Duration of Space Becomes Appropriation: “Use” as a Legal Predicate for a State’s Objection to Active Debris Removal, in 2013 PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 405 (2014).*