

Legal Implications of Debris Removal

Melissa K. Force*

Abstract

The Swiss Space Centre recently announced development of a new generation of satellites to remove debris from low-Earth orbit. Clean Space One would rendezvous with a target, extend an arm to grab it and then maneuver to fall out of orbit. Aside from political and security implications, legal issues confound the robust development of the industry and this paper targets some primary problems. Removing the legal protection from space debris afforded it by Article VIII (under which a state of registry retains jurisdiction and control over its space objects indefinitely) is one way to resolve the issue when an owner's space objects become nothing more than high-speed hazards. This article presents the argument that interpretation of the "use" of space objects as the predicate for their regulation under the treaties obviates issues that undermine confidence in the legality of a commercial ADR venture by viewing noncompliance with Treaties as a breach, remedied in accordance with international treaty law.

Introduction

Lest anyone believe the space community has been proactive in the effort to remove space debris, recall this exhortation in 1966: "Before long it will become mandatory for states to remove from orbit unmanned space vehicles and debris that pose a hazard to spacecraft navigation."¹ Even then, before there were any space treaties, the proliferation of debris remaining in orbit for extended periods had reached a point where interference with orbital spaceflight could be foreseen and the problem of congestion had become a popular target in the news, legal journals and *Life Magazine*.² Forty-six years, five multilateral

* B.S. Ch.E., J.D., LL.M., email: Force@MKForce.com, Adj. Professor, Loyola Law School, Los Angeles, California, USA.

1 Hall, R.C., *Comments on Salvage and Removal of Man-Made Objects from Outer Space*, Proc. 9th Colloquium on the Law of Outer Space 117 (1966).

2 *Id.*

treaties and thousands of launches later, international space law is *still* an obstacle to the facilitation of orbital debris removal; only now, it is restraining commercial enterprise that is technically capable of doing something about it.³

Active Debris Removal Is Necessary

NASA's orbital debris modeling studies show that the space debris environment has reached a "tipping point" in which the population of large orbital debris objects has reached a threshold where they will continually collide, creating a cascade of collisions that will make Lower Earth Orbit (LEO) unusable in decades from now.⁴ About 16,000 man-made objects large enough to destroy a spacecraft can be identified;⁵ of these, 999 are operational satellites⁶ and 2683 are dead satellites and spent stages orbiting LEO in an environment in which 2500 intact objects appears to be the threshold for inducing instability.⁷ Still, each year 30-40 launches continue to inject 60-70 new objects into orbit.⁸

3 See, Dunstan, J.E. and Werb, B., *Legal and Economics 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)*, October 30, 2009, available at <www.scribd.com/doc/23379988/Legal-and-Economics-Implications-of-Orbital-Debris-Removal> (hereinafter, Dunstan and Werb). All online citations for this paper were accessed as of 9 September 2012, unless otherwise specified.

4 National Research Council Committee for the Assessment of NASA's Orbital Debris Programs Summary Report, *Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs*, (2011) (hereinafter, NRC Report) (available at <www.nap.edu/catalog.php?record_id=13244>).

5 See, Report of the International Interdisciplinary Congress on Space Debris Remediation and On-Orbit Satellite Servicing, *Active Debris Removal – An Essential Mechanism for Ensuring the Safety and Sustainability of Outer Space*, presented to the UNCOPUOS Scientific and Technical Subcommittee, Forty-ninth session, A/AC.105/C.1/2012/CRP.16 (Jakhu, R., Ed., 27 January 2012) (hereinafter, the Third International Interdisciplinary Space Debris Congress Report) at 16. The numbers differ depending on the source of data. As of August 23, 2012, among the 38,751 objects larger than 10 centimeters being tracked by Celestrak, 1,123 are identified as active payloads and 5,413 as nonfunctional payloads. See, <celestrak.com/satcat/boxscore.asp>.

6 The Union of Concerned Scientists identified 999 operating satellites, 470 of which are in low Earth orbit; another 424 are in the geosynchronous orbit. See, <www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html>.

7 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 20.

8 Kallender-Umezu, P., *A Market for Cleaning Up Space Junk?*, G-SEC Working Paper No.30, (2012), available at <https://www1.gsec.keio.ac.jp/imgdata/working/32_pdf.pdf> (hereinafter, G-SEC Paper), at 10-12.

In the 1970s scientists postulated that the runaway growth of space debris owing to collisional cascading would eventually prohibit the use of Earth's orbit,⁹ and in the 1980s perceptive legal minds began asking the hard questions.¹⁰ But it wasn't until the 1990s that international law and policy even began to address the issue. Ultimately, the Inter-Agency Space Debris Coordination Committee (IADC) worked tirelessly to promulgate international guidelines to minimize the production of debris, which were subsequently adopted by the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) in 2007.¹¹ 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.¹²

But mitigation measures alone are not enough to constrain the space debris population¹³ and the emphasis has shifted to cull the herd by removing large objects that travel in congested orbits.¹⁴ The European Space Agency has recommended active debris removal (ADR) in LEO as soon as possible¹⁵ and a NASA study concluded that ADR of large debris over the next 200 years, at

9 See, Kessler, D.J. and Cour-Palais, B.G., *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 *Journal of Geophysical Research* 2637–2646 (1978).

10 See, Baker, H., *Orbital Debris: Legal and Policy Implications* (1989) (hereinafter, Baker).

11 The UN General Assembly endorsed the Space Debris Mitigation Guidelines in Resolution 62/217, December 22, 2007, and the Guidelines are available at <www.iadc-online.org/References/Docu/SpacenDebrisnMitigationnGuidelines_COPUOS.pdf>.

12 See, International Interdisciplinary Congress on Space Debris, *Towards Long-Term Sustainability of Space Activities: Overcoming the Challenges of Space Debris*, UN Doc. A/AC.105/C.1/2011/CRP.14 (2011) at 42 (hereinafter, IICSD Report).

13 See, NRC Report, *supra* note 4, at 5; European Space Agency, *Key Findings from the 5th European Conference on Space Debris* (Apr. 2, 2009), <www.esa.int/esaCP/SEMKO5EHIT/index.html>. See, e.g., Liou, J.C. & Johnson, N.L., *Risks in Space from Orbiting Debris*, 311 *Science*, 340-341 (2006). See also, Imburgia, J.S., *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.* 589-642 (2011).

14 See, Dunstan and Werb, *supra* note 3, at 4.

15 Klinkrad, H., Johnson N.L., *Space Debris Environment Remediation Concepts*, NASA-DARPA International Conference on Orbital Debris Removal, Chantilly, VA, 8-10 Dec 2009.

the removal rate of 1-5 objects per year beginning 2020, would stabilize the LEO population;¹⁶ other studies recommend an even faster rate of removal.¹⁷

Commercial Interest and CleanSpace One

Commercial proposals have emerged proposing to clean up space in two main regimes; active debris removal (ADR) and on-orbit servicing (OSS). ADR refers to the removal of objects from orbit while OSS, typically aimed at objects in geostationary orbit (GEO) refers to the servicing of operational satellites to extend their lifetimes (repair, refuel, etc.).¹⁸ OSS and ADR technologies share legal and political concerns about their potential of antagonistic use for intelligence gathering, surveillance, reconnaissance, docking and use for Anti-Satellite Tests (ASAT),¹⁹ since the ability to repair or deorbit a satellite also includes the capacity to disable or destroy it.

Several programs could help establish norms to enable the basis commercial ADR business in LEO.²⁰ The Swiss Space Centre has developed an orbital debris remover called CleanSpace One, which will use a versatile motor to maneuver itself by matching the speeds of target objects.²¹ On approach, it would rendezvous using a robotic arm to grab the object and then guide the composite to a disintegrating reentry in the Earth's atmosphere. There are many other technologies (such as lasers, robotics, space sails, solar concentrators, electrodynamic tethers, drag augmentation devices, orbital transfer vehicles, and ultra short optical pulse) being developed for ADR.²²

16 See, Ansdell M., *Active Space Debris Removal: Needs, Implications and Recommendations for Today's Geopolitical Environment*, 21 Princeton JPIA (2010), <www.princeton.edu/jpia/past-issues-1/2010/Space-Debris-Removal.pdf, citing Liou>, J.C. & Johnson, N.L., *A Sensitivity Study Of The Effectiveness Of Active Debris Removal In LEO*, IAC-07-A6.3.05 at 6 (2007).

17 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, 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 active debris removal in order to achieve the threshold of stability within the 200 year timeframe.")

18 See, G-SEC Paper, *supra* note 8, at 5.

19 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 37-38.

20 See, G-SEC Paper, *supra* note 8, at 10-12.

21 See, Azriel, M., *CleanSpace One*, 3 Space Safety Magazine 6 (Spring 2012), accessed at <www.spacesafetymagazine.com/wp-content/uploads/2012/04/Space_Safety_Magazine_-_Issue_3_-_Spring_2012.pdf>.

22 For more examples of ADR technology, see, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 24-28 and G-SEC Paper, *supra* note 8, at 10-12.

Although ADR/OSS technologies have wide application on a “for hire” (consensual) basis, this paper addresses the legal issues that arise when nonconsensual use of the technology to remove large (identifiable) space debris from orbit becomes necessary for the benefit of all. It is important to recognize that when ADR becomes commercially available as an option for removal of an object, it is also available to any non-consenting state that does not want its object destroyed. Thus, the focus here is on those states that refuse to consent to third-party removal of their satellites but also refuse to do anything about it; these are states that place the cost of an ADR mission above the safety and interests of all other present and future spacefaring states.

Primary Legal Issues Pertaining to ADR

Numerous legal issues arise when the subject turns to nonconsensual removal of another state’s property. This section contains an abbreviated discussion of some of the most prominent issues relating to ADR,²³ although there are other relevant considerations.²⁴ It is also important to keep in mind that, whether or not the state consents, it continues to be liable for any damage caused by the space object.²⁵

- (a) There is no agreement on the definition of either “space object” or “space debris”, although both have been debated for decades. The current literature perceives a need to define space debris because the concept of “waste” connotes an intention on the part of the owner to abandon the object in question.²⁶ The

23 See, overview discussion of the legal issues in Listner, M., *The Legal and Political Issues of Space Debris Removal*, On Orbit Watch, (hereinafter, Listner, Legal Issues), available at <www.onorbitwatch.com/feature/legal-and-political-issues-space-debris-removal>. See also, G-SEC Paper, *supra* note 8, at 8. See also, Jasentuliyana, N., *Regulation of Space Salvage Operations: Possibilities for the Future*, 22 J. Space L. 5, 9-16 (1994).

24 Registration is another important issue. “[W]hile the UN OOSA website claims that approximately 93.5% of all functional space objects have been registered with the Secretary-General, it has also been noted that about 56% of all registered space objects are non-functional. Rather than representing a hopeful trend among states to register their debris, this figure is really testament to the poor track record of registering states to voluntarily update the transmitted information on functional space objects. De Man, P., *The Threat of Space Debris to the Further Exploration of Outer Space: An ITU Solution?* GLEX-2012,13,2,6,x12308 (2012) at 3-4.

25 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.) Lachs, M., *The Law of Outer Space: An Experience in Contemporary Law-Making*, 73 (1972).

26 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 30.

concern is that a technical definition of space debris focusing on functionality does not suffice for purposes of ADR since space objects that are non-functional may still have value (e.g., proprietary or security information). However, just because something has value to its owner does not mean it has a right to occupy a congested space, at the unbounded expense and hazard to everyone else.²⁷ Space policy should favor the safe movement of all vehicles above the idiosyncratic concerns of an individual owner whose fruitless occupation of an orbit endangers other users. The owner – if it values the object – should be responsible for removing it or else accept the consequences of living in a society that must use and interpret its laws to protect the whole. If action to solve the debris problem is conditioned on international agreement on a definition of debris, nothing will get done.²⁸ We need to accept that we do not need an agreed definition of “space debris.”

- (b) Article VIII²⁹ of the Outer Space Treaty³⁰ provides the state of registry retains jurisdiction and control over it while in space. The prevailing legal analysis of the issue concludes debris removal activity that involves selecting and removing any object from space (other than the state’s own object) crosses international legal thresholds.³¹ Without consent from the owner, a nonfunctioning satellite cannot be interfered with, period.³² Removing the legal protection from space debris afforded by Article VIII is the primary challenge that ADR must overcome without having to amend treaty provisions or adopt new ones. (See discussion below)
- (c) Liability. In general, the international legal system is consensual: A state is free to do whatever it wishes unless there is a limiting rule of international

27 See, e.g., de Man, P., *supra* note 24 at 8.

28 See, Listner, M., *Legal Issues Surrounding Space Debris Remediation*, The Space Review (6 August, 2012), available at <www.thespacereview.com/article/2130/1> (“[A] strictly legal approach in the form of a treaty focused at the UN level has little chance of being implemented any time soon ...”) See also, Williams, M., *Space Debris as a “Single Item for Discussion*, Proceedings of the 53rd Colloquium on the Law of Outer Space IAC-E7.4.7 (2011) at 8.

29 Article VIII provides: 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 ... is not affected by their presence in outer space ...

30 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 18 UST 2410 (1967) (Outer Space Treaty).

31 See, NRC Report, *supra* note 4, at 4.

32 *Id.* See also, Sterns, P., and Tennen, L., *Orbital Sprawl, Space Debris and the Geostationary Orbit*, 6 Space Policy 221, 224-225 (1990) (hereinafter, Sterns and Tennen).

law.³³ The primary rules for liability in space law are contained in the Liability Convention³⁴ and customary international law. Under Article III of the Liability Convention, a state will be considered liable only if it can be shown that the damage caused was due to the fault of the state (or states) responsible for the launch of the space object. But the Liability Convention does not define what constitutes “fault.” Policies governing liability for collisions between spacecraft require certain considerations, such as the greater likelihood of contributory fault, assumption of risk and even the effect of orbital mechanics, which are not necessarily the same when evaluating terrestrial impact damage.³⁵ It has been argued that absolute liability should be imposed upon the state of registry for any damage caused by its nonfunctioning debris.³⁶ But in the absence of treaty modification, a decision to interfere with an owner’s space object involves consideration of the tradeoff of benefits that may be achieved for spacecraft navigation versus potential international disturbance caused by pursuing nonconsensual ADR. A state authorizing ADR will retain responsibility for damages caused in the course of the removal and accidents that cause further space debris contamination. But for the removal itself, fault will be shared by the state whose reckless nonfeasance threatens catastrophic damage to all other legitimate users of the orbits involved and it will ultimately be left to judge which one is the more culpable.³⁷ Custom and precedent proceed at the risk of conflict and any action designed to resolve the issue without international agreement will ultimately be subjected to the risk of litigation in an imperfect system. The strength of the legal arguments favoring ADR and the social and economic policies they further will ultimately be tested in contested proceedings or the court of public opinion and may, or may not, end in agreement.

33 See, Lampertius, J.P., *The Need for an Effective Liability Regime for Damage Caused by Debris in Outer Space*, 13 Mich. J. Int’l L. 447, 456 (1992), citing Stamps, R.F., *Orbital Debris: An International Agreement is Needed*, Proceedings of the 32nd Colloquium on the Law of Outer Space 152, 154 (1989).

34 Convention on International Liability for Damage Caused by Space Objects, 24 UST 2389 (1972) (Liability Convention).

35 See, McDougal, M.S., et al., *Law and Public Order in Space* 623 (1963) (contributory fault and assumption of risk); Space Traffic Management Final Report, International Space University (Summer 2007) at 15, available at <www.isunet.edu/index.php/component/content/374?task=view> at 7 (orbital mechanics).

36 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 42. See also, Cheng, B., *Studies In International Space Law*, Ch. 13: Outer Space: Legal Framework at 506-07 (1997); Pusey, N., *The Case for Preserving Nothing: The Need for a Global Response to the Space Debris Problem*, 21 Colo. J. Int’l Env’tl. L. & Pol’y 425, 448 (2010).

37 See, Listner, M., *Revisiting the Liability Convention: reflections on ROSAT, Orbital Space Debris, and the Future of Space Law*, *The Space Review* (October 17, 2011), available at <www.thespacereview.com/article/1948/1>.

- (d) The U.S. International Traffic in Arms Regulations (ITAR) covers the export of any U.S. components or technology onboard a spacecraft, including the transfer of control or ownership to a non-US person; disclosing or transferring technical data; and/or performing defense services for non-US persons.³⁸ Performing active debris removal of any satellite with US technology invokes ITAR since transfer of jurisdiction and control over the space object will likely occur.³⁹ Before satellite removal could take place, licenses or other waivers would be required to address issues that might arise from the need to share technical data and address other ITAR provisions.⁴⁰ Maritime Law of Salvage and Finds. The problem with salvage law and the law of finds is that they rely on abandonment. ADR legal issues arise not when an owner consents to removal (and expressly abandons the object) but when an owner objects. In that instance, there is no abandonment. Just as Admiralty and international law hold that “a sovereign vessel that appears to have been abandoned remains the property of the nation to which it belonged at the time of sinking unless that nation has taken formal action to abandon it or to transfer title to another party,”⁴¹ launching states own space objects in perpetuity under the current analysis,⁴² and an entity that wants to salvage or claim space debris must get permission to do so.⁴³

Indefinite Non-Use Is Appropriation

Removing the legal protection from space debris afforded it by Article VIII (under which a state of registry retains jurisdiction and control over the space object indefinitely) is the only way around the conundrum of owner nonfeasance when its space objects become nothing more than high-speed hazards in busy orbits.

Article I: Outer Space Is Free for Exploration and Use

There are few absolutes in space law, but one of them is the principle enunciated in Outer Space Treaty Article I, that “[o]uter space ... shall be free for exploration and use by all States without discrimination of any kind, on a basis

38 See, Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 34.

39 *Id.*

40 See, Listner, Legal Issues, *supra* note 23; Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 34.

41 *Sea Hunt, Inc. v. Unidentified Shipwrecked Vessel*, 221 F.3d 634, 643 (4th Cir. 2000). See also, Geneva Convention on the High Seas, United Nations, *Treaty Series*, vol. 450, p. 11, p. 82 (1958).

42 See, NRC, *supra* note 4, at 4; Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 32-33.

43 See, Jasentuliyana, *supra* note 23, at 18.

of equality and in accordance with international law, ...”⁴⁴ As long as a state is exploring space or otherwise performing some activity furthering a peaceful purpose or goal in space, it has a right to occupy space in outer space. The question is whether national jurisdiction ceases or is nullified when a space vehicle’s useful life is ended – when its transmitters are shut down and all equipment ceases to function – and it just becomes a hazard to spacecraft navigation for eons until the friction of the upper atmosphere slows it sufficiently for reentry.⁴⁵ In resolving the issue, there is no need to limit the concept of “use” by any means other than standard contract interpretation of the treaty language,⁴⁶ keeping in mind that loss of function is distinct from loss of control.⁴⁷ In this context, *use* is commonly defined as the “application or employment of something for a purpose,”⁴⁸ or to “take, hold, or deploy (something) as a means of accomplishing or achieving something.”⁴⁹ Inherent in *using* something is the existence of a goal to be fulfilled; remove the purpose that is its *raison d’être* and one removes the justification of a thing’s existence.⁵⁰ The ordinary meaning of “useful” is “serving some purpose; advantageous, helpful or of good effect.”⁵¹ If it has no purpose, a space object has no use. The largest organization in the space domain, the International Telecommunications Union (ITU), with a membership of 196 states, restricts its members’ activity based on use. Though hundreds of administrations file for rights to a protected frequency every year, only a third actually end up completing the process;⁵² in the meantime, efforts by new users to register and coordinate their satellite systems are stymied because orbit and spectrum positions are “reserved” by many satellites that are not actually using them (i.e., the problem of “paper satellites.”) Thus, the ITU has regulations to ensure operators “bring into use” an assignment within a finite period of time and, if not, the privilege is

44 Article I, Outer Space Treaty, *supra* note 30.

45 See, Hall, *supra* note 1, at 119.

46 See, Article 31, 1969 Vienna Convention on the Law of Treaties, United Nations, Treaty Series, vol. 1155, at 331.

47 It is possible to have a satellite that does not maneuver but still be of use, such as scientific craft providing useful data and information or satellites parked in orbit intended for activation later. See, Perek, L., *Rational Space Traffic Management*, 53 ZLW 573, 581 (2004). In addition, a satellite may be “repurposed” after having outlived its estimated operational lifetime, or after a technical anomaly renders it unfit for its primary function, but still able to perform useful functions. See, Baker, *supra* note 10, at 111.

48 The Free Dictionary.com, <www.thefreedictionary.com/use>.

49 Oxford University Press, <<http://oxforddictionaries.com/definition/english/use/>>.

50 See The Free Dictionary, <www.thefreedictionary.com/raison+d'etre>.

51 Random House Webster’s College Dictionary, (HAR/CDR IN ed., 2005).

52 Statement of Zoller, J.N., Chairman of the Radio Regulations Board in 2011, Satellite Regulations, Improving the international satellite regulatory framework, available at <www.itu.int/net/newsroom/wrc/2012/features/satellite_regulations.aspx>.

cancelled.⁵³ The ITU implicitly recognizes that legitimate “use”, in a congested frequency spectrum, is the central consideration of a state’s right to remain in space.

ITU procedures that require that an owner actually and continually use its assigned frequencies and orbital positions are a concrete elaboration of the main provisions of the Outer Space Treaty; both aim to ensure the actual and efficient exploration and use of outer space and its natural resources by states, in order to safeguard the corresponding rights of other states to engage in similar space undertakings.⁵⁴ The ITU – and its specialized function – is merely one component of the entire domain of space enterprise. But all users of space share the same foundations, including peaceful *use* as the reason for occupying space and the need for the Outer Space Treaty to regulate it.

Article II: Appropriation of Outer Space is Forbidden

Perhaps even more axiomatic than freedom of use is the principle that appropriation of outer space is forbidden. Article II of the Outer Space Treaty provides that “[o]uter 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.”⁵⁵

The prevailing interpretation of “appropriation” is a taking for exclusive use with a measure of permanence.⁵⁶ Permanence has typically been measured by the intent of the occupying party,⁵⁷ so the time frame for determining appropriation has been open to question. But the ambiguity inherent in gauging intent undermines the probative value of the appropriation principle.

Both precepts (nonappropriation and freedom of use) have crystallized into customary international law.⁵⁸ The question is: At what point does nature and duration of the use of an orbital path become appropriation?⁵⁹

I propose the following answer: Occupation of an orbital slot or position becomes forbidden “national appropriation” at the point that it is no longer

53 Article 11 (Notification and Recording of Frequency Assignments), ITU Provisional Final Acts, World Radiocommunication Conference (WRC-12), Modified RR NO. #819811.44. A frequency assignment is considered to be brought into use when the satellite has been deployed and maintained at the notified orbital position for a continuous period of 90 days. *Id.*, RR No. #820111.44B.

54 *See*, de Man, *supra* note 24, at 8.

55 Outer Space Treaty, *supra* note 30.

56 *See*, Gorove, S., *Studies in Space Law: Its Challenges and Prospects* 82 (1977).

57 *See*, Martinez, L., *Communication Satellites: Power Politics in Space* at 92 (1985).

58 *See*, Lyall, F., and Larsen, P., *Space law: A Treatise* at 71 (2009).

59 Bin Cheng alluded to the potential difficulties of the issue, without providing an opinion. *See*, Cheng, B., *Studies In International Space Law* at 401 and 506-07 (1997).

being “used”; no longer capable of furthering a legitimate purpose.⁶⁰ Not only is there an absence of the premise upon which Article I freedoms are granted (exploration and use) but the state is also violating Article II by misappropriating space.

Once rights granted under the Outer Space Treaty are interpreted as being predicated on executing beneficial exploration and use, the intent of permanence can be inferred (without control, it will remain in orbit indefinitely). When a state’s object becomes nonfunctional and uncontrollable, the state is appropriating space because its occupation of that orbital position is effectively keeping everyone else out of it indefinitely. As Eilene Galloway presciently observed immediately following adoption of the Outer Space Treaty, under Article II no state would

claim, use or occupy [outer space]for purposes of establishing national control; for example, the power to *keep other nations out except on its own terms*. This is practically a corollary of Article I whose provisions would not allow national space programs which prohibit others from exploring the space environment.⁶¹

Permitting Hazardous Space Debris Violates International Law

Article IX Requires that a State’s Use of Space Be Consonant with Due Regard for Other Uses

Concurrent with loss of control and function, the satellite is transformed into an object capable of being only a detrimental hazard to other states using the space. Not only does it lack any legitimate use, its only possible *raison d’être* is now to pose a threat to other states’ use of the orbit. It is this additional element of a threat to others’ peaceful use of space – i.e., active violation of international law – that gives rise to a duty to ameliorate risk of harm to others.⁶²

60 Other commentators have expressed similar views. *See, e.g.*, Sterns and Tennen, *supra* note 32, at 226 (“Although the law of outer space does not require removal of inactive satellites, refusal to remove a nonfunctional craft could be the equivalent of misappropriation of space prohibited by Art. II.”); Meredith, P., *Spacecraft Motion Management (SMM): Institutional and Legal Frameworks*, Proceedings of the 35th Colloquium on the Law of Outer Space 102, 107 (1992) (“[S]ituations are conceivable where the nature and duration of the use and occupation are such that, in essence, an orbital path, or a collection of orbital paths, is being appropriated.”)

61 *See*, Galloway, E., *Interpreting the Treaty of Outer Space*, Proceedings of the 10th Colloquium on the Law of Outer Space 143, 144 (1967).

62 *Cf.*, Roberts, L.D., *A Lost Connection: Geostationary Satellite Networks and the International Telecommunication Union*, 15 Berkeley Tech. L.J. 1095, 1126 (2000) (“While mere occupancy by a state or a party for which such state exercises jurisdiction might be insufficient to constitute national appropriation in light of the endorsement of free access and use under Article I of the Outer Space Treaty, *the broad prohibition contained in Article II limits the scope of that use*) (emphasis added.) *See also*, Martinez, *supra* note 57, at 87-88.

It is true that nothing in the Outer Space Treaty explicitly requires states to remove their space debris but they do have continuing responsibility for it.⁶³ Paragraph 4 of Article V of the Rescue and Return Agreement⁶⁴, is the first logical step in effecting removal of the space object: A state which has reason to believe that a space object “is of a hazardous or deleterious nature” would notify the launching state, which must then take effective steps to eliminate possible danger of harm.⁶⁵ Although this may be an imperfect application, since it refers to space objects “recovered” by the discovering state, it is possible to imply the provision applies to constructive recovery without having to literally recover it by capture or possession. In any event, the owner must have an opportunity to ameliorate or remove the danger.

Art. IX⁶⁶ of the Outer Space Treaty broadly requires states to conduct all activities with due regard for interests of other states. Permitting objects to endanger other states’ space navigation is contrary to their interests and due regard requires that states prevent their space objects from causing harmful interference with space activities,⁶⁷ presuming there is a means to do so.⁶⁸

International Law Defines the Standard of Conduct

Pronouncement of environmental responsibility to avoid interference with the environment of another state, alone, does little to define the types of conduct that cause harm; there must be a violation of generally accepted international rules and standards.⁶⁹

63 See, Articles VI and VII, Outer Space Treaty, *supra* note 30.

64 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205.

65 See, Diederiks-Verschuur, I.H.Ph., *The Increasing Problems of Space Debris and Their Legal Solutions*, Proceedings of the 32nd Colloquium on the Law of Outer Space 77, 79 (1989).

66 Article IX: In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.

67 See, Baker, H.A., *Application of Treaty Law to the Regulation of Space Refuse*, Proceedings of the 31st Colloquium on the Law of Outer Space at 215 (1988).

68 “Due care” in international law means a state can incur responsibility for private acts taking place on its territory or perpetrated by its national if the state could reasonably have prevented such acts. See e.g., International Law Commission, Draft Articles Responsibility of States for Internationally Wrongful Acts, November 2001, Supplement No. 10 (A/56/10), chp.IV.E.1, Arts. 11(2) and 23; See also, Brownlie, I., *Principles of Public International Law* at 440-441 (7th ed., 2008).

69 See, Gorove, K., *International Responsibility for Endangering the “Space Commons”*: Focus on a Hypothetical Case, Proceedings of the 33rd Colloquium on the Law of Outer Space 297, 299 (1990).

Principle 21 of the Stockholm Declaration,⁷⁰ endorsed by 178 countries, recognizes the right of all States to exploit their own resources pursuant to their own policies, on one hand, while on the other hand also recognizing their responsibility to ensure that activities within their jurisdiction and control do not cause damage to areas beyond the limits of national jurisdiction. The principle has long been recognized as customary law by most scholars⁷¹ and endorsed by the International Court of Justice:

The existence of the general obligation of States to ensure that *activities within their jurisdiction and control* respect the environment of other States *or of areas beyond national control* is now a part of the corpus of international law relating to the environment.⁷²

“[J]urisdiction and control” is also the operative term of art in Article VIII of the Outer Space Treaty, so it is logical to extend Principle 21 to the space environment⁷³ and, indeed, protection against the threat to others’ use of outer space is widely regarded as being equally applicable to the space environment.⁷⁴ But the duty not to cause significant transboundary environmental harm is not absolute; there is a due diligence standard:

The standard of due diligence against which the conduct of State of origin should be examined is that which is generally considered to be appropriate and proportional

70 United Nations Conference on the Human Environment, *Stockholm Declaration on the Human Environment*, U.N. Doc. A/CONF.48/14/Rev. 1, 3 (1973), U.N. Doc. A/Conf.48/14, 2, Corr. 1 (1972), *reprinted in* 11 I.L.M. 1416 (1972) (Stockholm Declaration).

71 *See, Amicus Curiae* Brief Submitted on Behalf of Fourteen International Environmental Law Professors And Practitioners in the case of *Arias, et al. v. DynCorp, et al.*, United States District Court for the District of Columbia, Case No. 1:01cv01908 (RWR-DAR) (2011). *See also*, Baker, H.A., *Current Space Debris Policy and its Implications*, Proceedings of the 32nd Colloquium on the Law of Outer Space 59, 60 (1989), *citing* Kiss, A., *The International Protection of the Environment*, in *Structure and Process of International Law* 1069 at 1074-75 (McDonald, R. St. J. and Johnson, D.M., eds., 1986).

72 *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, 1996 I.C.J. 226, ¶¶ 29-30 (July 8) (emphasis added). The International Court of Justice reaffirmed this statement in *Gabcikovo-Nagymaros Project* (Hung. v. Slov.), 1997 I.C.J. 7, ¶ 53 (Sept. 25), and again in the case *Concerning Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, I.C.J. Reports 2010, p. 14 at ¶ 193 (hereinafter *Pulp Mills case*).

73 *See*, Roberts, L.D., *Addressing the Problem of Orbital Space Debris: Combining International Regulatory and Liability Regimes*, 15 B. C. Int’l & Comp. L. Rev. 51-74 (1992).

74 *See, e.g.*, Marchisio, S., *Protecting the Space Environment*, Proceedings of the 46th Colloquium on the Law of Outer Space 9, 12 (2003); Baker, *supra* note 10, at 73.

to the degree of risk of transboundary harm in the particular instance. For example, activities which may be considered ultra-hazardous require a much higher standard of care in designing policies and a much higher degree of vigor on the part of the State to enforce them.⁷⁵

The due diligence inquiry is a fact-specific inquiry that requires evaluation of the potential risks of the activity with the actions taken to control the transboundary impacts of that activity. Under International law, a state is obliged to take all appropriate measures to prevent significant transboundary harm or at any event to minimize its risk.⁷⁶

Thus, in the event a state has knowledge that its space object is nonfunctional and permits it to occupy an orbit that causes hazards of navigation to other space users, that state is vulnerable to a claim of violating generally accepted international rules and standards if it fails to take steps “appropriate and proportional to the degree of risk” to abrogate or ameliorate the danger.⁷⁷ The opportunity to take measures in accordance with its duty of due diligence should be accorded under 4 of Article V of the Rescue Agreement, whereby after notification by the launching state, the owner must then take effective steps to eliminate possible danger of harm.⁷⁸

A material breach of a multilateral treaty by one of the parties entitles a party specially affected by the breach to invoke it as a ground for suspending the operation of the treaty in whole or in part in the relations between itself and the defaulting State.⁷⁹ A material breach is the violation of a provision essential to the accomplishment of the object or purpose of the treaty (VCLT 60(3)). The general rule of VCLT Article 31(1) is that treaties must be interpreted in good faith in accordance with their ordinary meaning in the light of the treaty’s object and purpose. The preamble – and the text of the treaty - emphasizes the peaceful use of space in the interests of international cooperation. Antithesis of peace, cooperation and friendly relations is the insistence of an individual state to recklessly endanger all other current and future users of a series of orbits without any redeeming purpose.

75 The Draft Articles on Prevention of Transboundary Harm from Hazardous Activities adopted by the International Law Commission at its fifty-third session and submitted to the U.N. General Assembly (A/56/10) (ILC Draft Articles), Article 3, ¶ 11. The International Court of Justice has recently applied the due diligence requirement to transboundary pollution in the *Pulp Mills* case, *supra* note 72.

76 *Id.* Article 3 derives from Principle 21 of the Stockholm Declaration. *Id.*, Comment 1.

77 *See*, Gorove, K., *supra* note 69, at 300.

78 *See*, Diederiks-Verschoor, I.H.Ph., *The Increasing Problems of Space Debris and Their Legal Solutions*, Proceedings of the 32nd Colloquium on the Law of Outer Space 77, 79 (1989).

79 VCLT Article 60(2)(b)).

Conclusion

Interpreting the status of space objects in terms of their usefulness permits us to work within the treaties, as they *currently* exist, to find a way to balance the competing interests of free use and due regard for all users of space. Standard contract interpretation of the treaty language provides a persuasive argument that indefinite non-use of space becomes appropriation when a space vehicle's useful life is ended. If it has no purpose, a space object has no use. As we have seen, ITU procedures and the Outer Space Treaty both aim to ensure the use of outer space in order to safeguard the corresponding rights of other states to engage in similar undertakings.

There is no disagreement that national appropriation of outer space is forbidden. This paper has argued that occupation of an orbital position becomes forbidden "national appropriation" when it is no longer being "used" or capable of furthering a legitimate purpose. Not only is there an absence of the premise upon which Article I freedoms are granted (exploration and use) but the state is also violating Article II by misappropriating space.

Finally, this paper has argued that the broad requirement in Article IX of due regard for interests of other states is confluent with the international law requirement that states ensure that activities within their jurisdiction and control respect the environment of areas beyond national control. States have a due diligence obligation to evaluate the potential risks and take action to control the harm or minimize its risk. A state is vulnerable to a claim of violating generally accepted international rules and standards if it fails to take steps "appropriate and proportional to the degree of risk" to abrogate or ameliorate the danger and breach of the treaty under VCLT Art. 60.

This analysis is not a panacea for all obstacles to ADR, such as the political concerns for its dual-use, the lack of political will on the part of States to fund the development of ADR technology and the prickly question of who decides which objects should be removed. Organizational management for debris removal is critical. Subjective approaches to identify and prioritize space objects for removal should be made by an impartial body of experts with the competence to determine the debris status of spacecraft.⁸⁰

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⁸⁰ See, e.g., Third International Interdisciplinary Space Debris Congress Report, *supra* note 5, at 39, *et seq.*; Jasentuliyana, N., *supra* note 23, at 19.

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