RULES REGARDING SPACE DEBRIS: PREVENTING A TRAGEDY OF THE COMMONS

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ABSTRACT

Outer space, the last global commons, is becoming choked with space debris. Without effective constraints, a "tragedy of the commons" will ensue, as states race to consume the resources of outer space, rendering it unfit for any use. Only recently have states begun to realize that past practices permitting unfettered deposition of space debris may not have been the most prudent.

First, this paper questions whether existing legal treaties, such as the Outer Space Treaty, the Liability Convention, and the Registration Convention, can prevent a tragedy of the commons caused by space debris. Next, this paper examines whether the duty to mitigate space debris has become customary international law. Finally, this paper discusses whether customary international law can prevent a tragedy of the commons caused by space debris.

This paper concludes that, although the existing legal treaties alone are insufficient to prevent a tragedy of the commons of outer space due to space debris, the duty to mitigate space debris has become customary international law, which should halt any further destruction of the commons.

FULL TEXT

Outer space is the last global commons left to Earth. Despite that privileged status, however, states have used it as a repository for pieces of equipment they either cannot or do not find efficient to bring back to Earth. These pieces of equipment, known as space debris, are incredibly dangerous – for example, a paint chip 0.2 millimeters wide caused such severe damage to the windshield of the U.S. space shuttle Challenger that it had to be replaced.[2]

Space debris, also known as orbital debris, is defined as "all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional."[3] The amount of space debris is continually growing, both because state and non-state actors continue to dispose of waste in outer space, but because more pieces of space debris are created when space debris collides with other space debris. Should the abandonment of space debris in outer space continue unabated, a tragedy of the commons almost certainly will ensue.

I. TRAGEDY OF THE COMMONS

The "tragedy of the commons," a term popularized by Garrett Hardin in his 1968 article in the journal *Science*,[4] is best illustrated in the following example from Hardin's seminal article:

Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. . . . As a rational being, each herdsman seeks to maximize his gain. . . . [T]he rational

herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another. . . . But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.

. . .

In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons but of putting something in . . . The rational man finds that his share of the cost of the wastes he discharges in to the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest," so long as we behave only as independent, rational, free-enterprisers.[5]

The tragedy of the commons applies to pollution of outer space in the same way as it does to pollution on Earth – each state actor, at least in the past, found it more efficient to release space debris into outer space than to engineer a system to bring back to Earth what would otherwise be space debris. Over time, outer space has become congested with these discarded items, much in the same way that a river might be congested with pollutants, trash and other debris.

As we have seen with terrestrial commons such as rivers, oceans and air, incentives or controls must be implemented to prevent states and other actors from continuing to use outer space as a junkyard, deposing pollutants and debris without concern for the future cumulative effect of those actions. Otherwise, outer space would soon be of little value to anyone.

II. Efficacy of Existing Legal Treaties

The first place to look for such incentives or controls is international treaty law. Thus, the first inquiry is whether any of the existing legal treaties of outer space, such as the Outer Space Treaty,[6] the Liability Convention,[7] and the Registration Convention,[8] sufficiently address the issue of space debris so as to prevent a tragedy of the commons.

A. Outer Space Treaty

The Outer Space Treaty, which has been likened to the Magna Carta for outer space,[9] contains three provisions that arguably could be relevant to the present inquiry into the existence of a duty to mitigate space debris.

First, Article I of the Outer Space Treaty confirms that outer space truly is a global commons. Article I states that the "use of outer space . . . shall be carried out . . . in the interests of all countries . . . and shall be the province of all mankind."[10] Read in the context of the issue of space debris, one could argue that ever-increasing quantities of space debris would run afoul of Article I because clogging outer space is not in the interests of all countries. It is unlikely, however, that such an argument could serve as the basis for a legal duty to mitigate space debris.

Second, 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."[11] Read in the broadest possible sense, this provision could be interpreted as conveying a duty not to discard space debris to such an extent that outer space no longer can be used by all. As with Article I, however, it is unlikely that such an interpretation could serve as the basis for a legal duty to mitigate space debris.

Finally, Article IX of the Outer Space Treaty requires states to "conduct exploration of [outer space] so as to avoid their harmful contamination . . . and, where necessary, . . . adopt appropriate measures for this purpose."[12] Although it might seem that Article IX would prohibit space debris, that conclusion is dependent upon the subjective interpretation of what constitutes "harmful contamination." Broadly read, Article IX could be read as forbidding the contamination of outer space through deposition of space debris. Indeed, there is nothing to suggest that such a reading necessarily would be improper. Without a more definite delineation, however, one could not use this provision to require and enforce measures of space debris mitigation.

Thus, although certain provisions of the Outer Space Treat, construed broadly, could be seen as relevant to the general issue of space debris, it is unlikely that the Outer Space Treaty could be considered binding international law on the specific issue of whether there is a duty to mitigate space debris.

B. Liability Convention

The second international space law treaty that might speak to the issue of whether there is a duty to mitigate space debris is the Liability Convention.

Although the Liability Convention gives rise to a number of interesting questions regarding space debris that are outside the scope of this paper,[13] no provision of in the Liability Convention has any bearing on the specific issue of whether there is a duty to mitigate space debris.[14]

C. Registration Convention

The third international space law treaty that might speak to the issue of whether there is a duty to mitigate space debris is the Registration Convention.

No provision in the Registration Convention, however, addresses the specific issue of whether there is a duty to mitigate space debris.

Thus, the only existing space law treaty that even comes close to addressing the issue of space debris mitigation is the Outer Space Treaty. Although certain aspects of the existing space law treaties may be pertinent to the issue of mitigating space debris, such as that in the Outer Space Treaty described above, none of them addresses the issue in a sufficiently definitive manner such as to show a duty to mitigate space debris and, therefore, prevent a tragedy of the commons.

III. Duty to Mitigate Space Debris Already Is Customary International Law

The second place to look for incentives or controls on mitigation of space debris, after determining that no treaty is on point, is customary international law.

As will be explained, the duty to mitigate space debris already has become customary international law. As a result, the failure of the space law treaties to directly address the issue of space debris is not a tragedy.

A. Requirements for Customary International Law

Customary international law is defined as "evidence of a general practice accepted as law."[15] More specifically, it is described as that which "results from a general and consistent practice of states [that they follow due to] . . . a sense of legal obligation."[16] That is, customary international law exists where: (1) states believe they have a legal obligation; and (2) states act according to that sense of legal obligation. These elements are known as: (1) *opinio juris*; and (2) state practice. [17]

1. *Opinio Juris*

The term *opinio juris* is the shortened form of the Latin phrase *opinio juris sive necessitatis*, which translates into English as "the perception that a behavior is required by law." There are no formal requirements as to what constitutes *opinio juris*. In fact, a state need not make an overt statement of what it believes is required by law; it is possible for *opinio juris* to be inferred either from a state's acts or omissions.[18]

Resolutions of the United Nations General Assembly can be considered both *opinio juris* and state practice[19] because the act of voting on the resolution is an action taken by a state government, and because the text of the resolution "provide[s] some evidence of what the states voting for it regard the law to be."[20] Especially where General Assembly Resolutions are adopted by consensus, they can carry great weight.

Even greater significance may attach to declarations of principles,[21] as these are not only evidence of what states adopting them believe the law to be, but they are statements that the state intends to be bound, at least in principle, by those laws.

Direct statements by state governments identifying what is perceived to be a legal obligation are perhaps the strongest evidence of *opinio juris*.

There is no formula as to what form of *opinio juris* is preferred, nor is there any required minimum quantity or duration. *Opinio juris* merely must exist in some form for the first half of the customary international law equation to be satisfied.

2. State Practice

The "state practice" component of customary international law is defined as actions taken by states that evidence their position on a particular issue. Those actions could be as simple as voting on a United Nations General Assembly Resolution or passing legislation on a particular issue. Indeed, state practice need not be an act at all; it could be an omission or the fact that a state has not acted to stop something from happening.[22]

The "state practice" necessary may be of relatively short duration. The only requirements are that it be "general and consistent."[23] "A practice can be general even if it is not universally followed; there is no precise formula to indicate how widespread a practice must be, but it should reflect wide acceptance among the states particularly involved in the relevant activity."[24]

There is no time limit required before state practice will be evidence of customary international law. In fact, the amount of time for which state practice must exist can be so small that some scholars have questioned whether "instant customary international law" might be possible.[25]

Thus, the requirements for establishing customary international law are rather loose;

there must be some evidence that states consider themselves to be bound by something and some evidence of states acting accordingly, but the actual proof of that *opinio juris* and state practice can take many forms.

B. Customary International Law Has Been Established

There exist in the international community both the *opinio juris* and state practice consistent with the emergence of a duty to mitigate space debris. Accordingly, the duty to mitigate space debris has become customary international law.

1. *Opinio juris* has been established

States have shown, through a number of mechanisms, that they consider there to be a duty to mitigate outer space debris. Accordingly, the first required element of customary international law, *opinio juris*, has been established.

The first way in which states have demonstrated their understanding that there is a duty to mitigate outer space debris is in the Space Debris Mitigation Guidelines of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (the "UNCOPUOS Space Debris Mitigation Guidelines").[26] The UNCOPUOS Space Debris Mitigation Guidelines demonstrate *opinio juris* not only because they were developed by state members of the United Nations but because UNCOPUOS, comprising sixty-seven (67) member states,[27] approved of and adopted the Guidelines. By approving the Guidelines, each state gave its official opinion that the Guidelines should be implemented. This is the very definition of *opinio juris*.

The second way in which states have demonstrated their understanding that there is a duty to mitigate outer space debris is in United Nations General Assembly Resolution 60/99 of December 8, 2005.[28] Paragraph twenty-seven (27) of that resolution describes the seriousness with which the United Nations General Assembly views the issue of space debris mitigation. Paragraph 27 reads, in pertinent part, as follows:

"The General Assembly, . . .

*Considers that **it is essential** that Member States pay more attention to the problem of collisions of space objects . . . with space debris, and other aspects of space debris, calls for the continuation of national research on this question, . . . and agrees that **international cooperation is needed to expand appropriate and affordable strategies to minimize the impact of space debris on future space missions**."*
(emphasis added)

As a United Nations General Assembly Resolution, Resolution 60/99 demonstrates *opinio juris* because it is the result of the member states voicing their opinions and recommendations on a particular topic.[29] This conclusion is strengthened by the fact that the member states considered this issue "essential." This highlights the importance given to the mitigation of space debris and indicates that member states consider it to be a duty, not just a recommendation.

2. State practice has been established

In addition to *opinio juris*, states have taken actions that are consistent with the understanding that there is a duty to mitigate outer space debris. This state practice, the second required element, firmly establishes that the international legal duty to mitigate

space debris has become customary international law.

The first way in which states have acted consistently with their understanding that there is a duty to mitigate space debris is by adopting and adhering to the Inter-Agency Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines.[30] The IADC is composed of twelve members, representing most, if not all, major space-faring nations.[31] Not only have the IADC Guidelines been in place for over five years, but the members of the IADC adopted the Guidelines via consensus, which only serves to strengthen their persuasive power as examples of state practice. Indeed, states reaffirmed their commitment to the IADC Space Debris Mitigation Guidelines and thereby confirmed their status as evidence of state practice when they revised the IADC Space Debris Mitigation Guidelines in 2004.[32]

The second way in which states have acted consistently with their understanding that there is a duty to mitigate outer space debris is by adopting the UNCOPUOS Space Debris Mitigation Guidelines. These Guidelines, discussed at greater length above, are an expression not only of *opinio juris* but also of state practice. Each state member of UNCOPUOS, in agreeing with the Space Debris Mitigation Guidelines, not only voiced its agreement with the guidelines but affirmatively acted to adopt them.

Predating the UNCOPUOS Space Debris Mitigation Guidelines is the UNCOPUOS Technical Report on Space Debris, which the UNCOPUOS Scientific and Technical Subcommittee published in 1999.[33] Much like the more recent UNCOPUOS Space Debris Mitigation Guidelines, this report not only embodied the opinions of state members of the Committee but it served as an expression of what states considered to be proper practice in international law. In adopting and publishing the report, the state members of the Committee took an affirmative action demonstrating what they consider to be international law on the issue of space debris mitigation.

The third way in which states have acted consistently with their understanding that there is a duty to mitigate outer space debris is by enacting domestic legislation indicating the duty to mitigate space debris. The United States, for example,[34] has implemented practices to mitigate space debris. In fact, the United States has had a space debris mitigation policy in place since 1981.[35] Many other countries also have enacted domestic legislation indicating that they consider there to be a duty to mitigate space debris.[36] Even China, which admits it has lagged behind other nations in adopting space debris mitigation policies, is now implementing measures to prevent and mitigate space debris.[37] Each of these actions, taken by multiple individual states, is evidence of the practice of states in implementing policies and procedures to mitigate space debris. These consistent state actions demonstrate state practice in its most fundamental form.

Thus, states not only have agreed to international resolutions and guidelines demonstrating their belief that there is an international legal duty to mitigate space debris, but they have acted in accordance with that belief, not only by adopting the aforementioned resolutions and guidelines but by adopting national legislation. This combination of *opinio juris* and state practice demonstrates that the duty to mitigate space debris has become customary international law.

IV. Can Customary International Law Prevent a Tragedy of the Commons?

Given that the existing space law treaties will not suffice to prevent a tragedy of the commons of outer space, and given that the duty to mitigate space debris has become customary international law, the pertinent question is whether customary international law can prevent a tragedy of the commons.

Unfortunately, the answer to that question is unclear. It certainly is possible that the customary international law of a duty to mitigate outer space debris could prevent a tragedy of the commons of outer space. The efficacy of that customary international law, however, largely will depend on whether states consider compliance with that customary international law to be in their self-interest.

On the one hand, the customary international law duty may suffice because customary international law does not occur by accident – as described above, it exists as an embodiment of what states are already doing and what states have expressed they feel they have a legal obligation to do. Thus, it does not depend on external enforcement; states largely police their own adherence to the rule.

In addition, the economic reality of the outer space environment is such that states effectively have no choice but to mitigate space debris if they expect to continue to take advantage of outer space. Each state has an incentive to abide by the duty because each piece of space debris it would otherwise add to the space environment would jeopardize its own future space missions, not just those of other states. Thus, it is in each state's self-interest to comply with the customary international law.

On the other hand, the fact that states largely police their own adherence to the rule is its Achilles Heel – should one or more spacefaring states determine that it is not in their self-interest to follow the customary international law and dump space debris with abandon, other states may question whether it continues to make sense for them to refrain from doing so as well.

At the moment, the widespread voluntary participation of spacefaring states in the various space debris mitigation guidelines leads to the tentative conclusion that the customary international law duty to mitigate space debris will suffice to prevent a tragedy of the commons of outer space.

That tentative conclusion, however, is far from foregone. The widespread participation that the various guidelines enjoy could change dramatically in a relatively short period of time. One can only hope, therefore, that states continue to see it in their self-interest to comply with the duty to prevent a tragedy of the commons. Only time will tell.

V. Conclusion

Although the existing international documents alone are insufficient to prevent a tragedy of the commons of outer space due to space debris, the duty to mitigate space debris has become customary international law. Assuming that states follow this customary international law, the incentives that are in place should halt any further destruction of the commons.

FOOTNOTES

[1] The views expressed herein may solely be attributed to the author and not to any organization with which she may be affiliated. Author's email: kgable218@yahoo.com.

[2] This and other examples of actual and potential dangerous consequences of space debris are discussed in Robert C. Bird, *Procedural Challenges to Environmental Regulation of Space Debris*, 40 American Business Law Journal 635 (Spring 2003).

[3] Space Debris Mitigation Guidelines of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, United Nations Doc. No. A/AC.105/890. The same definition appears in the IADC Space Debris Mitigation Guidelines, section 3.1 (Oct. 15, 2002), *available at* www.iadc-online.org/docs_pub/IADC-101502.Mit.Guidelines.pdf, last accessed Aug. 29, 2007.

[4] G. Hardin, *The Tragedy of the Commons: The population problem has no technical solution; it requires a fundamental extension in morality*, Science, vol. 162, No. 3859 (Dec. 13, 1968), pp. 1243-1248.

[5] *Supra*, note 4 at pp. 1244-45.

[6] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) (hereinafter, "the Outer Space Treaty").

[7] Convention on International Liability for Damage Caused by Space Objects, opened for signature Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 205 (entered into force Oct. 3, 1973) (hereinafter, "the Liability Convention").

[8] Convention on Registration of Objects Launched into Outer Space, opened for signature Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, (entered into force Sept. 15, 1976 (hereinafter, "the Registration Convention").

[9] *See, e.g.,* Statement by H.E. Ambassador Tang Guoqiang at the 50th Session of the COPUOS (June 8, 2007), *available at* http://www.chinesemission-vienna.at/eng/xw/t327707.htm, last accessed Sept. 6, 2007.

[10] *Supra*, note 6, art. I.

[11] *Supra*, note 6, art. II.

[12] *Supra*, note 6, art. IX.

[13] These questions include: Is space debris a space object under the Liability Convention? If not, does it lose sovereign attachments, therefore being free to be reclaimed by anyone? Does the definition of "damage" in Article I of the Liability Convention include that caused by space debris?

[14] Although some scholars have described the Liability Convention as "the major instrument dealing with space debris," they do not say why they think this is the case. *See Space Debris, A Status Review and Future Implications*, Mohsen Bahrami & Ali Akbar Golrounia, *published in* Proceedings of the Forty-Fourth Colloquium on the Law of Outer Space 294 at 299, American Institute of Aeronautics and Astronautics (2001).

[15] Statute of the International Court of Justice Art. 38(b)(1), 59 Stat. 1055, T.S. No. 993, 3 Bevans 1179 (June 26, 1945).

[16] Restatement (Third) of Foreign Relations Law § 102(2) (1987).

[17] *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua*

v. United States of America), Merits, Judgment, I.C.J. Reports 1986 (June 27) at para. 183 (quoting *Continental Shelf (Libyan Arab Jamahiriya/Malta),* I.C.J. Reports 1985, pp. 29-30, para. 27).

[18] Restatement (Third) of Foreign Relations Law § 102 comment c (1987).

[19] Restatement (Third) of Foreign Relations Law § 102, Reporters' Note 2 (1987).

[20] Restatement (Third) of Foreign Relations Law § 103 comment c (1987). *See also* Reporters' Notes 2, stating that "The evidentiary value of such a resolution is high if it is adopted by consensus or by virtually unanimous vote of an organization of universal membership such as the United Nations or its Specialized Agencies."

[21] Restatement (Third) of Foreign Relations Law § 102, Reporter's Note 2 (1987) (quoting a memorandum [E/CN.4/L.610] of the Office of Legal Affairs of the United Nations Secretariat).

[22] Restatement (Third) of Foreign Relations Law § 102 comment b (1987) ("Inaction may constitute state practice, as when a state acquiesces in acts of another state that affect its legal rights.")

[23] *See North Sea Continental Shelf Cases (Federal Republic of Germany v. Denmark; Federal Republic of Germany v. The Netherlands)*, I.C.J. Reports 1969, p. 3 at para. 74 ("the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law.").

[24] Restatement (Third) of Foreign Relations Law § 102 comment b (1987).

[25] *See, e.g.*, B. Cheng, *United Nations Resolutions on Outer Space: "Instant" International Customary Law?*, 5 Indian Journal of International Law 23 (1965).

[26] Space Debris Mitigation Guidelines of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, U.N. Doc. No. A/AC.105/890, Annex IV.

[27] This and other information regarding the United Nations Committee on the Peaceful Uses of Outer Space can be found at: http://www.unoosa.org/oosa/COPUOS/copuos.html, last accessed Sept. 6, 2007.

[28] United Nations General Assembly Resolution No. 60/99 (Dec. 8, 2005) ¶ 27.

[29] *See, e.g., Case Concerning Military and Paramilitary Activities in and Against Nicaragua (Nicaragua v. United States of America)*, Merits, Judgment, I.C.J. Reports 1986 (June 27) at para. 188.

[30] Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines, IADC-02-01 (Oct. 15, 2002), *available at* http://www.iadc-online.org/docs_pub/IADC-101502.Mit.Guidelines.pdf, last accessed Aug. 29, 2007.

[31] The members of the IADC are: the Italian Space Agency (ASI), the British National Space Centre (BNSC), le Centre National d'Etudes Spatiales (CNES), the China National Space Administration (CNSA), Deutsches Zentrum fuer Luft-und Raumfahrt e.V. (DLR), the European Space Agency (ESA), the Indian Space Research Organisation (ISRO), Japan, the National Aeronautics and Space Administration (NASA), the National Space Agency of Ukraine (NSAU) and the Russian Aviation and Space Agency (Rosaviakosmos). *See supra*, note 30 (IADC Guidelines), at iii.

[32] Support to the IADC Space Debris Mitigation Guidelines, IADC WG4 (Oct. 5, 2004), *available at* http://www.iadc-online.org/index.cgi?item=docs_pub, last accessed Sept. 5, 2007.

[33] Technical Report on Space Debris: Text of the Report adopted by the Scientific and Technical

Subcommittee of the United Nations Committee on the Peaceful uses of Outer Space, U.N. Doc. No. A/AC.105/720 (New York 1999).

[34] *See* E. Jason Steptoe, *Legal Standards for Orbital Debris Mitigation: A Way Forward*, *published in* Proceedings of the Forty-Fourth Colloquium on the Law of Outer Space 301, American Institute of Aeronautics and Astronautics (2001).

[35] *Supra*, note 34 at footnote 3 (describing that "NASA instituted its first orbital debris mitigation policy requirement for depletion of residual propellants from Delta second stages at the end of mission in 1981.")

[36] For a description of laws of other countries, see *The Impact of Orbital Debris on Commercial Space Systems*, Tare C. Brisibe & Isabel Pessoa-Lopes, *published in* Proceedings of the Forty-Fourth Colloquium on the Law of Outer Space 310, American Institute of Aeronautics and Astronautics (2001).

[37] Peter B. de Selding, *China Says Work Under Way to Mitigate Space Junk*, Space News Business Report (Sept. 3, 2007), *available at* http://www.space.com/spacenews/070903_businessmonday/china_debris.html, last accessed Sept. 4, 2007.