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**ENVIRONMENTAL PROTECTION IN OUTER SPACE: WHERE WE STAND
AND WHAT IS NEEDED TO MAKE PROGRESS WITH REGARD TO THE
PROBLEM OF SPACE DEBRIS**

*Stephan Hobe**

ABSTRACT

This paper provides a brief survey of current space law and its applicability to the problem of space debris. Starting from the definition of space debris, it asks what makes space debris a problem and thus a legal concern. Finally, it assesses the current space law framework with regard to legal rights and obligations to take preventive measures that address the risks posed by space debris; and the legal consequences in case such a risk materializes.

When assessing the applicability of space law to the problem of space debris, it does not make sense to jump immediately into the legal framework governing space activities. Space debris are man-made objects in outer space. Fifty years of space flight have left more than 500,000 pieces of so-called debris of sizes bigger than one centimetre in diameter. These pieces of debris are particularly dangerous because no shielding against them is possible. They can, therefore, destroy larger space objects such as satellites, which makes it necessary to think about this problem. In total, there are approximately 150 million pieces of space debris starting from a size of smaller than one centimetre. We even find such debris in most well-funded orbits for telecommunication, remote sensing, navigation and for the international space station.

While assessing the international legal order relating to debris, several questions arise:

1. What does current international law have to say about space debris? Does it address the problem at all?
2. Do we have international law for the mitigation of space debris? What about remediation of space debris and liability provisions? Is liability and registration equipped to deal with the problem?

* Director, Institute of Air and Space Law, University of Cologne. This is a written version of a lecture delivered at National Law School of India University, Bangalore on November 10, 2011.

3. Why is it so difficult to arrive at any solution?

With these questions in mind, in the following paper one has to first define what space debris is, then wonder why space debris is a problem, and finally assess how current space law might be applicable in this regard. This is the outline followed in this brief overview, which is neither intended to be exhaustive nor to provide definite conclusions.

I. SPACE DEBRIS – WHAT ARE WE TALKING ABOUT?

The Inter-Agency Space Debris coordination Committee's Space Debris Mitigation Guidelines¹ and the subsequent UN Space Debris Mitigation Guidelines² came up with the first internationally accepted definition of space debris, i.e. "*all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional.*"

Consequently, debris includes 'things' of all sizes that are the product of human activity and not of natural origin. These 'things' either never were functional or eventually became non-functional. Also, we consider only 'things' that are located in Earth orbit or are re-entering the atmosphere.

These definitional decisions and limitations are made from a technical point of view that identifies a certain hazard to outer space activities and the Earth's surface. The definition is not necessarily imperative from a legal point of view. Instead, one has to illustrate what makes space debris a practical and legal concern.

II. THE PROBLEM – WHY IS SPACE DEBRIS A (LEGAL) CONCERN?

It is not a well-kept secret that the impact of space debris may harm other objects. Although this paper is not primarily concerned with the technical aspects of space debris, it is pointed out that the UN Space Debris Mitigation Guidelines, that provides background information, states that there is a common understanding that "the current space debris environment poses a risk to spacecraft in Earth orbit... [and], there is also the risk of damage on the ground, if debris survives Earth's atmospheric re-entry."³ (emphasis supplied) The rationale of the guidelines

¹ IADC Space Debris Mitigation Guidelines, IADC-O2-01, Revision 1, Sept., 2007, <<http://www.iadc-online.org/>>, no. 3.1.

² UN Space Debris Mitigation Guidelines, Sept. 2007, as annexed to UN doc. A/62/20, Report of the COPUOS o. 1, para. 1.

³ .Id. at no. 1, para. 1, sent. 1 and 4.

focuses on the potential of space debris “to damage spacecraft, leading to loss of mission, or loss of life in the case of manned spacecraft.”⁴

Space debris is considered a problem because of its potential to cause damage on the ground and its potential to damage other spacecrafts that still have a mission to fulfill and are functional. Particular emphasis is placed on the aspect of crew safety. Although the UN guidelines speak of “a prudent and necessary step towards preserving the outer space environment for future generations,”⁵ it is debatable whether the preservation of the outer space environment as such in a pristine state without man-made space debris is intended, or whether it should be preserved in a state that is simply safe (enough) for “exploration and use” by future generations. The guidelines indicate that consensus so far only exists with respect to space debris as a problem to spacecraft in Earth orbit and to the ground on Earth. The space debris population and its projected growth in the Earth’s vicinity have alarmed the international community of the space debris problem as a potential hazard for outer space activities and as a potential cause of damage on the ground.

The international legal framework governing space activities will have to be analysed with regard to legal rights and obligation to take preventive measures that address the risks posed by space debris, but also with regard to legal consequences in case such a risk materializes. The former deals with prevention and/or minimization of the risk of damaging spacecrafts and causing damage on the ground through space debris as well as preserving the outer space environment in its own right. This entails legal questions of a broad spectrum ranging from the legality of generating space debris and obligations to mitigate and remediate the space debris environment to participation in collision avoidance schemes and exchange of data. Moreover, the active removal and possibly recycling of space debris as well as allocation of the financial burden and technology transfer is a concern. The latter primarily raises questions of responsibility and liability for space debris and the allocation of risks.

III. SPACE LAW – APPLICABILITY TO THE SPACE DEBRIS PROBLEM OR ONLY “NEAR MISS”?

International space law so far does not use the term “space debris” – at least if one disregards the body of “soft law” in form of resolutions of the General Assembly of the United Nations or other international documents and declarations. The question is, therefore, whether the current space law applies to aspects of the space debris problem as outlined above.

1. Prevention and minimization of risks posed by space debris

(1) Illegality of generating space debris as such

⁴ Supra note 3, at no. 2, para. 1.

⁵ Supra note 3, at no. 1, para. 1, sent. 5.

In answering the question as to whether generating space debris is illegal as such, the fundamental freedom of all States to explore and use outer space pursuant to Article I, paragraph 2 of the Outer Space Treaty⁶ features very prominently. Especially in early state practice, the generation of space debris has not been attributed with much legal significance as an often undesired but more or less inevitable by-product of otherwise perfectly legal space activities. The freedom of outer space is, however, not granted unlimitedly, but is subject to various limitations. It is in particular tied to the “benefit and interests of all countries” and international law according to Article I, paragraphs 1 and 2, and Article III, OST. Especially, cases of intentional generation of space debris, possibly but not necessarily as a means of warfare, raise the controversial question of their legality as such. Such activity may not be covered by the freedom to explore and use outer space or may even be specifically prohibited as environmental modification technique by the Environmental Modification Convention⁷ or other international, humanitarian and environmental law.

(2) Obligation to prevent or at least to minimize the risks related to space debris

In case the generation of space debris in a given context is not considered illegal per se, one may wonder whether international law imposes upon States the obligation to take appropriate measures to prevent the generation of space debris or at least to minimize related risks when conducting activities in outer space. Article IX, sentence 1 OST gains particular importance in this regard by providing that:

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. (emphasis supplied)

⁶ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 27 Jan. 1967, 610 U.N.T.S. 205 (hereinafter “OST”).

⁷ Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques, 10 Dec. 1976, 1108 U.N.T.S. 151. Article I provides: “Each State Party to this Convention undertakes not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party. ...”; Article II defines: “As used in Article I, the term “environmental modification techniques” refers to any technique for changing -- through the deliberate manipulation of natural processes -- the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space.”

The due regard principle flows from the status of outer space as global commons as a sort of counterbalancing to respective States' freedom to explore and use outer space in community interest. Article IX, sentence 2, OST further stipulates that:

States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. (emphasis supplied)

While the interpretation of "contamination" remains open for debate,⁸ the definitional decision to limit "space debris" to things that are in Earth orbit or re-entering the Earth's atmosphere might be relevant with respect to the qualification of "harmful". It is, so far, only in the Earth's vicinity where these things pose a potential risk of damage that is internationally recognized and could thus, be considered as "harmful".

The legal significance of the codification of general international environmental law in the ILC Draft Articles on the Prevention of Transboundary Harm from Hazardous Activities,⁹ for outer space activities is also worthy of discussion under Article III, OST. Article 3 of the Draft Articles states that "*The State of origin shall take all appropriate measures to prevent significant transboundary harm or at any event to minimize the risk thereof*".

It is also crucial to examine the relevance of Resolutions of the General Assembly, for example, in adopting the Principles Relevant to the Use of Nuclear Power Source in Outer Space¹⁰ or endorsing the Space Debris Mitigation Guidelines of the COPUOS¹¹, and a web of other international documents such as the IADC Guidelines,¹² the envisaged but yet to be implemented Code of Conduct for Space Activities.¹³ These also include standards such as those of the International Organisation for Standardisation (ISO)¹⁴ for identifying what appropriate

⁸ It is noteworthy that the European Code of Conduct for Space Debris Mitigation, 28 Jun. 2004, explicitly refers to Article IX sent. 2, OST in its introduction.

⁹ International Law Commission, Draft articles on Prevention of Transboundary Harm from Hazardous Activities, (2001), http://untreaty.un.org/ilc/texts/instruments/english/commentaries/9_7_2001.pdf (hereinafter Draft Articles).

¹⁰ Principles Relevant to the Use of Nuclear Power Sources in Outer Space, UN GA doc. A/RES/41/65 (1992).

¹¹ UN Space Debris Mitigation Guidelines, supra note 2.

¹² Supra note 1.

¹³ Council of the European Union, Draft Code of Conduct for outer space activities, approved 8-9 December 2008, online: EU <http://register.consilium.europa.eu/pdf/en/08/st17/st17175.en08.pdf>.

¹⁴ In particular, "Space Systems – Space Debris Mitigation Requirements", ISO/CD 24113, committee draft approved for registration as draft international standard (9 Mar.2009).

measures “good governance” in the exercise of due diligence required for the conduct of outer space activities.

When addressing the space debris problem as one form of environmental hazard associated with de-orbiting, one also has to assess the legal implications of creating another form of environmental hazard by dumping into the High Sea and/or possibly creating “marine debris”.¹⁵

(3) Collision avoidance, particularly exchange of data and manoeuvring

Avoiding collisions among functional objects as well as between functional objects and space debris is essential not only for mission success, crew safety and space security, but also for mitigating the growth of the space debris population. According to Article IV of the Registration Convention¹⁶ State Parties undertake to furnish to the Secretary-General a set of parameters about a space object, which are further harmonized by the related General Assembly resolution.¹⁷ For the purpose of differentiating between close conjunctions and potential collisions, however, the availability of accurate data is crucial. Article IX, sentences 3 and 4, OST contain procedural rights and obligations to enter into consultations in case there is reason to believe that “harmful interference” with outer space activities may occur.

If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.

A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.
(emphasis supplied)

¹⁵ In particular Article 194 et seq. United Nations Convention on the Law of the Sea, online: UN <http://www.un.org/Depts/los/index.htm>

¹⁶ Convention on the Registration of Objects Launched into Outer Space, 14 Jan., 1975, 1023 U.N.T.S. 15.

¹⁷ Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects, 10 Jan. 2008, UN GA doc. A/RES/62/101.

In line with the ILC Draft Articles on Prevention of Transboundary Harm¹⁸ and the emphasis on cooperation throughout the body of international space law; consultations, notifications and exchange of data for a precise risk assessment are important tools to prevent and minimize risks related to a hazard that has been identified by the international community. Satellite operators in Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space for Geosynchronous (SOCRATES-GEO) service already practice this exchange of highly accurate data by way of a prototype data center¹⁹ and the draft Code of Conduct for Outer Space Activities puts ample emphasis on notification, registration, information and consultations.²⁰ It will have to be further analyzed how States must endeavour to avoid harmful interference in the form of collisions in case, but limited to the situation if, close conjunction is projected.

(4) Removal and recycling

In order to stabilize the space debris environment, it might become or may already be necessary to go beyond “mitigation” and begin with “remediation” through active removal of mass from Earth orbit. While the question of whether a State is obliged to remove “its” space debris is again one of due diligence, the question whether space debris enjoys legal protection from removal or other forms of interference by other States, including manipulating the orbit as a means of collision avoidance as well as recycling, leads to the controversial issue of whether “space debris” can be subsumed under the definition of “space object”. According to Article VIII, OST (and as further concretized by the subsequent Rescue Agreement (RA)²¹ and Registration Convention)²²:

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. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return. (emphasis supplied)

¹⁸ Supra note 9, at Article 4, 8, 9.

¹⁹ SOCRATES-GEO powered by the Center for Space Standards and Innovation, online: CSSI www.centerforspace.com

²⁰ Supra note 13, at chapter III.

²¹ Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 22 Apr., 1 Jan.1968, 672 U.N.T.S. 119.

²² Supra note 16.

In absence of a definition of "space object", reference is made to Article I (d) of the Liability Convention²³ and Article I I(c) Registration Convention which stipulate identically that: "The term space object includes component parts of a space object as well as its launch vehicle and parts thereof."

Thus, it remains open for discussion as to:

- (a) whether all types of space debris, ranging from intact but non-functional satellites to very small particles, or only certain ones or in fact none, are to be considered space objects and/or (component) parts thereof;
- (b) whether a legal distinction has to be made between valuable/functional spacecrafts and space debris, and how this status is to be determined;
- (c) whether legal protection extends to space debris and what the scope is thereof;
- (d) whether legal protection has to be renounced by the State of registry or whether objective criteria exist in this respect;
- (e) whether transparency on the non-functional status and limiting the legal protection of space debris leads to a privileged position when having to determine whether a State has discharged its obligation to exercise due diligence.

(5) Allocation of financial burden and technology transfer

Mitigation and remediation measures including protection of space objects, specific design and operation, manoeuvring for collision avoidance or subsequent disposal, space surveillance to active removal of space debris, are associated with costs and technological know-how and raises issues of cost allocation and technology transfer.

Article VI, OST confirms that States bear international responsibility for "national activities in outer space". Article VII, OST and the Liability Conventions impose liability on the launching state if the damage occurs through a space object. This raises the question, whether the liability system is applicable in case of an accident through a piece of space debris because the identification of such piece of space debris as belonging to a certain launching state. In addition, the "polluter-pays" principle emerges as one of the pillars of general international environmental law, arguably being of relevance for outer space activities pursuant to Article III, OST. Yet, Article I, paragraph 1, OST provides that: "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

²³ Convention on International Liability for Damage Caused by Space Objects, 29 Mar. 1972, 961 U.N.T.S. 187.

province of all mankind.” (emphasis supplied) The Benefits Declaration²⁴ places particular emphasis on States’ freedom to participate in international cooperation in the exploration and use of outer space for peaceful purposes on an “equitable” and “mutually acceptable basis”. The above indicates that each State individually is burdened with the costs for measures related to its space debris and that there is no obligation to transfer technology on unilateral terms.

This allocation of costs, however, does not reflect the community interest in preserving the outer space environment, especially in cases where space debris can no longer be attributed to a certain source. The principle of “common but differentiated responsibility” may guide fair allocation here as well. In absence of schemes that address the distinct degrees of economic or scientific development, efforts to preserve the outer space environment might face the dilemma of being objectively in need of certain minimum measures, but left with a subjectively defined obligation of due diligence that factors in financial and technological resources.

2. Materialization of Risk

Outer space activities are ultra-hazardous. Especially space debris has been recognized by the international community as hazard with a potential to cause damage to other spacecraft and on the ground. It is important to clarify the legal consequences in case these risks materialize.

One major distinction is to be made between cases where a State (or another subject of international law) complies with its international obligations and the risks related to space debris materialize nonetheless; and cases where the State in question is in breach of its international obligations. The former may give rise to international liability under Article VII, OST and Articles II et seq. Liability Convention, whereas the latter may additionally entail responsibility for internationally wrongful acts²⁵. It is important to note that international responsibility under Article VI, OST is born for “national activities in outer space” while the matter of international liability is tied to “space objects”. Arguably, only the latter raises the definitional issue of space debris being or not being a “space object”.

Another major distinction is to be drawn depending upon the location where the damage is incurred by a State or its natural or juridical persons: in outer space, air space or on the Earth. As regards risks associated with the atmospheric re-entry of space debris, Article II, Liability Convention might be pertinent, as it provides that “[a] launching State shall be absolutely liable

²⁴ Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 13 Dec. 1996, UN GA doc. A/RES/51/122 (1996).

²⁵ See International Law Commission, Draft articles on Responsibility of States for Internationally Wrongful Acts (2001), available at http://untreaty.un.org/ilc/texts/instruments/english/draft%20articles/9_6_2001.pdf

to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft in flight.”

Whereas Article II, Liability Convention stipulates absolute liability, liability pursuant to Articles III of the same Convention is based upon fault:

In the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.

One has to further examine whether “damage” can be inflicted upon the space environment as such or if it becomes only relevant as potential breach of an international obligation due to the increased risk of damage to States.

IV. Conclusion

In conclusion, three questions have been addressed:

Is space debris a legal concern? Yes, it is. The International Community is about to make progress in giving legal answers. With regard to the mitigation of space debris the adoption of the Space Debris Mitigation Guidelines although legally not yet binding is definite progress. Moreover, there is ample evidence that a duty to remediate space debris can be derived from current International Space Law.

This leads to the second question: Are there “close conjunctions” between space debris and current space law? Yes, there are many such close conjunctions. Space law is better equipped than many people think.

Finally the third question: Does space law need clarification and further development to become a fully operational rule-based framework? Here the answer is clear: Space law definitely needs to be clarified in order to be more efficient. However, one must have no illusions. The best space law cannot help improve the situation if the space-faring states do not want help. Therefore any improvement of the legal framework should coincide with the concurring will of space-faring nations to do something about the problems facing them. The problem is serious but it is not too late for solutions with further strengthening of the legal framework.