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# SPACE DEBRIS AND THE LAW

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## 1. INTRODUCTION

The issue of space debris has already for some time been very high upon the agenda of scientists, worrying about the future possibilities to undertake astronomical observations from earth. Currently, these worries are increasingly spreading to the public at large, in view of the risks of damage being caused on earth – the de-orbiting of Mir, in a way the largest piece of space debris ever, was a media issue for many weeks. And even commercially oriented entities are rapidly coming to realise that the growing amount of tiny objects in outer space will not just obstruct or endanger scientific exploration, but also the commercial exploitation of outer space.

Hence, the issue has also worried legal experts, e.g. in the context of UNCOPUOS where it is a recurring agenda item. Here, however, some caution must be had. Legal experts have been discussing legal aspects of space debris for quite some time, and actually many legal proposals have seen the light of day, from fairly simple extensions of interpretations of legal terms to challenging new instruments.

For example, a few years ago a scientific team at the Department of Aerospace and Mechanical Engineering at the University of Arizona had devised a spectacular project to actually go out into debris-rich orbits with a space garbage collector – the ASPOD [1]. It was even patented – patents representing a legal instrument clearly used to achieve either a scientific or a commercial objective (or both) – but, as it turned out, the patent was never used. Actual building, launch and operation of the ASPOD would have cost millions of US dollars without bringing, as such, direct financial benefits to those paying those dollars.

Thus, in the last resort it is not law that will solve the problem of space debris, or at least solve it on its own. Once money and/or political will are there, law will be able to offer a number of interesting mechanisms for trying to ensure that such money would be well spent and such political will would be translated into useful practical results. But as long as the solutions that exist are seen as costing too much money or as resulting in unacceptable checks on national sovereignty, with perhaps a few interesting exceptions legal solutions would remain merely sleeping solutions. Would the waiting not perhaps be for a crucial triggering event, waking everyone up to the danger?

Fortunately, recent developments seem to suggest that such a crucial event would perhaps not be necessary; that the mere accumulation of, as such as of yet still minor, problems make states and other relevant players more willing to consider real improvements, perhaps even at the cost of substantial sums of money or of sovereignty. Hence, it may be rather timely to take a second look at what the law would be able to contribute in this regard.

## 2. SPACE DEBRIS AND INTERNATIONAL SPACE LAW

The word “space debris” is wholly absent from international space law – i.e. the five treaties commonly known as ‘space treaties’ plus five United Nations General Assembly Resolutions providing for authoritative, albeit as such non-binding principles [2]. Without yet going into definitional issues, there is little more than the one clause in the Outer Space Treaty’s Article IX coming close to dealing with this issue. It provides in particular that, in case of potentially harmful effects being foreseen as a consequence of a particular space activity, the state undertaking the activity should inform and consult, within the limits of reasonableness, the other states possibly concerned. There is, however, no such thing as a clear and unconditional prohibition of causing space debris by one’s activities in the first place, or an obligation of removing it once it has come into existence.

Worthy of mentioning is further the Resolution of 1992 on the use of Nuclear Power Sources, since it at least provides for some general guidelines for the safe operation of a special category of hazardous space activities, i.e. those involving the use of nuclear power sources. Obviously, this is of importance when it comes to the prevention of space debris, although one has to take note of the fact that the Principles as such are not formally binding, and of a rather technical character.

In addition, a few more Articles may be quoted that are of much wider relevance than just for this issue, but nevertheless have some specific impact also here once it comes to legal ways for dealing with space debris. Article VI of the Outer Space Treaty thus provides that states are internationally responsible for national activities in outer space, including those of non-governmental entities and international organisations. In other words: once relevant obligations *re* space

debris-prevention or -mitigation are to be established, it is up to the relevant states to ensure that also private entities and intergovernmental organisations will adhere to such rules. [3]

By contrast, Article II of the Outer Space Treaty provides for the absence of sovereignty, at least on a territorial basis, in outer space. For the issue of fighting space debris with legal means and instruments, this means that new rules and obligations as regards that area can never be established by a single state, but have to be principally established at the international level. National laws to be applied on a territorial basis do not apply; national laws to be applied on a personal basis only can be applied to those cases where a state's own nationals are the relevant actors, i.e. not on a comprehensive basis. [4]

Article VIII of the Outer Space Treaty to some extent mitigates the above consequence of the absence of sovereignty in outer space by providing that a state may (continue to) exercise jurisdiction over a space object carried on its national registry also when it is in outer space [5]. Thus, it may legally provide for rules and obligations regarding its operation in outer space that may diminish the potential harmful impact of space debris, even *after* the space object has already entered outer space.

Finally, the Rescue Agreement is worth mentioning here, since it deals with space objects likely damaged and/or posing certain threats to cause damage in the course of their return to earth. The purport of the legal regime provided by the Agreement, however, is to provide for assistance-related obligations and a safe and expeditious return home of the space object and possible astronauts on board, not to deal with any potentially harmful aspects of such space objects in their possible quality of 'space debris'.

In the end, one anyhow has to realise that space debris is not, legally speaking, an ethical, scientific or academic problem in itself, but constitutes a problem because of some of its practical consequences and ramifications. Hence, it is usually phrased by lawyers in terms of the damage caused by such debris and any liability for it, as the most down-to-earth aspect of these consequences and ramifications. This leads to three major problems to be solved.

### 3. THE DEFINITIONAL ISSUE: 'SPACE DEBRIS' AND 'SPACE OBJECT'

The first question that arises in this regard concerns to what extent space debris would still fall within the definition of "space object" or "component parts" thereof, so as to trigger application of the Liability Convention in cases of damage. Here, providing for an authoritative international interpretation of space debris would certainly be an interesting option. Many such efforts have indeed been undertaken. In particular Professor Perek has spent considerable attention to this issue. [6]

The underlying problem is that also "space object" has not been defined in any substantial manner. The first

effort at definition of Art. I(d) of the Liability Convention and Art. I(b) of the Registration Convention does not do much more than shift the issue, by including in the scope of the term "space object" also its "component parts". Nevertheless, it has generally been agreed upon, that this at least provides for a rather extensive scope: the classical example of a screwdriver let loose in outer space still being a component part of the space object it originally came from.

Consequently, few would dispute that for example large parts of a satellite after its explosion would also constitute component parts, and hence be equated with space objects. The major advantage thereof is that any damage then caused by such component parts would fall within the scope of the Liability Convention, i.e. leading at least to a theoretical possibility of compensation. [7]

Practical problems would still arise in view of the fact for example that the dispute settlement mechanism under the Liability Convention, in case the liable state(s) do not accept to pay after diplomatic consultation, does not *per se* lead to a binding decision. Such a binding decision can only result if both parties to the dispute so agree beforehand, which may not be the case too often. [8]

A more fundamental problem arises with another legal aspect of space objects. While the definition as such of a certain piece of metal as a "space object" is necessary (though not sufficient) to trigger application of the Liability Convention, it also triggers possible application of Article VIII of the Outer Space Treaty and the Registration Convention.

A space object after all can be – and usually indeed is – registered nationally, which means that the registration state retains jurisdiction and control over it – and calls, legally speaking, for solution of salvage problems similar to those in the law of the sea. Is anyone else but the owner of (and, in this case, also the sovereign over) the space object entitled to establish control over it, even if it is useless, for the reason that it is endangering the former's life or interests or has already caused damage thereto, and for the consequent purpose of deflecting such dangers or collecting evidence? Should an act of 'abandonment' explicitly take place, or be presumed? Such legal issues, if remaining unsolved, will certainly hamper any ASPOD-like or other debris-mitigating activity in outer space.

*Inter alia* for such reasons a definition which would establish space debris as a sub-category within "space objects" or "component parts", namely a sub-category subject to liability but not to the continuation of jurisdiction and control, or at least allowing for abandonment and/or salvage-like rights of other states or actors involved, might be desirable.

Thus, amongst others Professor Perek tends to lean towards a definition of space debris focusing on the (lack of) usefulness of the space object, since it would obviously be easier for a registration state to accept abandonment and/or actions by other states if it does

not have any use anymore for that space object. In other words: a space object should be considered space debris as soon as it stops having any sort of practical function, while remaining a space object for liability purposes nevertheless (albeit, logically speaking, only where the salvor does not incur liability himself for specific actions undertaken with the space object in question and the consequences of such actions). Obviously, then, first of all, one would have to elaborate what further consequences are to be exactly attached to such a new sub-category of space objects. More importantly, however, is that this discussion is of relevance only for those space objects or component parts which are large or distinct enough to be identified – and hence for the liable state(s) to be identified. This, however, is only applicable to a minor part of the space debris floating around in outer space, at least quantitatively speaking.

#### **4. THE IDENTIFICATION ISSUE: STRENGTHENING THE REGISTRATION CONVENTION**

Thus, secondly the practical problem of identification has to be faced: in case a certain piece of space debris can not be related/equated to a specific space object, effective operation of the Liability Convention for the purpose of redeeming damage is precluded. More stringent and comprehensive application in practice of the Registration Convention would have some positive effects in this respect, although it would never be able to solve the problem altogether.

Nevertheless, it is worthwhile here to briefly consider efforts currently or possibly being undertaken in this respect. Establishment of the Registration Convention for a large part was motivated by the desire to provide for means of identifying the launching state or states of a particular subject, in the event such space object would cause damage recoverable under the Liability Convention. Obviously, for space objects no longer functioning properly, or more to the point to be characterised as, alternatively having given rise to space debris, this is of special importance.

Article VIII of the Outer Space Treaty, by providing registration states the option to (continue to) exercise over space objects registered, at least stimulates actual registration in a national register. Following upon this, the Registration Convention does require international notification, namely to the Secretary General of the United Nations, of any space object so registered, thus making it possible for any party so interested to become aware of that space object's presence in outer space as well as some of its operational parameters.

However, to begin with the obligation or even suggestion of applying a proper registration mark was not provided for, partly because from a practical perspective it seemed to make little sense viz. be very difficult to achieve in any satisfactory measure by current technical means.

Also the parameters that were to be provided in accordance with Article IV(1) of the Registration

Convention to the UN Secretary General remained very basic: only the general function and character of the space object, plus a few fundamental orbital parameters. Moreover, there was no formal requirement to notify any change to these parameters, though the possibility to do so was offered under para. (2).

More importantly, any notification anyhow under Article IV(1) of the Registration Convention was only "as soon as practicable", which could well turn out to mean in actual fact 'after the space object had already ceased functioning', or worse still, simply 'never'. Especially with military or other strategic satellites, this was an evidently attractive escape clause, but also in many civil cases notification, if at all, was notoriously late, imprecise or otherwise unsatisfactory.

Finally, the clause of Article IV(3) may be noted, where provision is made for states notifying the UN Secretary General that previously registered space objects "no longer are in Earth orbit". This clause however is even severely curtailed in its effectiveness by *two* qualifications: "to the greatest extent feasible" and "as soon as practicable".

In this respect, it is indeed interesting to refer to the current efforts being undertaken in UNCOPUOS to come to more stringent requirements for registration states in terms of international notification to the Secretary General. Especially the time frame for notification is to be made shorter and more difficult in law to circumvent, and also any changes in essential parameters after launch and in-orbit delivery should now become subject to obligatory notification. In this respect, the growing practical relevance of in-orbit lease or even sale, ideally leading to a proper re-registration requirement and procedure, should be mentioned.

In the last resort however, obviously even comprehensive universal adherence to much tightened registration requirements will not be nearly sufficient to solve this aspect of space debris – allowing victims of damage caused by space debris to trace such damage back to an identifiable launching, and hence liable, state. Especially after break-ups, explosions or collisions it may soon be impossible to 'reverse-engineer' the track of tiny particles to the original, clearly identifiable space object.

#### **5. THE COMPENSATION ISSUE: TOWARDS A GUARANTEE FUND?**

This is where the third problem arises: how to deal with the damage caused by those pieces of debris which can not be retraced to a certain space object and thereby to a certain launching state? Theoretically speaking, options discussed by space lawyers and other experts have tended to focus on mitigation or prevention of such damage being caused in the first place.

Such a preventive option could be found e.g. in the establishment of a worldwide monitoring system, tracking debris not only in a more comprehensive fashion than is already the case, but also making these data available to all those potentially interested. NASA

is apparently doing an interesting and much welcomed job with some measure of comprehensiveness, in tracking all sorts of traceable objects down to quite small sizes, and some other organisations such as ESA/ESOC, NASDA and Rosaviakosmos are also building up capacity in this respect. Nevertheless, the general impression is that this is as of yet far from enough for satisfying the demand for transparent, easily accessible and readily available information on all potentially endangering space debris, especially the smaller particles.

There may be some room in this regard, therefore, for further capacity building, establishing a global and interdependent system of monitoring, hopefully with ever-increasing precision and detection-capabilities. Nevertheless, this option clearly also has its fundamental limits, not just when it comes to its proper task – tracking and monitoring space debris, and warning those potentially endangered by it – but even more so when it comes to the more fundamental issue of preventing damage from being caused by such space debris.

Another preventive legal option relates to after-mission planning, and in the case of private activities, the inclusion of provisions regarding obligatory after-mission scenarios in relevant launch or space licenses in the widest sense of the word, e.g. re-orbiting or de-orbiting, or in a ‘negative’ sense prohibiting explosion. A lesser option, maybe especially interesting as a starting point, would be to merely require *an* after-mission scenario to be included, in order to start forcing the operating entities at least to think seriously about these issues.

Whilst this is clearly an interesting – and hence already oftentimes discussed – venue, in the end it requires the political will of states to accept for themselves or for their private entities a certain additional economic cost. This will probably only happen if a substantial number of states will decide to accept such an extra cost-generating measure at the same time.

Furthermore, in case of private entities it indeed requires the existence or establishment of a licensing system, presumably under a national space law of some sort, to implement such international consensus. In this respect, it is noteworthy to realise that, so far, only eight states have actually realised any measure of comprehensive national space legislation including a system for authorisation – if sometimes very rudimentary only. This concerns, in more or less chronological order, the United States, Norway, Sweden, the United Kingdom, the Russian Federation, South Africa, Australia and the Ukraine. [9]

In addition, one might refer to the case of France, which has at least realised a special form of authorisation of Arianespace’s launching activities in conjunction with the other member states of the European Space Agency, and is now in the process of drafting a proper national space law. The latter also applies, in varying degrees, to such European states as Germany, the Netherlands, Belgium and Italy, as well

as such important space-faring states as Japan, India, Brazil and Argentina.

Nevertheless, in this area a lot remains to be done, especially to the extent that a substantial form of international harmonisation of national licensing systems might be required to prevent the phenomenon of ‘flags of convenience’, so well known from the law of the sea, from arising. Potential space entrepreneurs should not be able to shop for the most convenient licensing requirements in this respect.

All such options, however, will be fundamentally unable to preclude the occurrence of *any* damage as a consequence of space debris, whether existing or future. This brings us to the last option to be briefly discussed here: that of establishment of an international guarantee fund, similar to the one existing nationally in many countries with regard to road transport, which will compensate damage caused by unidentifiable space debris. The fund would be financed at least largely by the active space-faring community, for example by an obligatory contribution to it in the form of a particular percentage of the launch cost.

More refined options would be, for example, to link the contribution to the fund to a ‘maximum probable loss’, to be determined in an objective way, for example through the insurance premiums to the extent these would provide for ‘objective’ (since resulting from calculations by commercial enterprise guided by the Invisible Hand of competition) and comparable standards of risk, or similar devices. Not only would in this way any launch contribute to the launch fund, but also a substantial further impetus would be given to individual launch providers to enhance the safety of their operations further so as to diminish such ‘maximum probable loss’ or other relevant concept, and hence their obligatory contribution.

It is obvious, that such elaborated additions to the existing body of space law would require most probably even more than an amendment, such as a distinct treaty or protocol. In terms of strategy, however, putting discussions of such proposals on the agenda of the Legal Subcommittee of UNCOPUOS might serve as a push to arrive at least at other, less far-fetched and cumbersome additions required to enhance the effectiveness of space law *vis-à-vis* the growing problem of space debris.

Also, however, again one should realise that in regard of private entities involved in particular in launching activities, but indirectly certainly also those undertaking other space activities, any such results can only be achieved under the current configuration of international law by means of national space laws and their licensing systems. Thus, another element of uncertainty and non-comprehensiveness is introduced into the equation, to be tackled preferably by UNCOPUOS and its Legal Subcommittee in providing for obligatory core common elements of such licensing systems in this respect.

## 6. CONCLUDING REMARKS

In conclusion, it is encouraging to see that increasingly not just scientists, but also the public at large and the commercial sectors are becoming aware of the potential threats to their interests caused by the growing population of space debris. Thus, it would seem the appropriate time now to start thinking and discussing in detail the possible ways and means in which 'law' can help mitigate the threats posed by space debris, even if in the last resort one has to be modest about the possibilities for law to achieve effective results without the concurrence of money and political will.

In furthering the positive contribution of the law to the mitigation of the harmful consequences of space debris, then, various entities would have to fulfil their respective roles.

At the global international level it would be in particular UNCOPUOS and its Legal Subcommittee which should help develop the international framework, including working towards harmonised licensing regimes. Thus, efforts to arrive at coherent and effective definitions of such key terms as "space objects" and "space debris", and to develop rules regarding abandonment and salvage-like rights when a particular space object/piece of space debris has no longer any visible function yet may substantially threaten other state's interests, e.g. in terms of operating satellites.

Also, more specific and substantive law may be developed, if necessary firstly by means of 'soft', non-binding law such as Resolutions, guidelines or codes of conduct which later on could develop, if of proven value and feasibility, into 'hard' law. This should focus on establishing duties for any launching party in earlier stages to provide for an after-mission scenario *of whatever nature*, later on for *particular* after-mission scenarios. The latter, stronger option however likely requires more technical and scientific research, e.g. as to the relative benefits and risks involved in such scenario's as de-orbiting, re-orbiting and passivation.

In case of private launch parties, of course, such substantive duties would then have to be implemented through licensing systems. This is, consequently, where the second group of 'space players' comes into the picture: the individual states. Only they have the legal power and means to effectively impose the relevant obligations upon private operators, and monitor and enforce them, and this will not change in the foreseeable future, in spite of repeated clamours for a World Space Organisation or similar ideas.

Thus, those states which already do have some sort of licensing system should make sure that it will be constantly tuned to whatever international guidelines, codes of conducts or binding legal regulations will prescribe, whereas those states not yet having such a licensing system but nevertheless principally allowin<sup>g</sup> their private entities to become involved in

space activities, should be pressured into establishing such licensing system in line with current international requirements.

A third important role finally is to be played by the intergovernmental organisations. As mechanisms for joint efforts of states they play a particularly important role in space activities, and hence should play a particular role also in leading the way. Collective standards are to that extent already more easily acceptable to individual states in that the relative disadvantage borne by a state accepting the costs of debris-mitigating measures as towards other states not (yet) accepting them is shared with the other member states. Also, in view of their public international status, they may play an important role in establishing international customary law, since they may represent state practice and/or *opinio juris* of a number of states.

Thus, such organisations as ESA and Intersputnik, but also INTELSAT, IMSO and EUTELSAT to the extent that these may still (continue to) be classified as intergovernmental organisations, may have an important pioneering role to play. A special mention finally may be made here of the IADC, which, though no intergovernmental organisation in itself, also represents an important platform for relevant individual states as well as ESA to establish an even wider consensus on necessary, if perhaps costly measures.

Whilst maybe it will never be possible to completely fill the pit before the cow falls in (in reference to a famous Dutch saying), there may still be a realistic chance of at least making it so much shallower that the cow, once one comes to fall in, will not fall as deep and as painful as otherwise. Obviously, there would already be great benefit for all mankind in that. [10]

## REFERENCES

[1] ASPOD stands for "Autonomous Space Processor for Orbital Debris"; see Sterns P.M. and Tennen L.I., The Autonomous Space Processor for Orbital Debris (ASPOD) Project and the Law of Outer Space: Preliminary Jurisprudential Observations, *Proceedings of the Thirty-Eighth Colloquium on the Law of Outer Space*, 107-120, 1996.

[2] The five treaties respectively five UNGA Resolutions are the following:

■ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), London/Moscow/Washington, adopted 19 December 1966, opened for signature 27 January 1967, entered into force 10 October 1967; 6 ILM 386 (1967); 18 UST 2410; TIAS 6347; 610 UNTS 205;

■ Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement), London/Moscow/Washington, adopted 19 December 1967, opened for signature 22 April 1968, entered into force 3 December 1968; 19 UST 7570; TIAS 6599; 672 UNTS 119;

■ Convention on International Liability for Damage Caused by Space Objects (Liability Convention), London/Moscow/Washington, adopted 29 November 1971, opened for signature 29 March 1972, entered into force 1 September 1972; 10 ILM 965 (1971); 24 UST 2389; TIAS 7762; 961 UNTS 187;

■ Convention on Registration of Objects Launched into Outer Space (Registration Convention), New York, adopted 12 November 1974, opened for signature 14 January 1975, entered into force 15 September 1976; 14 ILM 43 (1975); 28 UST 695; TIAS 8480; 1023 UNTS 15;

■ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), New York, adopted 5 December 1979, opened for signature 18 December 1979, entered into force 11 July 1984; 18 ILM 1434 (1979); 1363 UNTS 3;

■ Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, UNGA Res. 1962(XVIII), of 13 December 1963; UN Doc. A/AC.105/572/Rev.1, at 37;

■ Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, UNGA Res. 37/92, of 10 December 1982; UN Doc. A/AC.105/572/Rev.1, at 39;

■ Principles Relating to Remote Sensing of the Earth from Outer Space, UNGA Res. 41/65, of 3 December 1986; UN Doc. A/AC.105/572/Rev.1, at 43;

■ Principles Relevant to the Use of Nuclear Power Sources in Outer Space, UNGA Res. 47/68, of 14 December 1992; UN Doc. A/AC.105/572/Rev.1, at 47; and

■ 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, UNGA Res. 51/122, of 13 December 1996; XXII-I Annals of Air and Space Law (1997), at 556; 46 Zeitschrift für Luft- und Weltraumrecht (1997), at 236.

[3] It may be noted that the exact definition of “national activities”, circumscribing the range of private space activities for which any particular state is to be held responsible at the international level, is far from agreed upon. See e.g. Von der Dunk F.G., *Private Enterprise and Public Interest in the European ‘Spacescape’*, International Institute of Air and Space Law, Leiden, The Netherlands, 1998, in particular para. II.2.2.B.

[4] See [3], para. II.2.1.

[5] See [3], para. II.2.4., also II.4.

[6] Perek L., Legal Aspects of Space Debris: A View from Outside the Legal Profession, *Proceedings of the Thirty-Eighth Colloquium on the Law of Outer Space*, 53-60, 1996. Also other contributions in the same *Proceedings*.

[7] See Artt. I(a), II,III, Liability Convention.

[8] See Art. XIX, Liability Convention.

[9] See [3], Chapter IV, as far as the United States, Sweden, the United Kingdom, the Russian Federation and South Africa are concerned; Von der Dunk F.G., Launching from ‘Down Under’: the New Australian Space Activities Act of 1998, to be published in the *Proceedings of the Forty-Third Colloquium on the Law of Outer Space*, 2001, as far as Australia is concerned; and Von der Dunk F.G., Vikings First in National Space Law; Other Europeans to Follow - The Continuing Story of National Implementation of International Responsibility and Liability, to be presented at the Forty-Fourth Colloquium on the Law of Outer Space, Toulouse, October 2001, as far as Norway and a few prospective national space laws are concerned.

[10] Cf. Art. I, Outer Space Treaty.