

SPACE DEBRIS IN THE UNITED NATIONS: ASPECTS OF LAW AND POLICY

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ABSTRACT

Space debris has become a severe and - regarding the recent collision of space debris with a French satellite - more than theoretical or probabilistic problem for the exploration and use of outer space. Although technical concepts for the mitigation of space debris have been developed, measures have been introduced only by a small number of space-faring nations for only a small number of their missions.

The existing international space treaties do not explicitly mention "space debris", but still they offer useful regulations which are applicable to important aspects of this issue. Nevertheless, the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) is faced with the task to elaborate a comprehensive set of additional rules for dealing with space debris.

Taking into account the current activities in the Scientific and Technical Subcommittee of UNCOPUOS, centering in a multi-year work-plan (1995-1998) on the technical aspects of space debris, the Committee will soon have to draft a mandate for the discussion of space debris in the Legal Subcommittee. At this important cross-roads great attention has to be paid to the danger that via the drafting of rules in the field of space debris, existing space law - in particular in the important fields of State liability and environmental protection - could be bypassed or even contradicted.

This paper describes the necessary steps to be taken for a constructive and sound approach in dealing with space debris in the Legal Subcommittee of UNCOPUOS. A solution should be found where the space debris question is dealt with on the basis of existing legal norms, thereby developing comprehensive regulations while protecting the values of existing space law.

1. INTRODUCTION

For almost a decade now, there has been a basic understanding among leading Space Agencies and technical experts that the issue of space debris is a growing problem for space utilization and exploration. Space debris could - if not properly dealt with - severely impede the use of outer space already during this generation (Ref. 1). While in the beginning of space flight in the 1960's the issue was not recognized, it has now become obvious that near-Earth outer space is not an area with unlimited possibilities for space activities of any type (e.g. experiments deliberately designed to destroy other objects in outer space such as the US SDI program or the former USSR antisatellite experiments.) Outer space must be considered as an extremely "fragile" environment which has to be protected accordingly.

The urgency of the matter has become clear through the first recorded collision of space debris (of an Ariane launcher) with an active satellite (the French satellite CERISE) on 24 July 1996. But also the situation of Earth-bound scientists has become delicate. Astronomers e.g. are already severely affected by space debris as well as "space traffic" in general (e.g. orbiting satellites). They claim that the efficiency of their work is hampered in many ways. For astronomers the sky has become so "bright" that space observation is already extremely difficult and photographs taken during this process (they necessarily have a long exposure time - sometimes several hours) are ruined by traces made by orbiting space objects or debris (Ref. 2).

But even though problems like these call for action the legal regulation of this situation is still an issue on which disagreements exist. While technical measures and concepts for the protection of the space environment are already elaborated and even executed in certain fields, the development of legally binding instruments

still faces a complex situation of national and individual interests and prejudices. The prevention of space debris as well as the solution of present problems can be expensive in many ways. Therefore, experience shows that not all nations accept their share of responsibility with respect to space debris. Without any binding regulation, they are not willing to restrict their space debris production. Examples are States like Indonesia - which as a leading space nation among developing countries has not ratified a single space treaty (Ref. 3), not even the 1972 Liability Convention (Ref. 4). Such States have narrow short term interests in outer space resulting from financial restrictions as well as the will to dominate or enter a promising space market - like China in the field of launchers. Concerns about the production of space debris become secondary for them in this context. Such a situation also leads to competitive disadvantages for those bidders as well as investors on the space market which try to avoid space debris opposite to those who do not. Also there are member countries of the UNCOPUOS which are generally reluctant to accept international regulation, as they fear to be forced to accept rules which are not based on an expert treatment of the subject. Ref. 5).

In this context, it becomes obvious that the elaboration of any legal instrument with regard to space debris has to take into consideration not only the possible technical approaches but also the differing interests of all parties. The goal will have to be a solution, which not only offers the greatest advantage for the space environment as well as any victim possibly affected by space debris, but which is also acceptable for countries which are newcomers on the space market as well as those which are already space powers. In this respect, it is important to see, what the existing space law already offers in this respect and what is still needed.

2. EXISTING LEGAL NORMS FOR THE PREVENTION OF SPACE DEBRIS

When in 1967 the Outer Space Treaty (Ref. 6) was elaborated, the general awareness for environmental problems, as it has become natural in the last 20 years, had not even started to develop. Other concerns in connection with the exploration of outer space were much more

prominent. Also in the Moon Treaty (Ref. 7), which was adopted in 1979, it can still be seen how different from today the attitude of the drafters of this Convention with respect to environmental protection was.

But anyhow, these Treaties are the only ones to deal with space environmental matters at all, even if their regulations are so general that they could be used for the *prevention of any* pollution problem. On the background of today's concerns, though, the Outer Space Treaty, which marks the cornerstones of international space law, presents only quite a superficial and weak legal framework for the prevention of specific problems such as space debris:

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, (...) with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, (...) 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.

This shows that the authors of the Outer Space Treaty had no *concrete* imagination of the consequences of space flight and exploration with respect to the outer space environment. The word "space debris" is not even mentioned. However, it has to be pointed out that the Treaty does not entirely neglect space debris in its regulatory framework. In its Article VIII, which is dealing with the important issue of State liability it refers to damage caused by "space objects and its component parts". This means that many common types of space debris are included in the regulation e.g., "dead" satellites, debris generated in case of an explosion, satellite upper stages, heat shields of satellites, nuts and bolts etc. This is extremely important for cases when damage has already occurred and questions of compensation arise.(Ref. 8) This regulation is naturally not *tailored* to space

debris either, although it is fortunately applicable to many cases. (Damage caused by mission related objects or space refuse for example does not seem to be covered by the article.) (Ref. 9)

As to the Moon Treaty of 1979 (which has not been ratified by any major space-faring nation) this international instrument stipulates the following:

Article 7

1. In exploring and using the moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties shall also take measures to avoid harmfully affecting the environment of the earth through the introduction of extraterrestrial matter or otherwise.

2. States Parties shall inform the Secretary-General of the United Nations of the measures being adopted by them in accordance with paragraph 1 of this article and shall also, to the maximum extent feasible, notify him in advance of all placements by them of radio-active materials on the moon and of the purposes of such placements. (Emphasis added)

Although environmental matters are mentioned here, these paragraphs still show that the general assessment with respect to the protection of the space environment at the time of the Moon Treaty's adoption could be summed up by technical laymen polemically as outer space is an environment which is "huge and empty". So environmental problems do not take the scope of waste and pollution on Earth which could be seen, grasped and smelled. Therefore, outer space could, according to this Treaty, even be used as a *nuclear waste disposal*. (See Art. 7.2). The problem that such nuclear waste has to be launched into outer space (before it can be disposed of) and that the risk of launching failures are conservatively assessed by all great space-faring nations as realistically being approx. between 15% and 20% did evidently not concern the authors of the Moon Treaty enough to block consensus on the matter or to elaborate a more acceptable solution. The horrible scenario in case that such nuclear material was

to fall back to the Earth - possibly on the territory of a State which is *not* responsible for the launching - did not seem to have bothered the drafters of the above mentioned article either. In this connection it is important to know that accidents which are due to so called launching failures do not only include cases when e.g. the payload explodes on the satellite's launching pad and pollutes the territory of a launching State. They also include all cases in which the payload does not reach its proper destination - this can also be due to an unscheduled reentry into the Earth's atmosphere after the payload has already half orbited around the Earth.

In the cases of both, the Outer Space Treaty and the Moon Treaty, though, it has to be pointed out that in the times of their elaboration the question of environmental protection was clearly secondary. During the Cold War such issues as peaceful vs. military uses of outer space, the sharing of resources and State responsibility as well as the liability of States for space activities were the predominant ones. As to the last two issues, it has to be emphasized that they have been solved so well, at least in their fundamental features, that even today a better concept with respect to the responsibility of the launching State as well as its liability for damage caused by space objects could not be elaborated. (In 1979 the question of State liability was regulated in more detail than in the 1972 Liability Convention.) It can even be doubted whether such regulations had a realistic chance to be adopted by consensus in the United Nations today. (Ref. 10)

3. DEFINITION OF SPACE DEBRIS/ STATE RESPONSIBILITY/ LIABILITY/REGISTRATION

3.1 Definition of Space Debris

As already indicated, the term "space debris" is not mentioned in the 1967 Outer Space Treaty. This is also the case for all other space treaties dealing with issues relevant to space debris, i.e. the 1972 Liability Convention, the 1975 Registration Convention (Ref. 11) as well as the already mentioned 1979 Moon Treaty. While the Outer Space Treaty speaks of "space objects or

its component parts" (see under section 2. above) the Liability Convention and the Registration Convention are somewhat more concrete in this respect and they stipulate that the term "space object" includes component parts of a space object as well as its *launch vehicle and parts thereof*. Thereby these conventions go a step further than the Outer Space Treaty. Nevertheless, these regulations show that an amendment of these international instruments with respect to space debris as we understand this phenomenon today is imperative. It is in this connection of course problematic that in international space law the terms "space debris" and "space object" cannot and should not be separated. The reason for this is that all already existing provisions related to environmental protection as well as to the extremely important issues of State responsibility and State liability refer to space objects as already described above *as well as* (implicitly) to space debris (even if debris is insufficiently defined). Therefore, the term "space object" should be extended properly. Already existing norms and regulations would have to be amended, whereas the fundamental structures of these norms should be left out of the discussion.

As a definition we have already proposed (Ref. 12) the following:

1. *The term "space debris means a space object regardless, whether it still exists as a whole or whether it is fragmented to any size, in the event that such an object is non-functional and there is no reasonable expectation of it assuming or resuming its function. /E.g. deactivated satellites, spent rocket stages, fragments of rockets and satellites, engine exhaust particles, refuse, paint flakes).*

2. *The term "space object" refers to the definition as contained in Article I (d) of the Convention on Liability for Damage Caused by Space Objects as well as to all mission related objects including refuse generated during space missions and space objects assembled in outer space.*

3.2 State Responsibility

As already mentioned under section 2., such a procedure is especially important for the issues of State responsibility and State liability. These are at least basically regulated in the Outer

Space Treaty and the Liability Convention which have been ratified and practiced for a long time by the majority of space faring nations. The structure of these regulations as they already stand is so important that one should refrain from a new debate within a discussion with respect to space debris. The controversial political situation as described in section 1. would otherwise lead to the risk, that such negotiations could have results which are less satisfactory than the results which were reached (way back) in 1967 by the Outer Space Treaty and in 1972 in the Liability Convention. In such a discussion it is likely that especially developing countries might, under financial restraints which could turn out as being shortsighted, try to soften up e.g. the provisions of strict State liability as regulated in the Liability Convention for their own interest group.

3.3 State Liability

State Liability in international space law today is already regulated in such a way that the launching State is held absolutely liable for all damage caused by space objects on the surface of the Earth or of aircraft in flight. In this connection, no *fault or negligence* of the responsible State for the accident has to be proven. (The victim must only prove the *causality* between the damage effected and the crash of the space object or its component part.) The amount of compensation to be paid in this connection is *unlimited*. This is a solution where international space law is exemplary in the field of law making. Such a regulation of absolute liability is unknown in terrestrial law even in the very strict legislation of western industrialized countries: here we either find a system where liability with full compensation is established but in all these cases the proof of fault or negligence has to be conducted.

There might also be a system of liability where only the *causality* between damage and the circumstances responsible for the damage has to be proven, but in such a case the commitment for compensation ends at a certain limit (this is the case e.g. for air traffic accidents or for accidents with nuclear power plants). Such a solution is generally supposed to be just and equitable because such a case of liability can be

covered by insurance. However, in cases of an *unlimited, absolute* liability as provided for in international space law, potential damage cannot be insured and the launching State in case of an accident is liable with all its possessions. For damage caused on the surface of the Earth or of aircraft in flight, the amount of compensation can reach incalculable sums. (E.g. in a case where a nuclear powered satellite, like Cosmos 954, re-enters the Earth's atmosphere and the debris is scattered on an area of several hundred km²) Such a liability regulation is of course beneficial for the victims of damage from debris on the surface of the earth or on board of an aircraft in flight and absolutely necessary when space flight, which is at the moment still and legitimately in an experimental stage, does not want to deny its responsibility towards innocent parties, which are not involved in space missions but possibly harmed by them.

These regulations, which could of course be improved in various aspects, but which are basically excellent, are sometimes questioned, at least in certain respects, by developing countries which are newcomers on the space market. In informal talks with such delegations as well as hidden in some of their statements it becomes clear that some countries would like to soften up this system, at least for their benefit as a launching State because this existing State responsibility and liability in its strictness is also immensely expensive. (As to the protection which is offered by these norms for their own population, they do of course not want to give up anything.)

These countries which have small financial resources would like to invest their money directly in space projects rather than in their responsibility, namely in the potential case where no new products for space flight can be bought but only the damage which has been done by accidental missions has to be repaired or compensated for. Therefore, the negotiations on space debris must not create a new and separate legal regime, but already existing and internationally adopted legal regulations have to be amended. E.g. through additional protocols. So it can be guaranteed that the difficult labour in the international field which has so far lead to good results is not sacrificed for new and only seemingly better regulations.

In this context also the term space object, which is used in the space treaties especially in the Outer Space Treaty and the Liability Convention, should be extended. It could be referred to as a *space object regardless whether it still exists as a whole or whether it is fragmented to any size in the event that such an object is non-functional and there is no reasonable expectation of its assuming or re-assuming its function.* Such definition shows that the difference between space debris and a functioning space object has not to be seen primarily in the fragmentation of a space object but in the decisive criterion whether a space object (as a whole or fragmented to any size) is functional, and thereby under control, or not. Furthermore, the definition could also refer to all mission related objects including refuse generated during space missions, as well as space objects assembled in outer space. Also it has to be considered whether as an amendment to already existing legal instruments also a catalogue of technical measures should be included through which the production of space debris could be prevented or at least minimized.

3.4 Registration

As to the registration of space debris or the information of the general public as well as the exchange of information among e.g. space agencies with respect to this problem with the goal e.g. to prevent a possible collision between functioning and non-functioning space objects, the 1975 Registration Convention is not precisely tailored to this problem. Also here a regulation would have to be created which takes into consideration the latest state of the art, and which should also be based on the Registration Convention, which is practiced by most of the space faring nations. For the above mentioned reasons this Convention should be amended and not substituted.

4. SPACE DEBRIS IN THE LEGAL SUBCOMMITTEE OF UNCOPUOS

The further development of space law is a task of the Legal Subcommittee of UNCOPUOS, where the already mentioned outer space treaties also have been elaborated. The time to begin

such further work is perfect at the moment, as the need for action to elaborate new regulations and amend old regulations has been recognized and because the Scientific and Technical Subcommittee of UNCOPUOS has already been entrusted since 1995 with the examination of the space debris problem through a multi-year work-plan. It is mandated to finish these studies until 1998. From 1997 on, it will be supported by the Inter-Agency Debris Coordination Committee (IADC), which comprises the combined technical knowledge in this field. The results of this work would be the basis for the activities of the Legal Subcommittee.

Therefore, it is now the time to consider the mandate for the Legal Subcommittee, especially as the drafting of such a mandate is in no way a mere question of procedure: in such a forum a mandate like this has a determining influence on the result of the task to be accomplished. As already indicated, no agreement has yet been reached whether the Legal Subcommittee should be entrusted with the examination of legal questions of space debris and how a future debate should be structured. A discussion on the one hand should not become so broad that during the next decade there will be no legal solution at all and it also has to be prevented that the debate becomes so general that already adopted and practiced legal instruments will be fundamentally questioned so that we will leave the debate with less than we have brought into it. Furthermore, such a debate has to be monitored so that the technical expertise of the Scientific and Technical Subcommittee will be fully used for any legal regulation. Such a work has already been completed before in the case of the "Principles Relevant to the Use of Nuclear Power Sources in Outer Space" (Ref. 13). In that case, the Legal Subcommittee has already elaborated a Resolution which contains highly technical matter.

Informal consultations with respect to a possible new agenda item "Space Debris" in the Legal Subcommittee (which would fill the void on the agenda caused by the adoption of the "Space Benefits" - Declaration) have been conducted in 1996 and as an unofficial working paper a background note of the Czech Republic was presented to the Legal Subcommittee:

Unofficial background note by the Czech Republic (Ref. 14)

Review of existing norms of international law applicable to space debris

The purpose of the consideration of this proposed item would be to examine the problem of space debris from the perspective of existing international law which could be applicable to the phenomena of orbital debris. In this regard, the following questions should be examined:

Does the definition "space object" as contained in the 1972 Liability Convention and the 1975 Registration Convention cover space debris?

Do provisions of the 1967 Outer Space Treaty concerning the avoidance of harmful contamination of outer space and adverse changes in the environment of the Earth apply to the problem of space debris?

Should the protection of ownership of space objects, and of their component parts, also be extended to space debris?

Should liability for damage caused to a space object and/or its crew by space debris depend on the proof of fault as in the case of a collision of two space objects?

These and other questions are of a legal nature and should be analyzed and answered by legal experts.

The consideration of these questions would not amount to the drafting of new provisions but should serve to clarify the issues involved and help to improve the interpretation and application of the existing norms of international space law.

The time-frame for consideration of the suggested item could be limited to two sessions of the Subcommittee with the understanding that no more than two to three meetings would be devoted to it at each of these sessions. Thus the consideration of this item would not require any extension of the current duration of the Subcommittee's session.

This paper shows that in the Committee considerations are already taking place whether it is possible to examine the necessity of additional regulations as a first step and thereby use the time until the Scientific and Technical Subcommittee has completed its report and the work based on concrete technical statements can begin. It can also be seen that for such preliminary examinations a time frame of two

years has been set, so that a discussion does not become borderless.

Since this paper does not contain the attempt for a definition of space debris and there is a confusing utilization of the terms "space debris" and "orbital debris", help could be sought in the Report of the Scientific and Technical Subcommittee, of 4 March 1996, where we find the following text (Ref. 15).

"It was understood that space debris are inactive manmade objects such as spent upper stages, spent satellites, fragments or parts generated during launch or mission operations or fragments from explosions or other break-ups."

But this attempt of a definition does not fulfill the requirements of an analytical legal text and thus shows the intricacies if one Subcommittee advance the task of another Subcommittee. The flaws of the text become clear, when compared with our above proposed wording (i.a. the reference to debris as space objects "as a whole" and the fragmentation "to any size").

Another weakness of the otherwise very meritorious Czech paper can be seen in the paras 1. and 2. where the general question is asked whether the definition "space object" as contained in the 1972 Liability Convention and the 1975 Registration Convention covers "space debris". In a political forum such as the Legal Subcommittee the danger exists that delegations could attempt through such a discussion to water down the absolute liability as stated in the 1972 Liability Convention or at least modify it for their own interests. In international space law it is undisputed that the Liability Convention can and must be applied also to cases with regard to space debris and that the definition of a space object includes of course the common types of such debris, so that a fundamental discussion about this topic in a Legal Subcommittee is useless and harmful. The same is true for the question with regard to the 1967 Outer Space Treaty.

But still it can, as a conclusion, be stated that it is necessary to discuss, as soon as possible, the issue of space debris in the Legal Subcommittee also with the view of further developing and possibly amending already existing legal norms and to examine, maybe as a first step, in the frame of the proposed two-year schedule, the

existing body of space law. Then it can be decided whether to amend existing legal texts (e.g. by additional protocols) or draft a separate instrument on space debris (e.g. as a UN General Assembly Resolution containing a set of principles).

5. REFERENCES

1. International Academy of Astronautics, Report of the Committee on Safety, Rescue and Quality, August 27, 1992 and Report of the ESA Space Debris Working Group of November 1988, ESA Document ESA SP-1109 In this connection see also UN Doc. A/AC 105/570, of 25 February 1994 Space Debris: Report of the International Astronautical Federation, submitted to the UNCOPUOS Scientific and Technical Subcommittee on 4 March 1994 (reprinted in Böckstiegel, Karl-Heinz / Benkö, Marietta, Space Law: Basic Legal Documents. Dordrecht / Boston / London, 1996, Vol. I/2 B.III. 11). See also: U.S. Congress, Office of Technology Assessment (OTA), Orbiting Debris: A Space Environmental Problem - Background Paper, OTA- BP-ISC-72 Washington, DC (U.S. Government Printing Office, September 1990); National Research Council (US) Committee on Space Debris, Orbital Debris: A Technical Assessment, National Academy Press, Washington DC 1995.
2. The International Astronomical Union (IAU) has therefore, in cooperation with the International Council of Scientific Unions (ICSU) and UNESCO, passed a "Declaration on the Reduction of Adverse Environmental Impacts on Astronomy" in July 1992. See also Kovalevsky, J., *The Protection of Astronomical and Geophysical Sites*. Editions Frontières, Gif sur Yvette, 1995; Crawford, David L. (ed.), *Light Pollution, Radio Interference and Space Debris*. Proceedings of the International Astronomical Union, Colloquium No. 112, Washington DC. August 1988, Astronomical Society of the Pacific Conference Series, Vol. 17, San Francisco, 1991.
3. These are especially the following international instruments:
Treaty on Principles Governing the Activities of States in the Exploration and Use of

Outer Space Including the Moon and Other Celestial Bodies, done on 27 January 1967 ("*1967 Outer Space Treaty*"), reprinted in: Böckstiegel / Benkö, op. cit. fn 1, Vol. I/1 A.I;

Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, done on 22 April 1968 ("*1968 Rescue Agreement*"), reprinted in: Böckstiegel / Benkö, op. cit. fn 1, Vol. I/1 A.II;

Convention on International Liability for Damage Caused by Space Objects, done on 29 March 1972 ("*1972 Liability Convention*"), reprinted in: Böckstiegel / Benkö op. cit. fn 1, Vol. I/1 A.III;

Convention on Registration on Objects Launched into Outer Space, done on 14 January 1975 ("*1975 Registration Convention*"), reprinted in: Böckstiegel / Benkö op. cit. fn 1, Vol. I/1 A.IV;

Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, done on 18 December 1979 ("*1979 Moon Treaty*"), reprinted in: Böckstiegel / Benkö op. cit. fn 1, Vol. I/1 A.V.

4. op. cit. fn 3.

5. At least the US seem to have abandoned this position. See The White House, National Science and Technology Council: *Fact Sheet on National Space Policy* released on 19 September 1996, sec. 7, space debris, p. 14 stating i.a. "It is in the interest of the U.S. Government to ensure that space debris minimization practices are applied by other spacefaring nations and international organizations. The U.S. will take a leadership role in international fora to adopt policies and practices aimed at debris minimization and will cooperate internationally in the exchange of information on debris research and the identification of debris mitigation options."

6. op. cit. fn 3.

7. op. cit. fn 3.

8. With regard to the definition of space objects as well as legal problems relating to space debris see especially: Baker, Howard A., *Space Debris. Legal and Policy Implications*. (Utrecht Studies in Air and Space Law, Vol. 6), Dordrecht, Martinus Nijhoff Publishers, 1989; Alwes,

Detlef / Benkö, Marietta / Schrogl, Kai-Uwe, *Space Debris: An Item for the Future*. In: Benkö, Marietta / Schrogl, Kai-Uwe (eds.), *International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space*. Forum for Air and Space Law, Vol. 1, Gif sur Yvette, 1993, pp 253.; Benkö, Marietta / Schrogl, Kai-Uwe / Gruber, Gerhard, *Space Debris: Legal Problems to be Solved in the United Nations*. Proceedings of the First European Conference on Space Debris, Darmstadt, Germany 5-7 April 1993 (ESA SD-01) pp 679.

International Institute of Space Law of the International Astronautical Federation:

- Proceedings of the 14th Session, Brussels, September 20-25, 1971. See especially part 4 on the protection of the earth environment, p. 52.

- Proceedings of the 25th Session, Paris, September 27 - October 2, 1982. See especially chapter on legal aspects of protection of the earth and outer space environment, p. 1.

- Proceedings of the 30th Session, Brighton (UK), October 10- 17, 1987. See especially chapter on legal aspects of outer space environmental problems, p. 121.

- Proceedings of the 32nd, Malaga, October 11-13, 1989. See especially chapter legal aspects of protection of the outer space environment, p. 59.

- Proceedings of 33rd Session, Dresden, October 6-12, 1990. See especially chapter on space activities and legal aspects of protection of the global environment, p. 133.

- Proceedings of the 38th Session, Oslo, October 2-6, 1995. See especially chapter on legal issues arising from recent technical studies relating to space debris.

The Proceedings are published by the American Institute of Aeronautics and Astronautics, New York.

Reijnen, G.C.M. / DeGraaff, Willem, *Pollution of the Outer Space, in Particular of the Geostationary Orbit: Scientific, Policy and Legal Aspects*. (Utrecht Studies in Air and Space Law, Vol. 4), Dordrecht, Martinus Nijhoff Publishers, 1989; Hacket, George T., *Space Debris and the Corpus Iuris Spatialis*. (Forum for Air and Space Law, Vol. 2), Gif sur Yvette, 1994.

9. See especially Baker op. cit. fn 8, p. 61 ff.

10. As to policy considerations and the debates in the UNCOPUOS Legal Subcommittee

preceding the adoption of the Convention on Liability for Damage Caused by Space Objects see especially Christol, Carl Q., *The Modern International Law of Outer Space*. New York, 1982 p. 59 ff. and Hurwitz, Bruce A., *State Liability for Outer Space Activities in Accordance with 1972 Convention on International Liability for Damage Caused by Space Objects*. (Utrecht Studies in Air and Space Law, Vol. 11), Dordrecht, Martinus Nijhoff Publishers, 1992, p.9.

11. op. cit. fn 3.

12. See Alwes/Benkö/Schrogl op. cit. fn 8, p.257.

13. UN Res. 47/68 of 14 December 1992 reprinted in: Böckstiegel / Benkö, op. cit. fn 1, B.III.9.

14. Report of the Legal Subcommittee of Its 35th Session, UN Doc. A/AC.105/639 of 11 April 1996, p. 38.

15. Report of the Scientific and Technical Subcommittee of Its 33rd Session, UN Doc. A/AC.105/637 of 4 March 1996, p.17, para 95.

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