

## Political and Legal Problems of Space Debris

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A legal institution is formed by the core concept and legal rules constituting its framework. We therefore should have first the common and clear understanding with respect to what the space debris is, viz, the definition of the space debris. The distinction of space debris from other objects can facilitate the consideration of applicable legal rules.

The space debris has an aspect of not only space law but also environmental law. It'd better consider the problems of space debris in both contexts.

### I. What is Space Debris<sup>1)</sup>

#### (A) Legal definition of space debris

1. Generally, the following garbages exist in space: (a) Malfunctioned or inactive space objects or upper stages of launch vehicles still

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- 본고는 1999년 10월 서울에서 "새 천년의 항공우주법 및 정책의 주요 과제와 방향"이라는 주제로 개최된 제9회 항공우주법 국제학술세미나대회에서 발표된 논문임

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1) With respect to legal and political text, please refer to the following: Technical Report on Space Debris of the S.T.S.C. (A/AC.105/720); Interagency Report on Orbital Debris of November 1995; NASA Safety Standard; NASDA Standard for Preventing the Generation of Space Debris; IDAC Papers.

remaining in earth orbit: (b)Operational debris composed of objects separated and released during the period of a mission such as lens, caps, shrouds, clamps, packing devices, wires etc; (c)fragments generated from intended explosions or accidental collisions on orbit or paint flakes resulted from deterioration of space object; (d)such particles as aluminium oxide generated from solid rocket fuels used during or after the placement of a space object into GSO or final orbit; (e)other mission related materials ejected during a mission.

2. From the etymological viewpoint, the term "ospace debris" is distinguished from "ospace refuse", "ospace garbage", "ospace waste", "ospace litter" or "ospace junk". It comes from French word "gd bris", viz something broken to pieces or destroyed. Therefore, "ospace debris" means etymologically "gscattered fragments", viz, drifted upper stages of launch vehicles or other fragments of space object. However, the present argument is not so simple.
3. According to some opinions, small particles are not regarded as space debris, because they do not result from space objects itself, but from chemical compound in reaction with oxide by burning of rocket fue l.<sup>2)</sup> According to other opinions, they must be considered space debris, because space debris means uncontrollable and useless manmade objects.<sup>3)</sup> The I.L.A. Buenos Aires International Instrument on the Protection of the Environment from Damage caused by Space Debris pro poses in its Article 1, that space debris may result from "gparticles and other forms of pollution ejected, for example, by solid rocket exhaust."

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2) H.Baker, "ospace Debris: Legal and Policy Implications", Martinus Nijhoff, 1989, p.62.

3) Position Paper on Orbital Debris of an Ad Hoc Expert Group of the I.A.A. Committee on Safety, Rescue and Quality, 1992, p.1~2.

4. Disagreement also exists with respect to whether other mission related materials resulted from material processing experiments based on micro-gravity environment or biological experiments must be regarded as space debris. For example, certain refuse ejected in the course of experiments on space shuttle or space palette may be pretended to be space debris.
  
5. There is an argument in respect of whether malfunctioned or mission terminated space objects is considered space debris. According to some opinions, these are space debris because they cannot attain their objectives because of uncontrollability, and have so much risk to collide with other objects. However, according to Dr. Kopal, even if they were malfunctioned and irreparable, in case that they have "a certain significance for exploring the causes of their non-functionality or the effects of their stay in outer space, they cannot be regarded as space debris."<sup>4)</sup> In fact, we can find certain practice endorsing this opinion.<sup>5)</sup>
  
6. There is no agreement with respect to legal definition of space debris. Legal definition means identifying and enumerating the components of a concept and thereby seizing the specificity of relations linking them together. It is undesirable that this definition is so different from the usual meaning of the word. From the viewpoint of ensuring security which is the aim of the establishment of a definition, only something resulting from space object itself and having risk to cause damage from the subject of definition must be considered space debris.

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4) V. Kopal, "Summary of Replies to the Questionnaire which Included Issues Concerning Space Debris", in the 36th Colloquium of the IISL, p.394.

5) For example, the recovery of Palapa B2 and Westar 6 by space shuttle and its resale were made on the basis of the delivery clause of insurance contract. There was also the case in which a malfunctioned satellite jointly launched was used for experiment useful for further studies before removing the satellite from its orbit on condition that the launching State refusing such an experiment did not assume any responsibility.

Up to now, various proposals were made. For example, according to Dr. M.Benk, space debris means "ga space object regardless whether it still exists as a whole or whether it 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 functionm, for example, deactivated satellites, spent rocket stages, fragments of rockets and satellites, engine exhaust particles, refuse, paint flakes."<sup>6)</sup> The above-mentioned I.L.A. Instrument proposes that space debris "gmeans man-made objects in outer space, other than active or otherwise useful satellites, when no change can reasonably be expected in these conditions in the foreseeable future."

7. The common elements of space debris resulting from the space object itself are the following: (a)any man-made object launched into earth orbit or beyond; (b)any object incapable of performing no longer its function originally intended or assigned after beginning of mission without reasonable expectation of being able to assume or reassume such function any longer; (c)uncontrolableness; (d)irrelevance to its size and present state. From these points, it may be deduced the following definition: Space debris means "gany man-made uncontrolable and useless object, regardless of its size and present state, launched into earth orbit or beyond, that perform no longer its function originally intended or assigned after beginning of mission without reasonable expectation of being able to assume or resume such functiom any longer".

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6) M.Benk and Kai-Uwe Schrogl, "g"«pace Debris in the United Nations: Aspects of Law and Policy" in the Proceedings of the Second European Conference on Space Debris in 1997, p.752.

**(B) Space debris may be regarded as space object or not.**

1. The principal argument of legal definition of space debris is whether it may be regarded as space object or not. The legal definition of space object was argued at the U.N.C.O.P.U.O.S. in the course of the elaboration of space treaties. Finally, the Liability Convention, Art.1d) stipulates that space object “includes its component parts as well as its launch vehicles and parts thereof”. This is adopted also in the Registration Convention Art.1 b). In my opinion, it may be deduced from construction of Article 8 of the Outer Space Treaty and Article 1b) and d) of the Liability Convention and from the fact that “Convention on Registration of Objects Launched into Outer Space” stipulates the registration of space objects “launched into earth orbit or beyond”) the following definition of space objects in a broad sense:<sup>7)</sup>

- (a) “space object means at least any object launched or attempted to launch into earth orbit or beyond, including any object landed or constructed on a celestial body.
- (b) “space object includes not only spacecraft or space vehicle itself but also its component parts and parts thereof”

2. The question is whether space debris falls under the category of (b). Because the definition of space object of the Liability Convention or Registration Convention does not refer to the condition of its function or control, we can conclude that “component parts” or “parts thereof” include space debris. As Prof.Diederiks Verschoor said, the component parts of a space object mean “any object without which the spacecraft would be regarded as incomplete”.<sup>8)</sup> As Prof.

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7) K.TATSUZAWA, “Space Law System Legal Regime for Space Exploration and Exploitation”, Kojinsha, Tokyo, 1987, p.136.

8) I.H.Ph Diederiks Verschoor, “The Legal Status of Artificial Space Objects” in the Proceedings of 24th Colloquium of the IISL, p.94.

C.Q.Christol said, "the term component parts is to be construed in a broad sense to include such property on board as would be conducive to the successful operation of the space object."<sup>9)</sup> Dr. M. Benk also proposed in her definition that space objects include "refuse generated during space missions and space objects assembled in outer space."<sup>10)</sup>

Also in practice, Interagency Report on Orbital Debris of 1995 said that "as orbital debris, a launching State's potential liability under the (Liability) Convention would continue despite the non-functional nature of its orbital debris space objects."<sup>11)</sup> As Prof. Christol said, "early views which would not have included unitary non-functional space objects as debris appear to have been modified."<sup>12)</sup>

## II. The Present Space Law Rules Applicable to Space Debris<sup>13)</sup>

### (A) Domestic Space Law

#### (a) U.S.A. Case

1. Actually, only the United States have domestic law rules directly applicable to space debris. It was already stated in 1989 National Space Policy that "all space sectors will seek to minimize the creation of space debris. Design and operation of space tests,

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9) C.Q.Christol, "Modern International Law of Outer Space", p.108, Pergamon Press.

10) Supra note (6).

11) Interagency Report on Orbital Debris of 1995, p.46.

12) C.Q.Christol, "Scientific and Legal Aspects of Space Debris" in the Proceedings of 36th Colloquium of the IISL, p.372.

13) With respect of the legal text, please refer to "The Original Text of Space Law" generally edited by K.TATSUZAWA, Maruzen Planet, Tokyo, 1999,

experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements and cost effectiveness."<sup>14)</sup> 1996 National Space Policy reconfirmed this direction and referred to the U.S. interest in the minimization of space debris practiced by other spacefaring States or international Organization, to the U.S. role to be played in the application of such practice, and to international cooperation in the exchange of information on space debris and in the identification of debris mitigation options. This policy was included in the 1991 NASA Authorization Act.

2. 1994 Commercial Space Launch Act, Article 170105 refers to the requirement "necessary to protect the public health and safety, safety of property, national security interests, and foreign policy interests of the" U.S. as that for the launch and the operation of a launch site. The CFR 14 refers to "flight plan and staging data sufficient for evaluating such factors as the potential for land overflight, impacts of spent stages, and debris issues" as information to be furnished for mission evaluation. This means that the O.C.S.T. of the D.O.T. is authorized to regulate space debris through mission evaluation in the course of commercial space launch licensing.
3. 1991 Remote Sensing Policy Act, Art.202(b)(4) stipulates, as requirement for licensing, the disposal "of any satellites in space in a manner satisfactory to the President" upon termination of operations. The D.O.C. is authorized to require a licensee to take measures preventing a satellite from remaining on orbit.

### (b) Other Countries Cases

The countries other than the U.S.A., legal grounds for dealing with space

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14) This policy was also applied to experiments of ASAT by the D.O.D.

debris matters were already established. However, up to now, no country has the detailed legal rules regulating space debris issues, although there are few countries such as Japan and the U.S.A. established on the political plane standards and guidelines preventg the generation of space debris.

## (B) International Space Law

1. From the viewpoint of international space law, we can find no rule directly applicable to space debris matters. Art.9 of the Outer Space Treaty stipulates that States shall pursue their studies of space and conduct all their explorative activities so as to avoid their harmful contamination and adopt appropriate measures for this purpose. It remains a question of whether the term "gcontamination" includes space debris. This article do not use the term "gpollution" meaning the environmental devastation in general but "gcontamination" meaning the contagious pollution by micro-organisms or radiological or chemical pollution by radioactive or chemical substances. The U.N. documents (A/4141. Part II, para.7) stated that certain space activities could lead to biological, chemical or radiological contamination jeopardizing further research and endanger possible extraterrestrial organisms. The above-mentioned I.L.A. Instrument proposes in its Article1 that "gcontamination/pollution" means "ga human modification of the environment by the introduction of undesirable elements or by the undesirable use of thoses elements"and that it may be considered as "gsynonyms" and is "ginclusive of all harmful elements other than space debris."

In the opinion of the present rapporteur, it is so reasonale to distinguish "gcontamination" and "glittering" of space objects or fragmented parts thereof.<sup>15)</sup>

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15) Supra note (5)p.71~72,please refer also to the following articles:

I.H.Ph Diederiks Verschoor, "gHarm Producing Events Caused by Fragments of Space Objects (Debris)", in the 25th Proceedings of the IISL,



### (C) Preventive Measures for Space Debris

1. Legal rules regulating space debris should be considered under two aspects. One concerns preventive measures mitigating debris. Another, responsibility and liability regime in case of accident. Preventing measures means the prevention of generation of existing space debris by the following means: (a) space salvage; (b) relocation into a disposal orbit; (c) controlled reentrance of space object into earth's atmosphere as earlier as possible after termination of its mission; (d) regulation of its design or space mission program in such a way as to prevent on-orbit break-ups. A legal ground for such measures is the principle of international space cooperation contained in Article 1, 9, 10 of the Outer Space Treaty of 1967 and being considered inter-national customary law rule at present.
2. As for (a), we can find already the examples in 1984, 1992 and 1993. Both Japanese Standard for Preventing the Generation of Space Debris of 1996 (hereinafter "gJ.S.") and Draft U.S. Government Orbital Debris Mitigation Standard Practices of 1988 (hereinafter "gD.U.S.S.") refer to direct retrieval after completion of mission. International maritime law rules of salvage are analogically applicable to such retrieval. These rules are based not only on inactiveness and uncontrollableness but also abandonment and desertion without hope of recovering it and intention of returning it. Space debris is considered space object. As certain domestic space laws such as Russian law prohibit the intended removal of space object, unilateral salvage is not legally possible.
3. In order to make salvage of space object, the act of abandonment of jurisdiction and control by registered State and of proprietary rights by the owner is indispensable. The act of abandonment may not exempt the abandoned State from application of the principle of international space cooperation. The abandoned State continues to

be obliged to cooperate with the concerned State in order to keep international peace and security.

4. In case of identifiable space debris, by the mutatis mutandis application of Article 5, para.1 of the Rescue and Return Agreement, the finding of space debris should be officially announced, and, after certain lapse of time, it should be disposed by the State finding it.
5. As for (b), we may refer to the above-mentioned Standards of the NASDA and of the NASA. These standards propose the following disposal orbit area: (i) The perigee altitude above 1,700Km (2,000Km for the D.U.S.S.), and, the apogee altitude below 19,900Km (19,700Km for the D.U.S.S.); (ii) The perigee altitude above 20,500Km (20,700Km for the D.U.S.S.), and, the apogee altitude below 35,288Km (35,300Km for the D.U.S.S.). The D.U.S.S. also proposes another disposal orbit (perigee altitude above 36,100Km) and removal of mission terminated object from earth orbit into heliocentric orbit.
6. As for (c), The above-mentioned standards require the following measures: (i) controlled fall to a determined area; (b) risk analysis of a fall; (d) possible burning by reentrance into atmosphere. D.U.S.S. proposes that "the total debris casualty area for components and structural fragments surviving reentry will not exceed 8Km<sup>2</sup>, or it will be confined to a broad ocean or essentially unpopulated area". According to Article 9 of the Outer Space Treaty, the State planning the reentrance of a satellite or the State whose national plans the reentrance of a satellite has reason to believe that the planned reentrance would cause potentially harmful interference with activities of other States, it shall undertake appropriate international consultation before making such reentrance. This obligation is closely related to the obligation of a State to carry out space activities with due regard to the corresponding interests of all other States. The nonfulfillment of the former may be considered a fault

constituting nonfulfillment of the later. With respect to the notification, 5th and 6th N.P.S. Principles may be applied analogously. The planning State must respond promptly to requests for further information or consultation sought by the State that might be affected.

7. As for (d), the space object should be designed in such a way as to reduce the possibility that it generates space debris during or after its mission.

#### **(D) Measures to Be Taken After Accident**

1. Another aspect of space debris concerns the problem of post accident measures. In my opinion, Liability Convention is applicable. According to the Convention, two cases are distinguished: (a) an accident by debris is caused in outer space, including the Moon and other celestial bodies; and (b) an accident is caused on the surface of the earth or to the aircraft in flight.

Fault liability is applied to the former and Strict Liability, to the latter. This means the difference between "imposed liability" and "accepted liability".

2. The most important question concerns (a). First, according to the Liability Convention, a State does not assume the liability with respect to generation of space debris in the course of lawful space activities. The fault of the State must be proved. In the opinion of the rapporteur, "fault" means the reasonableness of the act of a State in the control of a space object. Many elements must be taken into consideration. Particularly, in case of foreseeable accident, the question of whether the State of registry notified the State that might be potentially affected by space debris or tried to prevent

the generation of space debris by all means (“gobligation de moyens”) at its disposal becomes decisive.

3. As for identification of space debris, Registration Convention, in particular, its Article 6, is applicable. Wherever, in spite of the application of provisions of the Registration Convention, a State cannot identify the space debris which has caused damage to it or its natural or juridical persons, or which may be of hazardous or deleterious nature, other States, in particular States possessing space monitoring and tracking facilities, shall respond to the greatest extent feasible to a request by that State. Practical identification of space debris depends exclusively on indirect evidences based on system elements and circumstance. In case of accident by identifiable space debris, if the launching State of a space object generating space debris has no fault, the theory of neutrality may be applied and a damaged State bears its damages at its own account.
4. As for indemnity, Article 12 and para.2 and 3 of 9th N.P.S. Principle may be invoked. The principle of “grestitutio in integrum” is applicable and compensation may include reimbursement of the duly sustained expenses for assistance received from the third State.
5. In case of private space activities, as Article 6 recognized it, a State bears international responsibility for national activities concerning space debris, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that such national activities are carried out in conformity with the Outer Space Treaty.
6. In case of accident by non-identifiable space debris, the following doctrinal proposals are made: (i) A special fund for indemnifying the damage caused by space debris should be established by spacefaring States; (ii) Spacefaring States should be considered

jointly and severally liable for generation of space debris:  
 (iii) Spacefaring States regard the damage by space debris as an unavoidable risk accompanied with space activities and previously agree to bear its expenses on its own account.

7. In the opinion of the present rapporteur, we should distinguish
  - (a) the accident caused by space debris in outer space from (b) that on the earth's surface or to aircraft in flight. As for (a), the point (iii) is the most reasonable solution. Both damaged and damaging States have sufficient scientific and technological knowledge and know-how. Their relations are based on an equal footing in the sense that they may share the risk accompanied with space activities. The point (i) needs so much time for determining financial scale and contribution quota and it might meet the opposition of developing States that cannot accept the accumulated result of space activities by developed spacefaring States. With respect to the point (iii), legal grounds for several and joint liability is fragile, even if it invoke Article 5 of the Liability Convention.<sup>16)</sup>
  
8. As for (b), it'd better choose the point (i). it is unreasonable that the damage caused by private persons who are not the direct beneficiaries of space activities may be left without any indemnification. We should accept the several and joint liability of all space faring States.

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16) Dr.M.Benk said: "gSince it is beyond any doubt that the space debris in question has been generated by one of the few States involved in international space flight - it is only problematic which particular State can be singled out as the "gculprit". Therefore, all States who might have generated the space debris in question shall be jointly and severally held liable for the damage caused according to Articles V and II of the Liability Convention so that the victims can claim full compensation from any of these States."

(M.Benk & Kai-Uwe Schrogl, "gInternational Space Law in the Making Current Issues in the U.N. Committee on the Peaceful Uses of Outer Space", p.264.)

### III. Applicable Rules of International Environmental Law

1. We cannot find so much international environmental law rules directly applicable to space debris issues. It is normal because international environmental law has the earth's environment as its objective. Among them, 21st Principle of the Stockholm Declaration of 1972 is applicable. According to the said Principle, States have, in accordance with the U.N. Charter and the principles of international law, "the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction". This principle has been adopted in many international treaties, and may be considered international customary law rules.<sup>17)</sup>

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17) With respect to the legal text, please refer to "The Original Text of Space Law" generally edited by K.TATSUZAWA, Maruzen Planet, Tokyo, 1999,