

# 우주법의 관점에서 본 우주파편 (Legal Regime of Space Debris)

Prof. Dr. Kunihiro Tatsuzawa<sup>1)</sup>

The problem of space debris has been dealt with at the STSC of the COPUOS. The technical discussion at the said Committee was finished by adopting the Technical Report in 1999. Its legal discussion will be followed very soon at the LSC of the COPUOS. In this paper, I try to outline certain legal points concerning the space debris.

## I. The Legal Definition of Space Debris

### 1. The Legal Definition

Artificial space garbage in general means the following things:

- (a). Inactive or mission-terminated spacecrafts and the upper stages of launch vehicles still remaining in earth orbit or paint flakes resulting from the deterioration of a spacecraft.
- (b). Operational debris separated and released during the mission, such as lens, caps, shrouds, cramps, wire etc.
- (c). Fragments generated by intentional or accidental breakups of space objects.
- (d). Particles with a diameter of 10 $\mu$ m such as aluminum oxide dust

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<sup>1)</sup> College of International Relations, Ritsumeikan University at Kyoto, Japan

generated by solid rocket propellant burning.

(e). Other materials ejected during a manned or unmanned mission.

I used here the term “space garbage”, but, different from those terms as “space refuse”, “space junk”, “space waste”, “space litter” and “space garbage” which mean already used and valueless matters, the term “space debris” originated in French means “scattered fragments” (the noun of a verb “debriser”). It includes therefore etymologically those categories as (a), (b) and (c). It appears that the use of the term shows the general understanding of space debris as “scattered fragments”. However, the problem is not so simple.

First, as for the particles under the point (d), theoretical possibility of contamination to solar panel or very sensitive parts of a spacecraft exists. It may disturb the normal function of a spacecraft. Certain argument does not consider them as space debris, because they are not generated by spacecraft itself but by burning of rocket propellant. However another argument includes them in the category of space debris, because space debris is considered to include all artificial man-made objects in outer space. 1999 STSC Report on Space Debris defines space debris as “all man-made objects, including their fragments and parts, whether their owners can be identified or not, in Earth orbit or re-entering the dense layers of the atmosphere that are non-functional with no reasonable expectation of their being able to assume or resume their intended functions or any other functions for which they are or can be authorized”. It does not seem to include the category (d).

As for (e), this category includes the refuse resulting from space mission such as material or biological experiment, or manufacturing utilizing the micro-gravity environment in earth orbit. According to Article 1 (c) of the 1994 ILA Resolution No5, space debris means “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”. It

seems to exclude the category (e).

From the legal viewpoint, it is arguable whether malfunctioned or inactive spacecrafts may be regarded as space debris. The reasons for negative argument are the impossibility to accomplish their aims and the high probability of collision with other space objects. The reason for the affirmative argument is that even if space objects are malfunctioned or inactive, they may be used for certain experiments for checking the effects of malfunctioning or staying in outer space: if malfunctioned or inactive spacecrafts are intact and repairable, they may not be regarded as space debris.

In practice, when the decision was taken to deorbit a satellite jointly launched, a launching State proposed to use the satellite for the test useful for further space flight studies. They entered into negotiation, and the agreement that other launching States do not assume joint and several liability was finally reached. The experiment was terminated without accident, and the satellite was transferred into a higher disposal orbit. Another examples are two malfunctioned satellites, Palapa B-2 and Westar 6, that were recovered by the shuttle flight and sold over in accordance with the space insurance contract.

Legal definition of space debris is not yet established in positive law as well as in doctrine. Doctrinal definition should enumerate the components of the concept, and then grasp the characteristics of the relations tying them. What is essential in defining the term "space debris" is, first, not to go far beyond the original meaning of the term, and, second, from the viewpoint of security, to deal with the matters directly resulting from a spacecraft itself and immediately damageable to other spacecrafts by conflicts.

The components of space debris resulted from the spacecraft itself are the following:

- (a) Artificial man-made objects launched into earth orbit or beyond.
- (b) Any object which cannot accomplish or cannot reasonably be expected to accomplish their initiatively intended or thereafter authorized functions.
- (c) Any object which is out of control and useless.
- (d) The size and status of objects have nothing to do with.

It deduces there from that, from the legal viewpoint, when man-made objects launched into earth orbit or beyond cannot accomplish or cannot reasonably be expected to accomplish their initiatively intended or thereafter authorized functions and become out of control and useless, they may be regarded, irrespective of their size or status, as space debris.

## **2. Can Space Debris be considered space object?**

The most important issue of space debris is to know whether it may be regarded as space object or not. As I already said in the paper presented to the IISL, space object may be defined in the present positive space law system as follows:

- (a) A space object means any object launched or attempted to be launched into earth orbit or beyond and including the object landed or constructed on a celestial body.
- (b) A space object includes not only space object itself such as spacecraft, space vehicle but also their component parts as well as its launch vehicle and parts thereof.

We have to know whether the space debris falls under the category (b). Dr. Baker seems to consider that the space object includes any operational debris, except space litter, but the definition of space object adopted in the

Liability Convention of 1972 and the Registration Convention of 1975 do not specify the conditions concerning the functions as well as control. Therefore, according to Prof.P.-H.Dideriks Verschoor, the component parts of a space object mean “any object without which the spacecraft would be regarded as incomplete”<sup>1)</sup>. According to Prof.C.Q.Christol, they should 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>2)</sup>. In international practice, the fact that, in the russo-canadian negotiation concerning the Cosmos 954 crash into Canadian northern territory, both States agreed to apply Article 5, sec.1 of the Rescue and Return Agreement of 1968 indirectly showed that space debris might be regarded as space object<sup>3)</sup>. 1989 OTA Report and 1995 Interagency Report 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 object”. In this respect, almost all of space lawyer’s opinions are coincided. As Prof.Christol said, the initiative opinion that the intact and unique satellite may not be included in space debris seems to be corrected<sup>4)</sup>.

## II. International Space Law Rules Applicable to Space Debris

Legal rules for space debris should be considered under two aspects: preventive measures and post accident measures, viz, liability in an accident. First, preventive measures that mitigate the increase in the number of space debris and reduce it are as follows:

- (a).Space salvage
- (b).Transfer of a satellite into a disposal orbit
- (c). Earlier atmospheric reentry

(d). Regulation of the designs of spacecrafts and their mission plans

The legal grounds in carrying out these measures are the obligation of paying due attention to corresponding legitimate interest of other States and the principle of international space cooperation.

In the space salvage, the most important element is the intention of the States concerned, viz, the intention of abandonment. As Dr.Hall said, *res derelicta* is regarded as “abandoned and deserted by those who are in charge of it, without hope of on their part of recovering it (*sine spe recuperandi*), and without intention of returning to it (*sine animo revertendi*)”<sup>5</sup>). The USA insists that the intention of abandonment must not be tacit. In fact, because certain States such as Russia prohibit the intentional removal of a space object by the domestic law, unilateral salvage act is impossible.

The abandonment of jurisdiction and control over orbital debris space object by the State of registry or private owner is required, but even the act of abandonment does not exonerate the launching State from two coming customary law rules, the obligation of international cooperation and the obligation of carrying out space activities with due regard to the corresponding interest of other States.

In the event that the identification of space debris is impossible, Article 5, sec.1 of the Rescue and Return Agreement of 1968 may be applied *mutatis mutandis* and the orbital debris space object may be disposed after an official announcement and certain extension of time.

As for (a), we can find three precedents in 1984, 1992 and 1993 and the orbital debris mitigation standards of the NASA and NASDA referred to the direct retrieval. Apart from its cost effectiveness, I try to examine the legal aspect. Any problem exists if such retrieval is carried out according to the domestic law of the State of registry.

As for (b), we may refer to the NASDA and NASA Mitigation Standards. According to the NASDA Standard, two disposal orbits are indicated. One

has the perigee altitude of more than 1.7km and the apogee altitude of less than 19.9km. Another has the perigee altitude of more than 20.5km and the apogee altitude of less than 35.288km. It drew attention to the necessity that the effective orbital modification should be made, taking into consideration all the circumstances in each case.

According to NASA Standards, the following three storage orbits are indicated:

- (i). Between LEO and MEO: an orbit with perigee altitude above 2,000km and apogee altitude below 19,700km (500km below semi-synchronous altitude)
- (ii). Between MEO and GEO: an orbit with perigee altitude above 20,700km and apogee altitude below 35,300km (approximately 500km above semi-synchronous altitude and 500km below synchronous altitude)
- (iii). Above GEO: an orbit with perigee altitude of 36,100km (approximately 300km above synchronous orbit)
- (iv). Heliocentric, Earth-escape: the removing of a space object from Earth orbit into a heliocentric orbit.

As for (c), According to above-mentioned standards, such measures as the controlled reentry of space debris, for example, to the predetermined area, essentially unpopulated area or ocean, the analysis of the risk level (the USA Standard limits the casualty expectation to  $10^{-4}$ ), the increase in the possibility of burning out of space debris passing into the dense layer of the atmosphere become necessary. According to Article 9 of the Outer Space Treaty, the State planning the reentry of orbital debris space object or whose nationals plan the reentry of orbital debris space object has reason to believe any of the said planned reentries would cause potentially harmful effect with

peaceful space activities of other States, it shall undertake appropriate international consultations before proceeding to any such reentry.

This obligation of consultation synchronizes with the obligation of carrying out space activities with due regard to the corresponding interests of all other States. The non-fulfillment of the former may be regarded as a fault constituting the violation of the latter. With respect to the prior notification of reentry, the NPS Principles 5 and 6 may be applied *mutatis mutandis*. In the event orbital debris space object reenters into the Earth's atmosphere, the launching State should provide the information concerning its system parameters, including the name of launching State or States with the address of the authority which may be contacted for additional information or assistance in case of accident as well as the updated information as frequently as may be necessary.

The launching State should, as far as reasonably practicable, respond promptly to requests for further information or consultations sought by other States. The NASA and NASDA Standards recommend that the space object should be reentered into the Earth's atmosphere no longer than 25 years after completion of mission.

As for (d), the space object should be designed in such a way as to reduce the probability to generate space debris during its mission or the possibility of becoming itself the sources of space debris after completion of mission. In particular, the accidental explosion of spent rocket should be avoided by the release of pressurized gas or the propellant depletion burns etc. Minimizing the collision probability with other debris during its orbital lifetime as well as the shielding of such large space structures as space station should be considered. These measures should be based on cost effectiveness and not prevent the progress of space commercialization and privatization in the near future.



### III. Post Accident Measures

Another aspect concerning space debris concerns the post accident issues, viz, international responsibility. In this respect, in my opinion, the Liability Convention may be applied. According to the Convention, (a)if an accident by space debris takes place in outer space, fault liability is applied; (b)if an accident by space debris takes place on the surface of the Earth or with regard to aircraft in flight, strict liability is applied. This distinction is based on the difference between (1)"accepted liability" and (2)"imposed liability"6). As for (1), the damage in outer space should be dealt with in the equal relations between States which have the sufficient knowledge and know how of space science and technology and can share the risk resulting from space activities. As for (2), such damage is based on unequal relations between the State and private persons. The theory of ultra hazardous activities should be applicable7). If causality between an accident and crashed debris is demonstrated, a launching State shall assume responsibility only as a result of his causing damage.

In my opinion, the concept of "fault" used in (a) means here "reasonableness" in the operation and control of a space object8). If any action may not be justified by the fact being its motif, if any action is irrelevant to the fact being its motif or if any act is disproportionate or excessive to the fact being its motif, fault may be recognized. In recognizing a fault, many other elements should be taken into consideration. In particular, if an accident is not foreseeable, the obligation of means which requires a launching State to prevent the generation of space debris with all the means at his disposal should be examined.

In identifying a launching State whose space debris caused the damage, Article 6 of the Registration Convention may be applied. Wherever in the application of the said Convention, a State cannot identify space debris which has caused the damage to or may be of hazardous or deleterious nature to it

or its nationals, other States, in particular States possessing space monitoring and tracking facilities, should respond to the greatest extent feasible to a request by that State, or transmitted through the U.N. Secretary General. The effective identification of space debris depends exclusively on indirect proofs based on system parameters, in particular, orbital inclination and the circumstances. Even if a launching State can be identified, it can be exonerated from responsibility for the reason of committing no fault.

With respect to compensation for damage, Article 12 of the Liability Convention and NPS Principle 9, para.2 and 3 may be applied *mutatis mutandis*<sup>9</sup>). The principle of *statu quo* may be applied. The compensation may include reimbursement of the duty sustained expenses for assistance received from third States.

With respect to the damage caused by space debris generated by non-governmental activities, the State of nationality bears responsibility on the basis of Article 6 of the Outer Space Treaty. When activities generating space debris are carried on by an international organization, responsibility for compliance with the Outer Space Treaty is born by the international organization itself and by its member States.

In case that space debris may not be identified, following doctrinal proposals were made.

- (a). the establishment of an international fund destined for compensation to the damage caused by space debris:
- (b). Space faring States having generated space debris should assume severally and jointly liability.
- (c). Space faring States should accept in advance the damage caused by identifiable space debris as the potential risk for space activities and agree to assume itself such damage.

In my opinion, even if the establishment of the fund is negotiated in the milieu of the

UN, developing States may oppose to it. In fact, almost all of space debris has been generated by space faring States such as the USA, Russia, Europe, China, and Japan. It is quite difficult to convince the developing States to assume the responsibility for space debris. As for (b), it remains doubt as to the extensive construction according to which several and joint liability based on Article 5 of the Liability Convention is applicable. According to this argument, even if space debris has been generated undoubtedly by one of space faring States, it is difficult to single out any particular State as the culprit: it is therefore space faring States should assume jointly and severally liability. This is a weak argument as to whether all space faring States should have liability. In addition, in the case that the identification of a culprit is not possible, the theory of neutrality ordering compensation in such a case is normally applicable. In my opinion, Proposal (c) is not the best but an acceptable solution at present.

#### **IV. Conclusion**

Like almost all of other space problems, the problem of space debris was not initiatively foreseen. However, its scientific and technological aspect was already examined and, before us, the STSC Report was already presented. The LC of the UNCOPUOS will proceed to examine its legal aspects. We hope that the discussion will result in a formal and binding text later, even if it will take the flexible form at the moment.

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  3. With respect to russo-canadian negotiation documents, please refer to the NASDA Space Law Data Base (NASDA Home Page)
  4. Supra note (2), p.372.
  5. R.C.Hall, “Comments to Salvage and Removal of Man-made Objects from Outer Space”, Proceedings of 9th Colloquium of the IISL, p.117-126.
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