

The International Regime for Space Debris Remediation in Light of Commercialized Space Activities*

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In view of the greater concern about the threat of space debris to free space activities and the widely supported call for the active remediation of debris, this paper examines the possible solution. In light of the commercialisation of space activities, this paper argues that the experiences in maritime law on the one hand and the development of international environment law with regard to the activities and liability of private parties on the other hand must be referenced. Further, it explores into the possible international regime in which “space salvor” can conduct the remediation as a commercial service.

I. Active Debris Remediation: Getting nowhere?

Space Debris as Hindrance to the Space Activities

The concerns about the threat to space activities posed by space debris have become ever greater among the space community. The collision of space debris into an Ecuadorian satellite in May 2013, which resulted in making the satellite defunct just after launch, is only one of the incidents that justify such concern. Spacefaring nations have been tracking space debris of larger size and identified more than 16000 items in the catalogue¹. Such tracking and “catalogue-ing” have been useful for operators to avoid serious accidents in the space. Further, the Space Debris Mitigation Guidelines published first by the Inter-agency

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1 *Active Debris Removal – An Essential Mechanism for Ensuring the Safety and Sustainability of Outer Space: A Report of the International Interdisciplinary Congress on Space Debris Remediation and On-Orbit Satellite Servicing* (A/AC.105/C.1/2012/CRP.16), pp.15-16.

Space Debris Coordination Committee (IADC) in 2002² and then as the resolution of the United Nations Committee on the Peaceful Uses of the Outer Space in 2007³ have also proven effective in reducing the amount of debris that are newly generated.

Still, these measures cannot prevent the so-called cascade effect, which means the phenomenon that the existent debris collide into each other and create smaller but no less dangerous debris. Some experts forecast that the Low Earth Orbit (LEO) will be more congested than can be safely used for space activities as a result of such cascade effects⁴. Against these backgrounds, the need for active debris remediation has been voiced to ensure that the space remain safe and open for the exploration and use by all States⁵. Several entities in the world are developing the technology necessary for carrying out the debris remediation.

Just as the environmental issues on the earth, however, the preservation of the environment in the space seems to be easier said than done. No one is willing to bear the cost for the removal operations, including the possible liability of the operator of remediation (or the insurance premium to cover the liability), when it will benefit only partly and indirectly from the remediation. Thus, the problem appears to be a typical “tragedy of the commons”: the recognised problem is left unsolved because everyone wishes to free ride on others’ efforts.

The International Regime on Debris Remediation as the International Commons

If the space debris problem is getting nowhere because of the lack of any single party to bear the whole cost, the solution must be to establish an international regime that can work as the international commons to address the problem. Further, at the time when the private parties play the significant role in the space activities, such a regime will be workable only if it properly reflects the commercialised nature of such activities. In this context, three perspectives shall be useful.

First, the international regime must duly consider the private law aspects of the space debris. A satellite owned by a private company cannot be removed or destroyed without the consent of the owner, even after it has ceased to be functional for some reason and become debris. The maritime law on shipwrecks may be useful as a source of inspiration, as the activities on the sea have basically been commercial in the history.

2 IADC Space Debris Mitigation Guidelines (IADC-02-01, revision 1, September 2007).

3 Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of the Outer Space (A/62/20).

4 Mark Williamson, *Space: The Fragile Frontier*, p.79 (AIAA, 2006); Joseph S. Imburgia, Space Debris and Its Threat to National Security: A Proposal for a Binding International Agreement to Clean Up the Junk, *Vanderbilt Journal of Transnational Law* Vol.44, p.589, at pp.597-598 (2011).

5 Article I, the Outer Space Treaty.

Secondly, the international environment law have developed to meet both the responsibility of states and liability of private entities. In particular, the polluter pays principle is applied to the commercial entities that cause the damage to the environment. The international regime over space debris can appropriately base itself on such precedents of international environment law.

Thirdly, one can imagine that the debris remediation itself may be carried out as a commercial service. It is again not uncommon in maritime salvage, where commercial salvors usually carry out salvage based on a contract with the owner of the ship in distress.

This paper will deal with these issues in turn.

II. Salvage on the Sea: A Commercial Venture

Wreck Removal on the Sea: The Framework of the Nairobi Convention

Though the law of maritime salvage in many countries provide that a benevolent salvor is rewarded pursuant to the value of the property that is salvaged, in practice, professional salvors have provided salvage as commercial service for many decades. Such commercial service obviously makes sense, because the ship or cargo salvaged from the distress has commercial value, which gives the shipowner the incentive to purchase the service.

More recently, however, the salvage on the sea has been conducted less for the sake of the value of the property than to prevent the environmental damage that the distressed ship could cause. Still, the shipowner has the reason to arrange for a salvage service because the domestic or international regulation usually imposes on the shipowner the duty to remove wrecks with the aim of preventing the environmental damage or avoiding the obstructions of the traffic on the sea. The shipowner has to contract with the salvor by itself, since otherwise it has to bear the cost incurred by the government that remove the wreck.

Such scheme is reflected in the Nairobi International Convention on the Removal of Wrecks, adopted in 2007 by the International Maritime Organization (IMO). Though the Convention has only 8 States Parties and is not yet in force, it is the most updated instrument approved by the international community of maritime commerce. The Convention provides for the steps in removing the wreck: the reporting of the wreck; the determination of the hazard posed by the wreck; the locating and marking of the wreck; and then the duty of the registered owner of the ship to remove the wreck.⁶

Then the Nairobi Convention provides for the mandatory insurance to cover the cost of removal.⁷ In principle, the owner of the ship enters into a wreck removal agreement with the salvor, in which case the insurer will cover the cost incurred by the owner of the ship. If the government will carries out the removal and bill the owner of the ship for its cost, the insurer will indemnify the government.

⁶ Articles 5-9, Nairobi International Convention on the Removal of Wrecks.

⁷ Article 11, Nairobi International Convention on the Removal of Wrecks.

Comparable Scheme for Space Debris Remediation

The parallel to the scheme for the removal of wrecks on the sea may be made with regard to the space debris remediation, if one assumes that the private law aspect of the space debris must be duly addressed. Under such a scheme, the agreement for the active remediation of space debris will be concluded between the owner of the debris and the remediation operator (space salvor, so to speak). Because the ownership to the space object is not affected by its presence in the space,⁸ no one can remove or destruct the debris without the consent of the owner.

Alternatively, the ownership may be abandoned. In such a case, the state having jurisdiction over the space debris may approach the remediation operator and arrange for its removal. Differently from the removal of the wreck on the sea, the government usually lacks the authority to collect the cost of debris remediation from the (last) owner that has already abandoned the ownership, unless the domestic law provides for such an authority. The spacefaring states may wish to consider this issue in enacting or amending their national space legislation.⁹

Approval by the State Having Jurisdiction over the Debris

In the case of the wreck on the sea, the shipowner usually does not ask for the approval of the state of registry of the ship. As the principle governing the activities on the sea has traditionally been “the freedom of the sea”, contracting with the salvor for the removal of the wreck has been considered as the private matter.

The remediation of the space debris is different. It is because the involvement of states is much stronger in the case of space activities, as indicated by the responsibility of the states over the space activities of non-governmental entities.¹⁰ Even if the space object has lost its function and has technically fallen under the category of “space debris”, the responsibility and power of the states are not affected. As part of the authorization and supervision required by the Outer Space Treaty, the removal of space debris shall be subject to the approval of the appropriate state.

The question difficult to answer is which state shall have the authority to approve the removal of the space debris. If the space debris is registered, as may be the case with the defunct payload, it will be the state of registry, based on the

8 Article VIII, the Outer Space Treaty.

9 Up to now, some national space laws have included the requirement on the debris mitigation measures as a condition of space activity. (See R. Tremayne-Smith, *Environmental Protection and Space Debris Issues in the Context of Authorisation*, in: Frans von der Dunk (ed.), *National Space Legislation in Europe*, p.179 (Martinus Nijhoff, 2011). When the remediation technology develops and the international responsibility of the state for debris remediation is widely recognised, the national legislation will need to go further.

10 Article VI, the Outer Space Treaty.

jurisdiction over the space object.¹¹ The same shall be true with the space debris that can be tracked to a registered space object, as the jurisdiction will follow even if the space object becomes fragmented into pieces.¹²

However, the space debris may have never been registered, as in the case of the upper stage of the launcher,¹³ or cannot be tracked to a registered space object as its source. It is not clear which state shall have the authority to approve the removal of such space debris. If the space law has no specific rule on the space object not registered with any state, the general international law may apply. Based on the personal jurisdiction, the authority will lie with the state of the (last) owner of the debris.

In any case, assuming that the owner of the space debris contracts with the remediation operator, it is the owner that must report to the state having the authority in the case and apply for the approval. This implies that the states are advised to incorporate in their national space legislation also a requirement of the application for the approval when a private entity is going to remove the space debris.

III. Filling the Gap of Incentives: Commercial Interests and Responsibility for Leaving the Debris

It may be claimed that the debris remediation in the space is different from the salvage on the sea. First, the space debris has no commercial value comparable to the ship and cargo. Secondly, unlike the liability of the owner of the wreck on the sea that causes danger to the sea transport or pollution of marine environment, the owner of the space debris has not been considered liable for damages caused by the debris. These differences may indicate that there will be little incentives for the owner of the space debris to voluntarily arrange for the remediation. The situation, however, may be changing in view of the commercialisation of space activities and of the development of international environmental law.

Commercial Incentives to Arrange for the Remediation of Debris

First, as more and more commercial entities are using the orbital positions for their activities for profit, ensuring the safer use of such orbital positions has come to hold the commercial value. As a result, the debris remediation could be seen as recovering the “commercial value” comparable to the salvage on the sea. There still remains a difference in that the commercial value from the debris remediation is with the future operators in the space, while the commer-

11 Article VIII, the Outer Space Treaty.

12 Manfred Lachs, *The Law of Outer Space: An Experience in Law-Making*, p.67 (reprint, Martinus Nijhoff, 2010).

13 Not many states register the upper stage of launchers. See Stephan Hobe et al. (eds.), *Cologne Commentary on Space Law*, volume 1, Article VIII OST, paras. 35-39 (Carl Heymanns Verlag, 2009).

cial value from the salvage on the sea derives from the property involved in a distress. However, such a difference only affects *who* has the incentive to pay for the remediation, which is a question of less importance than *whether* there is a commercial incentive.

Secondly, the incentives for arranging for the removal of the debris will be even greater, if the technology for the remediation of space debris develops into a practical phase. The current international environmental law requires that the states take actions to prevent harming the environment beyond their jurisdiction by using the best available techniques or best practical means. The environment to be protected is not limited to that within the jurisdiction of other states but includes the global common areas.¹⁴ Therefore, as the debris remediation technology develops, the required “best practical means” will be of more and more enhanced level, and the responsibility of the states to use such technology for the remediation of the debris will be easier to be found.

Further, the precautionary principle is recognised as the basis for the responsibility of states to take actions.¹⁵ It affirms the responsibility even if the scientific data is not fully certain about the damages caused to the environment. In light of the precautionary principle, the responsibility to arrange for the active remediation of space debris before the cascade effects start increasing the number of dangerous debris beyond the threshold can be affirmed. It will be too late if the cascade effects reach such a level, and the precautionary principle does require that actions be taken in advance of that point.

Liability for Causing the Damage by Space Debris

Notwithstanding the possible responsibility after the debris remediation technology becomes the “best available means”, it is not so easy to establish the liability for damage caused by the debris, either the international liability of the launching state or the private law liability of an entity concerned. This is because the international liability of the launching state for damages caused on orbit is based on “fault”¹⁶ and the tort liability on domestic law is also fault-based liability in most jurisdictions.¹⁷

“Fault” is not a defined term in space law treaties,¹⁸ nor is it a commonly used concept in international law instruments.¹⁹ The comparative law studies have revealed that the “fault” in many Civil Law jurisdictions is close to the “negli-

14 Stockholm Declaration on the Human Environment, Principle 21.

15 Rio Declaration on Environment and Development, Principle 15.

16 Article III, the Liability Convention.

17 In some jurisdictions, the national space law provides for a special tort liability for damages arising from the space activities. Still, the liability tend to be fault-based for the damages incurred on orbit. See, for example, Article 13 of the French Space Operations Law and Articles 68 of the Australian Space Activities Act 1998.

18 Carl Q. Christol, International Liability for Damage Caused by Space Objects, *The American Journal of International Law* Vol.74, p.346, at p.368 (1980).

19 Stephan Hobe et al. (eds.), *Cologne Commentary on Space Law Vol. II*, Article II LIAB, para.128 (Carl Heymanns Verlag, 2013).

gence” in common law jurisdictions²⁰ and may be described as the conduct not amounting to “such care as could be expected from a reasonably careful person in the circumstances of the case.”²¹ The standard of care based on the ability of the individual at issue (subjective standard), which is conspicuous in Austria, is not widely supported.²² Apparently the international law literature accepts this concept under the domestic law.²³

Even when the objective standard of fault is adopted, the foreseeability of the outcome is needed as the basis of the duty of care.²⁴ In the case of space debris, it will usually not be possible for the launching state or the owner of the space object generating the debris to foresee that the debris will damage a particular other object. The vague imagination that a danger might occur to some object at some time in the future will not be sufficient to affirm the foreseeability, and hence the fault. Therefore, the liability can be affirmed only in a limited case where an action can be taken after the threat of collision with a concrete object arises but such an action was not taken after all.

A different argument may be made with regard to the products liability of the manufacturer of the space object that results in debris. The products liability is based on the “defect” in a product, which is usually defined as the lack of safety expected of the product, taking all circumstances into account, including the presentation of the product, the use to which it could reasonably be expected that the product would be put, and the time when the product was put into circulation.²⁵ Contrary to the general tort law based on fault or negligence, no foreseeability of a particular damage is required. If the space object is manufactured after the Guidelines of IADC and the UNCOPUOS has become internationally accepted but the standards contained in the guidelines are not met, it may be argued that the product lacks the expected safety. When such a defective product does become debris and causes damages to another space object, the manufacturer can be held liable.

20 Peter Widmer, Comparative Report on Fault as a Basis of Liability and Criterion of Imputation, in: Peter Widmer (ed.), *Unification of Tort Law: Fault*, pp.339-340 (Kluwer Law International, 2005).

21 Christian von Bar, *Principles of European Law: Non-Contractual Liability Arising out of Damage Caused to Another (PEL Liab. Dam.)*, Article 3:102 (b) (2009, Oxford University Press).

22 Id., Comment 17. See also Widmer, supra note 1191, p.340.

23 Frans G. von der Dunk, Too-Close Encounters of the Third-Party Kind: Will the Liability Convention Stand the Test of the Cosmos 2251-Iridium 33 Collision?, *Proceedings of the International Institute of Space Law 2009*, p.199, at p.203 (2010); Martha Mejía-Kaiser, Collision Course: 2009 Iridium-Cosmos Crash, *Proceedings of the International Institute of Space Law 2009*, supra, p.274, at p.277.

24 *PEL Liab. Dam.*, supra note 21, Article 3:102, Comment 18; Widmer, supra note 20, p.340.

25 See Article 6 (1) of the *Council Directive 85/374/EEC*; *PEL Liab. Dam.* Article 3:204 (7). Many other jurisdictions, such as Japan, adopt almost identical definition in their statutes.

Polluter Pays Principle and the Liability under the National Legislation

Once the debris remediation becomes the “best available means” due to the development of technology, the liability of a private entity could arise under the domestic law with regard to the debris already existing on orbit. The responsible state, by exercising its jurisdiction over the space activities, might require that an appropriate action be taken to remove the debris that is found to be threatening the space activities of other party. If such requirement is imposed as the obligation under the domestic legislation, the owner of the debris may have to either arrange for the remediation on its own behalf and at its own cost, or endure the remediation taken by the state and indemnify the latter of the cost. Thus, by way of national legislation, international responsibility of a state to prevent environmental harm beyond the jurisdiction could be made into liability of a private entity for the omission of leaving the debris on orbit. Alternatively, the state may enact a national law that holds the space operator strictly liable for damages caused by the debris due to its activities. In this latter case, the situation resembles the liability of a shipowner, where the principle of “polluter pays” has been well established. The strict liability of the owner for damages caused by the wreck under the Nairobi Convention covers the cost incurred by the coastal state for the removal of the wreck.²⁶ Similarly, if a national law provides for the strict liability for damages arising from the space debris, the liability will include the cost of remediation carried out to get rid of the threat to other party’s space activity.

IV. Steps to Follow: Marketplace for Debris Remediation

The national legislation holding the owner of the debris liable for leaving it in a dangerous situation may be ideal, but is unlikely to be made unless there is an internationally accepted regime. No state favours to place a burden on the space operator under its jurisdiction. It is anticipated that the operator will easily relocate itself to a state that has no such legislation. Therefore, the international regime is needed for the active debris remediation to be conducted widely.²⁷

Sharing of Cost: The Implications of the Coase Theorem

The hardest challenge in establishing such an international regime is how to share the costs of remediation. One possibility may be to emphasise the “polluter pays” principle and pursue the liability of the party that have caused the debris. Another approach is that the party who will benefit from the safer environment in the space pays for the cost of cleaning up.

²⁶ Article 10, Nairobi International Convention on the Removal of Wrecks.

²⁷ The idea of setting up an international fund to financing the remediation activities has been raised in *Active Debris Removal*, supra note 1, p.29 and Imburgia, supra note 4, p.629.

The well-known “Coase Theorem” tells us that which approach to take will not affect the level of activities, in our case the level of remediation. In other words, the choice between the two approaches will not be based on the efficiency of the regime. It is the problem of asset distribution among the parties involved. It is further to be noted that neither “the party that have caused the debris” nor “the party who will benefit from the safer environment” is in fact a single entity. For example, the operator on the low earth orbit and the one on the geosynchronous orbit have different interests in, for example, the choice of the debris to be removed or the amount of the cost to be shared by each of them. Also, the interests of the launch operator and payload operator are not identical, as the latter can be both the polluter and beneficiary, while the former will identify itself less as the beneficiary of the remediation.

As the problem is not one of efficiency, the question is which will enable the international regime to attract as wide support as possible. Considering the growing commercial interest in the cleaner orbit free of threats from debris, as well as the larger possibility of the international responsibility for leaving the debris in a dangerous position, the combined approach may be the most practical. Both the polluters and operators will be required to contribute according to some criteria.

Matching of Demands and Supply for Remediation Service through the Marketplace

As for the criteria for contribution, each contributor shall be given benefit for making a contribution. On the beneficiary side, the contributing operator (or the state making a contribution on their behalf) is given a right to make a request about which debris to be removed. The request is recorded on the marketplace.

On the polluter side, the operator who recognised that its space object has become or generated debris may record the generation of debris and add it to the list of remediation subject kept in the marketplace. In doing so, the operator (or the state on its behalf) make a certain amount of contribution and be relieved of any liability for a damage to be caused by the debris.

The international regime running the marketplace will match the demands (request for remediation) and supply (list of remediation subject) and determine the priority for the debris to be removed. As recording of both the demand and supply is accompanied by the contribution of funds, the remediation can be conducted by the commercial entity, similar to the salvor at sea. The owner of the debris who recorded the generation of the debris, or the international regime acting on its behalf, may conclude the agreement for remediation (“salvage agreement” in the space) before the actual remediation is carried out.

Such “marketplace” approach will make the remediation commercially viable service, providing for the benefit in return for the sharing of cost. However, there could be the case where experts find certain debris to be in imminent need of remediation but no request has been recorded. For the sake of public interest that individual party overlooks for some reason, a part of the contributed amount must be separated and used for such remediation for the sake of public interest. The determination of urgent need will best be determined by the panel of scientific experts.

V. Conclusion

The global community can no longer afford staying idle about the debris in the space. In order to ensure the safe and open access to the space, the active remediation of the debris existent in orbit, besides the debris mitigation efforts that have already been made, is needed.

Such remediation requires the international regime that properly reflects the current status of space and environmental law. On the one hand, the regime must take into account the commercialisation of space activities and address the private law aspect, in particular the property right (ownership) in the debris. In doing so, the authorisation by the state having jurisdiction over the debris must also be duly considered.

On the other hand, the established prevention and precautionary principles under the international environment law will support the responsibility of states to deal with the existent debris adequately. As these principles require the use of best available means, the development of the technology for the debris removal will enhance the chances of finding the responsibility. The experience in maritime law will be useful in converting such state responsibility into the liability under the domestic private law by way of national regulation.

Finally, if the debris removal is to be a commercially viable service, the international regime must be equipped with the contribution mechanism. The marketplace approach, which is the matching system of supply and demand for the remediation of debris, may be the practical solution, if combined with a limited room for the remediation conducted without any recorded demand but for the sake of the public interest.