Space debris as a 'single item for discussion'

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Abstract
Among the major threats to space security today the general opinion concurs that space debris is at the top of the list, together with the need to prevent an arms race in outer space and the presence of natural near-Earth objects (NEOs), such as asteroids and meteorites, entailing a risk of collision with planet Earth. All three issues are a serious challenge from the legal standpoint.

Whether there is a hierarchical order among the above-listed threats is outside the scope of this paper. The idea is, rather, to give an undivided look at space debris and its legal sides which call for treatment in the short term as an increasing risk for space security. The wreckage of Iridium 33 and Cosmos 2251 on 9 February 2009 has shown the way. Moreover, in addition to active satellites and abandoned or inactive satellites orbiting the Earth, minute particles known as 'second generation debris', originating from collisions between space objects, are a serious risk of impact on active satellites, sometimes with untold consequences. They travel at extremely high speeds and there are currently hundreds of thousands of those minute pieces in outer space.

The importance of the topic being currently on the agenda of the LSC should not be overlooked. The responses of space-faring countries on their national mitigation measures seem to indicate that this is a step forward towards clearer regulation. Nevertheless, one cannot escape the fact that the COPUOS Guidelines on Space Debris Mitigation are not binding and that they would only be applied on a voluntary basis. Furthermore, it is a matter of concern that these Guidelines were developed with no intervention whatsoever of the LSC and that they were not adopted by consensus at the UNGA (A/RES/62/217).

This paper explores the state-of-the-art in light of the current mitigation measures. It includes an evaluation of the effectiveness -over the span of four years- of the afore-mentioned UNGA Resolution. The objective is to determine whether, in the current world scenarios, it should be supplemented by more stringent rules on the governmental front.

The Problem

The collision between a non-functional satellite, Cosmos 2251, and an active satellite, Iridium 33, in February 2009 mentioned at the outset has no doubt unchained a new chapter in the field of space debris. This situation is clearly indicating the need to revisit questions relating to the concept of 'fault' in its application to this field with a view to protecting the space environment when damage has been caused to a space object or to persons or property on board that space object elsewhere than on the surface of the Earth.

International lawyers are quite familiar with this issue, particularly in the case of collisions at sea and the difficulties involved in determining the degree of fault of each of the parties responsible thereof. As **Aoki** wisely anticipates, Article IV (b) of the 1972 Liability Convention may now become effective and should be the object of deep study in new light[1]. Moreover, Article III of the Liability Convention clearly refers to the application of 'fault liability' when damage is caused to a space object by a space object of another launching State. Mejía-Kaiser, for her part, has clearly expressed her views on due diligence and the standard of care to avoid collisions in a context where no binding rules are in force[2].

A useful source for this study is being gradually reflected in the responses provided by states, in compliance with UNGA Resolution 62/217, to the effect of providing information on their domestic mechanisms designed to mitigate space debris. Even though the COPUOS Guidelines on Space Debris Mitigation are not binding this general exchange of information may lead to stricter measures in the future.

In short, as well as analysing the questions raised by small particles of non-functional satellites originated by collisions in outer space, the risk to space security created by Near-Earth Objects (NEOs) and the consequences of an arms race in space, we should now direct our work towards clarifying the scope and implications of 'fault liability' in the field space activities.

The background

In this historical review reference shall be made to one of the first landmarks in the early nineties, i.e. the Perek proposal on Removal of Inactive Satellites. This expert, in a letter to the present writer on the eve of the ILA Sixty-Fifth Conference (Cairo 1992) identified two basic problems, namely (1) the need for a compulsory, more agile and complete registration system and (2) the need to protect space objects if and when their protection appeared desirable by the launching country. To this end this expert suggested each launching state publish a list of its active and/or inactive space objects (in the latter case only those it wished to protect) and declare that the only ones protected by Article VIII of the 1967 Space Treaty were those on that list. All other objects remained unprotected and could be removed by any country with the adequate technology. Perek highlighted the importance of updating these lists by electronic means, which raised no serious problem[3].

The Perek proposal appeared very 'down-to-earth' to the doctrine. It is assumed, however, that the political will of States was not prepared for mechanisms of the kind which, at that moment, were considered akin to 'space policing'.

One of the earliest -if not the first- drafting example of guidelines on the topic *was The Instrument on the Protection of the Environment from Damage caused by Space Debris*, adopted in 1994 in Buenos Aires by the 66th Conference of the International Law Association (hereinafter referred to as the ILA). Article 1 embodies a description - by no means exhaustive- of what should be understood by 'space debris' in the following terms[4]:

Article 1: Definitions

For the purposes of this Instrument:

(a) "Contamination/pollution" means a human modification of the environment by the introduction of undesirable elements, or by the undesirable use of those elements.

(b) "Contamination/pollution" will be considered as synonyms and are inclusive of all harmful elements other than space debris.

(c) "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.

Space debris may result, inter alia, from:

- *Routine space operations including spent stages of rockets and space vehicles, and hardware released during normal manoeuvres.*
- *Orbital explosions and satellite breakups, whether intentional or accidental.*
- *Collision-generated debris.*
- *Particles and other forms of pollution ejected, for example, by solid rocket exhaust.*
- *Abandoned satellites.*

(d) "Environment", for the purposes of this Instrument, includes both the outer space and earth environments within or beyond national jurisdiction.

(e) "Damage" means loss of life, personal injury or other impairment of health, or loss of or damage to property of States or of persons, natural or juridical, or damage to property of international intergovernmental organisations, or any adverse modification of the environment of areas within or beyond national jurisdiction or control.

This Instrument is kept under permanent review by the ILA Space Law Committee and results are reported by the Committee Chair to the Biennial Conferences of this institution. The Instrument was adopted by the ILA, with no dissent, after a long stimulating discussion of the doctrine during 1990-1994. To this effect three drafts were circulated between the Queensland (1990), Cairo (1992) and Buenos Aires (1994) Conferences laying down the pillars for the future Instrument which was marked by a strong interdisciplinary approach[5].

One of the major issues at the time of drafting the ILA International Instrument surrounded the questions of responsibility and liability. On general lines the scientists - and particularly the Scientific Consultants of the ILA Space Law Committee, Professors Perek (Czech Republic), Rex (Germany) and Ricciardi (Argentina) - were strongly against any inclusion of regulations on this matter. For example, Rex -then Chairman of the Scientific and Technical Subcommittee of COPUOS- considered liability for damage hardly relevant in the context of

the ILA Instrument and the collision between large known objects a remote possibility. In his view it would be extremely difficult, in this case, to establish which of them was responsible or to determine the grade of concurrent fault. On these points Perek and Ricciardi fully agreed.

It should be noted that this situation and its ensuing difficulties are familiar to lawyers of all times. In today's world, and in spite of the provisions set forth in Article III of the 1972 Liability Convention and the similarities with the rules on collisions on the high seas pursuant to the 1982 Convention on the Law of the Sea, the problems remain outstanding, particularly in connection with establishing the grade of fault of each of the parties involved in the collision.

Conversely, the predominant position among the lawyers of the ILA Space Law Committee was that the obligations to prevent and control space debris, and the responsibility of states and international organisations to observe this commitment, would be more forceful when coupled with provisions on responsibility and liability. This stand clearly reflected the feeling at the time. Böckstiegel, for instance, considered that this approach was consistent with the Liability Convention and, for practical reasons, if at a later stage the Instrument were to be revised it would be much easier to delete -if necessary- any such provisions than try and include new ones *a posteriori*[6]. Seyersted, in his comments during the second reading of the Instrument, indicated the need for more ambitious methods of legislation and implementation, especially for outer space where no claims of sovereignty were admitted[7]. Cocca, for his part, firmly supported the inclusion of responsibility and liability in the text, thus confirming his position over the years as Argentine Representative to COPUOS[8]. This stance was fully supported by Committee member Leanza in both readings of the Instrument.

In like manner, at the First European Conference on Space Debris (Darmstadt 1993) -where space lawyers participated actively- the view was expressed that in the 1972 Liability Convention a few issues relating to space debris remained unclear, *inter alia*, whether the meaning of damage included damage to the space environment *per se*[9].

That question found an answer in 1994 in article 1 (d) of the ILA Instrument when stating that 'environment', for the purposes of that Instrument, included both the outer space and earth environments within or beyond national jurisdiction. This should be read together with the provisions of Articles 7 and 8 addressing international responsibility and international liability in a manner similar to the 1967 Space Treaty.

The international settings of today

Fifteen years on -in 2009- the Iridium-Cosmos wreckage became a glaring example. This accident changed the light in which collisions were viewed so far. In fact, collisions began to be seen as a real risk which made this possibility more realistic.

This risk is growing continuously as space activities are being accessed by developing countries and becoming more commercial by the day with very few exceptions - mainly in the USA where, in recent years, commercial systems were becoming dependent on governmental customers[10].

Be that as it may, from the nineties -a decade streamlined by a sharp move towards commercial space activities- developing countries became increasingly involved in space exploration and use. This resulted in the creation of a unity of action which allowed them, collectively, a role in space activities individually beyond their reach. Making full use of the principle of international cooperation these countries are currently concluding agreements with industrialised countries to ease their access to more sophisticated space technology.

Among the various and most recent illustrations is the launch of SAC-D/Aquarius -a scientific satellite designed and built in Argentina- from Vandenberg, California, on 10 June 2011. It is positioned in LEO and takes one and a half hours to orbit the Earth. It is, in fact, an observatory in the sky equipped with high technology to measure, among others, the salinity of oceans, rain, ice and water vapour, as well as the oceans' temperature. It has the capacity to detect, *inter alia*, the effects of cosmic radiation on electronic equipments and the position of micro-particles and space debris.

Mission Aquarius is the outcome of a prodigious effort of international cooperation between Argentina and the USA, with the participation of the national space agencies of Canada, Italy and France and the support of Brazil who provided its facilities for testing vibration and environmental resistance.

Such the way space activities are moving in developing countries at the moment and there are growing examples thereof which, in addition to meaning an increase in the activity, also mean an increase in the possibility of collisions and generation of space debris.

In addition to the 2009 Iridium-Cosmos wreckage there are further reasons for concern regarding the risk of collisions. In fact, on 28 June 2011 the six astronauts aboard the International Space Station (ISS) -namely three Russian, two American and one Japanese- were forced to seek refuge in the auxiliary vehicles designed for emergency evacuation in case of impact from 'floating' space debris which, in this case, was perilously near the space station (250 metres apart). As NASA reported later, the debris threat was not detected in time for manoeuvring which meant that the crew had to take immediate refuge in the Soyuz crafts. This example was not the first of its kind[11].

It therefore seems fair, at this stage, to have further regulation on the matter and give more legal force to the 2007 COPUOS Guidelines on Space Debris Mitigation to cover whatever future situations may result. To this end the information provided by States to the LSC on domestic measures applied for mitigation, under the current item of its agenda i.e. 'space debris as a single item for discussion', will no doubt be of use.

Thus the direction in which the general opinion is progressing within circles related to space exploration and use. International law and the principles of justice and equity –following the wording of article XII of the Liability Convention- require that stricter rules be agreed on to govern the legal aspects of space debris. Yet, the harsh facts of politics are making this very difficult. The political will of states is absent on the international arena for moving towards binding rules on this matter. Indeed States are very cautious to

engage in obligations the outcome of which seems unpredictable in a few years' time.

The recent Czech proposal (A/AC.105/C.2/L.283)

In light of the above-described situation the proposal made by the Czech Republic to the LSC appears sensible and worthy of support. As shall be seen in the next lines, it implies a slight, but distinct, step forward in the treatment of space debris and its legal implications.

For the last years this country has been advocating with extreme eloquence and impeccable reasoning the need for more rigorous legislation applicable to man-made space debris.

During the Fiftieth Session of the Legal Subcommittee (March/April 2011) a document entitled *Review of the Legal Aspects of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, with a view to transforming the Guidelines into a set of principles to be adopted by the General Assembly* was presented. This was a follow-up to the document submitted to the Forty-Ninth Session in 2010[12]. The idea was for those principles to be elaborated by the LSC and then adopted by the General Assembly of the United Nations having in mind that the COPUOS Guidelines on Space Debris Mitigation were drafted by the Scientific and Technical Subcommittee alone and, as noted at the outset of this paper, with no intervention whatsoever from the Legal Subcommittee.

The objective of the Czech proposal is to move from 'mitigation guidelines' to 'principles' adopted by a General Assembly Resolution along the lines of previous sets of UN Principles – particularly the 1986 Principles relating to Remote Sensing of the Earth from Outer Space and the 1992 Principles Relevant to the Use of Nuclear Power Sources in Outer Space. It should be considered that some of these principles, especially those on remote sensing, are part of, or on their way to becoming, rules of customary international law.

The Czech document wisely observes that 'guidelines' are generally conceived as a list of specific measures "that curtail the generation of potentially harmful space debris in the near term" but do not mention the protection of the environment as one of its aims[13]. Conversely, the ILA Instrument on Space Debris, discussed above, expressly includes these words in its title.

Moreover, the Czech Republic Document points out that the ILA Instrument contains a legal definition of space debris in Article 1 which is in harmony with the scientific and technical studies on that issue, as also a definition of damage, and establishes that the term "environment" should include both the outer space and earth environments[14].

It is further added that the proposed principles should include mechanisms for dispute settlement similar to the solutions adopted by the ILA Instrument.

In this proposal, to be developed in close cooperation with the Scientific and Technical Subcommittee of COPUOS (STSC), international cooperation becomes a key element together with capacity building.

In fact, space debris is of growing importance from the legal perspective. A clear illustration, and also a course of action to bear in mind, is the work carried

out by a group of educators from different countries in developing a curriculum on space law in the framework of the United Nations[15].

The objective is to have a basic course on space law to be integrated into the education programme of the four Regional Centres for Space Sciences and Technology Education of the United Nations. The curriculum is designed for use by the instructor to raise capacity in international law and space law and is intended for non-lawyer. It consists of two modules. The first one, directed to all students and addressing "Basic concepts of international law and space law", provides an introduction to the legal regime applicable to space activities and lays down a basis for the next four specific modules focusing on remote sensing and GIS, satellite meteorology and global climate, satellite communication and space, and Global Navigation Satellite System of Systems (GNSS)[16]. Among these topics space debris and dispute settlement take pride of place[17].

Furthermore, one of the conclusions of the UN/Iran Workshop on Space Law (Tehran, 9-11 November 2009) was the need for provisions to ensure the safe conduct of space activities, including the protection of the space environment. It welcomed the development of above-mentioned curriculum on space law for the UN regional centres. The Workshop noted that the addition of a basic course on space law would enable these regional centres to offer scholars with scientific and technical skills the necessary legal basis to conduct space activities[18].

Likewise, the Permanent Court of Arbitration (PCA) considered the time was ripe to engage in the elaboration of rules on dispute settlement. To this end an Advisory Group on the matter was set up under the conduction of Judge Pocar from Italy[19]. Results were submitted to the PCA Administrative Council in May 2011 and are currently being examined and commented upon by the States Parties to the PCA.

Shortly after consideration of the suggestions by States the final version of the *Optional Rules for the Arbitration of Disputes Relating to Outer Space Activities* will be submitted to the PCA Administrative Council. The Draft Rules, to a certain extent inspired in the 2010 UNCITRAL Arbitration Rules, and with adjustments for application to the field of outer space activities, lay a strong accent on disputes relating to the application and interpretation of the Space Treaties and damage caused by space activities such as space debris.

Another important source of information in support of the position taken up in this paper is a recent statement made by a member of the German Space Agency delegation to the Inter-Agency Space Debris Coordination Committee (IADC), Carsten Wiedemann, in the sense that the probability of collisions in space generating debris is very high, particularly in low polar orbits used by Earth Observation Satellites (EOS) where particles travel at a speed of 15 km per second. Figures are indeed telling. By 2005, for example, we already knew of the existence of some 44.000 particles larger than 5 cm, the impact of which could destroy a satellite. Also, at that time there were 600.000 particles larger than 1cm and 150 million objects larger than 1mm[20].

It is interesting to note that environmental contamination and harmful interference in

space activities is precisely the topic chosen for the Manfred Lachs Space Law Moot Court Competition this year in Cape Town. The major unresolved issues will no doubt surface in the written memorials and oral arguments and go a long way in creating awareness in the current international scenarios on the threats to the Earth and space environment stemming from space debris. Likewise a need should be perceived for normative solutions going beyond *a general exchange of information on national mechanisms relating to space debris mitigation measures as 'a single item for discussion'* [21].

As noted in the Czech proposal, neither the substantive legal problems of space debris nor a detailed analysis of the legal content and effectiveness of the Space Debris Mitigation Guidelines come under the current mandate of the LSC.

Perceptions and conclusions

The general conclusion is that space law in general, and issues arising from risks and/or damage caused by space debris in particular, are both of an undoubted interdisciplinary nature.

It follows that international lawyers should work together with space scientists to procure fair rules protecting third parties -and indeed the whole mankind- from a most serious threat.

Even though it is generally believed that the stage of treaty and principle adoption by the UN is over and the political moment is not the best to move towards more precise rules, it is also true that nothing precludes a reopening of that procedure in the case of threats with untold consequences, such as the alarming figures of space debris today.

At this point in time there are strong reasons to hold that the specific topic of space debris risks and their legal implications should be, at least, brought together as a set of UN Principles within the framework of a United Nations General Assembly Resolution (UNGA).

And, most importantly, UNGA Resolutions containing principles of the kind are not, in themselves, binding whether they include the term 'legal' in their title or not[22]. Unless of course they are declaring customary international law in accordance with Article 38 of the Vienna Convention on the Law of Treaties.

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[1] Aoki, Setsuko, Working Session of the ILA Space Law Committee, *Report of the Seventy-Fourth Conference of the International Law Association,* The Hague 2010, 287.

[2] Mejía-Kaiser, Martha, *Collision Course: 2009 Iridium-Cosmos Crash*, *Proceedings of the International Institute of Space Law (IISL*) 2009, 274-284.

[3] *Report of the Sixty-Fifth Conference of the International Law Association*, Cairo 1992, 144-145.

[4] *Report of the Sixty-Sixth Conference of the International Law Association*, James Crawford and Maureen Williams, eds., Buenos Aires 1994, 305-325, 317. Article1of this Instrument, entitled '*Definitions*', brings a non-exhaustive list of possibilities. For this Report, containing explanations by the present writer (then Rapporteur of the Committee) and the final text of this Instrument see the 1994 ILA Report, 9-13 (in book format).

[5] The ILA Draft was expressly elaborated as an 'Instrument'. The idea was to keep it as such so that it could be applied, indistinctively, as title for a set of principles or guidelines and a set of binding rules as well. '*Report of the Sixty-Sixth Conference of the ILA…',* 307-308 see note 4 *supra*.
[6] Ibid. 314.
[7] Ibid. 313.
[8] Ibid.
[9] See Howard Baker , *Policy Considerations for the Regulation of Space Debris*, *Proceedings of the First European Conference on Space Debris,* Darmstadt, Germany, 5-7 April 1993, chapter on *Liability for Damage caused by Space Debris*.
[10] Gabrynowicz, Joanne, when answering an ILA Questionnaire on Remote sensing*, Report of the Seventy-Second Conference of the ILA*, Toronto 2006, 701.
[11] Reuters, EFE and AFP. Information provided by *La Nación*, a leading morning newspaper, Buenos Aires, Argentina, 29 June 2011.
[12] See Doc. A/AC.105/942, paras 169 and 170 (b).
[13] As stated in Doc. A/AC.105/C.2/L.283, 2.
[14] See ibid. 3 for further details.
[15] UN Doc. A.AC.105/C.1/2011/CP.5. This document contains a revised version of the draft and structure of the education curriculum on space law made on the basis of the Third Meeting of the Experts Group in Vienna on 23 March 2010 and additional updates made by the Office for Outer Space Affairs.
[16] Ibid. 5-6. The Group of Experts consisted, among others, of Professors Stephan Hobe, Vladimir Kopal. Frans von der Dunk, Joanne Gabrynowicz, Vassilis Cassapoglou, José Monserrat Filho, Ram Jakhu, Armel Kerrest, Paul Larsen, Francis Lyall, Vladlen Vereshchetin, Tanja Masson-Zwaan, Sergio Marchisio, Justine Limpitlaw and the present writer.
[17] The papers presented at the Workshop are available on the website of the Office for Outer Space Affairs (http://www.unoosa.org/oosa/SAP/act2009/iran/presentations.html) and published as Proceedings of the United Nations/Islamic Republic of Iran Workshop on Space Law: '*Role of International Space Law in the Development and Strengthening of International and Regional Cooperation in the Peaceful Exploration and Use of Outer Space',* jointly organised and hosted by the Asia-Pacific Space Cooperation Organization (APSCO), 8-11 November 2009, Tehran, Islamic Republic of Iran.
[18] Paragraphs 36 (b), and 46-47 of Doc. A/AC.105/956, *Report on the United Nations/Islamic Republic of Iran Workshop on Space Law.*
[19] The PCA appointed the following members for the Advisory Group on this matter: Tare Brisibe, Frans von der Dunk, Stephan Hobe, Armel Kerrest, Ram S. Jakhu, Haifeng Zhao, Joanne Gabrynowicz, V.S.Vereshchetin, V.S. Mani, Justine C. Limpitlaw, José Monserrat Filho, Francis Lyall and the present writer.
[20] Presentation made by Dr.-Eng.Carsten Wiedemann on Space Debris Mitigation Guidelines at a Conference on *'Soft' Law in Outer Space. The function of non-binding norms in International Space Law*, University of Vienna, 2 April 2011.
[21] Italics of the present writer.
[22] This was the case of the 1963 United Nations General Assembly Declaration of Legal Principles governing the Activities of States in the Exploration and Use of Outer Space - UNGA Resolution 1962(XVIII).