

## Common but Differentiated Responsibilities for Space Debris – New Impetus for a Legal Appraisal of Outer Space Pollution

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*Since several years, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and its Subcommittees have considered and still consider the issue of space debris from different perspectives but always with a focus on how space activities can be carried on without further degrading the outer space environment. Apart from that, the deliberations in COPUOS and its Subcommittees were broadened by discussing the pollution of outer space with orbital debris from an equity perspective, namely in the context of the ‘common but differentiated responsibilities’ principle. Since this principle belongs to the multifaceted concept of sustainable development which aims at integrating environmental protection and economic development, such references raise the question as to the interrelation between debris pollution and environmental protection from a legal perspective. A closer look into international environmental law and into the legal substance behind its principles in fact allows to identify certain legal implications with regard to the pollution of outer space with man-made debris. Such considerations, however, should not be used as a pretext for deferring the adoption of space debris mitigation measures.*

### 1. Introduction

The increasing amount of non-functional man-made objects in outer space has grown to a serious concern for the utilization of outer space today. Not only the collision of the US Iridium-33 satellite and the abandoned Russian Cosmos-2251 satellite once again highlighted the detrimental effects of space debris pollution.<sup>1</sup> Besides this singular striking event, debris pollution has become a regular concern for many space missions. For example, the trajectory of the International Space Station (ISS) is permanently monitored in order to determine whether other known space objects could pose a risk of collision to the ISS. In case of a close conjunction and once the threshold to a certain probability of collision is reached, the ISS undertakes a collision avoidance maneuver meaning that it is transferred into another orbit in order to minimize the risk of collision.<sup>2</sup>

Permanent tracking of the space station’s orbit, however, does not provide total protection from collision: In March 2009, a conjunction event could only be recognized when it was already too late to plan and execute an avoidance maneuver. The only possibility left was to evacuate the ISS’ crew into the Soyuz spacecraft. Fortunately, the object did not impact the ISS but the incident once again demonstrated the high risk potential of the current debris environment.<sup>3</sup>

Within the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) the physical and technical nature of the space debris pollution was studied and guiding principles for space debris mitigation have been elaborated. Since 2009, states also inform each other on their national efforts to implement space debris mitigation measures in the Legal Subcommittee (LSC) and, since 2010, a new agenda item entitled “Long-term sustainability of outer space activities” is considered in the

<sup>1</sup> See *National Aeronautics and Space Administration*, Satellite Collision Leaves Significant Debris Cloud, in: *Orbital Debris Quarterly News* (13, 2), 2009, p. 1.

<sup>2</sup> See *Johnson, Nicolas*, The International Space Station and the Space Debris Environment: 10 Years On, in: *Proceedings of the Fifth European Conference on Space*

<sup>3</sup> Debris, ESA/ESOC, 30 March-2 April 2009, p. 5. See *National Aeronautics and Space Administration*, op. cit. footnote 1, p. 3.

Scientific and Technical Subcommittee (STSC). In the course of the deliberation on the problem in COPUOS, its equity dimension has also been discussed: With reference to the principle of ‘common but differentiated responsibilities’ (CBDR principle), some states demanded that the primary responsibility of long-standing space faring states for creating the debris population should be taken into account when seeking solutions for the problem and that such solutions shall not hamper developing states’ efforts to utilize outer space.

Since the CBDR principle is encompassed in the notion of ‘sustainable development’, a concept strongly related to environmental law, the explicit references to common but differentiated responsibilities for space debris provide impetus for the consideration of the debris issue from an environmental law perspective. This paper seeks to shed light on the role of environmental law in terms of debris pollution. This shall be done by examining the relevance of pertinent provisions in environmental and space law, including the consideration of the general status of outer space under international law and the role of the concept of sustainable development. Before turning to the legal appraisal, the nature of the debris problem and efforts to cope with the debris problem in the scope of COPUOS shall be briefly outlined, while special attention is to be paid to the discussion of the CBDR principle.

## 2. Space Debris: A Serious Concern for the Utilization of Outer Space

The creation of space debris is an inherent consequence of human activities in outer space. At the end of their lifetimes, all abandoned satellites and spent upper stages of launch vehicles become useless debris. Today, the number of trackable debris in space exceeding a diameter of five to ten centimeters amounts to approximately 13,500 pieces.<sup>4</sup> Most of this debris are not entire decommissioned satellites or launchers but their fragmented parts. The main source of debris currently consists in on-orbit fragmentations of abandoned space objects. Due to residual energy stored onboard these objects (i.e. propellant or electrical energy), decommissioned spacecraft often explode so that new debris is created.<sup>5</sup>

<sup>4</sup> See *Klinkrad, Heiner/Johnson, Nicholas L.*, Space Debris Environment Remediation Concepts, in: Proceedings of the Fifth European Conference on Space Debris, 30 March – 2 April 2009, ESA/ESOC, Darmstadt, Germany, p. 2.

<sup>5</sup> See *Krisko, Paula H.*, The Predicted Growth of the Low-Earth Orbit Space Debris Environment – An Assessment of

Collision events so far have not played a major role as a source for debris, but it is expected that because of the steadily growing debris population, the probability of collisions among space objects will significantly increase, especially in certain densely populated orbital regions. Rising numbers of collisions imply a rising number of debris so that collision events will eventually take over as the main source for debris.<sup>6</sup> It was even stated that the number of objects and collisions will exponentially increase which would eventually result in the formation of a self-sustaining debris belt around the Earth.<sup>7</sup> As the collision between the Iridium and Cosmos satellites has shown, such incidents have devastating consequences. Given the high velocities of debris of about seven kilometers per second, also collisions with smaller pieces can entail heavy damage or the complete loss of spacecraft.<sup>8</sup>

**The forthcoming increase of collision probability among objects in outer space enhances the risk potential for operational spacecraft.**

In view of these prospects, there are ongoing efforts to alleviate the detrimental effects of space debris. By adopting space debris mitigation measures, the production debris during space operations shall be reduced. The measures relate to the main sources of space debris and include the passivation of spacecraft after the end of their lifetime in order to avoid on-orbit fragmentation, the post-mission disposal of spacecraft in order to limit the long-term presence of abandoned satellites in outer space, and efforts to avoid collisions between space objects. The adoption of mitigation measures for all space activities is deemed necessary in order to avoid an uncontrolled growth of the debris population.<sup>9</sup> Guiding documents for the implementation of these measures have been elaborated at different levels. The activities of COPUOS in this regard will be described in the following section. In Europe, the Space Debris Network of

Future Risk for Spacecraft, in: Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace and Engineering (221, 6) 2007, p. 976.

<sup>6</sup> See *Liou, Jer-Chyi/Johnson, Nicolas L.*, Instability of the Present LEO Satellite Populations, in: Advances in Space Research (41, 7) 2008, pp. 1046-1047.

<sup>7</sup> See *Kessler, Donald J./Cour-Palais, Burton G.*, Collision Frequency of Artificial Satellites: The Creation of a Debris Belt, in: Journal of Geophysical Research (83, A6) 1978, p. 2637.

<sup>8</sup> See *Yasaka, Tetsuo*, Space Debris Protection: A Standard Procedure for the Future? in: Acta Astronautica (53, 4-10) 2003, p. 528.

<sup>9</sup> See *Liou/Johnson*, op. cit. footnote 7, p. 1052.

Competences, a body comprising the leading European space agencies,<sup>10</sup> drafted its own guidelines, namely the European Code of Conduct for Space Debris Mitigation.<sup>11</sup> At the same time, technical standards, which transform general guidelines into technical requirements that can be used by industry, are developed through the International Organization for Standardization (ISO)<sup>12</sup>; in Europe they are considered within the European Cooperation for Space Standardization (ECSS).

Apart from preventing the creation of space debris, active remediation of the debris environment gains more and more attention.<sup>13</sup> There are various options for remediation, among them the deployment of spacecraft that actively re-orbit or de-orbit useless objects. The practical deployment of such removal satellites would concentrate on specific high-mass pieces of debris in densely populated orbital regions that are deemed critical for the further development of the debris environment.<sup>14</sup>

### 3. The Consideration of the Space Debris Issue in COPUOS

#### 3.1. Three Phases of Consideration

Given its detrimental effect on space activities, space debris has become a matter of discussion for COPUOS from different perspectives. In general terms, one can identify three phases of consideration. In 1994, the issue of space debris was introduced in the agenda of the STSC with the aim of studying the nature and technical characteristics of the debris environment.<sup>15</sup> On the basis of a multi-year work plan,<sup>16</sup> the STSC discussed different technical aspects of the debris pollution and finally adopted the Technical Report on Space Debris<sup>17</sup> in 1999 which summarized these

considerations. The report intended to provide a common understanding of the nature of space debris and to create a basis for further deliberations.<sup>18</sup> A definition of the notion of space debris was also included in the report, while it was stated at the same time that no consensus could be reached on that question.<sup>19</sup> Until today, there is no commonly accepted, legally-binding definition of space debris.

In the second phase, the work of the STSC turned to space debris mitigation. In 2001, the subcommittee adopted a multi-year work plan for the period of 2002-2005.<sup>20</sup> In accordance with this plan, the Inter-Agency Space Debris Coordination Committee (IADC)<sup>21</sup> presented its proposals for debris mitigation to the STSC which reviewed these measures with the aim to possibly adopt them as own debris mitigation guidelines. The Working Group on Space Debris, which was first established in 2004 by the STSC in order to consider the IADC proposals,<sup>22</sup> concluded in 2005 that a separate document on space debris mitigation needs to be developed.<sup>23</sup> Based on the work of the IADC, the Working Group on Space Debris of the STSC subsequently drafted guiding principles for preventing the further proliferation of space debris. The work on the COPUOS Mitigation Guidelines<sup>24</sup> was concluded in 2007 with their adoption by COPUOS<sup>25</sup> and the UN General Assembly.<sup>26</sup> The document contains seven guidelines which address and explain various measures for the mitigation of space debris, among them the minimization of the potential for on-orbit break ups and the limitation of accidental collisions<sup>27</sup> which relate to current and future primary sources of space debris. As for the legal value of the COPUOS Mitigation Guidelines, it is important to note that they

<sup>10</sup> The Italian (ASI), British (BNSC), French (CNES) and German (DLR) space agencies as well as ESA form the current Space Debris Network of Competences.

<sup>11</sup> European Code of Conduct for Space Debris Mitigation, Issue 1.0, 28 June 2004.

<sup>12</sup> See *Davey, J.R./Stokes P.H.*, Status of the ISO Standards on Space Debris Mitigation, in: Proceedings of the Fifth European Conference on Space Debris, ESA/ESOC, 30 March-2 April 2009.

<sup>13</sup> In December 2009, the US National Aeronautics and Space Administration (NASA) organized the International Conference on Orbital Debris Removal, the first of its kind. See *National Aeronautics and Space Administration, NASA and DARPA Sponsor International Debris Removal Conference*, in: *Orbital Debris Quarterly News* (14, 1), 2010, p. 1.

<sup>14</sup> See *Klinkrad/Johnson*, op. cit. footnote 4, pp. 4-8.

<sup>15</sup> See A/AC.105/571, para. 63.

<sup>16</sup> See A/AC.105/605, para. 83.

<sup>17</sup> See UN doc. A/AC.105/720, Technical Report on Space Debris.

<sup>18</sup> See UN doc. A/AC.105/720, para. 10.

<sup>19</sup> See *ibid.*, para. 6. The following definition is set forth: "Space debris are all manmade 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."

<sup>20</sup> See A/AC.105/761, para. 130.

<sup>21</sup> The body consists of the space agencies of major spacefaring countries. See <<http://www.iadc-online.org/>> (last retrieved 26 March 2010).

<sup>22</sup> See UN doc. A/AC.105/823, Annex III, para. 1.

<sup>23</sup> See UN doc. A/AC.105/848, Annex II, para. 5.

<sup>24</sup> Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, in: UN Document A/62/20, Report of the Committee on the Peaceful Uses of Outer Space, Official Records of the General Assembly, Sixty-second Session, Supplement No. 20, 2007, Annex, pp. 47-50 (hereinafter COPUOS Mitigation Guidelines).

<sup>25</sup> See UN doc. A/62/20, para. 118.

<sup>26</sup> See UN doc. A/RES/62/217, para. 26.

<sup>27</sup> See Guidelines 2, 3, 5 COPUOS Mitigation Guidelines.

should only be implemented on a voluntary basis<sup>28</sup> so that they cannot be perceived as establishing a legally-binding commitment to space debris mitigation.<sup>29</sup>

After the review of the physical and technical nature of space debris and the development of mitigation guidelines, the topic also reached the LSC which might be considered as the third phase of space debris deliberations in COPUOS. Starting in 2009, member states of COPUOS now inform each other about their national efforts to implement space debris mitigation measures.<sup>30</sup> An indirect linkage to the debris problem consists with regard to the agenda item on national space legislation,<sup>31</sup> under which states exchange information on their national regulatory framework concerning space activities in accordance with a multi-year work plan.<sup>32</sup> The working group established under this agenda item i.a. deals with the conditions that need to be fulfilled for authorization of national space activities.<sup>33</sup> In some cases, the requirements relating to safety and technological standards were linked to concerns about space debris mitigation.<sup>34</sup> The absence or inclusion of such requirements might serve as an indication as to how much significance states actually attach to space debris mitigation. Although the arrival of the debris issue on the agenda of the LSC might be considered as progress, the discussions under the mentioned agenda items are rather narrow because they only represent an exchange of information on national procedures to implement space debris mitigation.

**The consideration of space debris in COPUOS has primarily focused on technical and practical aspects of the debris problem, in particular on space debris mitigation.**

<sup>28</sup> See COPUOS Mitigation Guidelines, 3. Application, UN doc. A/62/20, para. 119 and UN doc. A/RES/62/217, para. 27.

<sup>29</sup> For a more detailed analysis of the guidelines see *Hobe, Stephan/Mey, Jan Helge*, UN Space Debris Mitigation Guidelines, in: *Zeitschrift für Luft- und Weltraumrecht* (58, 3) 2009, pp. 388-403.

<sup>30</sup> See A/AC.105/935, para. 148. The agenda item is entitled "General exchange of information on national mechanisms relating to space debris mitigation measures".

<sup>31</sup> The agenda item is entitled "General exchange of information on national legislation relevant to the peaceful exploration and use of outer space". See UN doc. A/AC.105/935, para. 163.

<sup>32</sup> See UN doc. A/62/20, para. 219.

<sup>33</sup> See UN doc. A/AC.105/935, Annex III, para. 7 lit. e.

<sup>34</sup> See *ibid.*, para. 13.

The formal introduction of the debris issue in the agenda of the LSC cannot hide the fact that an examination of the implications of space debris pollution under international law did not yet find its way into COPUOS. At the same time, there exist many open questions that are due for consideration, such as the applicability of international legal norms to debris pollution or a legal definition of space debris. While proposals for a more substantive legal discussion are persistently brought up since several years,<sup>35</sup> consensus could not be reached yet. A new push for the issue could arise from the introduction of the new agenda item entitled "Long-term sustainability of outer space activities" in the STSC 2010.<sup>36</sup> Even though the exact terms of reference of the new agenda item are still to be developed,<sup>37</sup> it became clear from the initial discussions that the new agenda item encompasses a broad range of aspects that relate to space debris, among them mitigation, collision avoidance and space traffic management.<sup>38</sup> As it has been previously in the history of COPUOS, considerations of a particular issue in the STSC preceded its inclusion in the agenda of the LSC.<sup>39</sup> The recent new agenda item could perhaps also trigger a more comprehensive legal discussion in the LSC.

### 3.2. Common but Differentiated Responsibilities in the Discussion of Space Debris

As indicated above, the deliberations on debris pollution in COPUOS were broadened by linking the space debris issue to the idea of equity. Direct or indirect references to the CBDR principle stressed the fact that responsibility for the current degree of debris pollution is not equally distributed among states. As a result, it was argued that the mitigation of the problem should also be based upon differentiated responsibilities. A typical statement expressing this idea reads as follows:

"The view was expressed that States most responsible for the creation of space debris and the States having the capability to take action on space debris mitigation should make a greater contribution to space debris mitigation

<sup>35</sup> See UN doc. A/AC.105/514, para. 19 and UN doc. A/AC.105/935, para. 194 lit. b.

<sup>36</sup> See UN doc. A/AC.105/958, para. 174.

<sup>37</sup> See UN doc. A/AC.105/958, para. 183.

<sup>38</sup> See *ibid.*, paras. 184, 185, 195, 200, 201.

<sup>39</sup> See *Jasentuliyana, Nandasiri*, *International Space Law and the United Nations*, Kluwer Law International, The Hague et al., 1999, pp. 25-26.

efforts than other States.”<sup>40</sup>

Even though the idea of equity did not take much room in the overall discussion of space debris in COPUOS, and an analysis of this aspect can only be tentative, two observations seem to be noteworthy. First, the demanded consequences derived from the disparity in the causation of the problem in most cases remain rather vague. Many statements only stress the “lead role” of those states largely responsible for the present situation<sup>41</sup> or the need for them to “make greater contribution” to space debris mitigation efforts or contribute to these efforts “in a more significant manner” than others<sup>42</sup>. In some cases, however, they are described more specifically. States demanded that help shall be provided,<sup>43</sup> for instance by transferring “technological and financial means”<sup>44</sup> and “relevant technology”<sup>45</sup> to less-developed or non-spacefaring countries. In addition, one delegation distinguished between future and existing debris. Regarding the creation of debris through future missions, the COPUOS Mitigation Guidelines should be observed. With respect to the mitigation of existing debris (remediation), however, the CBDR principle should be considered. This implies that prospective arrangements for remediation should take account of the primary responsibility long-established space-faring states and should not create obstacles for developing states’ space activities.<sup>46</sup>

**By putting space debris pollution in the context of the principle of “common but differentiated responsibilities”, the discussion of the issue in COPUOS is broadened by equity considerations between developed and developing states.**

The second observation concerns the support among delegations in COPUOS for the equity approach to debris pollution. Almost all of the mentioned statements are introduced in the respective reports with the formulation “the view was expressed” indicating that only one delegation held this opinion. During the STSC and COPUOS 2009, however, there was more than one delegation making reference to equity in terms of space debris pollution<sup>47</sup> because the reports introduced the respective paragraphs with the words “some delegations expressed the view”.<sup>48</sup> Even though such slight changes should not be exaggerated, this change could indicate that the principle of common but differentiated responsibilities for space debris pollution gains ground among the states represented in COPUOS.

#### 4. Environmental Law and Space Debris

The CBDR principle forms part of the sustainable development concept, which is strongly related to the environmental protection. Sustainable development is a concept of environmental law which basically aims to conciliate the promotion of economic development and the protection of the environment. The reference in COPUOS to common but differentiated responsibilities gives reason not only to consider the principle itself but also to have a closer look at the space debris issue from an environmental law perspective, especially since space debris was explicitly referred to as an “environmental issue”.<sup>49</sup>

##### 4.1. Environmental Protection in Outer Space

Over the past decades, there developed a manifold corpus of international environmental

<sup>40</sup> UN doc. A/AC.105/911, para. 98. Almost verbatim formulations or similar formulations highlighting the principle of common but differentiated responsibilities can be found in the reports of the STSC in 2001 (UN doc. A/AC.105/761, para. 135), 2002 (UN doc. A/AC.105/125, para. 125), 2004 (UN doc. A/AC.105/823, para. 103), 2005 (UN doc. A/AC.105/848, para. 99), 2006 (UN doc. A/AC.105/869, para. 109) and 2007 (UN doc. A/AC.105/890, para. 95) and 2009 (UN doc. A/AC.105/933, para. 77) as well as in the reports of the LSC in 2007 (UN doc. A/AC.105/891, para. 27) and 2008 (UN doc. A/AC.105/917, para. 19).

<sup>41</sup> See UN doc. A/AC.105/761, para. 135, UN doc. A/AC.105/787, para. 125, UN doc. A/AC.105/848, para. 99.

<sup>42</sup> See UN doc. A/63/20, para. 124, UN doc. A/AC.105/869, para. 109, UN doc. A/AC.105/890, para. 95, UN doc. A/AC.105/911, para. 98 and UN doc. A/AC.105/933, para. 77.

<sup>43</sup> See A/59/20, para. 102.

<sup>44</sup> UN doc. A/AC.105/823, para. 103.

<sup>45</sup> UN doc. A/60/20, para. 132.

<sup>46</sup> See UN doc. A/AC.105/891, para. 27 and UN doc. A/AC.105/917, para. 19.

<sup>47</sup> See UN doc. A/AC.105/933, para. 77.

<sup>48</sup> A unified terminology for including the views of delegation into the reports was established by the LSC in 1978. It was decided to use the formulation “the view was expressed” when reference is made to a view expressed by only one delegation and “some delegations expressed the view” when reference is made to a view expressed by more than one delegation. See UN doc. A/AC.105/218, para. 18.

<sup>49</sup> See UN doc. A/AC.105/786, para. 125.

law comprising international agreements, customary rules as well as principles of environmental law. The subject matters of the treaties are very diverse as well as their geographical scopes.<sup>50</sup> In principle, the norms of international environmental law also apply to activities of states in outer space. This cannot only be deduced from articles I (2) and III of the Outer Space Treaty<sup>51</sup> (OST). The applicability also results from the fact that international law in principle governs the legal relations among states. The applicability does not depend on where this relation – which materializes through concrete action – actually occurs, either on the Earth or in outer space. In this regard, Article III OST might be considered as merely declarative.<sup>52</sup>

More interestingly, one could ask whether activities in outer space fall into the material scope of environmental law at all. Given that environmental law to a great extent is concerned with specific Earth-bound environmental problems, its applicability – quite obviously – cannot be affirmed for the entire corpus of environmental law. Since there is currently no dedicated international accord which directly addresses environmental protection in outer space, pertinent provisions could only be those whose regulative subject matter generally consists in ‘the environment’. This, of course, raises the question as to whether outer space can be regarded as part of the environment. Even though there is no conclusive legal definition of the term under international law and its notion is, therefore, somewhat vague, there is good reason to believe that space forms part of the human environment. This assumption is based on the anthropocentric approach of environmental protection. The preservation of the natural livelihood of mankind is the dominant motivation for environmental protection and, thus, for the development of environmental law.<sup>53</sup> Since outer space has gained outstanding significance for mankind and space applications today contribute to scientific progress and create economic benefits, outer

space can be considered as belonging to the natural livelihood of mankind. For that reason, whenever provisions of environmental law generally aim to protect the environment as such, they are in principle also applicable to outer space.

Such norms can be found in humanitarian law<sup>54</sup> but – more importantly for the present problem – also with regard to the customary rule that prohibits significant transboundary environmental harm. This so-called ‘no-harm rule’ first developed in the context of environmental damages occurring in the relations between neighboring states, induced by the famous Trails Smelter arbitration.<sup>55</sup> Today, it is regarded as being also applicable to areas not under state jurisdiction, including outer space.<sup>56</sup> The expansion of the scope of application into stateless spaces has to be seen against a general trend in international law towards accepting the preservation of the environment as a community interest of mankind as a whole. Since environmental concerns have grown beyond bilateralism, this development opens up possibilities for dealing with environmental problems of global scale.<sup>57</sup> The no-harm rule subsequently crystallized into a rule of customary international law, based on state practice and important judicature.<sup>58</sup> In 1996, the International Court of Justice referred to the no harm rule as follows:

“The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law.”<sup>59</sup>

<sup>50</sup> See *Gründling, Lothar*, Environment, International Protection, in: Bernhard, Rudolf (ed.), *Encyclopedia of Public International Law*, Volume Two, Elsevier Science Publishers, Amsterdam et al. 1995, p. 99.

<sup>51</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1967), 610 UNTS, pp. 204-300.

<sup>52</sup> See *Cheng, Bin*, *Studies in International Space Law*, Oxford University Press, New York 1997, p. 230.

<sup>53</sup> See *Birnie, Patricia W./Boyle, Alan E.*, *International Law and the Environment*, Oxford University Press, New York 2002, p. 5.

<sup>54</sup> Relevant provisions are articles 35 (3) and 55 (1) of the Protocol I to the Geneva Conventions. See Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) (1977), 1125 UNTS, pp. 3-608. The ENMOD Convention also needs to be mentioned in this context, in particular, because it refers to outer space in article II. See Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (1976), 1108 UNTS, pp. 151-210.

<sup>55</sup> See *Hall, Noah D.*, Transboundary Pollution: Harmonizing International and Domestic Law, in: *University of Michigan Journal of Law Reform* (40, 4) 2007, p. 696.

<sup>56</sup> See *Birnie/Boyle*, op. cit. footnote 53, p. 139.

<sup>57</sup> See *Simma, Bruno*, From Bilateralism to Community Interest in International Law, in: *Recueil des Cours*, 1994 (250, 6), p. 239.

<sup>58</sup> See *Epiney, Astrid*, Das „Verbot erheblicher grenzüberschreitender Umweltbeeinträchtigungen“: Relikt oder konkretisierungsfähige Grundnorm? in: *Archiv des Völkerrechts* (33) 1995, p. 317.

<sup>59</sup> Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, ICJ Reports 1996, para. 29, p. 241-242.

**International environment law is applicable to outer space activities while the customary no harm rule and the prohibition to avoid the harmful contamination of outer space constitute the primary norms for space environmental protection.**

Some remarks shall be made on the status of outer space under international law and the implications that has in terms of environmental protection. Outer space has been described as a *res communis*, a legal concept which describes the status of an area under international law that is characterized by a set of specific elements. These elements are non-appropriation, free access and use for all states, the requirement to give due regard to the interests of other states, environmental protection and demilitarization. All legal regimes of the *res communis* areas, which are the high seas, the Antarctica and outer space<sup>60</sup>, are shaped by these elements, even though their concrete form is different in each case.<sup>61</sup> In regard to the Outer Space Treaty, which established the legal regime for outer space, the second sentence of article IX OST represents the environmental protection element by stipulating that states shall avoid the “harmful contamination” of outer space.<sup>62</sup> An overall reflection on the no harm rule, the *res communis* concept, and the outer Space Treaty shows their strong interrelation: The customary no harm rule, while being applicable to areas beyond national jurisdiction, is reflected in the environmental protection element of the *res communis* concept.<sup>63</sup> In terms of outer space, this element is transformed into a space-specific provision by the second sentence of article IX OST.

<sup>60</sup> For outer space, non-appropriation is set forth in article II OST, free access and use in article I (2) OST, the requirement to give due regard to the interests of other states in sentence 1 of article IX OST, environmental protection in the second sentence of article IX OST and demilitarization provisions can be found in article IV OST.

<sup>61</sup> See *Durner, Wolfgang*, Common Goods: Statusprinzipien von Umweltgütern im Völkerrecht (Völkerrecht und Außenpolitik: 58), Nomos Verlagsgesellschaft, Baden-Baden 2001, pp. 159-178.

<sup>62</sup> See *Marchisio, Sergio*, Article IX, in: *Hobe, Stephan/Schmidt-Tedd, Bernhard/Schrogl, Kai-Uwe (eds.)*, Cologne Commentary on Space Law, Volume I: Outer Space Treaty, Carl Heymanns, Cologne 2009, margin number 28, p. 176.

<sup>63</sup> See *Brunnée, Jutta*, Common Areas, Common Heritage, and Common Concern, in: *Bodansky, Daniel/Brunnée, Jutta/Hey, Ellen (eds.)*, The Oxford Handbook of International Environmental Law, Oxford University Press, New York 2007, p. 557.

## 4.2. Space Debris in View of Environmental Law

After having identified the relevant law in regard to the protection of the outer space environment, some crucial aspects concerning its applicability to space debris pollution shall be briefly outlined, in particular with regard to the second sentence of article IX OST. In this context, the decisive question is whether space debris can be regarded as a harmful contamination of outer space. In answering this question, two aspects need to be distinguished. First, it has to be clarified whether debris constitutes is a contamination at all. It was argued – with reference to the preparatory works of the Outer Space Treaty – that contamination in article IX OST only encompasses the introduction of biological and chemical substances into outer space.<sup>64</sup> However, the term should be construed in a broader way because there is reason to believe that the ordinary meaning of contamination is not limited in such a way but also covers the introduction of any object into outer space, including space debris.

Such contamination, however, has to qualify as “harmful” before article IX OST requires states to avoid this kind of pollution. This limitation can also be found in the customary no harm rule where it corresponds to the criterion of significance. Only significant environmental harm is prohibited by the rule. It would be unreasonable to qualify every piece of debris as a harmful contamination or a significant environmental harm. Every space activity involves the creation of space debris – be it slag resulting from the combustion of propellant, mission-related debris or the fact that every satellite becomes debris at the end of its lifetime.<sup>65</sup> Regarding debris pollution resulting from a “normal” space mission as harmful or significant would entail the stop of all such space activities. Another aspect to consider is that the current state of debris pollution, which without any doubt can be described as harmful or significant, was created over many years of space flight by many space missions that cumulated the present amount of

<sup>64</sup> See *Reynolds, Glenn H./Merges, Robert P. (eds.)*, Outer Space: Problems of Law and Policy, second edition, Westview Press, 1998, p. 209.

<sup>65</sup> See *de Faraminán Gilbert*, Space Debris: Technical and Legal Aspects, in: *Lafferranderie, Gabriel/Crowther, Daphné (eds.)*, Outlook on Space Law over the Next 30 Years: Essays Published for the 30th Anniversary of the Outer Space Treaty, Kluwer Law International, The Hague et al. 1997, p. 306.

debris.

However, this does not imply that the Outer Space Treaty is without any effect when it comes to the prevention of space debris. The provision to avoid harmful contamination must be seen in its systematic context and in view of its object and purpose. In general, article IX serves as a limitation to the principle of free use as contained in article I (2) OST. The purpose of this limitation is to preserve the character of outer space as an area that can be freely used by all, meaning that every state has to consider possible detrimental consequences its space activity could have on the activities of other states.<sup>66</sup> This holds also true with regard to space debris: When smaller amounts of debris finally add up to a massive pollution that poses a serious risk to the usability of outer space, such smaller amounts of debris must be regarded as a 'harmful contamination'. They, therefore, fall into the scope of sentence two of article IX OST.<sup>67</sup>

**Only the adoption of space debris mitigation measures ensures that the debris created in the course of space activities remains below the threshold of harmful contamination. As a consequence, article IX OST implies that states are obliged to apply space debris mitigation measures.**

The same provision requires states to adopt "appropriate measures" in order to prevent harmful contamination of outer space. This formulation might be regarded as unclear and leave much room for discretion to the states.<sup>68</sup> It could, nevertheless, be possible to argue that the obligation requires states to act with due diligence in accordance with generally accepted standards and best practices. In terms of space debris, there already exist such practices (namely space debris mitigation measures) that are considered effective to reduce the production of space debris and preserve the usability of outer space. Against this background, the debris resulting from space

missions that are subject to space debris mitigation measures should not be considered as a harmful contamination of outer space. The adoption of mitigation measures ensures that the pollution caused remains under the threshold of harmfulness. For that reason, it is possible to derive from the second sentence of article IX OST an obligation to implement appropriate debris mitigation measures.

The COPUOS Mitigation Guidelines, which could also be regarded as appropriate measures in terms of article IX, are not legally binding but only possess a voluntary character as explicitly stated by the UN General Assembly.<sup>69</sup> On the other hand, the lacking legal force of the COPUOS Mitigation Guidelines must not lead to the assumption that there is no legal obligation to avoid the creation of debris at all.<sup>70</sup>

## 5. The Principle of Common but Differentiated Responsibilities

### 5.1. The CBDR Principle as a Part of Sustainable Development

Since debris pollution is perceived as an environmental problem and the relevance of environmental law is well-founded, it should not surprise that the problem is also put in the context of sustainable development, a concept which encompasses the CBDR principle. The above mentioned references to this principle in COPUOS made clear that such reasoning is already in progress. In general terms, sustainable development can be described as an attempt to bring together economic development and environmental protection by taking a cross-generational perspective.<sup>71</sup> Without explicitly using the term, the balance between these two often conflicting objectives already played a role during the UN Conference on the Human Environment in Stockholm in 1972 and references to it can be found in Stockholm Declaration.<sup>72</sup> The so-called Brundtland Commission, which was established with the aim of advising the UN Secretary-General on the relationship between development and environment, published its report in 1987 that contains a definition that is

<sup>66</sup> See *Bittlinger*, in: *Böckstiegel, Karl-Heinz (ed.)*, Handbuch des Weltraumrechts, Carl Heymanns Verlag, Köln et al. 1991, pp. 120 and 122-123 and *Fischer*, in: *Ipsen, Knut (ed.)*, Völkerrecht, Verlag C.H. Beck, München 2004, § 56, margin number 69, p. 965.

<sup>67</sup> See, with the same result, *Marchisio*, Article IX, in: *Hobe /Schmidt-Tedd /Schrogl (eds.)*, op. cit. footnote 62, margin number 29, p. 177.

<sup>68</sup> See *Goh, Gérardine Meishan/Kazeminejad, Bobby*, Mars through the looking glass: an interdisciplinary analysis of forward and backward contamination, in: *Space Policy* (20, 3) 2004, p. 219.

<sup>69</sup> See UN doc. A/RES/62/217, para. 27.

<sup>70</sup> See *Hobe/Mey*, op. cit. footnote 29, p. 400.

<sup>71</sup> See *Birnie/Boyle*, op. cit. footnote 53, pp. 44-45.

<sup>72</sup> Principles 1, 8, 11, 21 and 23 of the Stockholm Declaration indicate that there already existed a holistic approach. See *United Nations Conference on the Human Environment, Declaration of the United Nations Conference on the Human Environment*, in: *International Legal Materials* (11, 6) 1972, pp. 1416-1421.

often quoted:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>73</sup>

Sustainable development was the central theme at the UN Conference on the Environment and Development in Rio 1992 where, besides the Rio Declaration<sup>74</sup>, five instruments were adopted that enshrine this concept, among them the UN Framework Convention on Climate Change<sup>75</sup>. The successor conference in Johannesburg in 2002 was also guided by this concept and sustainable development subsequently established as an important concept in international environmental law.<sup>76</sup> Notwithstanding its generality and, therefore, vagueness as regards its content, the character of the concept was described as a meta-principle that provides guidance for the development of further treaty law and the interpretation of legal norms.<sup>77</sup> With regard to the question of which principles exactly the sustainable development concept integrates, there is also no definite clarity. It is clear though that besides elements like the precautionary principle, inter- and intra-generational equity, the CBDR principle certainly belongs to this set of elements.<sup>78</sup>

**The relevance of international environmental law also entails the applicability of environmental principles to outer space activities, including the CBDR principle which belongs to the concept of sustainable development.**

<sup>73</sup> *World Commission on Environment and Development, Our Common Future*, Oxford University Press, New York 1987, p. 43.

<sup>74</sup> United Nations Conference on Environment and Development, *The Rio Declaration on Environment and Development*, in: *International Legal Materials* (31, 4) 1992, pp. 876-880.

<sup>75</sup> United Nations Framework Convention on Climate Change (1992), 1771 UNTS, pp. 164-321.

<sup>76</sup> An in-depth description of the evolution of the concept is provided by *Marong, Alhaji B.M.*, From Rio to Johannesburg: Reflections on the Role of International Legal Norms in Sustainable Development, in: *Georgetown International Environmental Law Review* (16, 1) 2003, pp. 25-28.

<sup>77</sup> See *Magraw, Daniel Barston/Hawke, Lisa D.*, Sustainable Development in: *Bodansky, Daniel/Brunnée, Jutta/Hey, Ellen (eds.)*, *The Oxford Handbook of International Environmental Law*, Oxford University Press, New York 2007, pp. 621 and 625.

<sup>78</sup> See *Marong*, op. cit. footnote 76, p. 60 and *Dunoff, Jeffrey L.*, From Green to Global: Toward the Transformation of International Environmental Law, in: *Harvard Environmental Law Review*, p. 292. In terms of the CBDR principle, the assumption is backed by the fact that a formulation of the principle is enshrined in Principle 7 of the Rio Declaration.

In order to understand the latter principle one has to consider that many environmental problems, on the one hand, affect all countries irrespective of how this problem emerged. On the other hand, industrialized countries have contributed to a far greater extent to these problems than developing countries and at the same time economically profited from the exploitation of the environment.<sup>79</sup> In handling environmental degradation, equitable burden-sharing between developed and developing states was proposed as a solution for balancing these inequalities.<sup>80</sup> The CBDR principle is stipulated in Principle 7 of the Rio Declaration:

“[...] In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technological and financial resources they command.”

As regards the consequences arising out of these differentiated responsibilities, there does not exist a define template that could be applied to any environmental problem. Different standards for environmental protection could be applied, first, by stronger commitments of industrialized states to alleviate the problem, also in view of their higher technological and financial capabilities. Second, it is also possible to establish delayed compliance commitments for developing states to fulfill environmental protection standards. Apart from setting higher or lower standards, a further possibility to implement the principle can be attained by enhancing cooperation between North and South and by transferring financial means or technology to developing countries.<sup>81</sup> The views concerning the legal status of the principle range from a crystallization into a customary rule due to gradual implementation by environmental treaty law, to denial of any legal relevance due to the lacking normative value of the principle.<sup>82</sup> Irrespective of the uncertainties involved, the principle is relevant for the problem of debris pollution.

<sup>79</sup> See *Epiney, Astrid/Scheyli, Martin*, *Strukturprinzipien des Umweltvölkerrechts* (Forum Umweltrecht: 29), Nomos-Verlagsgesellschaft, Baden-Baden 1998, p. 64.

<sup>80</sup> See *Magraw/Hawke*, op. cit. footnote 77, p. 649.

<sup>81</sup> See *Birnie/Boyle*, op. cit. footnote 53, pp. 101-103 and *Magraw/Hawke*, op. cit. footnote 77, p. 631.

<sup>82</sup> See *ibid.*, pp. 624-625.

## 5.2. Space Debris Pollution in View of the CBDR Principle

The reasoning of CBDR principle, indeed, seems to match the current situation as regards debris pollution of outer space, an environmental problem of global scale. Those states that only recently started space activities or that are just about to participate in human space flight, find a degree of environmental degradation for which they are not responsible but whose negative consequences they have to face. These consequences are perceived as a barrier to future space missions, which they might consider an essential part of their technological and economic development.

As to concrete consequences, a possible step towards achieving equity in terms of debris pollution would be that the states that have created the debris pollution over the past decades undertake efforts to clean up debris in outer space, for example by active debris removal. This solution would come up to the view expressed in COPUOS, namely that “mitigation of existing debris should take into consideration the principle of [CBDR]”<sup>83</sup>, whereas the creation of future debris should be prevented by adopting space debris mitigation measures.<sup>84</sup> At the same time, the financial burden for the alleviation of the debris problem would remain on the side of the developed states that are obviously more qualified to undertake debris removal missions than developing states. From a legal point of view, such removal activities entail the necessity to further consider certain legal implications. A piece of debris might be regarded as falling into the notion of a ‘space object’ which is, pursuant to article VIII OST, subject to jurisdiction and control of the state of registry. An uncoordinated removal of debris could, therefore, infringe on other states rights. Remediation activities should also be guided by the result of scientific research which recently pointed out that targeted removal of debris in specific orbital regions would be most appropriate.<sup>85</sup>

Establishing lower standards for developing countries, meaning that they partly or completely refrain from undertaking efforts to prevent the creation of debris, would definitely

<sup>83</sup> UN doc. A/AC.105/891, para. 27 and UN doc. A/AC.105/917, para. 19 (emphasis added).

<sup>84</sup> See *ibid.*

<sup>85</sup> See *Finkelman, David et al.*, Identifying Threatening Objects for Removal and Planning Missions and Architectures to Avoid Collision, Presentation at the International Conference on Orbital Debris Removal, Chantilly, VA, 8-10 December 2009.

be a wrong approach to the problem. As noted earlier, only the collective implementation of space debris mitigation by all spacefaring states guarantees the usability of outer space in the long-term. Non-compliance with this practice would be counterproductive, also in regard to the aims of the sustainable development concept itself. Besides the CBDR principle, sustainable development also comprises the principle of inter-generational equity<sup>86</sup> which cannot be attained when some states refrain from taking necessary action. Such a situation would lead to a further uncontrolled growth of the debris population and, consequently, increase the risk that future generations were deprived of the possibility to use outer space in a way that allows them to meet their needs. Non-compliance could also entail consequences in terms of liability. Article III of the Liability Convention<sup>87</sup> establishes fault liability for damages that are caused by a space object to another space object. If a piece of debris caused damage to a functional satellite, non-compliance with space debris mitigation measures could be interpreted as an indication of negligent conduct so that the state refraining from such measures may be held liable for the damage caused by its piece of debris.<sup>88</sup>

**While the space debris pollution constitutes a concern for all states, there are different responsibilities for the development as well as alleviation of the problem. At the same time, the CBDR principle must not impede the necessary adoption of space debris mitigation measures to all space activities.**

The transfer of financial or technological means to developing countries is also considered as one of the options to implement the CBDR principle, while such discussions always involve much controversy.<sup>89</sup> In the context of outer space, a similar debate has already taken place

<sup>86</sup> For further reading, see *Kiss, Alexandre*, The Rights and Interests of Future Generations and the Precautionary Principle, in: *Freestone, David/Hey, Ellen* (eds.), *The Precautionary Principle and International Law: The Challenge of Implementation* (International Environmental Law and Policy Series: 31), Kluwer Law International, The Hague et al. 1996.

<sup>87</sup> Convention on International Liability for Damage Caused by Space Objects (1972), 961 UNTS, pp. 187-195.

<sup>88</sup> See *Taylor, Michael W.*, Trashing the Solar System One Planet at a Time: Earth's Orbital Debris Problem, in: *Georgetown International Environmental Law Review* (20, 1) 2007, p. 19.

<sup>89</sup> See *Shelton, Dinah*, Equity, in: *Bodansky, Daniel/Brunnée, Jutta/Hey, Ellen* (eds.), *The Oxford Handbook of International Environmental Law*, Oxford University Press, New York 2007, p. 650.

in terms of the “Space Benefits” discussion in COPUOS. The existing gap in access to space science and technology between developed and developing countries and the resulting imbalance in attaining space benefits prompted developing states at the end of the 1980ies to bring their concerns to the LSC.<sup>90</sup> The agenda item, that was subsequently introduced,<sup>91</sup> aimed to promote the principle embodied in article I (1) OST, namely that the utilization of outer space “shall be carried out for the benefit and in the interest of all countries”.<sup>92</sup> After lengthy discussions which were dominated by the desire to push for cooperation and transfer of financial and technological resources from the North to the South on the one hand, and strong emphasis of the principle of free use on the other hand, the LSC was able to agree on a text of a declaration that was finally adopted by the UNGA in 1996.<sup>93</sup> The declaration, however, did not contribute to establish an obligatory regime of equitable sharing of benefits.<sup>94</sup> While cooperation in the utilization of outer space should consider “the need for technical assistance and rational and efficient allocation of financial and technical resources”<sup>95</sup>, states remain “free to determine all aspects of their participation in international cooperation”<sup>96</sup>.

The debate on space benefits was centered on a provision of the Outer Space Treaty and should, therefore, not be confused with the question of cooperation and technology transfer on the basis of the CBDR principle. However, the fact that comprehensive negotiations in the LSC on how to implement a treaty provision in the end did not result in the a stronger commitment to cooperation or even technology transfer, leaves one rather skeptical about the prospects of a re-opened distributive discussion – this time in the context of the common but differentiated responsibilities for space debris.

## 6. Conclusion

The discussion of the CBDR principle in COPUOS sharpens the perception of debris pollution as a form of environmental degradation and, thus, sheds light on the role of international environmental law in this context. More generally, the references to the principle might represent the starting point for a discussion in which the problem is tentatively taken out of a merely technical context and put into a broader perspective of international law. Such an approach appears to be necessary because issues like a possible codification of mitigation rules or liability for damages caused by space debris require legal consideration in order to strengthen the rule of law in outer space.

In terms of environmental law it was shown that the no harm rule and in particular the environmental protection provision of the Outer Space Treaty in article IX OST are applicable to debris pollution. The latter norm implies that states are obliged to adopt space debris mitigation measures because non-compliance with such measures leads to a harmful contamination of outer space. It could also be shown that the CBDR principle is relevant for the problem of space debris. Since no standardized pattern for the implementation of the principle exists, ways need to be sought that allow for alleviating the debris problem without impeding developing countries’ efforts to utilize space. The future remediation of the debris pollution by active removal of particular pieces of debris and the conveyance of best practices in terms of effective debris mitigation could indicate possible options for achieving this objective. Debates on the transfer of technology or financial means, however, have proved to be rather unproductive.

In any event, the principle must not be construed in a way that tempts states to refrain from mitigation measures. This would contradict the entire idea of sustainable development because it undermines efforts to halt the proliferation of space debris which puts at risk the future usability of outer space. Only collective action can reverse the trend of ongoing degradation of the outer space environment which is in the interest of all states – be it developing or developed.

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This “ESPI Perspective” is written in the sole opinion of the author and does not reflect nor is it intended to reflect the views of any organisation with which he is or has been affiliated.

<sup>90</sup> See UN doc. A/AC.105/430, para. 43.

<sup>91</sup> The agenda item was discussed in the LSC from 1989-1996 and was entitled “Consideration of the legal aspects related to the application of the principle that the exploration and utilization of outer space should be carried out for the benefit and in the interest of all States, taking into particular account the needs of developing countries”. See, for example, UN doc. A/AC.105/430, paras. 39-60.

<sup>92</sup> See *Jasentuliyana*, op. cit. footnote 39, p. 158.

<sup>93</sup> UN doc. A/RES/51/122, Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 13 December 1996 (Space Benefits Declaration)

<sup>94</sup> *Benkő, Marietta/Schrogl, Kai-Uwe*, The UN Committee on the Peaceful Uses of Outer Space: Adoption of a Declaration on “Space Benefits” and Other Recent Developments, in: *Zeitschrift für Luft- und Weltraumrecht* (46, 2) 1997, p. 233.

<sup>95</sup> Space Benefits Declaration, para. 5.

<sup>96</sup> Space Benefits Declaration, para. 2.



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