CONNECTING THE PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW TO SPACE ACTIVITIES

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As the awareness of the fragility of the Earth's environment and the exhaustibility of its resources increases around the globe, unavoidably also questions concerning the impact of space activities on that terrestrial environment and in a further step on the impact of our human activities on the outer space environment arise.

The legal appreciation of these environmental impacts of space activities needs to combine a number of different view points. This paper approaches the question under different angles: the interpretation of the basic public international space law provisions, starting from the general *sedes materiae* Article IX of the Outer Space Treaty, in the light of the developing international environmental law context will be discussed as well as the direct relevance of general environmental law and policy, such as the 1972 Stockholm Declaration, the 1992 Rio Declaration and the 1992 Convention on Biological Diversity to space activities. In addition, a short outlook will be given on the current development concerning specific instruments for certain aspects of space activities, their legal qualification and implementation by national regulations and governmental and space agencies' policies. Mention needs to be made in this context of the 1992 UN Principles relevant to the Use of Nuclear Power Sources in Outer Space, the 2009 UN Safety Framework for Nuclear Power Source Applications in Outer Space, the 2007 UN Space Debris Mitigation Guidelines and the 2002 (amended lastly 2008) COSPAR Planetary Protection Policy.

Connecting these different approaches and putting the respective developments into perspective will allow discerning the evolution in the focus of the international law-makers with regard to the environmental impact of the exploration and use of outer space. A concluding chapter will try to highlight possible underlying ethical considerations and also provide some considerations concerning possible future developments.

A. LAUNCHING THE REFLECTION: *LEGES SPECIALES*

Any consideration of public international law related to space activities needs to start with the cornerstone of public international space law, the 1967 Outer Space Treaty, OST[1]. *Sedes materiae* in the OST concerning the protection of the environment is Article IX, and more specifically its second sentence, which stipulates,

> *"States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extra-terrestrial material and, where necessary, shall adopt appropriate measures for this purpose."*

It is unclear why the provision specifically addresses studies and exploration, and not the broader "exploration and use" that is commonly used throughout the OST, and in the foregoing sentence of the Article. The provision remains vague leaving main terms on the factual side, like "harmful contamination" and "adverse changes", undefined and leaving the nature and extent of the "appropriate measures" to be adopted by the States Parties to the Treaty at their discretion. It is interesting to note in this context, that only in case a State Party has reason to believe that an activity or experiment planned by

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 610 U.N.T.S. 205

* The views expressed are purely personal and do not necessarily reflect the view of any entities with which the author may be affiliated.

itself or its nationals would cause potential *harmful interference with activities of other States Parties*, a first "appropriate measure" is spelt out in the following sentence of Article IX: In that case, the State Party concerned shall undertake appropriate international consultations before proceeding with any such activity or experiment. This is not foreseen for the "mere" harmful contamination of the outer space environment or the adverse changes in the environment of the Earth. The environmental integrity of outer space as such is not at the heart of this provision. The same Earth-oriented perspective can be found in the 1972 Liability Convention[2], which establishes a system of absolute liability to be applied in case of damage caused by a space object on the surface of the Earth or to aircraft in flight, and of fault-based liability if the damage is caused elsewhere than on the surface of the Earth to a space object or to persons or property on board such a space object of another launching State. Damage is defined for the purposes of the Convention as meaning "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 property of international intergovernmental organisations". This can also comprise environmental damage. However, international liability under the Liability Convention does not address any kind of environmental damage outside the surface of the Earth.

The 1979 Moon Agreement[3] negotiated in a time when environmental considerations had become a global concern, elaborates a bit more on the principles regarding the protection of the outer space environment. According to its Article 7.1

> *"In exploring and using the Moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties to the Treaty shall also take measures to avoid harmfully affecting the environment of the Earth through the introduction of extra-environmental matter or otherwise."*

For the first time in space law, the existing balance of the extra-terrestrial environment is thematised. The third paragraph of Article 7 of the Moon Agreement is also of interest in this context, since it foresees the possibility of zones of special protection being established on celestial bodies[4]. The potential establishment of these international preserves is mainly driven by scientific interest and not by the recognition of an intrinsic value of the extra-terrestrial environment as such. There is another novelty with regard to the principles of international environmental law and space law to be found in the Moon Agreement: the second sentence of its Article 4.1 stipulates that due regard shall be paid to the interests of present and future generations: The principle of intergenerational equity[5], which is part of the more general concept of sustainability, is evoked.

The fact, that the Moon Agreement has so far only been able to gather thirteen States Parties - as e.g. opposed to the 100 States Parties to the OST, does, however, shed a not too favourable light on the status of commitments contained in the Moon Agreement: they are binding on the thirteen States Parties only.

The finding that the specific rules of public international space law, as enshrined in the traditional space law instruments, the five UN space treaties, are neither very detailed nor far-reaching with regard to the protection of the outer space environment does not mean the end of the story. Even though the issue of environmental integrity of outer space was not at the centre of concerns of the authors of the five UN space treaties, the outer space environment benefits from later developments in general public international law.

B. THE BIGGER PICTURE: *LEGES GENERALES* BEYOND THE OST

Article III of the OST reaffirms that States Parties to the Treaty shall carry on activities in the exploration and use of outer space in accordance with international law. This, obviously, includes international environmental law. There are several aspects[6] of international environmental law that need to be taken into account when considering the

[2] Convention on International Liability for Damage Caused by Space Objects, 961 UNTS 187.
[3] Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 1363 UNTS 3.
[4] On the concepts of "planetary parks" see: *Gerda Horneck, Charles Cockell* Planetary Parks - Suggestion for a Targeted Planetary Protection Approach in the IAA 2010 Cosmic Study Protecting the Environment of Celestial Bodies, edited by *Mahulena Hofmann, Petra Rettberg, Mark Williamson*.
[5] See in more detail in section D.
[6] A comprehensive treatise can be found in *Lotta Viikari*, The Environmental Element in Space Law: Assessing the Present and Charting the Future, Leiden Boston 2008.

protection of the environment on Earth in the course of space activities as well as the environmental protection of outer space as such[7]:

According to Principle 21 of the 1972 Stockholm Declaration[8]

> *States have, in accordance with the Charter of the United Nations and the principles of international law, […] the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.*

Thus, the environment of outer space as one of the areas beyond the limits of national jurisdiction is directly protected by this principle. The United Nations General Assembly Resolution 2996 (XXVII) 1972 asserts that Principle 21 [and 22] of the Stockholm Declaration 'lay down the basic rules governing the matter'.[9] Principle 2 of the 1992 Rio Declaration[10] and Article 3 of the 1992 Convention on Biological Diversity[11] repeat the Principle. In its Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons the International Court of Justice affirmed that

> *"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 relating to the environment."*[12]

Taking one step beyond the concept of *sic utere tuo, ut alienum non laedas*,[13] States are obliged to exercise their taking advantage of the general freedom to explore and use outer space granted by Article OST while taking due regard not only for the rights of other States but also for the protection of the global environment. They have a continuing duty to take appropriate measures to prevent, minimize, and control the environmental harm potentially resulting from their space activities, whether these are carried on by governmental agencies or by non-governmental entities. This obligation is *erga omnes* in character, which means that any State may invoke the responsibility of another State failing to comply with its obligations and may claim from that responsible State the cessation of the internationally wrongful act, assurances and guarantees of non-repetition, and performance of the obligation of reparation in the interest of the beneficiaries of the obligation breached.[14]

This continuing duty to take appropriate measures to prevent, minimize, and control the potential environmental harm equals an obligation for States to act with due diligence. It is an obligation of conduct rather than of result. Such due diligence necessitates, first, the close monitoring of scientific knowledge, technological developments and standards and second, a prompt transposition of new scientific and technological findings into policies and rules applicable to public and private undertakings. In that manner internationally agreed guidelines or standards, as the UN Space Debris Mitigation Guidelines[15], the COSPAR Planetary Protection Policy[16] or the STSC/IAEA Safety Framework for Space Nuclear Power Source Applications[17], gain

[7] The fact that terrestrial space-related activities also have to comply with the general international law and the applicable national law aimed at the protection of the Earth's environment is self-evident. Specific international rules that are of particular relevance to these activities include e.g. the 1987 Montreal Protocol on Substances That Deplete the Ozone Layer, UKTS 19 (1990) Cm. 977 which constrains industry in its choice of substances used for a number of applications during the manufacturing process of space components.

[8] Declaration of the United Nations Conference on the Human Environment, adopted in Stockholm on 16 June 1972, 11 ILM 1416.

[9] 112 States voted in favour of this resolution, none opposed, the then Eastern Bloc States abstained on Res. 2996, but have supported subsequent treaties recognising the content of Principle 21.

[10] Declaration of the United Nations Conference on Environment and Development, adopted in Rio de Janeiro on 12 August 1992, 31 ILM 874.

[11] 31 ILM 818.

[12] Advisory Opinion of 8 July 1996, ICJ Reports (1996) 226, para 29.

[13] "Use what is yours in a way that you don't harm what is another's". Although rooted in property law, the sense of this maxim is easily transposed and generalised to the exercise of rights and freedoms.

[14] Article 48 of the 2001 ILC Articles on the Responsibility of States for Internationally Wrongful Acts, UN GAOR 56th session, supplement 10, UN DOC A/56/10 (2001).

[15] Adopted by the Scientific and Technical Subcommittee of the UN Committee on the Peaceful Uses of Outer Space at its 44th session in 2007, A/AC.105/890, para. 99, and endorsed by the General Assembly in its resolution 62/217 of 22 December 2007; http://www.unoosa.org/pdf/bst/COPUOS_SPACE_DEBRIS_MITIGATION_GUIDELINES.pdf. See below under C.II.

[16] The current version of the COSPAR Planetary Protection Policy, 20 October 2002, as amended to 24 March 2011, is available at: http://cosparhq.cnes.fr/Scistr/PPPolicy%20(24Mar2011).pdf. See below under C.I.

[17] UN DOC A/AC.105/934, United Nations Committee on the Peaceful Uses of Outer Space and IAEA, 2009; see *Leopold Summerer, Ulrike M. Bohlmann*, The STSC/IAEA Safety Framework for Space Nuclear Power Source Applications – Influence of non-binding recommendations, in: *Irmgard Marboe*, (ed.) 'Soft Law' in Outer Space. The

significance by providing an international benchmark. Therefore, even though these texts do not fall into the category of legally binding instruments, they may over time acquire customary force by virtue of the obligation of due diligence if international support is sufficiently wide-spread and representative.[18]

Principle 15 of the Rio Declaration elaborates further on the *precautionary approach*:

> *In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*

Thus, if there is enough scientific evidence to establish the *possibility* of a risk of serious harm, States cannot justify their lack of action with the absence of a *proof* of harm.[19]

C. ZOOMING IN ON SOME OF THE DETAILS

Three areas of concern may serve as examples for the implications of due diligence in the context of outer space activities:

I. Planetary Protection
II. Space Debris Mitigation
III. The use of Nuclear Power Sources in Outer Space.

I. Planetary Protection

The concept of protection against forward- and backward contamination that are also woven into Article IX 2nd sentence OST[20], has experienced another concretisation and implementation in the form of COSPAR's Planetary Protection Guidelines. COSPAR, the Committee on Space Research, was established in October 1958 by the International Council of Scientific Unions, ICSU. It is an interdisciplinary scientific committee concerned with scientific research and defines itself as a non-political organisation. Its activities with regard to scientific programmes have a consultative and co-ordinating character. COSPAR's Panel on Planetary Protection is concerned on the one hand with biological interchange in the conduct of solar system exploration, including possible effects of contamination of planets other than the Earth, and of planetary satellites within the solar system by terrestrial organisms; and contamination of the Earth by materials returned from outer space carrying potential extraterrestrial organisms on the other hand. COSPAR maintains and promulgates its planetary protection policy[21] for the reference of space-faring nations, both as an international standard on procedures to avoid organic constituent and biological contamination in space exploration, and to provide accepted guidelines to guide compliance with the wording of Article IX OST and other relevant international agreements. The policy bases itself on the policy statement by *DeVincenzi* et al. of 1983:

> *Although the existence of life elsewhere in the solar system may be unlikely, the conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized. In addition, the Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a*

Function of Non-Binding Norms in International Space Law, Vienna (forthcoming); See below under C.III.

[18] See for more details: *Patricia Birnie, Alan Boyle, Catherine Redgwell,* International Law and the Environment, 3rd ed., Oxford 2009, pp. 148.

[19] Magnitude and probability of harm are factors to be taken into account. See, also on the limited legal significance of the principle, *Patricia Birnie, Alan Boyle, Catherine Redgwell,* International Law and the Environment, 3rd ed., Oxford 2009, pp. 159; see also: *Paul B. Larsen,* Application of the precautionary principle to the Moon, in Journal of Air Law and Commerce, Spring 2006: 295.

[20] This concern finds its general international law equivalent in the 1992 Convention on Biological Diversity, 31 ILM 818 (1992), Article 8 (h) of which provides that

> *Each Contracting Party shall, as far as possible and as appropriate prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species*.

According to Article 4 of the Convention, its provisions apply, in relation to each Contracting Party, regardless of where the effects of activities occur, when carried out under the jurisdiction or control of a Contracting Party, within the area of its national jurisdiction or beyond the limits of national jurisdiction. Thus, it is also applicable to the outer space activities of Contracting Parties, which include with the exception of the United States of America, all space-faring nations.

[21] The current version of the COSPAR Planetary Protection Policy, 20 October 2002, as amended to 24 March 2011, is available at: http://cosparhq.cnes.fr/Scistr/PPPolicy%20(24Mar2011).pdf.

> *spacecraft returning from another planet. Therefore, for certain space mission/ target planet combinations, controls on contamination shall be imposed, in accordance with issuances implementing this policy.*

Five different categories are established for target body/mission type combinations and respective suggested ranges of requirements, based on the degree of interest they represent for the understanding of the process of chemical evolution or the origin of life. Rather precise technical procedural instructions are proposed for each possible combination. The policy remains flexible in that it can be updated fairly easily in order to adapt swiftly to new scientific insights and understanding.[22]

It is the established policy of the concerned space-faring nations to take into account the COSPAR Planetary Protection Guidelines in the definition of requirements for their missions. One prominent example is the NASA Policy Directive NPD 8020.7G[23], Biological Contamination Control for Outbound and Inbound Planetary Spacecraft, and its implementing procedures and guidelines contained in 8020.12D[24], Planetary Protection Provisions for Robotic Extraterrestrial Missions. NPD 8020.7G rephrases the COSPAR policy statement and adopts it as the basis for the NASA policy. NPG 8020.12D affirms that

> *the objectives of NASA's planetary protection policy, which is consistent with the policy and guidelines of the Committee on Space Research (COSPAR), shall be met at all times.*[25]

It implements the general policy in detail by listing the general planetary protection requirements applicable to the different categories of missions. The fact that NASA takes planetary protection issues very seriously is also illustrated by the provision that

> *NASA shall provide hardware, services, data, funding, and other resources to non-NASA missions […] only if the recipient organization(s), whether governmental or private entity, demonstrate adherence to appropriate policies, regulations, and laws regarding planetary protection that are generally consistent with the COSPAR Planetary Protection Policy and Guidelines.*[26]

The ESA Planetary Protection Policy[27] explicitly complies with the COSPAR Planetary Protection Policy and the corresponding implementation guidelines[28]. According to the ESA Policy

> *The assignment of planetary protection mission category and specific requirements imposed on a spaceflight mission shall be determined following receipt of multi-disciplinary scientific advice. The categorization and requirements shall take into account advice from internal and external advisory groups, most notably the COSPAR Planetary Protection Panel*[29].

and

> *Spaceflight missions carried out with any degree of ESA involvement shall comply with this policy and its associated requirements.*[30]

Although the quality of these policies and guidelines remains that of internal documents that do not give rise to internationally binding commitments directly, they may provide guidance in the assessment of international benchmarks on the required conditions of "due diligence".

II. Space Debris Mitigation

The number of non-functional man-made objects in Earth orbit is growing rapidly. According to the United States Space Surveillance Network, 4 765 launches and 251 on-orbit break-ups have led to 16 200 objects that have been catalogued.[31] 77% of these objects are in low Earth orbits, 6% are in near-geo stationary orbits, 10% in highly eccentric orbits

[22] E.g. for the recent changes incorporated at the 2008 COSPAR Assembly in Montréal, see: *Cassie Conley, Petra Rettberg*, COSPAR Planetary Protection Policy - Present Status, in the IAA 2010 Cosmic Study Protecting the Environment of Celestial Bodies, edited by *Mahulena Hofmann, Petra Rettberg, Mark Williamson,* pp 16.
[23] Revalidated 25 November 2008, Available at: http://nodis3.gsfc.nasa.gov/npg_img/N_PD_8020_007G_/N_PD_8020_007G__main.pdf.
[24] Effective Date: 20 April 2011, Available at: http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8020&s=12D.
[25] Chapter 1.3.1.
[26] Chapter 2.2.2.
[27] ESA/C(2007)143.
[28] Reference is made to its latest current version, Chapter 8.b of the policy.
[29] Chapter 4 of the policy.
[30] Chapter 2 of the policy.
[31] Status as of December 2010.

and 7% in other orbits, including GNSS orbits. 20% of the catalogued objects constitute satellites (of which only 6% are operational), 11% are rocket bodies, 5% figure as mission-related objects and 64% as fragments[32].

This environment causes an ever increasing collision hazard for man-made satellites. For this reason it was decided in 1993 to establish an Inter-Agency Space Debris Coordination Committee, IADC, an international governmental forum for the worldwide coordination of activities related to the issues of man-made and natural debris in space. According to its terms of reference[33]:

> *The primary purpose of the IADC is to exchange information on space debris research activities between member space agencies, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities and to identify debris mitigation options.*

Current members include ASI, CNES, CNSA, CSA, DLR, ESA, ISRO, JAXA, NASA, NSAU, ROSCOSMOS and the UK Space Agency. The IADC Space Debris Mitigation Guidelines[34] were formally adopted by consensus in October 2002 during the Second World Space Congress in Houston, Texas. They

> *describe existing practices that have been identified and evaluated for limiting the generation of space debris in the environment. The Guidelines cover the overall environmental impact of the missions with a focus on the following:*
> *(1) Limitation of debris released during normal operations*
> *(2) Minimisation of the potential for on-orbit break-ups*
> *(3) Post-mission disposal*
> *(4) Prevention of on-orbit collisions*[35].

The IADC presented its guidelines to the UNCOPUOS Scientific and Technical Subcommittee, STSC, where they served as a baseline for the development of the UN Space Debris Mitigation Guidelines. At its forty-fourth session, in 2007, the Subcommittee adopted these space debris mitigation guidelines[36], and in the same year, at its fiftieth session, the COPUOS Main Committee endorsed them[37]. In its resolution 62/217 of 22 December 2007, the General Assembly endorsed the Space Debris Mitigation Guidelines and agreed that the voluntary guidelines for the mitigation of space debris reflected the existing practices as developed by a number of national and international organizations, and invited Member States to implement those guidelines through relevant national mechanisms.

The document recognizes two broad categories of space debris mitigation measures: those that curtail the generation of potentially harmful space debris in the near term, i.e. the curtailment of the production of mission-related space debris and the avoidance of break-ups, and those that limit their generation over the longer term, i.e. end-of-life procedures that remove decommissioned spacecraft and launch vehicle orbital stages from regions populated by operational spacecraft.

The seven numbered guidelines remain very high-level:

1. Limit debris released during normal operations;
2. Minimize the potential for break-ups during operational phases;
3. Limit the probability of accidental collision in orbit;
4. Avoid intentional destruction and other harmful activities;
5. Minimize potential for post-mission break-ups resulting from stored energy;
6. Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low-Earth orbit region after the end of their mission;
7. Limit the long-term interference of spacecraft and launch vehicle orbital stages with geosynchronous region after the end of their mission.

The transformation in character that the guidelines experienced in their passage from IADC through to

[32] 41% before the FengYun 1C ASAT test on 11 January 2007 and the collision between Cosmos-2251 and Iridium 33 on 10 February 2009.
[33] Available at http://www.iadc-online.org/index.cgi?item=torp.
[34] Available in their current version, revision 1 of September 2007 at: http://www.iadc-online.org/index.cgi?item=docs_pub.
[35] Section 1 of the guidelines, see also *Nicholas L. Johnson,* Developments in space debris mitigation policy and practices, in: Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering, June 1, 2007; vol. 221, 6: pp. 907-909.
[36] UN doc A/AC.105/890, para. 99.
[37] UN doc A/62/20, paras. 118-119.

the UN system and the UN COPUOS specifically[38] can easily be attributed to the different composition of the fora, their different focus and scope. Whereas the IADC is an open association of technical entities of space-faring nations, the UN gathers the representatives of States, both space-faring and non-space-faring States. The patterns of motivations of the IADC members are far more homogeneous than the different positions of Member States of the UN COPUOS. The focus of IADC is very technical, whereas COPUOS is in addition more politically influenced, readily taking into account the positions of Member States in other debates. Therefore, it is not surprising that the IADC Guidelines go into much more technical detail than the UN Guidelines. Being more easily amendable, they can afford to. The UN guidelines make a clear reference to the version of the IADC space debris mitigation guidelines at the time of the publication of the UN Guidelines[39], but they also invite Member States and international organisations to

> *refer to the latest version of the IADC space debris mitigation guidelines and other supporting documents, which can be found on the IADC website, […] for more in-depth descriptions and recommendations pertaining to space debris mitigation measures.*[40]

From a legal perspective, both sets of guidelines are not binding under international law. Over the years there have been repeated attempts to bring the subject of space debris also on the agenda of the Legal Subcommittee of UNCOPUOS in one way or the other, so far without success.[41] Member States shy away from any legal discussion of the matter, a behavioural pattern that can also be observed with regard to other subject matters connected to aspects of sustainability and environmental impact of space activities[42]. Nevertheless, States and space agencies implement the guidelines, aware of the fact that this implementation serves their own interest in keeping the relevant orbits accessible and useable. However, the point at which they consider themselves ready to commit themselves internationally in exchange for the same commitment from other States seems not to have been reached so far.

For example, NASA has developed its Procedural Requirements (NPR) for Limiting Orbital Debris[43], which requires formal assessments and disposition plans. Although it states that

> *Compliance with this NPR meets the guidelines and intent of the following documents (as of the date of this NPR): the U.S. Government Orbital Debris Mitigation Standard Practices and the IADC-0201, Space Debris Mitigation Guidelines,*[44]

it is also very clear on its internationally non-binding character:

> *This NPR shall not be construed as conferring upon any international body, agency, or committee the right to place upon the U. S. Government or NASA any restrictions or conditions as to its space operations unless required by separate agreement or treaty.*[45]

The NPR comes accompanied by the NASA technical standard Process for Limiting Orbital Debris[46], which is approved for use by NASA Headquarters and NASA Centres and may be applied on contracts for spacecraft, instrument.

ESA's Administrative Instruction on Space Debris Mitigation for Agency Projects[47] translates the guidelines of both the IADC and the UN COPUOS into requirements that are applicable standards for all

[38] Interesting to note in this context also the recommendation of another UN entity: the ITU in its Recommendation ITU-R S.1003-2 (12/2010) *Environmental protection of the geostationary-satellite orbit*, embraces the IADC guidelines concerning GSO spacecraft disposal.

[39] As contained in the annex to UN document A/AC.105/C.1/L.260.

[40] Chapter 6 of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space.

[41] The latest in the form of a Working Paper submitted by the Czech Republic to the Legal Subcommittee of UN COPUOS proposing as a new agenda item of the Legal Subcommittee the 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, UN document A/AC.105/C.2/L.283. This initiative gained support from quite a number of other Member States but could not secure the required consensus in order to give rise to a new agenda item.

[42] Having regard to the fact that the agenda item on the long-term sustainability of space activities in the UN COPUOS are currently planned to be carried out exclusively under the auspices of the Scientific and Technical Subcommittee.

[43] NPR 8715.6A Effective Date: May 14, 2009 Expiration Date: May 14, 2014, available at http://nodis3.gsfc.nasa.gov/npg_img/N_PR_8715_006A_/N_PR_8715_006A_.pdf

[44] Chapter 1.1.3.

[45] Chapter P.1.7.

[46] NASA-STD-8719.14 (with Change 4) of 14 September 2009, available at http://www.hq.nasa.gov/office/codeq/doctree/871914.pdf.

[47] ESA/ADMIN/IPOL(2008)2 Annex 1, effective as of 1 April 2008.

ESA procurements of space systems, such as new launchers, satellites and inhabited objects and of launch services for ESA programmes. The Space Debris Mitigation Policy is an "applicable document" for all new ESA space projects and has as such an effect on the statements of work, management requirements and operational requirements and becomes part of the contractual baseline in the Agency's invitations to tender and requests for quotation of any space project.

Space Debris and their cascading effects have been identified as one of the greatest challenges for the long-term sustainability of space activities. Still, the existing international texts as presented above can be characterised as "soft law"[48] at best. By implementing the guidelines contained in these soft-law-instruments via national or agency policies, policy-makers might, however, contribute to the formation of a due-diligence-standard if international practice is sufficiently wide-spread and representative.

III. The use of Nuclear Power Sources

The risks associated with the use of nuclear power sources, NPS, led to the adoption of the 1992 "UN Principles Relevant to the Use of Nuclear Power Sources in Outer Space"[49]. Although they do not create binding commitments under public international law, the Principles do provide some guidance.[50] The preamble of the Principles already recognizes that for some missions in outer space NPS are particularly suited or even essential due to their particular qualities. The first paragraph of Principle 3, contains the general provision that

> *In order to minimize the quantity of radioactive material in space and the risks involved, the use of nuclear power sources in outer space shall be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way.*

What factors to take into account and how to weigh them for establishing reasonableness is left to discretion. Particularly interesting about Principle 3 Section 1, which lays down general goals for radiation protection and nuclear safety, is the fact that it requires not only that individuals, populations and the biosphere be protected against radiological hazards in operational and accidental circumstances, but also that

> *the design and use of NPS shall ensure with high reliability that radioactive material does not cause a significant contamination of outer space.*

Sections 2 and 3 of Principle 3 then establish specific guidelines for the use of nuclear reactors on the one hand and radio-isotope generators on the other hand. Principle 4 stipulates that a launching State has to ensure that a thorough and comprehensive safety assessment is conducted, the results of which shall be made publicly available prior to each launch. Furthermore, the Principles contain provisions as to the notification in case of re-entry of satellites with nuclear power sources on board, Principle 5.[51]

The main objective of the 2009 Safety Framework for Nuclear Power Source Applications in Outer Space[52] is to

> *protect people and the environment in Earth's biosphere from potential hazards associated with relevant launch, operation and end-of-service phases of space nuclear power source applications.*

[48] On that notion, see *Steven Freeland*, The Role of 'Soft Law' in Public International Law and its Relevance to the International Legal Regulation of Outer Space, in: *Irmgard Marboe (ed.)*, 'Soft Law' in Outer Space - The Function of Non-Binding Norms in International Space Law, Vienna (forthcoming).

[49] UNGA Res. 47/68 of 14 December 1992.

[50] For a comprehensive analysis of the Principles and their legal significance see: *Daniel A. Porras*, The United Nations Principles Relevant to the Use of Nuclear Power Sources in Outer Space: the significance of a soft law instrument after nearly 20 years in force, in: *Irmgard Marboe (ed.)*, 'Soft Law' in Outer Space - The Function of Non-Binding Norms in International Space Law, Vienna (forthcoming). For a general overview of international law regarding nuclear energy, see: *Mohamed Elbaradei, Edwin Nwogugu, John Rames*, International law and nuclear energy: overview of the legal framework, available at: http://ecolu-info.unige.ch/colloques/Chernobyl/pages/Opelz.html, where the authors sketch the picture of a mix of legally binding rules and agreements on the one hand and advisory standards and regulations on the other hand.

[51] Principle 5 builds on the stipulations of the 1986 Convention on Early Notification of a Nuclear Accident, INFCIRC/335. This duty to inform "States concerned" and the UN Secretary general is supplemented by the 1987 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, INFCIRC/336; very detailed on the relationship between the NPS Principles and the Convention, see *Marietta Benkö*, Nuklearenergie im Weltraum, in: *Karl-Heinz Böckstiegel* (ed.) Handbuch des Weltraumrechts, Köln, Berlin, Bonn, München 1991, pp. 457, 475.

[52] UN DOC A/AC.105/934, United Nations Committee on the Peaceful Uses of Outer Space and IAEA, 2009; see *Leopold Summerer, Ulrike M. Bohlmann*, The STSC/IAEA Safety Framework for Space Nuclear Power Source Applications – Influence of non-binding recommendations, in: *Irmgard Marboe (ed.)*, 'Soft Law' in Outer Space - The Function of Non-Binding Norms in International Space Law, Vienna (forthcoming).

Neither the extra-terrestrial environment nor humans in outer space are included in the scope of protection.

The international safety framework defines a space nuclear power source as

> *a device that uses radioisotopes or a nuclear reactor for electrical power generation, heating or propulsion in a space application.*

By not making any reference to current designs nor type of uses, this definition substantially enlarges the scope of the framework in comparison to the scope of the 1992 Principles, which address only applications for electricity generation

> *generally comparable to those of systems used and missions performed at the time of the adoption of the Principles*.[53]

The Safety Framework is intended to provide technical guidance. In its preface it is explicitly stated that it is not legally binding under international law and that it is not a publication in the IAEA Safety Standards Series with the corresponding legal implications[54], but intended to complement the Safety Standards with appropriate guidance concerning the particular aspects resulting from the specific characteristics of space NPS applications in comparison to NPS applications on Earth. It is a model framework that represents the state of the art in the use of NPS applications in outer space, and transposes this state of the art into "guidance": guidance for government, management and technical guidance. The guidance for governments and relevant international intergovernmental organisations that authorise, approve or conduct space NPS missions addresses regulatory aspects, namely the establishment of and ensuring compliance with safety policies, requirements and processes, the verification of the justification for the use of a NPS and the establishment of a dedicated, supplementary nuclear launch authorisation process, but also direct governmental activities, namely the preparation for emergency preparedness and response. The guidance for management section addresses all organisations involved with NPS space applications. The technical guidance provided for in the safety framework relates to design, development and mission phases of space NPS applications and encompasses key areas for developing and providing a technical basis for authorisation and approval processes as well as for emergency preparedness and response.

Even though, neither the Principles nor the Safety Framework give rise to binding commitments, voluntary compliance with their guidance they provide seems advisable, since it assures that space activities involving the use of NPS are carried out 'state of the art', thereby fulfilling a due diligence requirement.

D. SHIFTING THE FOCUS

Much of the ethical background to the developments presented here stems from considerations related to the general idea of sustainable development as reflected in Principle 3 of the Rio Declaration. Sustainable development stands for the integration of environmental protection with economic development and encompasses aspects of equity[55] between peoples as well as intergenerational equity. Whereas the first aspect finds a root in the very first paragraph of Article I of the OST, the concept of intergenerational equity makes its first outer-space-specific appearance only in Article 7.1 of the Moon Agreement, event though reflections on the concept can historically be found in a number of different cultural circles all around the globe[56]. According to

[53] Paragraph 6 of the Preamble of the 1992 Principles.

[54] According to Article III.A.6. of its Statute, the IAEA is authorized to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the UN and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy; see *Hans Blix*, The role of the IAEA in the Development of International Law, 58 Nordic Journal of International Law (1989) pp. 231.

[55] Here in the sense of fairness in distribution.

[56] See *Edith Brown Weiss*, Intergenerational equity: a legal framework for global environmental change, in: *Edith Brown Weiss (ed.)*, Environmental change and international law: New challenges and dimensions. United Nations University, 1992, who identifies mainly three different approaches to defining intergenerational equity:

- the preservationist one, where the present generation does not destroy or deplete resources or significantly alter anything, preserves same level of quality in all aspects of the environment;
- the Calvinist or Stalinist one, where today is sacrificed for the future;
- the approach of opulence, where the present generation consumes all that it wants today and

the 1987 Brundtland Report[57], sustainable development is

> *a process that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The conservation of options, of quality and of access is thematised. The spreading awareness of the limitedness of resources contributes to the further application of these concepts to the developments in the legal assessment also of space activities. Examples can be found in such different texts as the in the Art. 44 II of the ITU Constitution[58] and the UN Space Debris Mitigation Guidelines.[59]

New non-anthropocentric developments in international environmental law, such as the recognition of biodiversity as a non-renewable resource in itself, that is valuable for its naturalness as such[60] or the 1991 Protocol to the Antarctic Treaty on Environmental Protection[61] designating Antarctica a Special Conservation Area and acknowledging its intrinsic value, including its wilderness and aesthetic values, reveal the growing recognition of intrinsic values as opposed to the more anthropocentric and utilitarian approach of earlier days. First voices are being heard for the adoption of a holistic approach that also embraces the protection of the lifeless universe[62]. A method to balance and safeguard the legitimate interests of all will need to be found sooner rather than later in light of the on-going technological developments. The intricate situation depicted above navigating between different layers of legal intensity ranging from Treaty Law and customary international law to technical guidelines, and intertwined categories of classical international space law and environmental law announces this task difficult, whereas the currently prevailing trend in international space law away from binding commitments to more informal soft-law settings[63] can be expected to remain valid for the environmental law aspects of space law as well.

> generates as much wealth as it can, either because there is no certainty that future generations will indeed exist or because a maximum consumption is understood to economically lead to a maximum wealth for future generations.

[57] Report of the World Commission on Environment and Development: Our Common Future Transmitted to the General Assembly as an Annex to UN document A/42/427 Development and International Co-operation: Environment.

[58] Article 44 II of the Constitution of the International Telecommunication Union, as amended, reads:

> *In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.*

[59] See above under C.II

[60] See the 1992 Convention on Biological Diversity 31 ILM 818 (1992).

[61] See *Margaret S. Race*, Policies for Scientific Exploration and Environmental Protection : Comparison of the Antarctic and Outer Space Treaties, in : *Paul Arthur Berkman, Michael A. Lang, David W. H. Walton, Oran R. Young (eds.)*, Science Diplomacy: Antarctica, Science and the governance of international space, Washington 2011, pp. 143-152.

[62] See e.g. *Ivan Almár,* New Concepts for an Advanced Planetary Protection Policy, in: the IAA 2010 Cosmic Study Protecting the Environment of Celestial Bodies, edited by *Mahulena Hofmann, Petra Rettberg, Mark Williamson,* pp 26; *Ivan Almár,* Protection of the lifeless environment in the solar system, IISL 2002, p 438; *Lotta Viikari*, The Environmental Element in Space Law: Assessing the Present and Charting the Future, Leiden, Boston 2008.

[63] See *Irmgard Marboe (ed.)*, 'Soft Law' in Outer Space - The Function of Non-Binding Norms in International Space Law, Vienna (forthcoming).