PLANETARY PROTECTION IN PUBLIC INTERNATIONAL LAW*

*Dr. jur. Ulrike M. Bohlmann***
European Space Agency, Legal Department,
8-10, rue Mario Nikis, 75038 Paris Cedex 15, France,
Tel. +33 (0) 1 53 69 72 79, Fax +33 (0) 1 53 69 76 71,
Ulrike.Bohlmann@esa.int

Abstract

More and more exciting missions are planned or are already on their way to explore our solar system. One of the driving forces behind these missions is the desire to search for life beyond the Earth. Basic ethical considerations lead to the conviction that the protection of the space environment including these potentially existing forms of life is a goal in itself. More specifically and from a more practical point of view, it is essential to prevent the contamination of celestial bodies with Earth organisms that might be taken there by scientific missions. This paper aims at giving an overview over the existing international rules relevant to the subject of planetary protection and their legal value. Furthermore, some recommendations as to possible future developments, especially in the European and international context, are elaborated.

I. Introduction

On 2nd June 2003, ESA launched the Mars Express spacecraft, Europe's first space-craft to the Red Planet. It carries seven instruments that perform remote sensing of Mars and a lander, Beagle 2, which will perform in-situ investigations of the surface, using geo-chemical, exobiological, and atmospheric parameters. Mars Express is also designed to look for signs of past or present life.

The question what Mars Express is going to find, inspires imagination. If it is going to find traces of life, questions emerge as to where this life might come from - whether it is Martian life or Terrestrial contamination left by earlier visitors - what the characteristics of this life might be, and to what kind of protection it might be entitled.

More generally, in a time where the number of missions that are planned in carried out to study our solar system increases constantly and where sample return mission become conceivable, the issue of environmental aspects of these space activities, the protection of the environment of our solar system comes to the forefront of concern. This concern has been conceptualised under the catchword of "planetary protection".

** The views expressed are purely personal and do not necessarily reflect those of the European Space Agency.

In essence, the notion of planetary protection, as it is currently understood and as it is also at the basis of this paper, is the activity that seeks to prevent the biological cross contamination of solar system bodies, especially those that may (or do) harbour living entities[2]. Thus, it has a two-fold orientation: it encompasses protection against forward contamination, e.g. the contamination of the extra-terrestrial environment with terrestrial organisms, and protection against backward contamination, e.g. the contamination of the Earth by extra-terrestrial organisms.

II. The current legal framework with regard to planetary protection

Several sets of legal instruments, several sources and guidelines may be cited in connection with the subject matter: The classical outer space law as incorporated in the international space law treaties has its' role to play as well as the planetary protection guidelines developed by COSPAR, national policies based thereupon or also the more general international environmental law.

1. Relevant provisions of the Outer Space Treaty

The most important provision of the Outer Space Treaty, OST,[3] in this context is the second sentence of Article IX, 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."

Since the main terms, like "harmful contamination" and "adverse changes", are not defined, the factual side of the provision remains rather ambiguous. Furthermore, the nature and extent of the "appropriate measures" to be adopted by the States Parties to the Treaty remain at the sole discretion of the respective Party. Hence, the provision heavily lacks specificity. It is not self-executing, but requires additional rule making. Its effect as such is minimal[4]. This becomes even more evident, when having a look at the following sentence of Article IX: "If a State Party has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potential harmful interference with activities of other States Parties in the exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment." Accordingly, it is only in case of potential harmful interference with activities of other States that States Parties shall undertake consultations. The issue of environmental integrity of outer space on the other hand has not been considered important enough to endow it with even this quite weak protection of "undertaking

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2 United Nations, Highlights in Space 2001, p. 140. "Solar system bodies" can be defined as all the celestial bodies physically located in our solar system. Celestial bodies in a legal sense are commonly understood to be all natural objects in Outer Space, including their eventual gaseous coronas, see for example: *W. v. Kries/ B. Schmidt-Tedd/ K.-U. Schrogl*, Grundzüge des Raumfahrtrechts – Rahmenbestimmungen und Anwendungsgebiete, 2002, p. 17.

3 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, opened for signature 27 January 1966, entered into force 10 October 1967, 610 United Nations Treaty Series (UNTS) 205.

4 See also *A. McCloud*, Space Pollution, in: IISL 1987, pp 142, 143.

appropriate international consultations" as foreseen by Article IX 3rd sentence.[5]

2. Relevant Provisions of the Liability Convention

Article II of the Liability Convention[6] stipulates, "A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft in flight." Article III goes on to stipulate "In the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching State or to persons or property on board such a space object of another launching State, the latter shall be liable only if damage is due to its fault or the fault of persons for who, it is responsible."

Thus, should a space object cause damage, which in Article I (a) of the Convention is defined as meaning for the purposes of the Convention "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", on the surface of the Earth a victim State Party to the Convention does not have to prove fault, the launching State is absolutely liable. This also comprises damage caused by the introduction of extra-terrestrial material, so-called back-contamination. However, international liability under the Liability Convention does not address any kind of environmental damage outside of the Earth.

3. Relevant provisions of the Moon Treaty

The Moon Treaty[7], the provisions of which also apply to other celestial bodies within the solar system other than the Earth, and the respective orbits or trajectories around them, elaborates a bit more on the principles regarding the protection of the extra-terrestrial environment. This is probably also due to the period in which it was written. In the late 1970s, environmental considerations were becoming a global concern.

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." Thus, issues of forward and

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5 *Reijnen* argues that it is more the spirit of the OST, as articulated in its Article I stipulating that, the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, and not the wording of its actual provisions that forms the basis for the protection of outer space against contamination, since the major benefits and interests are best served by an unpolluted outer space (*G.C.M. Reijnen*, Environmental Pollution of Outer Space, in particular of the geo-stationary orbit, in: IISL 1987, pp. 155). Given the fact that also Article I OST was not intended to specifically protect the environmental integrity of outer space (See also *P.M. Sterns, L.I. Tennen*, Principles of Protection of the Outer Space Environment in the Corpus Iuris Spatialis, in: IISL 1987, pp.172), this argumentation seems too far-reaching. In any case, we can state that the primary objective of protection of these provisions of the OST is the human exploration and use of outer space, human space activities and not an intrinsic value of the outer space environment.

6 Convention on International Liability for Damage Caused by Space Objects, opened for signature 29 March 1972, entered into force 1 September 1972, 961 UNTS 187.

7 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, opened for signature 18 December 1979, entered into force 11 July 1984, 1363 UNTS 3.

backward contamination are addressed, but once again, we can state with *Williamson*[8], that there is good intention, but unfortunately, the definitions are missing. Anyway, we can assert as already elaborated by *P.M. Sterns and L.I. Tennen*[9] that the language of the Moon Treaty clarifies, that harmful contamination is but one means of disruption of the natural environment of celestial bodies. For the first time in space law, the existing balance of the extra-terrestrial environment becomes the focus.

The third paragraph of Article 7 of the Moon Treaty is also of interest in this context. It stipulates "States Parties shall report to other States Parties and to the Secretary-General concerning areas of the Moon having a special scientific interest in order that, without prejudice to the rights of other States Parties, consideration may be given to the designation of such areas as international scientific preserves, for which special protective arrangements are to be agreed upon in consultation with the competent bodies of the United Nations." This provision is quite interesting, since it foresees the possibility – even though not mandatory – to establish zones of special protection on celestial bodies, but once again, the potential establishment of these international preserves is driven by scientific interest only and not by the recognition of an intrinsic value of the extra-terrestrial environment as such.

Another novelty with regard to the principles of international environmental law and space law can be found in the Moon Treaty: the second sentence of its Article 4.1 which stipulates "Due regard shall be paid to the interests of present and future generations [...]" evokes for the first time in the - admittedly short - history of space law the principle of intergenerational equity, which is part of the more general concept of sustainability.

The last provision of the Moon Treaty, we want to mention in this paper is Article 5.3, which formulates: "In carrying out activities under this Agreement, States Parties shall promptly inform the Secretary General, as well as the public and the international scientific community, of any phenomena they discover in outer space, including the Moon, which could endanger human life or health, as well as any indication of organic life." The most interesting aspect of this provision is the fact that States Parties are not only obliged to inform the other State Parties and the Secretary General but also the public and the international scientific community.

However, since the Moon Treaty has received only ten ratifications and five additional signatures[10], its force and value is – contrary to the Outer Space Treaty and the Liability Convention[11] - rather limited; no customary value can be attributed to its regulations and it is only binding upon its States Parties.

4. The COSPAR Planetary Protection Policy

COSPAR, the Committee on Space Research, was established in October 1958 by the International Council of Scientific Unions, ICSU, to continue the co-operative

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8 *M. Williamson*, Protection of the Space Environment under the Outer Space Treaty, IISL 1997, pp 296.

9 *P.M. Sterns, L.I. Tennen*, Principles of Protection of the Outer Space Environment in the Corpus Iuris Spatialis, in: IISL 1987, pp.172.

10 Status as of 1 January 2003, A/AC.105/C.2/ 2003/CRP.5.

11 The Outer Space Treaty has been ratified by 98 States, and signed by an additional 27, Status as of 1 January 2003, A/AC.105/C.2/ 2003/CRP.5, it is regarded as having a universal customary value; The same applies to the Liability Convention, that has been ratified by 82 States, signed by an additional 25 States and the rights and obligations of which have been accepted by two international organisations, Status as of 1 January 2003, A/AC.105/C.2/ 2003/CRP.5.

programmes of rocket and satellite research undertaken during the International Geophysical Year (1957 – 1958). COSPAR's objectives are to promote on an international level scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research. 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 coordinating character.

COSPAR's Panel on Planetary Protection is concerned 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, on the one hand, and contamination of the Earth by materials returned from outer space carrying potential extraterrestrial organisms, on the other hand. The primary objectives of the Panel within COSPAR are to develop, maintain, and promulgate planetary protection knowledge and policy, and plan to prevent the harmful effects of such contamination, and through symposia, workshops, and topical meetings at COSPAR Assemblies to provide an international forum for exchange of information in this area.

At the second session of its 34th meeting, the COSPAR Council adopted a revised and consolidated planetary protection policy[12]. In addition to providing specific guidelines, the policy recommends that COSPAR members provide information to COSPAR within a reasonable time not to exceed six months after launch about the procedures and computations used for planetary protection for each flight and again within one year after the end of a solar-system exploration mission about the areas of the target(s) which may have been subject to contamination.

The COSPAR Planetary Protection Policy is intended 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 in this area to guide compliance with the wording of this UN Space Treaty and other relevant international agreements. It 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 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."

This new Planetary Protection Policy develops further the direction already taken by COSPAR in 1964, when the approach of absolute pre-launch sterilisation proved to be unobtainable and, consequently, a policy of probabilistic avoidance of contamination was adopted.[13]

The five categories for target body/mission type combinations and their respective suggested ranges of requirements are the following:

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[12] The text of this policy can be downloaded at: <http://www.cosparhq.org/scistr/PPPPolicy.htm>

[13] For additional information, see: *G. Schwehm* Planetary Protection in: *K. H. Böckstiegel* (ed.) Environmental Aspects of Activities in Outer Space – Proceedings of an international colloquium, Cologne May, 16 – 19, 1988, pp 61.

Category I includes any mission to a target body, which is not of direct interest for understanding the process of chemical evolution or the origin of life. No protection of such bodies is warranted and no planetary protection requirements are imposed by the COSPAR Planetary Protection Policy.

Category II missions comprise all types of missions to those target bodies where there is significant interest relative to the process of chemical evolution and the origin of life, but where there is only a remote chance that contamination carried by a spacecraft could jeopardize future exploration. The requirements are for simple documentation only. Preparation of a short planetary protection plan is required for these flight projects primarily to outline intended or potential impact targets, brief Pre- and Post-launch analyses detailing impact strategies, and a Post-encounter and End-of-Mission Report which will provide the location of impact if such an event occurs. Solar system bodies considered to be classified as Category II are listed in the Appendix to the COSPAR Planetary Protection Policy, and include Comets, Carbonaceous Chondrite Asteroids, Jupiter, Saturn, Uranus, Neptune, Pluto/ Charon and Kuiper-Belt Objects.

Category III missions comprise certain types of missions (mostly flyby and orbiter) to a target body of chemical evolution and/or origin of life interest or for which scientific opinion provides a significant chance of contamination, which could jeopardize a future biological experiment. Requirements will consist of documentation (more involved than Category II) and some implementing procedures, including trajectory biasing, the use of cleanrooms during spacecraft assembly and testing, and possibly bioburden reduction. Although no impact is intended for Category III missions, an inventory of bulk constituent organics is required if the probability of impact is significant. Category III specifications for selected solar system bodies are set forth in the Appendix to this document. Solar system bodies considered to be classified as Category III also are listed in the Appendix to the COSPAR Planetary Protection Policy and include Mars and Europa.

Category IV missions comprise certain types of missions (mostly probe and lander) to a target body of chemical evolution and/or origin of life interest or for which scientific opinion provides a significant chance of contamination, which could jeopardize future biological experiments. Requirements imposed include rather detailed documentation (more involved than Category III), including a bioassay to enumerate the bioburden, a probability of contamination analysis, an inventory of the bulk constituent organics and an increased number of implementing procedures. The implementing procedures required may include trajectory biasing, cleanrooms, bioload reduction, possible partial sterilization of the direct contact hardware and a bioshield for that hardware. Generally, the requirements and compliance are similar to Viking, with the exception of complete lander/probe sterilisation. Category IV specifications for selected solar system bodies are set forth in the Appendix to the COSPAR Planetary Protection Policy. Solar system bodies considered to be classified as Category IV also are listed in the Appendix and include Mars and Europa.

Category V missions comprise all Earth-return missions. The concern for these missions is the protection of the terrestrial system, the Earth and the Moon. (The Moon must be protected from back contamination to retain freedom from planetary protection requirements on Earth-Moon travel.) For solar system bodies deemed by scientific opinion to have no indigenous life forms, a subcategory "unrestricted Earth return" is defined. Missions in this subcategory have

planetary protection requirements on the outbound phase only, corresponding to the category of that phase (typically Category I or II). For all other Category V missions, in a subcategory defined as "restricted Earth return," – including Mars and Europa - the highest degree of concern is expressed by the absolute prohibition of destructive impact upon return, the need for containment throughout the return phase of all returned hardware which directly contacted the target body or unsterilised material from the body, and the need for containment of any unsterilised sample collected and returned to Earth. Post-mission, there is a need to conduct timely analyses of the unsterilised sample collected and returned to Earth, under strict containment, and using the most sensitive techniques. If any sign of the existence of a nonterrestrial replicating entity is found, the returned sample must remain contained unless treated by an effective sterilising procedure. Category V concerns are reflected in requirements that encompass those of Category IV plus a continuing monitoring of project activities, studies and research (i.e., in sterilisation procedures and containment techniques).

Obviously, the COSPAR Planetary Protection Policy is a very consistent and highly developed system of recommendations by an independent and international body of scientists with a high reputation in the field. However, COSPAR is a non-government organisation that is not endowed with institutionalised authority and although it is the continuous policy of many actors in the space field to comply with COSPAR's recommendations, these are not legally binding but their quality amounts more to a moral kind of obligation.

Another quality of the COSPAR Planetary Protection Policy is that, by the setting of standards, it influences the national planetary protection policies. The most prominent example is probably the NASA Policy Directive NPD 8020.7E, Biological Contamination Control for Outbound and Inbound Planetary Spacecraft[14], and its implementing procedures and guidelines contained in 8020.12B, Planetary Protection Provisions for Robotic Extraterrestrial Missions[15].

NPD 8020.7E rephrases the above-cited COSPAR policy statement and adopts it as the basis for the NASA policy. NPG 8020.12B implements this policy in detail by listing the general planetary protection requirements applicable to the different categories of missions and goes on to affirm that specific requirements will be determined by the NASA Planetary Protection Officer in accordance with NPG 8020.12B and under the NASA accepted policy guidelines of COSPAR and in consultation with the Space Studies Board of the National Research Council. The very detailed and elaborated NASA Planetary Protection Guidelines are intended to apply not only to NASA missions but also to the flight of NASA instruments or experiments on non-NASA spacecrafts. However, the quality of these policies and guidelines remains that of a national, internal document that is not binding internationally. According to the NASA Planetary Protection Officer, *J. Rummel*, the policy is based on the desire to preserve extraterrestrial environments for the science opportunities[16].

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14 The text can be downloaded at: <http://planpro.jpl.nasa.gov/npd80207.html>.

15 The text can be downloaded at: < http://nodis3.gsfc.nasa.gov/library/displayAll.cfm?Internal_ID=N_PG_8020_012B_&page_name=all>.

16 Cited after *L. Woodmansee*, If Life exists on Mars, our robotic probes may have brought it there, <http://www.spacedaily.com/news/life-01zg1.html >; See also *J. Rummel*, Planetary exploration in the time of astrobiology: Protecting against biological contamination, in: Proceedings of the National Academy of Sciences, available at: <http://www.pnas.org>.

5. International Environmental Law

When addressing international environmental law, the most prominent texts to cite are the so-called Stockholm[17] and Rio[18] Declarations.

The UN Conference on the Human Environment, that was held from 5 – 15 June 1972 in Stockholm, was the first universal conference of States that tackled questions of international environmental protection. Delegations from 114 States[19] participated and numerous international institutions and non-governmental organisations were represented. One of the main outputs of the Conference was the Stockholm Declaration that states the common convictions of the participants in 26 principles. Of peculiar interest in our context is Principle 21, that – clearly following the Trail Smelter Arbitration[20] - states "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and 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, also the environment of outer space as one of the areas beyond the limits of national jurisdiction, is protected by this principle, in other words: The Stockholm Conference was convinced of the responsibility of States to ensure that activities within their jurisdiction or control do not cause damage to the outer space environment. This protection, however, is weakened by the reference to a State's own environmental policy.[21]

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'. 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 normative character of Principle 21. With minor changes – a reference to national developmental policies was added – the principle was repeated in Principle 2 of Rio Declaration and Article 3 of the Convention on Biological Diversity[22], so that – although the Stockholm Declaration has not a binding character – at least Principle 21 may be regarded as reflecting customary international law.

Principle 15 of the Rio Declaration, elaborates further on the so-called precautionary approach by stating "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, there is an international obligation of diligent prevention and control. This obligation arises when there is a foreseeability of harm, in the sense of an objectively determined risk. Risk can be defined as encompassing both a low probability of causing disastrous harm and a high

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17 Declaration of the United Nations Conference on the Human Environment, adopted in Stockholm on 16 June 1972, 11 ILM 1416 (1972).

18 Declaration of the United Nations Conference on Environment and Development, adopted in Rio de Janeiro on 12 August 1992, 31 ILM 874 (1992).

19 The States of the then Eastern Bloc were not represented.

20 3 Reports of International Arbitral Awards pp 1903 (1949).

21 For more details, see *P. Birnie/ A. Boyle*, International Law and the Environment, 2nd ed. 2002, pp 109.

22 31 ILM 818 (1992), opened to signature on 22 May 1992 and entered into force on 29 December 1993.

probability of causing significant harm[23], thereby taking into consideration both the magnitude and the probability of harm. This international obligation comprises also a duty to enquire potential dangers of a planned activity. The question, to what extent a risk of damage to the environment, including the extra-terrestrial environment, a risk that can never be excluded totally, is socially acceptable, remains to be answered in each single case after a careful risk assessment.

The legal significance of the precautionary approach as embedded in Principle 15 of the Rio Declaration is best described by *P. Birnie* and *A. Boyle*[24]: it has a legally important core on which there is international consensus – this is proven by its use by national and international courts, by international organisations and in treaties[25]. This essence is that in performing their obligations of environmental protection states cannot rely on scientific uncertainty to justify a lack of action when there is enough evidence to establish the possibility of a risk of serious harm, even if there is as yet no proof of harm. This also applies to activities that might be dangerous to the extraterrestrial environment.

Another text of international environmental law that is of particular interest to the area of planetary protection is the Convention on Biological Diversity[26]. According to its Article 4, subject to the rights of other States, and except as otherwise expressly provided in the Convention, the provisions of it apply, in relation to each Contracting Party in the case of processes and activities, regardless of where their effects occur, 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 outer space activities.

Article 8 (h) of the Convention provides "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". "Ecosystem" is defined as a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit and "Habitat" as the place or type of site, where an organism or population naturally occurs, Article 2 of the Convention. Accordingly, the issues of forward and backward contamination are dealt with by the Convention, the potentially harmful introduction of species that are foreign to a given environment, be it terrestrial or extra-terrestrial, is to be prevented, or at least controlled or eradicated. This obligation is, however, limited to "as far as possible and as appropriate".

III. Some thoughts on the development of the law: So far and beyond ?

The short overview of public international law that is relevant to planetary protection issues under II, shows also the influence a new kind of thinking in ethical and environmental terms has had on the development of the law.

The early texts, like the Outer Space Treaty and the Liability Convention, base themselves on anthropocentric and geocentric values, the protection of the

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23 See Article 2 of the International Law Commission's Draft Convention on the Prevention of Transboundary Harm from Hazardous Activities, 2001, the text can be downloaded under: <http://www.un.org/law/ilc/texts/prevention/preventionfra.htm>.

24 International Law and the Environment, 2nd ed. 2002, pp 120.

25 For examples see: *P. Birnie/ A. Boyle*, International Law and the Environment, 2nd ed. 2002, pp 118.

26 The Convention was opened to signature on 22 May 1992 and entered into force on 29 December 1993, 31 ILM 818 (1992).

extra-terrestrial environment found its reason in the preservation of scientific opportunities. The COSPAR Planetary Protection Policy and the relevant NASA Policy Directive based upon it follow along the same lines. The Moon Treaty, then, elaborates further on the balance of the extra-terrestrial environment, and mentions for the first time in space law the principle of intergenerational equity, which is one of the main subjects of modern international environmental law based on the Rio Declaration and which is geared at the avoidance of irreversible harm. Nevertheless, also the Moon Treaty lays the emphasis on the scientific interest, for which international preserves might be established and not an intrinsic value of the extra-terrestrial environment. The idea to conserve species and their habitat for their own value and not just as resources exploitable by man is still relatively young; steps of a shift of the anthropocentric to an eco-centric or bio-centric ethical approach, that attributes value to all life as part of an ecosystem or to all life as such, have taken place in the framework of the Convention on Biological Diversity. The further steps to a cosmo-centric ethic that recognises the intrinsic value of the extra-terrestrial environment and of its existing balance have not been taken, yet. In that context, we can only underline what has already been written by *I. Almár*, that it would be highly desirable to extend the attitudes of environmentalists' movements also to the extraterrestrial environments.[27]

IV. Steps to take

Several ways would allow strengthening the position of the extraterrestrial environment ranging from raising the public's awareness of the issue to supporting the work done by expert groups, such as COSPAR. Furthermore, each public actor in the field of space activities should reflect the concerns of planetary protection and develop a corresponding policy, be it on a national or on a regional basis.

All this, however, can only be complementary to the development of an internationally binding legal instrument. Given the universality of the issue, obviously, the best forum to work on a suitable text is COPUOS. The work done by COSPAR is invaluable in that context and it should be made use of to the largest extent possible. Furthermore, it would be useful not to content oneself with vague principles and intentions, but to also include supervisory mechanisms and efficient procedures in case of non-compliance.

Such a legal instrument might help to avoid scenarios as the well known one *H. G. Wells* evoked in his famous "War of the Worlds", the terrestrial and the extraterrestrial environment are worth some serious thoughts.

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[27] *I. Almár*, Protection of the lifeless environment in the solar system, IISL 2002, p 438.