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Art.IX of the Outer Space Treaty and Peaceful Purposes: Issues and Implementation

A Pragmatic Approach to the "Harmful Contamination" Concept in Art. IX of the Outer Space Treaty

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1. Abstract

Article IX of the Outer Space Treaty (OST 1967) made an early attempt to address the issue of space environment protection, but understandably failed to predict the breadth of "peaceful purposes" for which the space environment would be used. The concept of "harmful contamination" has an obvious relevance in the recognised field of Planetary Protection, but this should be extended, inter alia, to the protection of unique geomorphological features and historic exploration sites.

This paper explains why it is necessary to broaden the definition of harmful contamination in the context of space environment protection, while recognising the challenges in developing policies and laws that will be endorsed at an international level. It suggests that this requires a pragmatic approach that strikes a balance between protection and preservation on the one hand, and exploration and development on the other

Part of the solution in this pragmatic approach is to include as many interested parties as possible - spacefaring nation states, emerging nations, commercial companies and entrepreneurs - in the decision-making process (to encourage 'ownership' of the policies). Practical strategies include highlighting the concepts of 'environmental asset value' and 'sustainability' and, in general, incorporating terrestrial best practice and lessons learned from terrestrial environmentalism.

Given the rise in the orbital debris population and plans to send remotely-operated rovers to the Moon, it is time to negotiate a comprehensive and internationally-agreed policy for protection of the space environment…and time is of the essence.

2. OST Article IX

Protection of the space environment - to allow future generations to benefit from safe and sustainable access to space - should be central to any space exploration or development programme, but the space community as a whole has yet to appreciate the logic of a sustainable approach.

Several aspects of space environment protection, such as limiting biological contamination of other planets and the production of debris in Earth orbit, have been studied for decades and policies have been enacted, but the field of space protection policy and legislation must be broadened considerably before the goal of sustainability can even be approached.

Article IX of the Outer Space Treaty (OST 1967 - see Section 6: Appendix) made an early and laudable attempt to address the issue of space environment protection (though not in those words) with its stipulation that the Moon and other celestial bodies should be explored "…so as to avoid their harmful contamination...", but it was a victim of its timeliness (just ten years after the Space Age opened with the launch of Sputnik). Understandably, in concentrating on state-sponsored space exploration, it failed to predict the breadth of "peaceful purposes" [Preamble and Art. IV] for which the space environment would be used. Although OST Article VI addresses the "activities of non-governmental entities" to some extent, with the gift of hindsight we now realise that commercial applications such as communications, navigation and Earth imaging, and increasingly space tourism, offer even greater challenges to the "harmful contamination" concept than a handful of planetary probes and government astronauts.

Moreover, the phrase "harmful contamination" is open to interpretation and argument in terms of what constitutes "contamination" and, indeed, how one defines "harmful". In the context of the Treaty, it appears to mean harmful to humans rather than harmful to the environment [1]. In addition, Article IX's mention of "…potentially harmful interference with activities in the peaceful exploration and use of outer space…" strongly suggests that - in common with the rest of the Treaty - it is more concerned with protecting activities than protecting the environment [2].

As is well known, the later Moon Agreement sought, among other things, to take the concept of harmful contamination further, but failed to attract the approbation of the spacefaring states. This is largely blamed on the inclusion (in Article 11) of the phrase "The Moon and its natural resources are the common heritage of mankind…", which seemed to outlaw the unilateral appropriation of those resources [3], and a return to the matter of sovereignty (introduced in OST Article II): "The Moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means."

For spacefaring nations with a penchant for and history of commercial development, most notably the US, this was tantamount to driving a nail in the coffin of the Moon Agreement. This leaves those concerned with protection of the space environment with OST Article IX, which is well-meaning, but open to interpretation and far from comprehensive.

3. Broadening the Definition

The concept of harmful contamination has an obvious relevance in the recognised field of "Planetary Protection", which seeks mainly to limit the *biological* contamination of the celestial bodies and reduce the likelihood of 'false positives' in the search for extraterrestrial life. However, it could also be extended to encompass the 'contamination' of orbital space by defunct satellites and manmade orbital debris, and the contamination of frequency space by radio interference, for example. These issues are now broadly recognised as part of the 'space protection ethic' and benefit from the attention of officially constituted and respected bodies: the Inter-Agency Space Debris Coordination Committee (IADC) and the International Telecommunication Union (ITU), respectively. Nevertheless, in an era that promises

the manned exploration of Mars and lunar tourism (first telerobotic, then human), this recognition does not go far enough.

This was one of the main conclusions of an International Academy of Astronautics (IAA) Cosmic Study on "Protecting the Environment of Celestial Bodies" published in 2010 [4]. It recommended, for example, that 'planetary protection' should be extended beyond the biological realm to include, inter alia, the protection of unique geomorphological features, partly by the definition of international planetary parks [5], but also by prioritising smaller areas of special scientific interest [6]. While most authors concentrate on preserving large areas of Mars, it is important not to forget that many of the moons of the solar system (and even asteroids) are also of scientific interest.

Beyond that, we should recognise that there are cultural aspects of some surface environments worthy of protection. The Apollo lunar landing sites, and arguably the exploration sites of early unmanned spacecraft, are part of our global cultural heritage as explorers. Any protection policy should include the definition of *cordons sanitaires* surrounding at least the key sites, and recommendations regarding the preservation of historical artefacts (the spacecraft and experiment hardware). One of the worst scenarios of future space development has lunar tourists placing their boots in Armstrong's footprints and removing parts of the Eagle to sell on eBay! [7]

Following several decades of wanton disregard for the sustainability of operations in Earth orbit, the space community has at last realised the importance of space debris mitigation, and is even making serious technical proposals for the removal of existing debris. This realisation should be extended from Earth orbit to the orbits of the Moon, Mars and even the Lagrange Points *before* we are forced to face the issue of debris contamination in those regions.

When the OST was written, the potential for harmful contamination of Earth orbit was there for all to see: the Able Star upper stage explosion of 1961; the clumps of poorly deployed copper dipoles from Project West Ford in 1963; and a nuclear weapons test that, according to Dean Rusk (Kennedy's secretary of state), produced "a little Van Allen Belt of its own" [8]. It is unlikely, however, that the Treaty authors could foresee the potential for harmful contamination of lunar orbit and the Lagrange Points.

When we begin the development of a lunar orbit infrastructure - in support of science stations, mining bases or tourist hotels - the constellations of communications, navigation and imaging satellites will have to be coordinated by a body similar to the ITU. It will be important not only to obviate radio interference between commercial networks, but also to protect the frequencies used by scientists (some of whom wish to site radio astronomy observatories on the lunar farside).

In a nutshell, the breadth of "peaceful purposes" for which the space environment could be used in future is far greater than is recognised by current space laws, policies and protocols. It is clear that internationally-agreed guidelines, policies and possibly even laws are required to protect aspects of the space environment. However, the considered academic approach of the space law treaties is poorly matched to the sometimes fast-paced developments of space commerce. While new space laws may

be the eventual long-term goal, in the short term we need to take a more pragmatic approach.

4. Pragmatic Approach

Typically, when the subject of protection, preservation or any other term that appears to limit freedom of action is raised, the knee-jerk reaction is to argue against it, resist it or even to attempt to belittle the proposer. We have decades of experience of terrestrial environmentalism to show how not to propose a policy for protection of the space environment.

Moreover, those at the forefront of the 'space protection movement' have no wish to ban space exploration and development, or place unnecessary constraints on an already technically and financially challenging field of human endeavour. Certainly, there is a place at the table for ethicists and philosophers, who will help to inform our understanding of the human condition as we venture out towards the planets, but if it is to happen at all we must take a pragmatic stance.

4.1 Balance

Part of the challenge is to strike a balance between protection and preservation on the one hand, and exploration and development on the other. Of course, this is the philosophy behind the designation of certain areas of solar system bodies as planetary parks, while other areas remain open for potential development. For example, in the case of the fragile lunar atmosphere, which is thought to be comparable in mass to the efflux of a single firing of an Apollo spacecraft returning to Earth [9], the pragmatic solution to harmful contamination would be to 'characterise first, contaminate later' [7].

The fragility of many aspects of the space environment, and our general lack of understanding of much of that environment, is behind the reasoning of those who have argued, by analogy with Principle 15 of the Rio Declaration, that we should take a "precautionary approach" [10]. The Declaration - the result of the 1992 United Nations Conference on the Environment and Development (UNCED) - states that:

> "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."

Although the phrase "according to their capabilities" could be construed as a 'get out clause', this is the sort of universally-agreed declaration required for protection of the space environment.

Of course, this is not the same as an outright ban on the use of the space environment. It is more about ensuring that the exploration and development of the planetary bodies is conducted with a view to the rights of future explorers and developers; it is concerned with ensuring that the actions of one group of users do not make an environment inaccessible to or unusable by others.

4.2 Inclusivity

A key method of ensuring balance is to include all players - whether spacefaring nation states, emerging nations, commercial companies, or entrepreneurs - in the decision-making process. They need to have 'ownership' of the policies if they are to comply readily with their demands.

At first sight, this might seem impractical, as there are a large number of potential players. However, as it is not uncommon for many of their representatives to attend the annual International Astronautical Congress, a pragmatic solution would be to organise the likes of a "UN Conference on the Space Environment & Development" to which they could be invited [11]. As far as designating an official body for policy development is concerned, a likely candidate must be the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which has already taken an interest in space debris.

Of course, persuading the various parties that they should take an interest is a matter of education, and a key part of the curriculum is the concept of 'asset value' [12]. Part of the problem of environmental degradation, here on Earth or in space, is a lack of appreciation of the value of that environment. By contrast, if something has a recognisable value, it is usually considered worthy of protection.

For example, the geostationary orbital positions and radio frequencies assigned to satellite operators by the ITU are both natural resources and both severely limited in supply. However, though there have been examples of spectrum auctions, satellite operators are not required to purchase these assets and do not include them on their balance sheets. This makes it difficult to assign an asset value and to insure that asset against future loss. Perhaps if the situation had been otherwise, we might not today have the growing problem of satellites abandoned in geostationary orbit - a threat to the future sustainability of satellite communications.

The example of an established commercial industry is perhaps the most obvious way to highlight the value of an 'environmental asset', but it should be clear by extension that the asset concept applies well beyond geostationary orbit. Even scientists should consider elements of the space environment to be fundamental assets for their research: if low Earth orbit was clogged with debris, their space telescopes would be unable to operate there; if the surface of Phobos had been strip-mined for its material resources, they would be unable to investigate its unique groove structure.

Even future lunar tourism companies must recognise the value of the Moon's natural and cultural assets. In the long term, its clients will probably want to experience the "magnificent desolation" poetically ascribed to the lunar surface by Buzz Aldrin, not the modules, tanks and storage depots of some industrial development. And when it comes to historic sites, the value of being able to see the remains of the Eagle at Tranquillity Base just as the Apollo 11 astronauts left it in 1969 is incalculable. Imagine, by analogy, the cultural value of an actual Lewis and Clark encampment - not a reconstruction - preserved in its original condition. The concept is impossible on Earth, but not on the Moon.

Obviously, a failure to place a value on celestial environments and consider their protection now could have irreversible effects.

4.3 Sustainability

A further tactic to bring commercial space users to the table, which again we can take from terrestrial environmentalism, is the concept of sustainability. The simple argument is that, if environmental assets are not protected, their use will not be sustainable. For example, a manned presence in low Earth orbit will be unsustainable if the debris population rises above a certain, yet-to-be-decided 'safety threshold', while lunar historic-site tourism will be unsustainable if the landing sites are compromised and the spacecraft hardware and other artefacts are removed.

The challenge is the conception of a sustainable and environmentally-aware model for space exploration and development. Part of the solution, in this pragmatic approach, is to ensure that any guidelines or policies are informed by terrestrial best practice and incorporate familiar terminology. For example, proposals for science bases, spaceports, hotels or mines should be expected to incorporate formal planning applications, environmental impact statements and waste management solutions [7]. The space environment may be alien, challenging and expensive to access, but it has become an integral part of our business and cultural environment and should be treated as such.

4.4 Systematic analysis

A fourth, but by no means final aspect of this pragmatic approach to the harmful contamination concept is the need for a systematic analysis of threats to the space environment. At the top level, this involves identifying the types of environment potentially at risk (e.g. orbital, surface and subsurface environments, atmospheres and the radio spectrum) [7]. A second level would specify particular environments in each category (e.g. low Earth orbit, the subsurface of Mars and the atmosphere of Titan), allowing the environments to be prioritised, while a third level could identify specific sites of scientific, commercial or cultural interest.

Although one is unlikely to be able to identify all possible categories of interest at a first attempt, a systematic approach is crucial to the formulation of a relatively 'future-proof' policy. By contrast, a non-systematic approach that identified planned missions, for example, would very quickly become out-of-date and would risk missing threats that were either not well publicised or arose in the short term (such as a small tele-operated lunar rover competition funded as part of a commercial marketing scheme).

The key to all of this is to be able to 'stand back far enough' when considering what is necessary to protect the space environment. This requires one to take what could be termed a holistic approach. In other words, rather than considering space environment protection as a specialised field or minority interest, it should be viewed in the context of other recognised areas of interest [7]. Planetary protection, frequency regulation and orbital debris mitigation have already been mentioned; other recognised areas, still in their infancy, are space traffic management and space safety, both of which - along with debris mitigation - are concerned in different ways with the sustainability of

operations in Earth orbit. In that sense, they are subsets of the larger 'protection issues' described here.

When the contributions of supporting fields such as space law, space policy and space ethics are included, it becomes clear that we are already on a path to organising, controlling or regulating our use of the space environment…and hopefully ensuring sustainability for future uses.

5. Time is of the essence

The concept of "harmful contamination" of the celestial bodies introduced by the OST in 1967 was an important early recognition, by the international community that ratified the Treaty, that the space environment is worthy of protection. But it is too general and too open to interpretation to form more than the basis for a policy that will actually protect the space environment. The later Moon Agreement made a valiant effort to take the issue further, but it was not sufficiently pragmatic to win the approval of the spacefaring nations.

The world has moved on since the OST, and threats to the space environment that were not, or could not be, considered at the time are now a reality. Technology moves fast sometimes and sets technical and legal precedents to which space treaties cannot react. An internationally agreed policy for protection of the space environment is required, and time is of the essence.

The result of a laissez-faire approach to orbital debris in low Earth orbit is now clear to the extent that experts believe that the debris population is bound to increase - whether or not we launch more satellites - simply as a result of collisions. The collision of debris from an Ariane rocket stage and the Cerise microsatellite in July 1996 should have provided a wake-up call for the space community, but it took the much larger collision in February 2009, between the Iridium 33 commercial communications satellite and the defunct Russian Cosmos 2251, to galvanise attention on the issue. Meanwhile, plans to launch automated rovers as part of the Google Lunar X-Prize competition threaten the sanctity of the Apollo landing sites and the sustainability of future lunar tourism.

All too often, legislators and developers are cast as antagonists, destined to occupy opposing camps, never seeking a compromise. It is important to note, however, that space environment protection/legislation and space exploration/development are not incompatible: the latter actually require the former to ensure sustainability.

In the final analysis, space environment protection is not a legal nicety or an academic exercise, it is a requirement for the sustainable exploration and development of the solar system…and potentially beyond.

6. Appendix: OST Article IX

> In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. 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 extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty 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 potentially harmful interference with activities of other States Parties in the peaceful 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. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.

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