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Law, Ethics, and Space: Space Exploration and Environmental Values

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This paper offers an analysis of the ethical values that have accompanied human exploration of space so far, and emphasizes the need to infuse human space activity with new ethical values by means of new and well-constructed legislation. One of the values that we deem particularly important in the creation of a new approach towards space exploration is care for the natural environment, including the space environment.

Introduction

Space exploration and human space activity is receiving more widespread media attention in the second decade of the twenty first century than at any time since the Apollo missions took humans to the Moon in the late 1960s and early 1970s.[1] This attention is fuelled partly by imaginative entrepreneurs engaging in high-profile, media-focused rocket launches,[2] but is also crucially underpinned by a considerable amount of commercial activity. An increasingly diverse range of actors, both private companies and state-sponsored entities, are looking to develop the rich profit potential of space-based applications. Indeed, 2018 is poised to see a record number of rocket launches, with no fewer than 170 launches planned. With many of these launches containing multiple payloads, the orbit of Earth is set to become ever more congested. While there is agreement in place

1 Of the myriad of writings available on this, still the most accessible text remains A. Chaikin, *A Man on the Moon*, New York, Penguin 1998.

2 See J. Gunter, *Elon Musk: The Man Who Sent His Sports Car into Space*, BBC Online, 10 Feb 2018. http://www.bbc.co.uk/news/science-environment-42992143 [11.03.2018].

on guidelines[3] to mitigate the creation of new debris,[4] there are still vast numbers of defunct satellites, remnants of previous missions, and even flecks of paint orbiting the earth, posing not only a "significant hazard to operational space craft"[5] but a more severe threat to on-going activity in space.

It has been clear for some time that the proliferation of debris, if unchecked, could start a cascade effect leading to a debris belt that would render the orbit unusable[6] and higher orbits inaccessible (the Kessler Syndrome).[7] After the Cerise incident in 1996, where a fragment from the exploded Ariane hit the still operational Cerise satellite,[8] the reality of the effects of space debris became apparent to the space faring community. This was thrown into even sharper relief with the collision in February 2009 of an inactive Russian communications satellite, Cosmos 2251, and an active US communications satellite, Iridium 33, producing almost 2000 pieces of debris over 10cm in diameter.[9] Similarly, an increase in missions to other planets within the solar system have led to awareness about the potential damage caused to these scientifically significant environments. The need for guidelines for so-called 'planetary protection' measures to protect these environments was recognised amongst the scientific community and introduced by the COSPAR (Committee on Space Research).[10]

It is against the backdrop of such a clear environmental threat to space activity that this article is set. The inquiry will consider whether the values of space exploration have been sufficiently concerned with the environmental impact of such activity and whether it is possible to generate the consensus needed to embed an ethical approach to space exploration leading to robust planetary protection.

3 *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space* as annexed to UN doc. A/62/20, Report of the UNCOPUOS (2007).

4 J. Foust, *International Partnerships to Address Orbital Debris in Absence of Broader Accord*, Space News, 24 Sep 2017, http://spacenews.com/international-partnerships-to-address-orbital-debris-in-absence-of-broader-accord/ [11.03.2018].

5 B. Weeden, *Overview of the Legal and Policy Challenges of Orbital Debris Removal*, Space Policy 27 (2011), pp. 38–43, 38.

6 It should also be noted that collisions and explosions in orbit are not confined to a "single" orbital track. Depending on the trajectory of the ensuing debris, there could be a wide variety of orbital altitudes and inclinations affected by such a cascade.

7 D. J. Kessler & B. G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a debris Belt*. Journal of Geophysical Research 83/A6 (1978), pp. 2637–2646.

8 *UN Comm. on Peaceful Uses of Outer Space, Sci. & Tech. Subcomm.,* Technical Report on Space Debris 15, UN Doc. A/AC.105/720 (1999), pp. 15–16.

9 For further information see B. Weeden, *2009 Iridium-Cosmos Collision Fact Sheet*, https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf [11.03.2018].

10 C. J. Newman, *The New Space Ethics: COSPAR, Planetary Protection and Beyond*, ROOM – The Space Journal 2/4 (2015), https://room.eu.com/article/The_new_space_ethics_COSPAR_Planetary_Protection_and_beyond [11.03.2018].

It is contended that only through embedding a concern for the environment at the core of human space activity will there be an enduring solution to the crisis posed by debris in Earth orbit. This article is not seeking to advocate mere preservation of the space environment. It is accepted and, indeed crucial, that humans seek to utilise the manifold advantages of exploiting space resources. Promoting sensible consumption of materials from outer space must become part of the natural processes in missions rather than being viewed as an unnecessary burden which may limit progress. More crucially, such an overarching ethical position would ensure that the problems which have affected Earth orbit and wider issues of planetary protection will not be exported when human space exploration leads to settlement on other celestial bodies.

Therefore, as can be seen, the environmental impact of human activity in space can be framed into two broad categories. The first is the threat to the space around Earth and the second is ensuring planetary protection of other celestial bodies. There is copious scientific and technical literature analysing the issues of the environmental threat to the orbital space around Earth.[11] There is also now increasing legal awareness of the problems facing the space environment.[12] These inquiries almost always focus on solutions based on processes, technology, or providing sufficient alarm to jolt the international community into action. This discussion will adopt a different focus, providing an overview of the value system that is currently in place regarding human space activity and examining how this value system has shaped normative ethical positions on space exploration. The inquiry will start by examining the evolving nature of space activity, looking at the predominantly military backdrop to the early years of exploration. During these early years, the challenge of simply getting into space overrode any environmental consideration. More significantly, there was not the diversity of entities looking to go into orbit, meaning that the amount of debris was limited, thereby softening concern. Space activity during this time was largely (although not exclusively[13]) limited to two superpowers, Russia and America.

11 For a clear articulation of the problems see M. Williamson, *Space: The Fragile Frontier*, Reston, American Institute of Aeronautics and Astronautics 2006. For the scale of the current problem see H. Lewis, *Sensitivity of the Space Debris Environment to Large Constellations and Small Satellites*, European Conference on Space Debris Risks and Mitigation, April 2017, full details available at http://www.esa.int/Our_Activities/Operations/Space_Debris/European_conference_on_space_debris_risks_and_mitigation [11.03.2018].

12 See, *inter alia*, L. Viikari, *The Environmental Element of Space Law,* Leiden, Brill 2008, and also J. N. Pelton, *New Solutions for the Space Debris Problem*, New York, Springer 2015.

13 For information on the early years of the Chinese space program, see B. Harvey, *China's Space Program: From Conception to Manned Spaceflight,* Chichester, Springer Praxis 2004.

Inevitably, this geopolitical situation shaped the law that was to govern space activity,[14] and this is the law which has moulded normative behaviour in space. Indeed, had space remained the purview of states, environmental damage may have been significantly reduced, making it easier to regulate. This development is crucial to understanding the way in which shared human values have evolved, but it is only part of the picture. Following this, the different generations of space travellers will be studied allowing for an evaluation of how their competing interests and backgrounds have shaped the value systems underpinning the exploration of space. The discussion will then go on to review the emerging body of literature discussing ethical approaches to space and establish the extent to which ethical values have shifted to match the diversity of actors in the space environment. There will then be a critique of how the change in the global space environment has necessitated a change in environmental governance, and whether this has actually occurred. Finally, the discussion will conclude with suggestions as to the way in which legal devices can be used to shape behaviours and begin the process of embedding a much-needed environmental ethic into space activity.

The Evolution of Human Space Activity and Legal Framework

The militaristic nature of competition between the two superpowers in the years after the Second World War made it seem inevitable that such conflict would spill over into space. It is against this backdrop of nuclear conflict that the founding principles of space exploration were created. The emerging body of space law promoted the use of space for "peaceful purposes," a core principle which was later asserted within the relevant international treaties. Indeed, as has been observed elsewhere,

> […] *the search for normative values will, therefore, lead inevitably to the legal framework governing international space law… in international space law, rather than the ethics shaping the regulation; it is the law that seemingly has come to ordain the values that underpin space activity.*[15]

14 See J. Gabrynowicz, *Space Law: Its Cold War Origins and Challenges in the era of Globalization*, Suffolk University Law Review 37 (2004), p. 1041.

15 C. J. Newman, *The Undiscovered Country: Establishing an Ethical Paradigm for Space Activities in the 21st Century,* [in:] Ethics in Public Policy and Management, eds. A. Lawton, Z. van der Wal, L. Huberts, London, Routledge 2016, p. 301.

Space law primarily flows from the Treaty on Principles governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies 1967, popularly referred to as the Outer Space Treaty (OST). The binding principles underpinning space governance[16] are recognised as the cornerstone of international space law[17] and the OST draws on a number of previously non-binding UN Resolutions in respect of space exploration.[18] As such, a first reading of the OST starkly contradicts the circumstances surrounding its creation, citing from the preamble that "the progress of exploration and use of outer space for peaceful purposes" is the "common interest of all mankind." A core principle of the OST can be found in Articles I and II of the Treaty. Article I provides that all states should have free access to space. Couched in such vague terms, "free access" could be taken to mean unencumbered by restrictions regarding the prevention of environmental damage and protecting other planets.

This is complemented by the provisions of Article II that outer space is *res communis*, non-subjectable to national appropriation.[19] The idea that space belongs to all humanity for exploration has been suggested as being originally intended as "the moral equivalent to war."[20] Certainly, the principle of the OST that attracted the most attention at the time of its signing in 1967 is Article IV, prohibiting the use or placement of nuclear weapons or weapons of mass destruction in space. This provision, hailed as a great breakthrough, was viewed as ending space's potential as an off-world nuclear armoury and closing space as a further theatre of Cold War conflict. Yet despite these peaceful overtures, the practical execution of the treaty (and a significant amount of funding of space activity) has remained militarised. If space and its exploration is meant to be war's moral equivalent, then the Space Race simply reasserted war's primary objective, that of conquest, into a new arena.[21] The difficulty of conquest often comes at the expense of local resources, environmental protection, and planetary protection.

16 M. Lachs, *The Treaty on Principles of the Law of Outer Space, 1961–1992*, Netherlands International Law Review 39/03 (1992), pp. 291–302.

17 H. Qizhi, *Outer Space Treaty in Perspective*, Journal of Space Law 25 (1997), p. 93.

18 Resolution 1962 (XVIII) of 13 December 1963 A/RES/1962 *Declaration of Legal Principles Governing the Activities of the States in the Exploration and Use of Outer Space.*

19 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (hereinafter *Outer Space Treaty 1967*), 1967, Article II.

20 L. Billings, *To the Moon, Mars, and Beyond: Culture, Law, and Ethics in Space-Faring Societies*, Bulletin of Science Technology Society 26/5 (2006), pp. 430–437.

21 W. McDougal, *The Heavens and the Earth: A Political History of the Space Age*, Baltimore, John Hopkins University Press 1985.

From Cold Warriors to Scientists: Shaping Individual Behavioural Norms

Notions of 'conquest' and the promise of a new unknown land to be discovered have historically centred upon the gains to be reaped and, more specifically, the territory to be claimed.[22] As stated above, a core principle of the OST, found in Article II of the Treaty is the prohibition on claims of ownership or sovereignty in outer space.[23] This prohibition means that no part of outer space, including planets, other celestial bodies and—crucially—the orbit of the Earth is permitted to be appropriated by states for their usage,[24] lest weapons be installed or developed from outer space materials.[25] Instead, the Soviet Union and the USA had to settle for the conquest of accomplishment, historical prestige via discovery. The Space Race re-orientated US and Soviet tensions around being the first nation in space; a challenge completed by Russia in 1961 with Yuri Gagarin and then the first nation on the Moon, as attained by America's Neil Armstrong and Buzz Aldrin in 1969. As Laurence Taylor asserts, "one of the major goals of the race [was]: to imprint a specific, national, ideological and colonial meaning on the Moon,"[26] which was successfully achieved by the USA,[27] as illustrated in the use of the American flag at the lunar landing site.[28] Yet again this is detrimental to the environment since discovery requires proof, leading to interference and removal of often finite resources for research, which later become trophies confined to display. This pattern of activity is less problematic on Earth,

22 For a modern interpretation of this within the context of space activity, see L. Billings, *Are We on the Cusp of a War in Space?*, Scientific American, 10 August 2015.

23 Article II of the OST states that "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."

24 *Outer Space Treaty 1967*, op. cit., Article II.

25 For a discussion on the early interpretations of Article II of the OST, please see S. Gorove, *Interpreting Article II of the Outer Space Treaty*, Fordham Law Review 37/349 (1968–1969). The modern lens through which Article II tends to be viewed is that of property rights for space mining. For a contemporary discussion on this see F. Tronchettii, *Legal Aspects of Space Resource Utilization*, [in:] Handbook of Space Law, eds. F. von der Dunk, F. Tronchettii, Cheltenham, Edward Elgar 2015, pp. 769–812.

26 L. A. Taylor, H. H. Schmidtt, W. D. Carrier III, M. Nakagawa, *The Lunar Dust Problem: From Liability to Asset*, http://www.isruinfo.com//docs/the_lunar_dust_problem_-_from_liability_to_asset.pdf [11.03.2018], p. 102.

27 A. Gorman, *The Cultural Landscape of Interplanetary Space*, Journal of Social Archaeology 5 (2005), pp. 85–107, 100.

28 The fact that initially the United Nations flag had been the favoured choice was disregarded by NASA's Committee on Symbolic Activities for the First Lunar Landing, translating a war of weapons into a war of symbolism instead. The fact that NASA's appropriations bill was amended to permit this, whilst forbidding any other flags on US funded missions speaks loudly of desired sovereignty. Despite the official interpretation being of "an historic forward step for all mankind," there was clear desire that the world remember that this was the accomplishment of the USA. See A. M. Platoff, *Where No Flag Has Gone Before: Political and Technical Aspects of Placing a Flag on the Moon*, *NASA Contractor Report* 188251 (1993), http://history.nasa.gov/alsj/alsj-usflag.html [05.05.2015].

since resources remain within the atmosphere of their home planet regardless how far they travel geographically. The same cannot be said regarding the foreign alterations exporting this behaviour causes via human space travel in outer space's atmosphere.

Indeed, a crucial imprint has been left by the early influence of military travellers in respect of individual behaviour. The planners and those implementing missions rely on a central belief: the fundamental compliance of the traveller with the internal discipline of the crew and the mission. This assumption was undoubtedly shaped by the features of the early space pioneers; test pilots who had gone through a rigorous selection process and were governed by military discipline.[29] Even when the pool of astronauts was broadened to include scientists, the thoroughness of selection and the intense struggle for places ensured that mission planners could safely assume the compliance of the crew, an assumption that still permeates mission plans.[30] With the anticipated expansion of the number of humans in space, this position, however, can no longer be taken for granted. The time is ripe, therefore to refocus on human activity in space and reframe the underpinning values. Yet, the historical, geopolitical, and personal characteristics of the early years of space activity are still dominant in the discourse of space exploration.[31] Trying to impart a new value system, running contrary to the pioneering spirit of Cold War space activity will be challenging, but given the environmental issues posed by current usage of space, a wholly necessary endeavour.

Human Space Activity and the Space Environment

Just as the early pioneers of space activity can be regarded as models for individual emulation, the rules and treaties that emerged from the early years have shaped normative behaviour amongst states in space. It is perhaps unsurprising that care for the delicate space environment is missing from these early behavioural

29 For examples of this, see the discussion by P. Maschke, V. Oubaid, Y. Pecena, *How Do Astronaut Candidate Profiles Differ from Airline Pilot Profiles?*, Aviation Psychology and Applied Human Factors 1/1(2011), pp. 38–44.

30 Notwithstanding this assumption, it should be noted that there is a code of conduct for the crew on the International Space Station to which all crew members must adhere. For further details, see A. Farand, *The Code of Conduct for International Space Station Crews*, ESA Bulletin 105/2001, pp. 64–68.

31 For a discussion on this, see L. Billings, *Overview: Ideology, Advocacy, and Spaceflight: Evolution of a Cultural Narrative*, [in:] Societal Impact of Spaceflight, ed. S. J. Dick, Washington, National Aeronautics and Space Administration, Office of External Relations, History Division 2007, pp. 483–500.

constructs. If space was to be the next terrain of conquest then its resources were justifiably expended in the advancement that crusade. As has been identified, the notions of conservationism and environmental concern are very much rooted in the latter half of the twentieth century.[32] Writings by early environmentalists such as Rachel Carson[33] and Paul Ehrlich[34] contributed to the recognition that the Earth environment was at risk from damaging human behaviour.

> *The risk identified is broadly that the resources of the Earth might be exhausted but also that the wider environment could be damaged beyond nature's ability to repair itself.*[35]

There are clear parallels between terrestrial environmentalism and the proliferation of debris in Earth orbit. The risk posed by this debris overwhelming the Earth's natural ability to deal with orbital debris could not be clearer.[36] Accordingly, the notion of environmental responsibility in outer space is perhaps best understood in terms of the *Hardinian* theory regarding the so called "tragedy of the commons."[37] This theory is that, in a shared resource system, users of that system will act in their own self-interest and consume the resource accordingly. If that consumption is multiplied to the scale of a full community, without thought to limitation, it will result in depletion or despoiling "of the very thing upon which the interest relies—the commons."[38] As Welly states, "individual countries have received benefits from individual [space] missions while damaging the global commons."[39] At the start of human exploration, the 'orbital commons' was viewed as a limitless natural resource. It both provided rare resources and enabled disposal of unnecessary equipment along the way. Again, the normative behaviours embedded at the start of the space age have endured through to present day. Lack of planetary protection is perhaps one

32 W. Kramer, *Extra-Terrestrial Environmental Impact Assessments: A Foreseeable Prerequisite for Wise Decisions Regarding Outer Space Exploration, Research and Development*, Space Policy 30 (2014), pp. 215–222, 215.

33 R. Carson, *Silent Spring*, Boston, Houghton Mifflin 1962.

34 P. R. Ehrlich, *The Population Bomb*, New York, Sierra Club/Ballentine Books 1968.

35 C. J. Newman & M. Williamson, *Space Sustainability: Reframing the Debate*, Space Policy (2018) (in publication), p. 2.

36 For details on the current threat, see H. Klinkrad, *Space Debris: Models and Risk Analysis*, Berlin, Springer 2014.

37 G. Hardin, *The Tragedy of the Commons*, SCIENCE 162/3859 (1968), pp. 1243–1244.

38 N. Welly, *Enlightened State Interest: A Legal Framework for Protecting "the Common Interest of All Mankind" from Hardinian Tragedy*, Journal of Space Law 36 (2010), p. 284.

39 Ibidem, p. 279.

of the most prevalent of all, due to the overwhelming debris humanity's visits to space have left behind. Space actors—both states and now private sector—see a duty to protect the space environment as secondary to either maintaining national interests or the garnering of profits.

It may seem somewhat disingenuous to lay the blame for environmental degradation in space at the feet of the pioneers of space activity. During the Cold War, those responsible for space exploration in both states had to contend not only with the challenge of safely sending humans to the moon and then returning them to Earth, but also with a deadline of achieving this by the end of the decade as announced by President Kennedy.[40] Under such terms, however, the effect of ignorance regarding the consequences humanity's intrusion would have upon outer space itself led to environmental casualties via space debris. In addition to the aforementioned Kessler Syndrome, the risk of harm from debris extends to potentially sparking conflict by rogue pieces of debris that could cause damage to satellites and be misconstrued as an intended attack by other states.[41]

The legal framework is equally as ambivalent about protecting the space environment and almost totally silent concerning the threat posed by orbital debris. The environmental focus of the OST is found in Article IX[42] and provides that states must conduct their space activities so as to avoid harmful contamination of outer space and to protect the terrestrial environment from changes resulting from material brought from outer space. In practice, the protection offered by Article IX is extremely limited in that it is almost entirely insular to Earth. Furthermore, current planetary protection policy[43] is generally concerned[44] with a planet's capability to support life,[45] looking once again towards human benefit rather than human impact. This is supported by criticism that those drafting the Treaty were interested only in protecting states' activities rather than protecting the space environment.[46] It is significant that Article IX's contamination

40 *Address to Congress on Urgent National Needs*, 25.05.1961.

41 C. Mortimer, *Rise in Space Junk Orbiting Earth Could 'Provoke Armed Conflict', Russian Scientists Warn,* The Independent, 24 Jan 2016, http://www.independent.co.uk/news/science/rise-in-space-junk-orbiting-the-earth-could-provoke-armed-conflict-warn-russian-scientists-a6831256.html [26.02.2018].

42 Article IX of the OST states, *inter alia*, that states conduct their activities in outer space "… so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extra-terrestrial matter and, where necessary, [to] adopt appropriate measures for this purpose."

43 For full details, see *COSPAR Planetary Protection Policy*, 20 October 2002, https://cosparhq.cnes.fr/sites/default/files/pppolicy.pdf [1.05.2018].

44 C. J. Newman, *The New Space Ethics: COSPAR, Planetary Protection and Beyond,* op. cit.

45 Ibidem.

46 L. Viikari, *The Environmental Element of Space Law*, op. cit., p. 60.

must be "harmful" and the scope of this is not defined. It is suggested here that this insufficiency be remedied by expanding planetary protection to encompass the space environment altogether, rather than just planets. For instance, the planting of the American flag upon the Moon was only not harmful because NASA has deemed it so in order to serve the powerful agenda of the Space Race. International space law, in respect of binding treaty commitments, has not sought to deal with the environmental issues affecting space. As has been observed

> [...] *this atrophy is reflected in the regulation of terrestrial environmental issues, where it seems that achieving the necessary consensus for a binding treaty* (*with appropriate punitive sanctions*) *is currently beyond the grasp of the international community.*[47]

The progress of space exploration into the 21st century is something of a contradiction in terms, for as the technology and interdisciplinary involvement has increased, the distance of human involvement has shrunken, mainly, to Lower Earth Orbit (LEO). Irrespective of China[48] and the USA's[49] expressed desire to return man to the moon, this intention comes from states, which has become the exception rather than the norm in space activity. Commercial activity has overtaken that of states to the point that a new space race has developed, played out in LEO. In keeping with the idea of utilising space to improve living on Earth,[50] there is also the intention of LEO constellation satellites to provide global internet coverage.[51] "There's going to be several choices just in the category of broadband satellite,"[52] suggesting a breadth of choice that will spread across each space industry. The rapidity of space activity's pace and the focus of these commercial companies on ease of access suggests that an environmental ethic

47 C. J. Newman, *The New Space Ethics: COSPAR, Planetary Protection and Beyond,* op. cit.

48 N. Connor, *China Prepares for Manned Moon Landing,* The Telegraph, 7 Jun 2017, https://www.telegraph.co.uk/news/2017/06/07/china-prepares-moon-landing/ [10.03.2018].

49 *Presidential Memorandum on Reinvigorating America's Human Space Exploration Program*, The White House, 11 December 2017, https://www.whitehouse.gov/presidential-actions/presidential-memorandum-reinvigorating-americas-human-space-exploration-program/ [08.03.2017].

50 A. LeBeau *Space and Protection of the Environment*, [in:] The Ethics of Space Policy, ed. Alain Pompidou, COMEST/UNESCO 2000, p. 64.

51 S. D. Ilčev, *New Aspects of Hybrid Satellite Orbits (HSO) Constellations for Global Coverage of Mobile Satellite Communications (MSC)*, International Journal of New Technologies in Science and Engineering 2/4 (2015), p. 328.

52 Tom Stroup in: T. Shields, D. Hull, J. Johnsson *Space X's Elon Musk Dares to Go Where Others Failed with Space Based Web*, LA Times, 28 Feb 2018, http://www.latimes.com/business/la-fi-spacex-satellite-constellation-broadband-20180228-story.html [10.03.2018].

in the shape of planetary protection has no place in 21st century space activity. That is not to say that any environmental concern is wholly absent. Space X particularly is focused on reusability of its spacecraft via its Grasshopper Reusability Test program.[53] Yet as aforementioned, the particularity of environmental conditions mean that tests must be carried out in space and so the damage caused in pursuit of reusability must be accounted for.

The attention which space law academics draw towards planetary protection, the space environment, and the sustainable use of LEO is particularly invaluable for this reason. Yet the contrast between discussion on the question of LEO sustainability looks stagnant in comparison with this progress of space exploration overall. Explorers are looking ever onwards, with colonisation efforts quickly becoming the order of the day. Available literature centres upon jurisdiction[54] and human evolution in the form of transhumanism[55] whereas environmental impact lies forgotten. However, it is submitted here that although "law must proceed man into space"[56] and keep pace with developments such as the colonisation of Mars[57] and the ESA's lunar village,[58] it must also persist to champion the issue of space debris until a management strategy is effective.

Without clear obligation beyond the vague scope of Article IX's policy of non-interference, motivation and therefore advancement of environmental protection stagnates. The way in which the environmental element of space law protects the fragile environment of space is, therefore, extremely limited. International action on dealing with space debris is restricted to the non-binding, voluntary codes, specifically the UN Debris Mitigation Guidelines 2007.[59] The guidelines finally provided a definition of space debris, although the definition

53 *Reusability*, Space X website, http://www.spacex.com/reusability-key-making-human-life-multi-planetary [10.03.2018].

54 See e.g. G. S. Robinson, *Transcending to a Space Civilisation: The Next 3 Steps Toward a Defining Constitution,* Journal of Space Law 32/1 (2006) pp. 147–175; T. S. Hardenstein, *In Space, No One Can Hear You Contest Jurisdiction: Establishing Criminal Jurisdiction of the Outer Space Colonies Tomorrow*, Journal of Air Law & Commerce 81 (2016), http://scholar.smu.edu/jalc/vol81/iss2/4 [10.03.2018].

55 G. S. Robinson, *Space Law for Humankind, Transhumans and Post Humans: Is There a Need for a Unique Theory of Natural Law Principles?*, Annals of Air & Space Law XXXIII (2008), pp. 287–323.

56 A. G. Hayley, *Space Age Presents Immediate Legal Problems*, 1 PROC COLLOQ L. Outer Space 5, eds. A. G. Hayley, W Henderson, Springer 1959.

57 E. Musk, *Making Humans a Multi-Planetary Species*, New Space 5/2 (2017), pp. 46–61.

58 J. Woerner, *Moon Village*, European Space Agency, https://www.esa.int/About_Us/Ministerial_Council_2016/Moon_Village [10.03.2018].

59 UN Gen. Assembly, *Report on the Committee on the Peaceful Uses of Outer Space*, UN Doc. A/62/20 (July 26, 2007), § 117.

is restricted to that document[60] which itself is non-binding[61] as a voluntary[62] procedure for dealing with debris. Space exploration is contingent on ensuring that the orbit of the Earth does not become so congested as to created conditions for a debris belt. Yet lack of a legally-binding commitment demonstrates that the endeavour behind exploration does not extend to ensuring that space is free for future generations to use, beyond a "simply safe"[63] workable condition. Self-interest continues to dominate the usage of the orbital commons.

Human space activity has been influenced by a multitude of professions and stakeholders. The initial military approach has left a definite impression upon the development of space exploration. The broad terms of the OST and its vague language ought to assist with broad and fluid interpretation, allowing policy to evolve as a result. However, although this breadth of application has allowed commercial and scientific involvement, science has been fettered by the political goals and insistent militarism of states. The result is a lack of a clear value system that could function to guide development in an efficient, ethical way. Additionally, relying on voluntary codes to embed underpinning values has issues. A legally binding framework establishes a bedrock of harmonized practices, built on an international consensus. Without this, each individual (state or private) actor is free to pursue their own agenda, adopting environmental considerations only when it does not endanger profit or national interest.[64]

Ethics, Values, Environmentalism, and Space Activity

The inquiry has identified the need for a widely accepted environmental value system underpinning space activity. Yet despite all that has been said about the militaristic origins of the OST framework, it is also a little surprising that space environmentalism did not have more traction in the early years of space exploration. Discussions on the ethics of space activity emerged in the early years of science fiction,[65] with the writings of Tsiolkovsky[66] and latterly Gerard O'Neill.[67]

60 S. Hobe & J. H. Mey, *UN Space Debris Mitigation Guidelines*, ZLW 3 (2009), p. 393.
61 *UN Space Debris Mitigation Guidelines*, UN doc. A/62/20, Report of the COPUOS (2007), no. 3, § 2, sent. 2.
62 UN doc. A/AC.105/848, Report of the STSC (2005), § 95 and annex II; UN doc. A/60/20, § 126 (d).
63 S. Hobe, *Environmental Protection in Outer Space: Where We Stand and What Is Needed to Make Progress with Regard to the Problem of Space Debris,* Indiana Journal of Law & Technology 8 (2012), p. 3.
64 C. J. Newman, *The New Space Ethics: COSPAR, Planetary Protection and Beyond,* op. cit.
65 For a comprehensive discussion on this, see S. Baxter, *Dreams and Nightmares of the High Frontier: The Response*, [in:] The Ethics of Space Exploration, eds. J. Schwartz, T. Milligan, 2016, Springer, pp. 15–30.
66 K. Tsiolkovsky, *Vne Zemli (Beyond the Planet Earth),* trans. K.Syers, , New York, Pergamon Press 1960.
67 G. O'Neill, *The High Frontier*, 2nd Ed, London, Corgi Books 1978.

Whilst these writings were in the realm of fiction, serious ethical debate originated as an "off-shoot" of the environmental ethics discussions of the late 1960's and early 1970's.[68]

Such discussion, however, did not concern the impact of humanity upon the space environment, or even the more prevalent theme regarding the presumed threat posed to humanity and Earth by space's far harsher environment. Rather, space ethics came to centre upon the resources to be gained from space and the viability of terraforming.[69] Although this does further expand upon the environmental illiteracy and self-interest which fuelled the Space Race of the Cold War, it should not be assessed in a purely negative light. As Williamson formulates, ethics thrives best when it is constructed as a "workable tool"[70] around the dominant issues of the day largely because the majority of those involved in space activity will have little or no awareness of ethical paradigms and will seek to focus only on their practical application. Environmental values in terms of space, particularly the outward impact of humanity, has traditionally been of little concern and has only come to notice when mated alongside scientific discussions such as those regarding the Kessler Syndrome. Given the perceived need to accomplish the mission, it is not difficult to understand why the introduction of binding environmental values would be viewed as "a source of unhelpful constraints which could stand in the way"[71] of all that space exploration promised.

Writers such as Schwartz and Milligan have brought a welcome depth and richness to the field of space ethics, although even they recognise that

> [...] *the challenges posed to ethics by the space environment will not be settled in a purely formal way … The most valuable contributions we can make at present come from offering proposals about how we might think about intrinsic value, virtue etc., in space contexts.*[72]

At the present time, therefore, the search for an underpinning environmental value system is best summarised by Williamson when he states that it is "what

68 J. Schwartz & T. Milligan (eds), *The Ethics of Space Exploration*, op. cit., p. 4.

69 McKay, C. P., & Davis, W. (1989). Planetary protection issues in advance of human exploration of Mars. Advances in Space Research, 9, 197–202, McKay, C. P. (1990). Does mars have rights? An approach to the environmental ethics of planetary engineering. In D. MacNiven (Ed.), Moral expertise (pp. 184–197). New York: Routledge

70 M. Williamson, *Space Ethics and the Protection of the Environment*, Space Policy 19 (2003), p. 48.

71 J. Schwartz & T. Milligan (eds), *The Ethics of Space Exploration*, op. cit., p. 4.

72 J. Schwartz, *On the Methodology of Space Ethics*, [in:] The Ethics of Space Exploration, op. cit. p. 94.

we should and shouldn't do in space."[73] The need to identify what "we should and shouldn't do" was articulated in the first part of this discussion. Humanity's entrance into the outer space environment was foreseen as a potential intrusion by the drafters of the Outer Space Treaty, in the wording of Article IX to avoid harmful contamination of the Moon and other celestial bodies, albeit in preserving investigation for our own scientific understanding.

But the question regarding the harm that humanity can cause to outer space by visiting necessitates the question of whether humans should explore space at all. This, however, is rendered moot by the fact that there is already a human presence in outer space. The question, therefore, is not about whether humans should continue to engage with space but rather how this engagement ought to be constructed. A suitable lens through which to determine human presence in space is in relation to the preservation or conservation of outer space. Preservation focuses upon maintaining space's present condition with the hopeful albeit daunting task of removing space debris. This can be discounted almost immediately. Whilst preservation may appear to be the solution which will be more protective of the delicate space environment, as Schwartz points out, "no amount of theorizing will eradicate the practical difficulties about the shape of our duties in the space environments."[74] Preservation of the Earth's orbit is almost certain to be considered undesirable, not only amongst the space-faring community—it is also wholly impractical in a society that has grown ever more dependent on space-based applications.

Conservation as a Base upon Which to Build Consensus

The alternative, however, is perhaps a more useful foundation upon which to try and build an environmentally focused value system. Conservation demands a sustainable approach to the use and management of outer space resources.[75] Those with space faring interests will undoubtedly favour conservation.[76] The reason for this favouritism stems from the presumption of right of access to space, given by Article I of the OST, and the resources it contains, irrespective of scarcity.[77] When discussing prospective resource exploitation, two contemporary examples are

73 M. Williamson, *Space Ethics and the Protection of the Environment*, op. cit., p. 48.

74 J. Schwartz, *On the Methodology of Space Ethics*, [in:] The Ethics of Space Exploration, op. cit. p. 94.

75 J. Schwartz, *Near-Earth Water Sources: Ethics and Fairness*, Advances in Space Research 58 (2016), pp. 402–407.

76 Perhaps the earliest proponent of conservation can be found in M. Williamson, *Space: The Fragile Frontier*, op. cit.

77 J. Schwartz, *Near-Earth Water Sources*, op. cit., p. 407

those of mining the Moon for Helium-3[78] and extracting water from near Earth sources.[79] Despite the excitement discovery of these resources caused, using them as reasons to continue space exploration is at the moment, technically implausible, due to the lack of meaningful infrastructure and the level of effort (and by extension waste) caused by the jettison of single-use space objects in retrieving them. This may change with the developments in reusability pioneered by Space X and Blue Origin. Such developments would then shift the burden of discussion from the waste of Earth-based resources to the impact of sustained and regular access to space and what this means for already congested LEO orbits.

Discussions on conservation of the space environment will inevitably focus on whether humanity's usage of space and especially other celestial bodies should continue if life is discovered, even if extra-terrestrial life proves to be solely microbes. As Schwartz illustrates, exploration is often cited as one avenue by which to attempt to ensure human survival,[80] but the act of extracting water, even in such scarce quantities as has been predicted[81] to supplement Earth's supply, can hardly be regarded as ethical, conservative treatment of space. Rather, the very fact that water on Earth is consumed in such vast quantities as requiring supplementary outsourcing from outer space suggests an uncomfortably parasitic side to humanity. In support of Schwartz,[82] it is suggested here that the ethical beginning to conservation beyond mitigation and mediation of space debris is the effort to heal detrimental impact to our own celestial body in matters such as climate change before looking to outer space to remedy human generated environmental problems.[83]

The response to the conservation of space approach as a means of protection by those responsible for crafting international space law does not, at first glance, provide much cause for optimism.[84] The Agreement governing the Activities of States on the Moon and Other Celestial Bodies 1979,[85] otherwise known as the Moon

78 For details see R. B. Bilder, *A Legal Regime for the Mining of Helium-3 on the Moon: US Policy Options*, Fordham International Law Journal 33 (2009–2010), pp. 243–299.

79 F. Tronchettii, *The Moon Agreement in the 21st Century: Addressing Its Potential Role in the Era of Commercial Exploitation of the Natural Resources of the Moon and Other Celestial Bodies,* Journal of Space Law 36 (2010), pp. 489–524.

80 J. Schwartz, *Near-Earth Water Sources*, op. cit., p. 406

81 I. A. Crawford, *Lunar Resources: A Review*, Progress in Physical Geography 39 (2015), p. 146.

82 J. Schwartz, *Near-Earth Water Sources*, op. cit., p. 403.

83 For discussion on the need for ecologically sound practices in space exploration, see S. Krichevsky, *Green Space?,* ROOM – The Space Journal (2014), http://www.room.eu.com/articles?id=29 [10.03.2018].

84 An example of how difficult consensus is to achieve can be found in the discussions on the Lima Climate Change Conference in December 2014 at http://www.bbc.co.uk/news/science-environment-30468048.

85 Hereinafter *Moon Agreement 1979*.

Agreement (MA) exemplifies the difficulties to be had in regulating access to outer space resources. The attempted legislation called for an "international regime … to govern the exploitation" of lunar resources for national, and by extension, commercial gain.[86] The reliance on what has become known as the Common Heritage of Mankind (CHM) principle was the main reason behind the failure of the MA.[87]

It is an indication of the values held by the international community that restrictions of access and equitable distribution, core methods of environmental conservation, are viewed as commercial losses rather than protective measures. As a result, the Moon Agreement was never ratified by any of the main space faring nations: China, Russia or the USA.[88] As the states with the most significant and intimate connection to space exploration, China, Russia and the USA, carry the most influence and hold the balance between the success or failure of law and policy,[89] their clear refusal to sign the MA from the outset led to the failure of the MA as a significant piece of international law.[90] However, the Moon Agreement is worthy of note for the clarification it would have established towards the ethical exploration of space toward the prevention of disrupting "the existing balance of its environment, whether by introducing adverse changes in that environment."[91]

Developing the Environmental Ethic in Space Activity

Despite the lack of practical application by the international community, the avenues for considering and developing humanity's sense of environmental responsibility beyond our own celestial borders is well pronounced. After the Cerise incident in 1996, awareness of humanity's environmental impact increased dramatically since "space debris is an issue of concern to all nations."[92] This resulted in the development of the Inter-Agency Space Debris Coordination Committee

86 See *Moon Agreement 1979*, op. cit. Article 11.

87 For discussion on this, see C.Q. Christol, *Evolution of the Common Heritage of Mankind Principle*, W St U Intl Law Journal 1 (1981), pp. 63–75.

88 United Nations Office of Outer Space Affairs, *Status of International Agreements Relating to Activities in Outer Space*, 2017, http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2017_CRP07E.pdf [10.03.2018].

89 C. De Visscher, *Theory and Reality in Public International Law*, 3rd ed., Princeton, Princeton University Press 1960, p. 149.

90 B. Cheng, *United Nations Restrictions in Space: 'Instant' International Customary Law?*, Indian Journal of International Law 5 (1965).

91 *Moon Agreement 1979*, op. cit., Article VII (1).

92 G. A. Res. 48/39, 58, UN Doc. A/Res/48/39, (10 Feb 1994).

(IADC), succeeded later by the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). COPUOS has succeeded, albeit in a mild, more limited capacity where the Moon Agreement failed. The highly qualitative[93] guidelines[94] COPUOS produced not only provided a workable definition of space debris[95] but also enjoy a wide rate of acceptance within the international community[96] since the limitations they do introduce are efficient[97] in design. The fact that these guidelines are non-binding and that COPUOS operates via consensus shows the lack of importance placed upon humanity's environmental footprint in space. As of 2018, COPUOS has 84 member-states[98] benefitting the international community by nullifying political connotations through the facilitation of compromise. It is of little wonder that COPUOS is an oft-chosen champion for the development of environmental ethics in space whilst still leaving much needed to be done.[99] It is promising that there is an increased awareness of the need for activity from Russia, China, and the USA. Additionally, France and the UK are creating domestic space legislation with some concession to environmental provisions.

Having detailed the development of responsibility towards the space environment, it is now important to consider the values which may be applicable. Framed inside Williamson's effective terms that space ethics concerns "what we should and shouldn't do in space,"[100] environmental ethics appear to be that of conserving the environment via sustainable and careful management. However, the inclusion of a multitude of stakeholders, whilst enriching the debate overall, has made the application and enforcement[101] of a paradigm of core values more difficult than the original, wide remit of the OST allowed. In terms of core values themselves, the examination and insertion into space policy of Earth's environmental values[102] hold value given the recent shift in awareness and development of poli-

93 UN Comm. on Peaceful Uses of Outer Space, *Report of the Scientific and Technical Subcommittee on Forty-Fourth Session,* UN Doc. A/AC.105/890, 99 (6 Mar 2007) at 42–43.

94 UN Gen. Assembly, *Report on the Committee on the Peaceful Uses of Outer Space*, op. cit., § 117.

95 UN Space Debris Mitigation Guidelines, UN doc. A/62/20, *Report of the COPUOS* (2007), no. 1, § 1.

96 UN Comm. on Peaceful Uses of Outer Space, *Report of the Scientific and Technical Subcommittee on Forty-Fourth Session*, UN Doc. A/AC.105/890, 99 (Mar. 6, 2007) at [43].

97 N. Welly, *Enlightened State Interest,* op. cit. p. 277.

98 United Nations Office for Outer Space Affairs, *Membership for the Committee on the Peaceful Uses of Outer Space*, http://www.unoosa.org/oosa/en/members/index.html [10.02.2018].

99 See e.g. L. Billings, *To the Moon, Mars, and Beyond: Culture, Law, and Ethics in Space-Faring Societies*, op. cit.; C. J. Newman, *Seeking Tranquillity: Embedding Sustainability in Lunar Exploration Policy*, Space Policy 33/Part I (2015), pp. 29–37; N. Welly, *Enlightened State Interest*, op. cit. p. 273.

100 M. Williamson, *Space Ethics and the Protection of the Environment*, op. cit., p. 48.

101 *Outer Space Treaty 1967*, op. cit., Article VI.

102 A. Pompidou, *The Ethics of Space Policy*, COMEST/UNESCO 2000, p. 25.

cy, for instance, towards reducing usage of plastic. This resurgence in concern for the treatment of environments by humanity would well serve environmental ethics, provided momentum is not as sporadic as in the past.

With the continuing desire to use space, it may well be best to adapt the wilderness rationale, the notion of "preserving pristine space environments for their own sake"[103] and creating outer space nature reserves. Treating space as a place of nature reserves would limit the environmental protection of space to certain areas. Nonetheless this type of approach would preserve the health of the most delicate parts of the space environment, which lacks the regenerative capability of Earth. Furthermore, this preservation would also be achieved without infringing upon the "freedom of scientific investigation"[104] in space. The environmental value of nature reserves is a successful Earth environmental policy and is well suited to space adaption. Nature reserves on Earth are, by definition, conservatively managed areas, thereby suiting the forward contamination policy states currently have in place.

It is impossible to return space environments to a pristine state once they have been contaminated. In most cases, once probes have entered the area, it has been despoiled by human influence. Rather than trying to impose, top-down, an environmental directive upon space operators,[105] it is suggested that treating space as an avenue for nature reserves would be appropriate. It does not restrict access to space for stakeholders but would rather increase the responsibility of this access in a manner which promotes environmental concern and planetary protection. Such an approach is not a far extension from the environmental policy states such as France and the UK have already embedded in their domestic legislation.[106] The environmental values present in space policy must be one of protection through sustainable conservation while recognising the need to use space and work in it.

Legal Mechanisms for Embedding Environmental Values

At first glance, there are a myriad of approaches that could be used to embed an environmental value system within space operations and space law. Binding bilateral and multilateral treaties, Memoranda of Understanding, customary

103 L. Billings, *To the Moon, Mars, and Beyond: Culture, Law, and Ethics in Space-Faring Societies*, op. cit., p. 252.
104 *Outer Space Treaty 1967*, op. cit., Article I.
105 L. Billings, To the Moon, Mars, and Beyond: Culture, Law, and Ethics in Space-Faring Societies, op. cit., p. 253.
106 See the *French Space Operations Act* 2008 and the *UK Outer Space Act* 1986, specifically the licensing requirements under Section 5.

international law and non-binding guidelines have all been utilised in international law to try to shape and direct normative behaviour.[107] However, the degrees of success these different implements have enjoyed raises questions as to which is the most suitable for effectively enshrining environmentally responsible behaviour in space activity where a mixture of military and mercantile self--interest has predominated.

Treaties as international legal agreements have the benefit of being binding upon the states party to them.[108] Usage of this device would permit the express inclusion into law of the measures by which the space environment must be protected by those states wishing to interact with outer space. Yet creating a specific environmental treaty or embedding a clear environmental ethic within other space treaties could simply mean that states will refuse to be bound and, therefore will not be influenced by attempts to shape normative behaviour in respect of the space environment.[109] As the Moon Agreement attests, particularly where the refusing states hold a significant degree of influence in the matters at hand, this can result in the failure of the treaty to enter into force at all.[110] Coupled with this, the nature of space activity has changed. There are no longer two dominant superpower actors but several emerging space nations. Top-down imposition of an environmental value system will not be well received by the wider community and it may, indeed, prove impossible to negotiate a treaty that satisfies all stakeholders.

There is some hope on this front in the mediating nature of the acceptance of reservations to treaties under Article 19 of the Vienna Convention on the Law of Treaties 1969 (VCLT). This Article permits flexibility via the modification of terms which party states are unable to accept.[111] However, reservations, despite their intention to function as a method of resolution, are rather problematic for the function of new treaty law. The VCLT favours reserving states to a ruinous effect on the treaty as a whole.[112] Whilst reservations that would be "incompatible with the object and purpose of the treaty"[113] are not permitted to take effect. This is not without issue, since reservation incompatibility is determined by the

107 For details on these mechanisms, please see J. Crawford, *Brownlie's Principles of Public International Law*, 8th Ed., Oxford, Oxford University Press 2012, Part IV International Transactions.
108 *Vienna Convention on the Law of Treaties,* 1969, Article 2 (2). Hereinafter *VCLT 1969*.
109 Ibidem, Article 11.
110 Ibidem, Article 24 (1).
111 Ibidem, Article 21.
112 E. Lijnzaad, *Reservations to UN-Human Rights Treaties: Ratify and Ruin,* Dordrecht, Kluwer 1994, p. 107.
113 *VCLT 1969*, Article 19 (c).

state parties themselves.[114] The choice permitted to states in deciding reservation incompatibility is especially worrisome as it demonstrates that treaties are not as binding as to give concrete assurance that the space environment could be free from continued exploitation.

With that in mind, it is possible to forbid reservations altogether as intolerable, though this once again leads to the risk that states will simply not consent to be bound by the treaty at all. In a similar manner, interpretation of treaties presents another obstacle to space environment protection. Interpretation of treaties varies between the strictly objective textual approach, defining the terms subjectively via the drafters' intent or considering the object and purpose. The textual approach to interpretation is widely practised, although it must be said that Article 31 VCLT uses a collaboration of all three methods. State practise so far, in space law specifically, also seems to favour textual interpretation; the broad language of OST allows states to interpret in a way that may not openly permit behaviour but does not does not object to it either because much of the progress of space exploration and policy was not envisioned as technologically possible.

Despite the status of the OST as the foundational principles of space law, a fresh legal device—treaty or otherwise—stands as the best option for clarity regarding an environmental protection. Whilst the OST enjoys widespread acceptance, it provides little more than a skeletal framework and there is no appetite to revisit these underpinnings.[115] This renders fresh attempts of interpreting the OST somewhat futile. Any environmental protection treaty would have to be explicitly worded to enjoy success in this way. This is, of course, achievable as demonstrated by the Moon Agreement but, as the Moon Agreement also proves, this interpretative method was not particularly favoured by states in the field of space law. Following the Vienna Convention's blend of textual and teleological methodology, which the drafters aimed to achieve, is perhaps the best avenue for any environmental treaty. This is because a treaty constructed in this way uses the ordinary meaning of the text with the additional stipulation of its object and purpose thereby minimising risk of exploitation.[116]

An environmental ethic embedded in a new treaty may be attempted to be viewed as an obligation *erga omnes*, that is, as an obligation which states must protect

114 International Court of Justice (ICJ), *Advisory Opinion Concerning Reservations to the Convention on the Prevention and Punishment of the Crime of Genocide*, 28 May 1951.

115 J. West, *Back to the Future: The Outer Space Treaty turns 40*, The Space Review, 15 Oct 2007, http://www.thespacereview.com/article/982/1 [10.03.2018].

116 *VCLT 1969*, Article 31.

as an obligation to the international community as a whole[117] since space belongs to the international community. Indeed, this would appear to be a restatement of the CHM principle[118] though this adds to the difficulty in embedding an environmental ethic via treaty. *Erga omnes* obligations are binding because of their character as customary international law. Attempting to utilise the Common Heritage of Mankind principle and ensuring its acceptance by major stakeholders in space activity, such as the USA, is unlikely. It may be viewed as "a form of common ownership that is akin to 'international socialism'"[119] and, in any event, such an ill-defined idea would clearly be unpalatable and politically unacceptable.

Given the complexity and lack of assurance when it comes to political motivations and ideologies in embedding an environmental ethic via treaty law, it is beneficial to consider the success of alternative legal devices. Memoranda of Understanding are not legally binding but are documents of "legal consequence."[120] A persuasive example of this device already exists in space law, namely the Memorandum of Understanding (MoU) between NASA and RSA concerning co-operation on the civil international space station 1998, which governs the International Space Station. This memorandum demonstrates the ease by which amendments may be affected on an international scale given the introduction of Europe, Canada, and Japan as parties to the agreement. This device permits the evolution of the space environment and our understanding of it to be readily met with a similarly developing chain of legal obligations. This has been supported by the International Court of Justice which established that where documents enumerate commitments to which the parties have consented an international agreement has been formed.[121] Despite the International Space Station operating successfully courtesy of an intergovernmental MoU, such memoranda are not common overall in international law and may not achieve widespread acceptance.

Nevertheless, another available method which has been tried and tested in space law is the creation of specific guidelines akin to the UN Guidelines on space debris.[122] The fluidity of guidelines as a device and the freedom for parties to opt-in precludes reservations of being bound to these terms. Additionally, as with the UN Guidelines, any guidelines on the space environment's protection

117 *Case Concerning the Barcelona Traction, Light and Power Company, Limited (Belgium* v. *Spain)*, Judgment of 5 February 1970, ICJ Reports (1970) 4, § 33–34.

118 *Moon Agreement 1979*, op. cit., Article XI (1)

119 C. J. Newman, *Seeking Tranquillity: Embedding Sustainability in Lunar Exploration Policy,* op. cit. p. 12.

120 M. N. Shaw, *International Law,* 6th ed., Cambridge, Cambridge University Press 2008, p. 906.

121 *Quatar v Bahrain ICJ Reports*, 1994, p. 112.

122 *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*, op. cit.

regardless of the shape the policy might take would not necessarily be forbidding in nature. Instead, an environmental ethic guideline could be "concerned with guidance on how to conduct space activities in principle to prevent or at least to minimize harmful effects, consequences or by-products of space activities."[123]

The loose affiliation of guidelines raises another prospect in the form of customary international law (CIL). CIL has enjoyed a great deal of success in the field of space law to the extent of formulating the establishing principle of non-sovereignty.[124] Given the still developing degree of activity, an environmental ethic via CIL could also have the effect of being both the *opinio juris* obligation as well as the state practise element. However, the fragility of the notion of environmental responsibility must serve to preclude the idea of CIL as an option. As aforementioned, states with the most intimate connection to an area have a significant level of influence and if those states and the companies which operate under them were to change their mind regarding environmental CIL, the damage to the environment would be significant. Therefore, the solidity of a legal instrument, preferably binding if possible, would be the most beneficial. If a treaty is impossible, guidelines—both despite their overall fluidity as a device and because of it—would be the best option.

Conclusion: From Values to an Underpinning Ethical Commitment

The management and regulation of space activity that is harmful to the fragile environment has been restricted to the non-binding, voluntary codes described above in respect of planetary protection and space debris mitigation. The dangers inherent in relying on voluntary codes to protect ethical values are clear. Without a legally binding framework based on harmonized practices and built on an international consensus, each individual actor will pursue its own agenda, forsaking environmental considerations for either profit or national interest. The subsequent damage to the fragile environment risks seriously impeding sustainability.

This discussion has illustrated how the ending of the Cold War saw a radical realignment of the geopolitical world order with an obvious impact on space activities. Space activity in the second decade of the 21st century has seen the emergence of a number of companies working alongside established and emerging state space

123 S. Hobe & J. H. Mey, *UN Space Debris Mitigation Guidelines*, op. cit. p. 394.

124 *UN Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, General Assembly Resolution 1962 (XVII) (1963).

powers.[125] Accordingly, the exploration of space is now open to a broad spectrum of actors pursuing a broad range of interests.[126] It is contended that while there has been a commercial and institutional shift, there has not been the resultant attitudinal shift towards recognizing the strain that such a dramatic increase in the usage of space can place on the orbit of the Earth. The underpinning legal system reinforces the notions of security and equality of access.[127] The ethos of individuals in space is shaped by romantic notions of space as a frontier to be tamed by military test pilots boldly pursuing mission goals at all costs. Meanwhile companies and states view space as a potentially limitless source of profits and minerals. Yet there is also an opportunity to start a new conversation about space activity. Scientists, engineers, and the space community at large realise the threat posed by space debris in Earth's orbit. There is now a recognition that without dramatic action the orbit of the Earth could be rendered unusable.[128]

The exploration of space is no longer driven by Cold War ideologies, and there exists an opportunity for discourse to ensure that a concern for the delicate space environment is at its core. Embedding environmental protection as a legal as well as an ethical imperative, both present and future space missions would have to integrate planetary protection or debris limitation measures from the initial design concept. As has been recognised, the emerging consensus on space debris needs to build on the agreement found in the voluntary guidelines and into robust, legally mandated mechanisms outlined in this discussion.[129] The move from state actors to a multi-sectored space activity poses legal and ethical questions that go to the very heart of the continued exploration of space. The different imperatives that drive state and commercial activity must be reconciled with the need to protect the extra-terrestrial environment. Failing to adopt sustainability as a core value endangers the future of all space activity.

125 See J. Foust, *For Commercial Cargo, Ideas Old and New*, The Space Review, 23 Mar 2015, http://www.thespacereview.com/article/2717/1 [11.03.2018]. Foust discusses the development of commercial cargo provision for NASA with various companies.

126 For further articulation of the broadening scope of commercial activity, see D. Webber, *Commercial Space Exploration: No Longer an Oxymoron*, The Space Review, 9 Feb 2015, http://www.thespacereview.com/article/2692/1 [11.03.2018].

127 J. Gabrynowicz, *Space Law: Its Cold War Origins and Challenges in the Era of lobalization*, op. cit., p. 1041.

128 See, inter alia, the work of the Inter Agency Debris Committee (https://www.iadc-online.org), European Space Agency Space Debris Office. (https://www.esa.int/Our_Activities/Operations/gse/ESA_Space_Debris_Office), and NASA Orbital Debris Removal Program (https://www.orbitaldebris.jsc.nasa.gov).

129 C. J. Newman, The New Space Ethics: COSPAR, Planetary Protection and Beyond, op. cit.

Abstrakt

Prawo, etyka, przestrzeń kosmiczna. Eksploracja przestrzeni kosmicznej i wartości środowiskowe

Niniejszy artykuł jest próbą analizy etycznych wartości, które towarzyszyły dotąd ludzkiej eksploracji kosmosu. Podkreślono w nim potrzebę zaszczepienia w ludziach nowych wartości etycznych za pomocą nowej, dobrze skonstruowanej legislacji. Jedną z wartości, którą autorzy uważają za szczególnie istotną w tworzeniu nowej postawy wobec eksploracji przestrzeni kosmicznej, jest troska o środowisko naturalne, w tym o przestrzeń kosmiczną.