

The Promotion of Space Sustainability Through National Licensing Regimes

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Abstract

The private sector is poised to reap untold riches in space, with new and imaginative ventures being announced almost daily. With great opportunities come great responsibilities, including the duty grounded in the Outer Space Treaty to conduct activities in space in a sustainable manner. The COSPAR Planetary Protection Policy and the IADC Space Debris Mitigation Guidelines establish detailed policies to promote sustainability, but these instruments have applicability only in limited defined contexts. The elements of space sustainability are yet to be clearly articulated, especially with regard to private sector activities. The development of legal standards will need to consider the interests of all stakeholders, including the global public interest, and policies must consider history, culture, ethics, and aesthetics.

The absence of comprehensive international agreements on standards of conduct places states, especially licensing regimes, at the forefront in determining and shaping the contours of acceptable activities. States such as the United States and New Zealand have taken initial steps in their domestic laws to articulate specific policies to promote sustainability and prohibit certain activities as contrary to public policy, such as obtrusive space advertising or harming, interfering with, or destroying other spacecraft or Apollo landing sites.

This study examines the role that states and national licensing regimes can play in defining the elements of space sustainability with special emphasis on private sector activities. Substantive policy considerations are identified and analyzed regarding, *inter alia*, the protection of scientific investigations, prevention of interference with activities of other entities, preservation of sites of special historic, scientific or aesthetic interest, disclosure of information concerning activities and discoveries, and the impact of activities on orbital and celestial environments. The study concludes with specific recommendations that states can implement to promote space sustainability.

Keywords: public policy, global public interest, sustainability, environment, New Space, lunar activities and payloads

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1. Introduction

The licensing of commercial ventures on the Moon presents issues of cultural, philosophical, religious, ethical, and aesthetic importance.¹ The traditional list of stakeholders included in discussions regarding the private sector in space is replete with entities that promote their own self-interest, including governments, companies, and international organizations. But the interests of the global public, including future generations, lack a dedicated voice at the table. The customary stakeholders may not give adequate representation for the interests of the whole of humanity, which will not always be compatible with the narrow profit-making motive of entrepreneurs.

Central to the peaceful exploration and use of space by the present and future generations is the concept of sustainability. In 2019 COPUOS approved Guidelines for the Long-term Sustainability of Outer Space Activities, which defined sustainability as:

the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations *while preserving the outer space environment for future generations* (emphasis added).²

National licensing regimes have an obligation to give due consideration to the interests of the global public, including future generations, as they authorize commercial activities in space.³ The central theme of this study is that *it is essential for the peaceful and sustainable use of outer space⁴ that local licensing and permitting agencies give adequate consideration to the interest of the global public, such that certain activities should not be authorized as a matter of public policy even if not expressly prohibited by law or treaty.* That

1 Rummel, J.D., Race, M.S., Horneck, G., *Ethical Considerations for Planetary Protection in Space Exploration: a Workshop.*, *Astrobiology*, 12(11), 1017-1023 (2012).

2 UNCOUOS, *Guidelines for the Long-term Sustainability of Outer Space Activities*, February 2019, para. 5, U.N. Doc. A/AC.105/C.1/L.366, https://www.unoosa.org/oosa/oosadoc/data/documents/2019/aac.105c.1/aac.105c.1l.366_0.html.

3 Jakhu, *Legal Issues Relating to the Global Public Interest in Outer Space*, 32 J. SPACE L. 31, 55 (2006); Moteshar, *Commentary, Artemis: the Discordant Accords*, 44 J. SPACE L. ____ (2020).

4 This study focuses on private sector activities on the Moon, and by extension, other celestial bodies. This is not intended to minimize the importance of the sustainable use of orbits around the Earth and other locations, which merits comprehensive discussions beyond the scope hereof. Nevertheless, the interests of the global public are ever present in the use of orbiting satellites and other spacecraft operating in the outer space void.

is, there are some activities which even if not illegal *per se* are so inconsistent with the global public interest that they should not be allowed to take place. Moreover, there are certain minimum standards of behavior which are so fundamental to sustainability and public order in space⁵ that they should be applicable to all private sector missions to the Moon and other celestial bodies. In the absence of an international agreement on baseline conduct⁶ it will be up to national licensing regimes to protect the global public interest as a matter of public policy.⁷

2. The Nature of Public Policy in Law

All laws are an expression of public policy, that is, a policy to further the interests of the public in some manner. But public policy goes beyond direct statutory pronouncements and prohibitions. Public policy is a vague term, which eludes categorical, precise or exhaustive definition,⁸ yet can be considered as:

Community common sense and common conscience, extended and applied throughout the state to matters of public morals, health, safety, welfare, and the like; it is that general and well-settled public opinion relating to man's plain, palpable duty to his fellowmen, having due regard to all circumstances of each particular relation and situation.⁹

At its core public policy concerns the protection of a societal interest that is essential and beneficial to the general welfare. The contours of public policy are shaped by public morals and natural justice to prevent acts which are harmful to the interests of the public or against a public good, contravene an

5 See generally M.S. McDougal, H.D. Lasswell & I.A. Vlasic, *Law and Public Order in Space* (1963).

6 Cf. the IADC Debris Mitigation Guidelines.

7 See M. Hofmann & F. Bergamasco, *Space Resources Activities from the Perspective of Sustainability: Legal Aspects*, 3 *Global Sustainability* 1, 6 (2020), <https://doi.org/10.1017/sus.2019.27>. As this study was in preparation, the U.S. Supreme Court, in *West Virginia v. EPA*, ___ U.S. ___ (2022) defined the limits of regulatory authority and held that a clear congressional mandate is required for agency authorization to regulate “major questions.” Although this holding could be argued as contrary to the central theme of this study, and while a comprehensive analysis of that case is beyond the scope hereof, it is noteworthy that the majority opinion did not negate the role of public policy nor discuss any international implications of the agency action at issue.

8 *Troutman v. Southern Railway Company*, 441 F.2d 586 at note 2 (5th Cir. 1971).

9 *Neiman v. Provident Life & Accident Ins. Co.*, 217 F. Supp.2d 1281, 1286 (S.D. Fla. 2002) (internal citations omitted).

established interest of society, or interfere with the public welfare.¹⁰ A violation of public policy is measured by the tendency to injure the public good rather than by actual injury.¹¹

Public policy is to be ascertained “by reference to the laws and legal precedents and not from general considerations of supposed public interests.”¹² In addition to long governmental practice and statutory enactments, public policy can be adduced by obvious ethical or moral standards.¹³ Moreover, the “clear dictates of common sense” must be considered.¹⁴

Sometimes such public policy is declared by Constitution; sometimes by statute; sometimes by judicial decision. More often, however, it abides only in the customs and conventions of the people – in their clear consciousness and conviction of what is naturally and inherently just and right between man and man.¹⁵

A statute, proclamation, executive order or other formal governmental pronouncement could expressly recite declarations of specific policies, but the public interest extends to policies which are implicit as well as explicit.¹⁶ Disputes concerning the existence, extent and applicability of public policies *vis-a-vis* a particular activity arise at a local level and are administered and adjudicated by national authorities such as courts and regulatory agencies. That is, whether a license should be issued for an activity as a matter of public policy is determined by local processes and procedures. Decisions made by these local authorities, however, will have implications for other states as well as the global public, including future generations.

States can be expected to engage in bilateral and multilateral discussions where they perceive an actual or potential benefit to or infringement of their interests, in which event concerns over national sovereignty will dictate policy. But the interests of the global public transcend national borders, and may not be adequately represented or even considered by states. This is the current situation presented by a number of proposed private sector missions,

10 *Canal Ins. Co. v. Ashmore*, 126 F.3d 1083, 1087 (8th Cir. 1997); *McCullough Transfer Co. v. Virginia Surety Co., Inc.*, 213 F.2d 440, 443 (6th Cir. 1954); *Great Frame Up Systems v. Jazayeri Enterprises*, 789 F.Supp. 253, 254 (N.D. Ill. 1992).

11 *Orange v. Medical Protective Company*, 394 F.2d 57, 60 (6th Cir. 1968).

12 *Vidal v. Mayor, etc., of Philadelphia*, 43 U.S. (2 How.) 127, 197-98, 11 L.Ed. 205 (1844).

13 *Muschany v. United States*, 324 U.S. 49, 66 - 67, 65 S.Ct. 442, 451, 89 L.Ed. 744 (1945).

14 *U.S. Postal Service v. American Postal Workers Union*, 736 F.2d 822, 825 (1st Cir.1984).

15 *Orange v. Medical Protective Company*, 394 F.2d 57, 60 (6th Cir. 1968), quoting *Pittsburgh, Cincinnati, Chicago & St. Louis Railway Co. v. Kimmey*, 95 Ohio St. 64, 68, 115 N.E. 505, 507, L.R.A. 1917D, 641 (1916).

16 *Branch v. Mobil Oil Corp.*, 772 F.Supp. 570, 571 (W.D. Okla. 1991).

especially missions to the Moon.¹⁷ Thus, local regulatory authorities are in the position to grant or deny licenses, and thereby determine which activities can be conducted and which activities can be prohibited.

3. Public Policy and Due Regard

Article IX of the Outer Space Treaty (OST)¹⁸ obligates states to conduct activities in space with due regard for the “corresponding interests” of other states. Respect for the rights of others is the foundation of the obligation of due regard, and is essential for the promotion of sustainability in space. In addition to the obligation to respect the rights of other states, Article IX directs that states shall avoid harmful contamination of space, thereby inextricably linking the concepts of due regard and protection of the space environment. Nevertheless, and notwithstanding this linkage, the obligation of due regard is not restricted to environmental protection concerns, but rather extends to all activities conducted in the exploration and use of space. The broad application of the concept of due regard is underscored by the Moon Agreement (MA)¹⁹ which places this obligation in Article 4(1), separate from the obligation to protect celestial environments in Article 7. Moreover, the MA makes clear that the scope and the beneficiaries of due regard are expansive by providing in Article 4(1) that:

due regard shall be paid to the interests of present and future generations as well as the need to promote higher standards of living and conditions of economic and social progress and development in accordance with the Charter of the United Nations.

It is difficult to define the precise contours of the concept of due regard, which is not a guarantee that an activity will not impact other States. Nevertheless, the failure of a state to exercise due regard can, in appropriate circumstances, lead to liability. One such circumstance is where a state passively tolerates offending conduct by an entity within its control. Thus, a state which licenses an activity can be internationally responsible and liable

17 This study primarily is directed to missions to the Moon and other celestial bodies, and will not discuss in detail other aspects of space Sustainability, including orbital crowding or debris, technical or safety standards, or atmospheric pollution from space tourism and launch activities.

18 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, January 27, 1967, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html> [hereinafter referred to as the “OST”].

19 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, December 5, 1979, https://www.unoosa.org/pdf/gares/ARES_34_68E.pdf [hereinafter referred to as the “MA”].

for the consequences of that activity.²⁰ Consideration of the interests of the global public by national licensing regimes is an indispensable component of the exercise of due regard, and it therefore is in a state's own best interest to include a thorough examination of public policy concerns in the review of applications to conduct activities on the Moon.

4. National Licensing Regimes

Article VI of the OST provides that states shall authorize and continuously supervise the activities of their non-governmental entities in space. As a matter of application, Article VI is not self-executing, and a growing number of states have enacted legislation to provide a domestic mechanism for the licensing and permitting of private sector space ventures. There is little in the way of uniformity in the laws adopted by the various states, although there are certain common elements which run through the national regimes. For example, it is usual for licensees to be required to obtain insurance, maintain safety standards, and register space objects.²¹ While the national regimes often primarily are directed to regulating launch service providers, the owners and operators of payloads must also obtain a license for their activities.

The U.S. Commercial Space Launch Act provides that licenses shall be granted which do not jeopardize "the public health and safety, safety of property, and national security and foreign policy interests of the United States."²² Although this phrasing is repeated throughout the domestic statutory framework, and the regulations promulgated thereunder, it is beyond question that this is an incomplete formulation, as, *inter alia*, there are additional factors, such as "laws, regulations and policies" which must be considered in the license application review process.²³ Thus, legislative standards such as environmental laws apply to licensed activities.

4.1. Environmental Review

National licensing regimes often require that applicants comply with environmental laws and regulations, however these measures typically were drafted for the purpose of protecting the environment of the Earth. But private sector activities on or below the Moon's surface could profoundly disrupt the balance of the natural lunar environment.

20 South China Sea Arbitration (The Republic of Philippines v. The People's Republic of China), Permanent Court of Arbitration Award, Case No 2013-19, para. 754 (2016).

21 *See generally* National Regulation of Space Activities (R.S. Jakhu ed. 2010); Global Space Governance: An International Study 87-112 (R.S. Jakhu, J.N. Pelton eds. 2017).

22 51 U.S.C. 50905.

23 FAA, Streamlined Launch and Reentry License Requirements, 85 Federal Register 79590 (December 10, 2020) <https://www.federalregister.gov/d/2020-22042/page-79590>.

Several states have expressly included a reference to protecting the environment beyond Earth in their licensing regimes. For example, the Finnish Act on Space Activities (63/2018) provides that “Space activities shall be carried on in a manner that is *environmentally sustainable* and promotes the sustainable use of outer space” (section 10). The Netherlands Space Activities Act (chapter 2, § 1, section 3) and the Indonesian Law on Space Activities (article 2) reference *protection of the space environment*, while the Hong Kong Outer Space Ordinance Law (section 6(2)(e)(1)) refers to *prevention of contamination* of space. The Austrian Outer Space Act (section 4(1)(5)) and the Russian Federation Decree 5663-1 About Space Activity (article 4(2)) prohibit the *harmful contamination* of space. The Japanese Basic Act on Space Policy (article 20) is phrased in terms of developing and utilizing space “in consideration of *harmony with the environment*” and “for the *preservation of the space environment*.” The Portuguese Decree-Law no. 16/2019, of 22 January, Legal regime of access to and exercise of space activities (article 7(1)(b)) provides that licensees shall take appropriate *safeguards against damage* to outer space, and the Slovenia Space Activities Act (article 5(1)(e)) conditions licenses on applicants “*limiting adverse environmental effects*” in outer space. The Belgian Law of 17 September 2005 on the Activities of Launching, Flight Operation or Guidance of Space Objects requires license applicants to prepare a study of the potential impact of the project on the outer space environment (article 8, § 2).

Commercial ventures on the Moon will alter the natural environment, whether from the mere presence of a spacecraft on the surface, to changes resulting from the release of propellants and other materials, tracks of roving vehicles, and operations such as resource extraction, collection activities, and construction of facilities. The exploration and use of the Moon will have unavoidable consequences for the natural lunar environment, and the international community will need to determine the level of environmental disruption that can be sanctioned and tolerated. The interest of the global public is to limit the environmental impact of activities on the Moon as much as possible,²⁴ and as a matter of public policy state licensing authorities should consider the disruption a permitted operation will cause to the natural environment even if the national licensing laws do not have an express direction to do so.

4.1.1. Historical Abuse of the Space Environment

The environmental protection directives, conditions, requirements and stipulations in national licensing regimes are important but are incomplete and have been ineffective to adequately protect the environment of outer space including the Moon and other celestial bodies. The track record of the private sector in missions conducted to date is replete with examples of

24 COPUOS Sustainability Guidelines A.2, number 2(d).

careless disregard and demonstrable irresponsibility for natural space environments. This track record has an unfortunate antecedent in the practice of states in the exploration of the Moon, Mars and other bodies.

The first spacecraft to reach the surface of a celestial body, Luna 2, scattered banners and medallions emblazoned with the hammer and sickle of the USSR on the surface of the Moon. Subsequent robotic spacecraft and human explorers have left remnants and components in dozens of locations on the Moon, Mars and other celestial bodies establishing an *in situ* historical record.

Most of the private payloads launched into space have been satellites in Earth orbit for telecommunications and remote sensing purposes. The problems caused by the proliferation of debris in Earth orbit from satellites, rocket boosters and fairings, and ASAT tests are well documented. While satellite operators and the international community have moved to reduce the amount of debris in orbit such as by the IADC Guidelines, New Space companies have moved in the opposite direction. In early 2018, the American company Swarm launched four small satellites on an Indian rocket despite being denied a license by the U.S. government. The FCC was concerned that the satellites were too small to track and would pose a hazard to other space objects. Swarm also illegally conducted pre-launch tests and utilized ground communication stations without authorization. The company was assessed a fine of \$900,000 for these transgressions.²⁵

Early 2018 also saw the launch of Humanity Star, a satellite constructed of reflective material to produce visible flares, which re-entered the atmosphere after a few months.²⁶ This satellite created unnecessary obstacles and pollution of LEO as well as other impediments to the work of the international astronomy community.

In late 2018 an inflatable satellite called Orbital Reflector was launched from Vandenberg Air Force Base. After insertion into space, the mission plan called for the satellite to slowly move into position over several weeks where it would inflate and be visible with the naked eye. Communications with the satellite were disrupted by a temporary government shutdown and could not be restored.²⁷ The following year a Japanese company launched the “Sky Canvas” project. The plan was to sell artificial shooting star displays generated by an orbiting satellite for entertainment and the amusement of those sufficiently affluent to afford the cost. The satellite malfunctioned in orbit and the artificial meteor shows were cancelled. The company claimed that the satellite ostensibly was to conduct scientific investigations as the

25 Space News, December 20, 2018, <https://spacenews.com/fcc-fines-swarm-900000-for-unauthorized-smallsat-launch/>.

26 https://en.wikipedia.org/wiki/Humanity_Star.

27 Trevor Paglen, May 2, 2019 https://medium.com/@trevor.paglen_21030/an-unseen-star-5f2ddfa0de19.

shooting stars disintegrated in the atmosphere.²⁸ Whether the scientific benefits would be worth the cost, or whether the benefits could be obtained in a less obtrusive manner, the mission plan posed the potential for severe interference with astronomy among other concerns.

Proposals to utilize satellites to create visible displays continue to arise. One of the most recent was a plan announced by SpaceX to utilize a satellite to beam advertisements and other messages into space. Pixels on the satellite's screen are to be available for purchase, and are to be paid for with cryptocurrency.²⁹ The use of space for advertising or publicity is not limited to satellites in orbit. In 2018, SpaceX launched a Falcon 9 rocket as a demonstration of ability to reach Mars. The rocket carried a Tesla automobile as ballast. This payload was not disclosed until just prior to the launch, and posed a potential risk as a source that could potentially contaminate Mars in the event of an impact with the red planet. The launch license was approved at the last minute when calculations indicated that the probability of the payload coming into contact with Mars was within limits deemed acceptable. The mission met its goal of garnering an incredible amount of free publicity.

Another action that can accurately be described as a publicity stunt occurred in 2019 when the Israel IL Beresheet lunar landing craft was unknowingly used to smuggle tardigrades to the Moon. Unfortunately, the spacecraft crashed into the surface while attempting to land. A few months later a third party revealed that they had secretly hidden some tardigrades in components of the spacecraft.³⁰ The presence of these tardigrades was not disclosed to the authorities during the launch licensing process.

4.2. State Licensing Regimes, Public Policy and National Interests

State licensing frameworks generally evaluate mission authorization applications with reference to criteria such as compliance with domestic laws, the protection of public health and safety, safety of property, and compliance with national security interests and foreign policy obligations or interests. A limited number of states have addressed the possibility that proposed missions may not violate an express law but nevertheless contravene important societal interests, and have included a reference in their authorization regimes to public policy in one form or another.

Indonesia for example will not authorize activities that threaten the public interest (Indonesian Law on Space Activities article 8). Similarly, the Portuguese law on space activities requires that a licensed activity must not

28 <http://star-ale.com/en/>.

29 Business Insider August 7, 2021 <https://www.businessinsider.com/spacex-start-up-launch-satellite-space-advertising-cryptocurrency-2021-7>.

30 Johnson, C.D., Porras, D., Hearsay, C.M., O'Sullivan, S., *The Curious Case of the Transgressing Tardigrades* (part 2), *The Space Review* (2019), <https://www.thespacereview.com/article/3786/1>.

jeopardize the strategic interests of the nation (article 7(1)(e)). Both the South Africa Space Affairs Act (para. 11(2)(b)) and the New Zealand Space Law (article 17, § 9 (2)) provide that licensed and permitted activities must be consistent with their national interests. The Hong Kong Outer Space Ordinance (section 5(1)) provides discretion to the Chief Executive to deny authorization if he “thinks fit.” These domestic laws codify the importance of consideration of proposed missions from a public policy perspective, which supplements the criteria expressly articulated in their regulatory regimes. New Zealand has published a list of four categories of activities that will not be granted a launch permit, even if they comply with all other requirements for launch authorization, because they are determined to not be in the national interest. The specific prohibited activities are:

- payloads that contribute to nuclear weapons programmes or capabilities
- payloads with the intended end use of harming, interfering with, or destroying other spacecraft, or systems on Earth
- payloads with the intended end use of supporting or enabling specific defence, security or intelligence operations that are contrary to government policy
- payloads where the intended end use is likely to cause serious or irreversible harm to the environment.³¹

The identification of these specific forbidden activities is reflective of public policy considerations which underlie New Zealand’s national interests and also her foreign policy interests. At least three of the four listed prohibited activities are also in conformity with and in furtherance of the global public interest. This list of ineligible activities is not exhaustive, and it is implicit that state licensing regimes must consider the national and international public policy interests in addition to the criteria expressly articulated in the domestic laws and regulations.

5. Application of Public Policy to New Space Ventures

The ingenuity and entrepreneurial spirit of the private sector are poised to flourish in space, and while the possibilities for a myriad of creative and novel commercial ventures seem endless, they are not without limitations. It is possible *now*, while the commercialization of space is in a nascent stage and the opportunity to take proactive preventive measures still exists, to identify initial specific aspects of space sustainability and the global public

31 *Approach to payload assessments under the Outer Space and High-altitude Activities Act 17 December 2019*, <https://www.mbie.govt.nz/assets/approach-to-payload-assessments-under-the-outer-space-and-high-altitude-activities-act.pdf>.

interest that must be considered by states in the exercise of the obligation of due regard, recognizing that ventures yet to be proposed may present additional and unforeseen challenges for public policy.

5.1. Duties of Disclosure

Article XI of the OST provides that states shall disclose the nature, conduct, locations and results of activities in space to the UN Secretary General, the general public, and the international scientific community “to the greatest extent feasible and practicable.” This is an amorphous standard which allows for wide latitude, permitting states to find a balance between the public’s right to know and the legitimate proprietary concerns of private entities. The COPUOS Sustainability Guidelines note the need for timely disclosure of information that contributes to long-term sustainability in space (A.5, number 2). The disclosures referenced in the OST and the Sustainability Guidelines generally are to report on acts and events that have already occurred, but it will be essential that certain information is made available in advance of operations, even in some instances at the license application stage.

5.1.1. Advance Disclosures and Opportunity for Review

Each state will set its own standards for disclosure of information to be made available to the public during the license approval process. The information disclosed could be minimal, and whatever the level of disclosure required by individual states there is at present no formal mechanism to coordinate this data and provide advance notice to the international scientific community or the public at large of proposed missions. Unless and until states adopt a common baseline of information to be disclosed by license applicants and a mechanism to disseminate the information to the global community for timely review and scrutiny, individual states should incorporate broad disclosure requirements during the pendency of the launch approval process while protecting trade secrets. At a minimum applicants should be required to make available to the scientific community and the public (1) the location of their prospective mission, (2) the purpose of the mission, (3) a description of all material components of and on a spacecraft, (4) the particular activities to be conducted *in situ*, and (5) a detailed assessment of the anticipated impact the proposed mission will have on the local celestial environment.³² Advance disclosure of relevant information is necessary to provide an opportunity for meaningful review by interested stakeholders at an early stage in the application process.

32 W.R. Kramer, *Extraterrestrial Environmental Impact Assessment – a Foreseeable Prerequisite for Wise Decisions Regarding Outer Space Exploration, Research and Development*, 30 SPACE POLICY 215 (2014).

5.1.2. **End of Mission Disclosures**

It will be important that missions also disclose information at the end of operations. While the precise contents of the post-mission reports are to be determined, they should include a detailed description of the impact of the operations conducted on or below the surface, as well as a full inventory of organic material, fuel and other volatiles released from and remaining on the spacecraft. This post-mission report can be compared with the pre-launch assessment to determine the accuracy of the forecast in the launch license application, to assist in planning by future missions, and to develop best practices.

It is notable that the Artemis Accords³³ contain several provisions calling for disclosure of information to the public and the international scientific community, including Sections 4 (Transparency), 8 (Release of Scientific Data) and 11(7 and 9) (notification and coordination of activities). However, the Artemis Accords are not directed to private sector activities, but rather are aspirational standards of conduct for governments.³⁴ Moreover, Section 8(3) expressly provides that “the commitment to openly share scientific data is not intended to apply to private sector operations unless such operations are being conducted on behalf of a Signatory to the Accords.” Nevertheless, these substantive provisions of the Accords are reflective of the global public interest, that is, public policy, which can and should be considered by national licensing regimes.

5.2. **Application of the COSPAR Planetary Protection Policy to the Private Sector**

The location of mission landing sites, and resource extraction, collection, and other activities will be of particular interest to the international scientific community, which will insist on as complete and comprehensive disclosures as possible, especially for missions to the lunar farside, permanently shadowed regions, and other previously unexplored areas.³⁵ This information will also be needed for future commercial ventures to be able to plan and develop their own operations. Each mission will present a unique context in the then extant circumstances, and economics will factor into the technical and engineering requirements and solutions, which may or may not also have a public policy component, for example the proposed use of a nuclear power source. Nevertheless, all missions will pose a risk to the integrity of scientific

33 Artemis Accords, October 13, 2020, <https://www.nasa.gov/specials/artemis-accords/index.html>.

34 *Id.* §1. But see § 2(1)(d) which provides a signatory state is to take “appropriate steps to ensure that entities acting on its behalf comply with the principles of these Accords.” This begs the question whether a purely private, commercial venture is “acting on behalf” of the authorizing state.

35 See Outer Space Institute, *Vancouver Recommendations on Space Mining*, April 20, 2020, Section VII(3), urging states to be guided by the precautionary principle.

investigation, especially in regard to the search for evidence of past or present extraterrestrial life.

Governments which have conducted missions beyond Earth orbit to date have complied with the Planetary Protection Policy (PPP)³⁶ of the Committee on Space Research (COSPAR). The PPP is comprised of a set of detailed guidelines to prevent the introduction of Earth organisms into celestial environments which could interfere with the search for evidence of past or present life, that is forward contamination, and to prevent the introduction of alien life into the environment of the Earth, *i.e.*, back contamination. The COPUOS has recognized compliance with the COSPAR PPP as the baseline international reference standard to satisfy the obligation in Article IX of the OST to avoid harmful contamination of celestial bodies *vis-a-vis* the introduction of terrestrial biological material.³⁷

The standards set forth in the COSPAR PPP are reflected in the internal regulations and procedures of states applicable to activities conducted by their national space agencies or otherwise with the participation of the government.³⁸ But these national regulations and procedures are not necessarily applicable to missions conducted by the private sector. The global public interest in protecting the integrity of scientific investigation, particularly in the search for alien life, is equally strong whether a mission is conducted by a governmental or a non-governmental entity. There is no public policy favoring the pursuit of private profit at the expense of the integrity of scientific investigation and the interests of all mankind. National licensing and permitting regimes should require compliance with the substance of the COSPAR PPP by non-governmental entities.³⁹

The cost to the private sector to comply with the COSPAR PPP for missions to the Moon is minimal, as the only requirement is documentation and there is no mandate that lunar landing or orbiting craft be subject to any active

36 Committee on Space Research (COSPAR) Planetary Protection Policy (2021) https://cosparhq.cnes.fr/assets/uploads/2021/07/PPPPolicy_2021_3-June.pdf.

37 Report of COPUOS, ¶ 332, p. 42 (2017), U.N. Doc. A/72/20, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/V17/044/69/PDF/V1704469.pdf?OpenElement>.

38 See e.g., NASA Policy Directive 8020.7G, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*; NASA Interim Directive 8020.109A/NASA Policy Directive 8020.12A, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*; European Cooperation for Space Standardization (ECSS), *Space Sustainability – Planetary Protection* (1 August 2019), ECSS-U-ST-20C, <https://ecss.nl/standard/ecss-u-st-20c-space-sustainability-planetary-protection>.

39 Babb, R.J., Erb, H., Howard, D., *Cost Reduction Solutions in Regard to PP for Commercial Companies*, IAF Paper, No. IAC-18-F1.2.3 (2018). In 2019 the FAA released a draft of proposed “streamlined” launch regulations for public comment. This author submitted formal comments urging that the regulations apply the COSPAR PPP to private missions. The FAA responded that the concerns raised were valid but beyond the scope of revisions. 85 Federal Register 79589 (2020). <https://www.federalregister.gov/d/2020-22042/page-79589>.

biological decontamination techniques. Spacecraft sent to Mars, Europa, Enceladus, and other celestial bodies to be determined, however, present a unique risk of contaminating the target body unless the bioload of terrestrial organisms is required to be within the proscribed limits of the PPP, whether conducted by governmental or non-governmental entities. This conclusion is even more apparent regarding the possibility of back contamination by any extraterrestrial material returned to Earth by the private sector. Thus, even without an express statutory or other official mandate, public policy demands that commercial missions to celestial bodies not cause forward or back contamination and at a minimum comply with the COSPAR PPP.

5.3. Hazardous Materials and Environmental Disruption

The PPP establishes baseline requirements tailored to the search for life, but spacecraft to the Moon and other celestial bodies could carry non-biological contaminating matter such as propellants and other materials that could have ramifications for future exploration and use of the area in relative proximity to the spacecraft. Thus, licenses issued to private entities should include a requirement for the preparation and disclosure of a complete inventory of all biological, chemical and other potentially contaminating or hazardous matter carried to the Moon in or on-board a spacecraft. This should not be limited to landing craft, but should include craft intended to orbit the Moon, to protect against the possibility of an off-nominal event.

5.4 Disclosures of Scientific Discoveries

5.4.1. Discovery of Dangers to Life or Health

The disclosures made during the application process and through the pre-launch procedures will need to be supplemented during operations as circumstances require. In addition to the general directive to disclose information in Article XI of the OST, Article V contains a specific mandate for disclosure of any phenomena discovered in space which could constitute a danger to the life or health of astronauts.

5.4.2. Discovery of Evidence of Extraterrestrial Life and Other Scientific Findings

The MA Article 5.3 expands on the mandatory disclosure requirements of the OST to include disclosure of the discovery of any indication of organic life. In the event a government-sponsored mission was to discover evidence of past or present extraterrestrial life, the international scientific community would be expected to take all necessary measures to document the discovery and protect and preserve the evidence for thorough examination and investigation. However, a commercial venture which may make such a discovery would not have the same interests, motivations, desires or ethics as the scientific community, and may be hesitant to disclose any information, including the fact of the discovery, pending an internal assessment and

evaluation of the potential intellectual property rights that can be derived and exploited from the discovery.⁴⁰ In this regard it is noteworthy that as a matter of statutory law, private entities in the U.S. are prohibited from claiming proprietary rights in any living organisms which may be discovered in space.⁴¹

The global public interest requires that the discovery of evidence of past or present extraterrestrial life by a non-governmental entity be thoroughly documented and immediately and fully disclosed to the world. In addition, all activities in the vicinity of the discovery must immediately be halted to prevent disturbing or destroying additional evidence at the site pending scientific investigation.⁴² However, a requirement for an immediate cessation of activities could be financially disastrous to a mission, possibly even resulting in the termination of the venture. Companies would understandably be reluctant to make an announcement of such a discovery, and for that reason national licensing regimes should include an express condition in any license to conduct a mission on a celestial body that the licensee will immediately (however defined) disclose such a discovery to the licensing agency for dissemination to the world.⁴³

The scope of mandatory disclosures could go beyond discovery of evidence of extraterrestrial life and include other discoveries of scientific significance. It has even been suggested that pristine samples of materials extracted or collected on the Moon and celestial bodies by private entities should be made available to the international scientific community for study.⁴⁴ A balance will need to be found between the global public's right to know and the right of a private entity to exploit the benefits of discoveries it makes as a result of its own investment of talent and resources. At a minimum, it should not be open to serious dispute that the discovery of evidence of extraterrestrial life should be shared with the entire world.

5.5. Limitations on Otiose and Vanity Payloads

Several private sector missions to land on the Moon are in preparation and many others are in the conceptualization and formative stages. These

40 Long, G.A., *The Meaning of Life and Close Encounters of the Commercial Kind*, in 2015 Proceedings of the International Institute of Space Law 345 (Jorgenson, C.M. ed. 2016).

41 Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act of 2015, 51 U.S.C. § 51301(2)(a).

42 See Vancouver Recommendations, *supra* note 35, Section VII(23).

43 There is an underlying assumption, which may not be warranted, that a government in control of the information would release the data to the international scientific community. But a state could withhold disclosure pending thorough analysis and evaluation of the data to determine whether there is any strategic advantage that could be exploited from the discovery.

44 Vancouver Recommendations, *supra* note 35, Section VII(14).

missions generally seek to perform a useful service or eventually provide a product, such as to transport hardware for third parties to conduct experiments *in situ* or to conduct experiments themselves. But a new category of mission has emerged, that is the placement of payloads on the Moon which are otiose and have no purpose other than to proclaim the novelty of being on the lunar surface to satisfy the vanity of the sender. For example, an art gallery has announced a project to send physical sculptures and an NFT digital work to the Moon onboard a lunar landing craft bound for Mare Crisium. The sculptures are to be “housed in a transparent, thermally coated, sustainably built enclosed art cube” which is unilaterally claimed to become a “Lunar Landing Heritage Site” where the sculptures are to remain in perpetuity.⁴⁵ That may be an economic benefit to the artist and his promoters, but is that an appropriate and sustainable use of the Moon?

Proposals even more disturbing than placing artwork on the Moon are already in preparation and could be launched in the coming months. Companies have been marketing the transportation of cremated human remains to the Moon for permanent interment on the lunar surface. One company claims to have sold out its manifest, which *includes the remains of at least one dog*. The advertised interment services can include the placement of remains on the surface of the Moon, together with identification markers and individualized messages. As if the use of the Moon as a cemetery for people and pets is not troublesome enough, another company has taken the next step in what may be the quintessential application of the adage that one person’s treasure is another person’s trash. This company advertises that it will transport virtually any object the customer wants to send to the Moon and place it on the surface as long as it fits within a prescribed container.

The amount being charged for sending an object to the Moon is only a few hundred U.S. dollars, and the cost for lunar interment of a person or animal is comparable with the cost of a funeral. Thus, these so-called services are not merely for the rich and affluent, but are within the financial reach of billions of people currently sharing this planet, which highlights that it is axiomatic that these activities are not sustainable and are contrary to the global public interest.

The human species has as an undeniable connection with the Moon that transcends history, culture, science, and perhaps even biology such that our link with the Moon is almost genetically programmed into each of us. Specific cultures including the Hopi, Hindu and Inuit have a unique and special relationship with the Moon which is revered as a deity.⁴⁶ Article I of the OST provides that the exploration and use of the Moon is the province of all mankind. The intentional placement of human and animal remains and vacuous, improvident and other irresponsible payloads on the lunar surface

45 <https://www.pacegallery.com/journal/jeff-koons-un-veils-moon-phases-nft-project/>.

46 https://en.wikipedia.org/wiki/List_of_lunar_deities.

will be considered by many to be grotesque and even blasphemous. *The Moon should not be forever despoiled and the cultural heritage of present and future generations irreparably damaged for the sake of petty temporal financial gain benefitting a small number of private investors.*

National licensing regimes have an obligation to the global public to prevent this kind of befolement of the Moon from taking place in the first instance, for once it is allowed to occur it will be impossible on policy grounds to deny others the ability to conduct similar missions, and the only remaining question will be a matter of scale.⁴⁷ The temptation will be great for persons with financial means to erect monuments to themselves, their loved ones, and their pets to stand on the Moon for all eternity as ultimate narcissistic shrines to conceit. Groups also could place structures on the surface to attract attention for whatever message is desired. Whether as a grave marker or for some other purpose the more obtrusive the structure the better. The placement of these payloads on the lunar surface could constitute a violation of Articles I, II, III, VI, VII, and IX of the OST and will have foreign policy repercussions. Clearly, the use of the Moon in this way is contrary to the interests of the global public in the sustainable exploration and use of space, and would be inherently provocative and threaten international peace, stability and security.⁴⁸

5.6. Restrictions on Operations and Activities

5.6.1. Advertising and Messaging from Space

Missions such as Humanity Star, Orbital Reflector and Sky Canvas were harshly (and rightly) criticized by the international astronomical community. While these missions were short-lived publicity stunts, long-duration commercial programs utilizing constellations of hundreds or thousands of satellites have been deployed, much to the consternation of astronomers.⁴⁹ The U.S. has addressed the use of satellites for publicity purposes by enacting a statutory prohibition against obtrusive space advertising, which is defined as “advertising in outer space that is capable of being recognized by a human

47 NASA set an unfortunate precedent when a container of ashes of Gene Shoemaker was sent to the south pole of the Moon on the Lunar Prospector. This was intended to be a tribute, not a policy statement, but was ill-advised and rightly criticized at the time. Sterns, *The Scientific/Legal Implications of Planetary Protection and Exobiology*, in Proceedings of the 42nd Colloquium on the Law of Outer Space 483 (2000).

48 Tennen, L.I., *The Role of COSPAR for Space Security and Planetary Protection*, in Handbook of Space Security. Policies, Applications and Programmes (Schrogl, K.-U. ed. 2020), <https://www.sciencedirect.com/science/article/abs/pii/S2214552418301007>.

49 COPUOS, Obtrusive Space Advertising and Astronomical Research: Background Paper by the International Astronomical Union, U.N. Doc. COPUOS A/AC.105/777, 18 December 2001.

being on the surface of the Earth without the aid of a telescope or other technological device.”⁵⁰

This statutory prohibition promotes the public policy of protecting scientific research and astronomical exploration, including the use of star trackers and sun sensors for satellite guidance and navigation control systems.⁵¹ The public policy of protecting scientific integrity is so fundamental that the prohibition against obtrusive space advertising applies notwithstanding any other provision of law and may not be waived.⁵² But there are messages that are violative of public policy that fall outside of the statutory definition, that is, space advertising that is not obtrusive, or obtrusive messaging that is not advertising, as well as other activities.

The statutory prohibition on obtrusive space advertising would not apply to messages in orbit or on the Moon which are not in the nature of advertising, no matter how obtrusive. Thus, the statute does not prohibit the placement of an obtrusive message for purposes other than advertising, such as a political slogan or symbol,⁵³ a personal message like a marriage proposal, or a celestial headstone comprised of an array of laser beacons to mark the placement of cremated remains. Nor would such obtrusive but non-commercial messages directly jeopardize the public health or safety, safety of property, national security or international obligations of the U.S. Nevertheless, such obtrusive messages would contravene public policy, even without the inclusion of any advertising content.

The Apollo 11 lunar landing site and other historic and unique locations on the Moon could be attractive targets for a company to conduct an *in situ* advertising campaign. Signs and other visual displays on the Moon’s surface next to or on the lunar module would not constitute obtrusive space advertising as defined by the statute. Nor would such displays run afoul of the payload review factors enumerated in the current U.S. regulations. Nevertheless, this kind of activity would contravene national public policy and the global public interest by altering the fragile historical record as left by the astronauts, and potentially by interfering with U.S. government property.

5.6.2. Restrictions on Areas of Operations

In 2020 the U.S. Congress enacted the One Small Step to Protect Human Heritage in Space Act, which recites the Congressional finding that robotic and crewed spacecraft and landing sites on the Moon are of outstanding universal value to humanity,⁵⁴ and that such landing sites “contain artifacts

50 51 U.S.C. § 50902(12).

51 See 71 Federal Register 51969, August 31, 2006.

52 51 U.S.C. § 50911(a)(2).

53 See the NASA rebuke of Russia for utilizing the International Space Station to make an anti- Ukraine political statement, <https://spacepolicyonline.com/news/nasa-rebuked-russia-for-using-iss-for-political-purposes/>.

54 Pub.L. 116-275, December 21, 2020, Section 2(a)(6).

and other evidence of human exploration activities that remain a potential source of cultural, historical, archaeological, anthropological, scientific, and engineering knowledge.”⁵⁵ The Act codifies Recommendations drafted by NASA to protect and preserve the U.S. lunar artifacts⁵⁶ for all missions with NASA involvement. The Recommendations generally establish three-dimensional “exclusion zones” of varying sizes around the specific items on the lunar surface, however they could be waived for particular missions.⁵⁷

The One Small Step Act declares the establishment of exclusion zones as a best practice. The Act recognizes that robotic spacecraft on the Moon “are of outstanding universal value to humanity” but limits its application to the Apollo landing sites. Spacecraft from the USSR/Russia, China, India and Israel are on the Moon, and may be equally worthy of protection as historic sites.⁵⁸ The global public has an interest in the protection of all of these sites, and national licensing regimes should not authorize activities that will disturb historic spacecraft on the Moon, regardless of the original launching state. The Artemis Accords call for the protection of artifacts on the Moon without regard to the launching state as part of the outer space heritage of mankind.⁵⁹ In addition to protecting sites with man-made artifacts, it has been proposed that certain natural locations on the Moon be protected from commercial development as planetary parks,⁶⁰ such as unique vistas and sites of special scientific interest.⁶¹ These areas could include but would not be limited to the “special regions” on Mars as defined by the COSPAR PPP where environmental conditions of temperature and the existence of water may be present that would be conducive to supporting life.

The interest of the global public in protecting locations of scientific or aesthetic interest is not well defined, and states should be reluctant to proscribe all activities from areas on uncertain criteria. Any proscriptions would be limited in application to entities subject to the jurisdiction of that state alone, as any attempt to cordon off areas of the Moon to other states would violate the right of states in Article I of the OST to explore and use all areas of the Moon, as well as the non-appropriation doctrine in Article II. Nevertheless, states should be open to giving due consideration to specific

55 *Id.* Section 7(C).

56 NASA Recommendations to Protect and Preserve the Historic and Scientific Value of U.S. Government Lunar Artifacts', October 28, 2011 https://www.nasa.gov/sites/default/files/617743main_NASA-USG_LUNAR_HISTORIC_SITES_RevA-508.pdf.

57 Pub.L. 116-275, Section (3)(c).

58 *See generally* For All Moonkind, <https://moonregistry.forallmoonkind.org/about-us/>.

59 Artemis Accords, § 9.

60 International Academy of Astronautics, Cosmic Study, *Protecting the Environment of Celestial Bodies: The Need for Policy and Guidelines*, chap. 4.5 (Hofmann, M., Retberg, P., Williamson, M. eds. 2010).

61 Capper, *What Should We Do with Our Moon?: Ethics and Policy for Establishing International Multiuse Lunar Land Reserves*, 59 *Space Policy*, article 101462 (2022).

concerns that will arise on a case-by-case basis. Moreover, states can establish requirements for disclosure of matters of scientific concern as licensees venture into previously unexplored locales on and below the lunar surface.⁶²

5.7. End of Mission Removal and Reuse of Hardware and Environmental Remediation

Hardware sent to the Moon will be intended to accomplish a specific objective, and once that goal is met, the commercial venture may try to repurpose the object if possible. However, at some point the hardware will become inoperable and remain static in place. This raises the question of what, if anything should be done with spent hardware on the Moon? Pursuant to Article VIII of the OST, ownership of an object is not affected by its presence in space, nor is ownership affected by an object's operability *vel non*. But the presence of inoperable spacecraft littering the surface of the Moon serves no purpose and is not sustainable, and, similar to debris in orbit, could pose an obstacle to the future scientific exploration and commercial and other uses of the occupied locations.

Given the present state of technology it would be impractical to require licensees to remove the items they send to the Moon at the end of their useful life or the conclusion of the venture in general. The future may make that possible, and it also may be possible that spent spacecraft or some of their components could be salvaged and utilized in the operation of a separate venture. For this to occur, there must be a legal basis for a third party to take and use property of another on the Moon. National licensing regimes can provide this legal basis by including a condition in licenses that at the end of the authorized activities, the spacecraft and equipment remaining on the Moon will be deemed abandoned by the licensee or the rights therein otherwise transferred to the state of registry. Jurisdiction and control of the material would remain with the registry state, and that state could authorize subsequent licensees to utilize component parts that are already present *in situ*. Specific details such as the time period before abandonment would occur, and whether there would be any rights of compensation, would need to be determined.

The formal abandonment of spent hardware in space serves the global public interest in two ways: first, it provides one small means by which the proliferation of debris on the Moon can be reduced in furtherance of the goal of sustainability. Second, abandonment of the material negates any question or implication that the extended, indefinite and essentially permanent occupation of a location on a celestial body by the space object could be considered as appropriation in violation of Article II OST.

⁶² Vancouver Recommendations, *supra* note 35, Section VII(14) calls for licensees to make representative and pristine samples of materials available for scientific research.

A related issue concerns whether licensees should be required to remediate disruptions to the natural environment occasioned by their operations. Just as recycling of *in situ* debris must await future development, the restoration of natural environments is not currently technologically possible.⁶³ Nevertheless, the implications of environmental restoration for sustainability and the global public interest are apparent, and states should be open to consider novel approaches to remediation and restoration as they review applications to conduct activities that will disrupt the lunar environment.⁶⁴

6. Statement of IISL Board of Directors

The burgeoning era of commercial space presents a multitude of policy and legal issues, and there is a growing awareness that the interests of the international scientific community and the global public in general are not adequately represented by the traditional stakeholders in the discussions of these issues. In July 2021, the Board of Directors of the International Institute of Space Law issued a statement highlighting the importance for national authorities to consider the interests of the global public in the review and evaluation of applications for launch and payload licenses.⁶⁵ The full text reads:

Consideration of the Interests of the Public and other Stakeholders in the Authorization and Continuing Supervision of Commercial Space Activities

Outer space holds unprecedented opportunities for all countries to conduct activities for societal benefit and commercial gain across the globe. The commercial sector is at the forefront of developing many new capabilities, products and services that will lead to new kinds of commercial space activities, including activities on the Moon and other celestial bodies. These space activities should be developed in accordance with the rule of law, for peaceful purposes, and in a manner that is sustainable for the present and future generations. Among the activities proposed to be conducted are the placement of various types of artefacts, human and animal remains on the Moon, advertising and entertainment displays in Earth orbit, and the launch of large constellations of satellites. The Board of Directors of the International

63 Remediation of the environment is difficult enough to accomplish on Earth. Nevertheless, that has not deterred some from advocating the questionable action of terraforming other planets.

64 Tennen, *supra* note 48.

65 https://iislweb.space/wp-content/uploads/2021/07/IISL_Statement_Authorization_and_continuing_supervision_2021.pdf.

Institute of Space Law (IISL) is of the opinion that there is growing importance for national regulators responsible for the authorization and continuing supervision of outer space activities to give careful consideration to the interests of all stakeholders, including the scientific community and the public, regarding the consequences of authorizing such activities for the future exploration and peaceful uses of outer space, including the Moon and other celestial bodies. Consideration should also be given as to whether there are adequate mechanisms in place to ensure compliance with the Outer Space Treaty (OST) and other applicable regulations and international guidelines for space debris mitigation, space sustainability, and planetary protection to ensure that the activities are conducted with due regard to the corresponding interests of all other States Parties to the Outer Space Treaty.

7. Conclusion

States have an obligation pursuant to Article VI of the OST to authorize and continuously supervise the activities of non-governmental entities in space. Compliance with this international duty requires that states carefully scrutinize proposals by the private sector to conduct commercial activities in outer space and on the Moon and other celestial bodies. Each state can define and establish the criteria by which proposals will be scrutinized, and a number of states have enacted laws and promulgated regulations for this purpose.

There is little uniformity in the various national licensing regimes, but they all, in one form or another, are designed to determine if the proposed mission can be conducted in conformity with national laws and interests. However, there are certain activities which are so incompatible with the global public interest that they should not be allowed to take place as a matter of public policy even if not illegal *per se*. Furthermore, there are certain minimum norms of behavior that should be applicable to all private sector missions to the Moon and other celestial bodies as fundamental to sustainability and the interests of the global public.

This study has identified the following non-exhaustive list of specific norms and policies that should be implemented by state authorization regimes as a matter of public policy and the global public interest supplementing the criteria expressly specified in the national licensing laws and regulations:

- Applicants for authorization to conduct activities should be subject to broad disclosure requirements as early as possible during the pendency of the launch approval process, with appropriate protections for trade secrets. The disclosures will be made available to the scientific community and the public and include:

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- the location of the prospective mission
- the purpose of the mission
- a description of all material components of and on a spacecraft, including a complete inventory of all biological, chemical and other potentially contaminating or hazardous matter carried to the Moon in or on-board a spacecraft
- the particular activities to be conducted *in situ*
- a detailed assessment of the anticipated impact the proposed mission will have on the local celestial environment
- Post-mission disclosures should be required and should include at a minimum:
 - a detailed description of the impact of the operations conducted on or below the surface
 - a full inventory of organic material, fuel and other volatiles released from and remaining on the spacecraft
- Missions to the Moon and other celestial bodies should comply with the substance of the COSPAR PPP
- In the event of the discovery of evidence of past or present extraterrestrial life:
 - the discovery must be immediately and fully disclosed to the licensing authority for dissemination to the world
 - the discovery must be thoroughly documented
 - all activities in the vicinity of the discovery must immediately be halted to prevent disturbing or destroying additional evidence at the site pending scientific investigation
- States should require ongoing disclosure of matters of scientific concern as licensees venture into previously unexplored locales on and below the lunar surface
- States should refuse to authorize activities that will disturb historic spacecraft on the Moon, regardless of the original launching state
- States should refuse to authorize missions to place any signs or other messages on or near historic spacecraft, regardless of whether or not obtrusive
- States should refuse to authorize missions to place advertisements or other commercial messages on or below the surface of the Moon, regardless of whether or not obtrusive
- States should refuse to authorize missions to carry materials such as cremated human and animal remains, assorted detritus, and other otiose payloads to the Moon solely to exploit the novelty of being in the celestial location
- States should refuse to authorize missions to place structures on or below the surface of the Moon which are neither functional nor utilized for any purpose in support of the mission. This would include using the Moon as an *in situ* backdrop for advertisements or

other messaging, whether or not obtrusive, or the erection of monuments, markers and other edifices

- States should consider including a condition in licenses that at the end of authorized activities the spacecraft and equipment remaining on the Moon will be deemed abandoned by the licensee and thereby available for potential use by a third party under terms and conditions yet to be determined
- States should consider requiring licensees to rededicate the physical area of their operations as technologically feasible and practicable

New Space enterprises are proliferating at a rapid pace, placing pressure on national licensing regimes to develop appropriate procedures and substantive policies to authorize commercial ventures while at the same time promoting the sustainable use of space, including the Moon and other celestial bodies. A best practice has been instituted by New Zealand by publishing an initial list of activities that will not be permitted as contrary to the national interest. This serves to protect the interests of the global public and is consistent with and in furtherance of the foreign policy interests of New Zealand and all other countries. States should emulate this best practice and expand the list of prohibited activities. This is a matter of some urgency, lest an improper use of space be allowed to take place as a matter of inaction or default resulting in irreparable injury to the interest of the global public. Ideally, there should be an international consensus on the baseline standards of conduct by the private sector. Until then, national licensing regimes can and should invoke public policy concerns to protect the global public interest.

This study is dedicated to the memory of my late wife, Patricia Margaret Sterns, a shining light and interplanetary environmental advocate.