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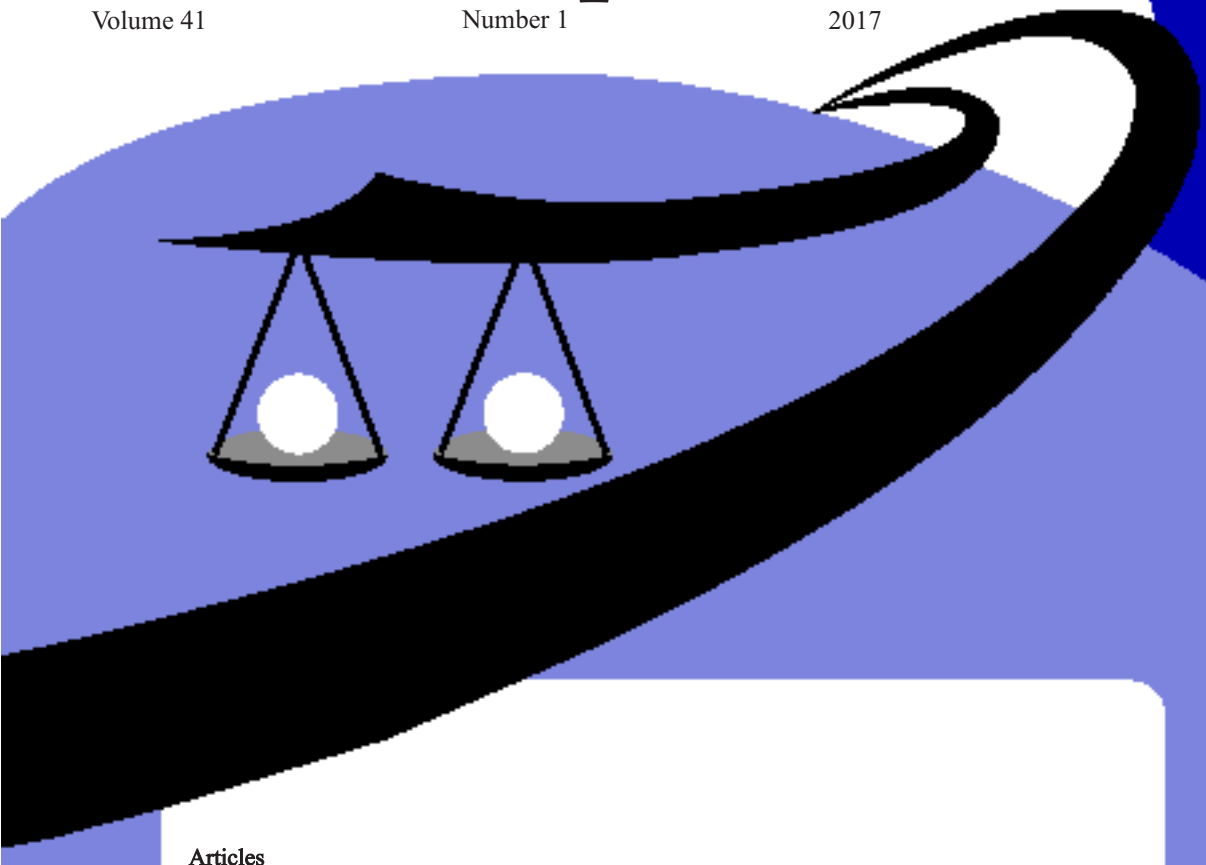

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ARTICLES

A DISCOURSE ON THE REMODELING OF ILA MODEL LAW ON NATIONAL SPACE LEGISLATION

Sandeepa Bhat B.[*]*& Arthad Kurlekar*[**]

I. INTRODUCTION

Nandasiri Jaysantuliyana has credited the success of the evolution of the five constitutive treaties of space law to the United Nations.[1] Undoubtedly, the United Nations' contributions in outer space law-making are praiseworthy, and but for its efforts, outer space would have been the central area of conflict in the modern era of technology. Yet after 1979, the United Nations has failed to adopt a single binding legal instrument governing outer space. Though this is due to the absence of political consensus amongst the member States, the consequences are far-reaching in today's world, wherein the technology has transformed the nature and scope of space activities.[2] Empirically, thus, it is evident that the

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This article is a part of broader endeavor of drafting a viable model of national space legislation for India undertaken by the Society for Studies in Outer Space Law, The WB National University of Juridical Sciences, Kolkata.

[1] NANDASIRI JAYSANTULIYANA, SPACE LAW: DEVELOPMENT AND SCOPE, 4 (1992).

[2] *See* Claudia Pastorius, *Law and Policy in the Global Space Industry's Lift-Off*, 19(1) BARRY L. REV. 201, 204-20 (2013).

evolution of space law, especially in creating binding norms upon the diverse and increasing number of space actors, has become somewhat stagnant on the international level.

It is important to note that the space treaties were entered into during the period when states were the only actors in space activities. The rise in space activities by private space actors has occurred primarily after the drafting of the Moon Agreement[3] in 1979.[4] Thus, space treaties have become somewhat anachronous primarily due to their focus on only inter-state relations. This gross deficiency must be addressed in order to regulate private space activities within the four corners of the law before it is too late. Moreover, the space treaties simply provide for generic rules that often lack enforceability or suffer due to ambiguous phrasing, resulting in conflicting interpretations.[5] Thus, national space legislation would aid significantly in detailing out the procedures and rules required for the purpose of engaging private space actors. As an illustration, a significant need for private space legislation is felt upon analysis of Article VI of the Outer Space Treaty[6] and Article XIV of the Moon Agreement, which provide for supervision and authorization of national space actors.[7] The provisions impose

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[3] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 UNTS 3 (entry into force July 11, 1984) (hereinafter the Moon Agreement).

[4] Fabio Tronchetti, Fundamentals of Space Law And Policy, 13 (2013).

[5] One illustration of the same is the province of all mankind principle, which was dismissed as unenforceable by the United States and the USSR. (*See* J.I. Gabrynowicz, *The Province and Heritage of Mankind Reconsidered*, *in* Proceedings Of The Second Conference on Lunar Bases And Space Activities of The 21st Century, 691, 694-95 (W. W. Mendell ed., 1988)).

[6] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 610 UNTS 205, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entry into force Oct. 10, 1967) (hereinafter the Outer Space Treaty).

[7] Outer Space Treaty, Art. VI states: "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization." Moon Agreement,

an obligation upon states to supervise and also be responsible for the activities of national and non-governmental private space actors. However, the means and mechanisms of this supervision and authorization have not been established by the treaties. Thus, national space legislation is required to address these concerns.

Stephan Hobe suggested that to alleviate this shortcoming, draft legislation should be annexed in the form of a Protocol to the Outer Space Treaty, whereby States would be mandated to enact harmonized legislation.[8] Such a view is tenable, as it would prevent excessive diversification of norms in various jurisdictions. Although there is the potential that this suggestion may raise a question of interference with state sovereignty in its domestic affairs, it has given rise to the formulation of the Sofia Guidelines of 2012, which presented a draft of the ILA Model Law on National Space Legislation.[9] This draft of the ILA Model Law has been further fine-tuned in the 52nd Session of the Legal Subcommittee of the United Nations Committee on Peaceful Uses of Outer Space (UNCOPOUS).[10] The Model Law seeks to serve as an instrument of harmonizing and developing space law. In this article, the authors start with a critical analysis of the provisions of the Model Law by addressing its loopholes in detail. The next part of the article points out the specific aspects that need to find due recognition in the Model Law to comprehensively regulate the space activities at the national level. Finally, the article concludes with the

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Article XIV states: "States Parties to this Agreement shall bear international responsibility for national activities on the Moon, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in this Agreement. States Parties shall ensure that non-governmental entities under their jurisdiction shall engage in activities on the Moon only under the authority and continuing supervision of the appropriate State Party."

[8] *See* Maureen Williams (Report), '*Review of Space Law Treaties in view of Commercial Space Activities*,' Report of The Sixty-Ninth Conference of International Law Association 571, 573 (July 25–29, 2000).

[9] Res. No. 6/2012, 75th Conference of International Law Association.

[10] United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), Legal Sub-Committee, 52nd Session April 2013, Information on the activities of international intergovernmental and non-governmental organizations relating to space law, A/AC.105/C.2/2013/CRP.6, Mar. 26, 2013 (hereinafter 'ILA Model Law'/ 'Model Law'). The Model Law also incorporates explanatory notes in the form of comments by Stephan Hobe (hereinafter 'comment').

summation of arguments, and suggestions for remodeling the ILA Model Law.

II. CONCERNS IN THE SCOPE OF APPLICATION AND DEFINITIONS

A. Scope of Application

Article 1 of the Model Law defines its scope of application.[11] Commentary on the Model Law argues that the jurisdiction *rationaemateriae* is defined by the term 'space activity.'[12] It is interesting to note however, that the term 'space activity' has not been defined in any of the space treaties. At present, various states have diverse definitions of what constitutes space activities; the array ranging from a narrow construction where the launch is the starting point, to a significantly broad scope where the allied ground activities are also considered to be a part of a 'space activity.' Moreover, no scientific or legal criteria have been developed for defining 'space activity' since the beginning of space ventures. This is why the functionalist approach to define outer space and to demarcate it from airspace has also failed.[13] Consequently, a provision that is based on such an ambiguous phrase would have the effect of making the scope of application unclear. Though attempts have been made to provide a definition of 'space activity' under the

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[11] ILA Model Law, Art 1. "The present law applies to space activities carried out by citizens of XY or legal persons incorporated in XY and space activities carried out within the territory of XY or on ships or aircraft registered in XY."

[12] Stephan Hobe, Et Al. (Eds), Cologne Commentary on Space Law, Vol. III, 579 (2015).

[13] There are two approaches to define and demarcate 'outer space'; spatialist approach and functionalist approach. The spatialist approach tries to use different criteria like atmosphere, gravitational force of the earth, lowest satellite orbit, security of the states, ability of the states to have effective control, Karman line, etc. as different criteria for the demarcation of outer space from airspace. Unfortunately, none of these criteria succeed in establishing a precise line of demarcation between the outer space and airspace. (*See* Stanley B. Rosenfield, *Where Airspace Ends and Outer Space Begins*, 7(2) J. SPACE L. 137, 137-48 (1979)); (*See also* He Qizhi, *The Problem of Definition and Delimitation of Outer Space*, 10(2) J. SPACE L. 157, 157-63 (1982)). The functionalist approach, in contrast with the spatialist approach, tries to define outer space in terms of the nature of activity. However, it has been found that defining 'space activity' is as difficult as defining 'outer space' itself. (*See* M. J. Peterson, International Regime for the Final Frontier, 60 (2005)).

Model Law, it is still ambiguous as demonstrated below in the definitional concerns of 'space activity.'

Further, the scope of application encompasses three aspects in relation to a state; space activities conducted from within its territory, space activities conducted outside its territory by its citizens or legal persons, and space activities conducted by its nationals. The commentary further elaborates by stating the need for an effective connecting factor, which in turn hints at the requirement of delineating the jurisdiction of one state *vis-a-vis* other states particularly in situations where there is more than one launching state. However, such a scope of application creates several ambiguities in the interpretation.

The first problem with the phrasing relates to the broad ambit covered within the scope of Article 1. In particular the disjunctive 'or' creates ambiguities. As an illustration, hypothetically assuming that all states have adhered to the Model Law, there may arise a situation where one space activity with a space vehicle registered in the United Kingdom with American nationals on board and launched from a facility located in Australia, may be governed by all three laws; namely that of the United Kingdom, United States, and Australia. Thus, it envisages a situation where there could be more than one law applicable to a particular launch. Assuming that supervision and authorization are the two most important features obligated under Article VI of the Outer Space Treaty, the operation of multiple laws can create problems regarding supervision authority and the states that would supervise or authorize the launch.

The second problem with this is that the scope of application provision is not entirely in synchronization with that of the parameters for a 'launching State' under the space treaties.[14] Article 1 of Model Law does not speak about the use of facility as a crite-

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[14] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 UNTS 187; 24 UST 2389; 10 ILM 965 (1971) (entry into force Sept. 1, 1972) [hereinafter the Liability Convention] and Convention on Registration of Objects Launched into Outer Space, June 6, 1975, 28 UST 695, 1023 UNTS 15 (entry into force Sept. 15, 1976) [hereinafter theRegistration Convention] provide the definition of 'launching State'. Art. I(c) of the Liability Convention and Art. I(a) of the Registration Convention state that "The term "launching State" means: (i) A State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space object is launched."

rion for the application of Model Law, which is a departure from the definition of 'launching State'. Hence, for example, if the facility of State 'A' located in State 'B' is used by State 'C,' to launch a space object of Y, a private space actor from State 'D' (assuming that all States have adopted the Model Law), the laws of State 'A' would not be applicable even though it falls squarely under the definition of 'launching State.' However, the laws of B, C, and D would be applicable to the launch and thus, it poses further ambiguities.

The commentary states, "it is notable that the recommendation does not include 'facilities' of a State as representing one of the four criteria for a launching State."[15] It goes on to argue that this absence does not pose a problem as 'facilities' are *per se* not required and that even without a facility of launch the definition has no gaps. However, as demonstrated above, 'facilities of a State' form an important part of the definition of a launching State and create several obligations, particularly so with its inclusion in the Liability Convention and Registration Convention. Moreover, since such a possibility is not merely a speculation but also found in practical terms,[16] the exclusion of 'facilities' from the provision has far-reaching consequences.

The commentary has envisaged an overlap of applicable laws, but it states that the mere possibility of the overlap is not sufficient and the actual overlap needs to be addressed.[17] However, this does not seem to be a correct proposition and addressing potential overlap is equally necessary. It is only after foreseeing the existence of such an overlap that a State Party may enter into a bilateral or multilateral agreement at the outset to determine the laws applicable in case of an overlap. The commentary also states that there is a need to draft a provision in the national legislation itself, to determine the law applicable during the overlap. No such provision has been addressed in the Model Law.[18]

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[15] Hobe, *supra* note 12, at 567.

[16] Russia owns the Baikonur facility inside Kazakhstan. *See* Roland Oliphant, *Inside Baikonur, the Space Station that will Send Major Tim Peake into Space* (Dec. 13, 2015), *at* http://www.telegraph.co.uk/news/worldnews/asia/kazakhstan/12047437/Inside-Baikonur-the-space-station-that-will-send-Major-Tim-Peake-into-space.html.

[17] Hobe, *supra* note 12, at 575.

[18] *Id.*, at 575, 576.

B. Definitions

Article 2 of the Model Law enlists an illustrative list of important definitions that need to be included in the national space legislation. As noted before, it is pertinent to define 'space activities' under Article VI of the Outer Space Treaty, as supervision and authorization are two important requirements for any space activity. Hence, the definitions part of the Model Law starts with an inclusive definition of 'space activity.'[19] There are two issues pertaining to its definition. First, the definition includes "other activities essential for the launch, operation, guidance and re-entry of space objects into, in and from outer space." Thus, the line between those launch-support activities that would fall into the category of space activities and those that would fall outside that scope is blurred and ambiguous. The second issue pertains to the inclusion of aerospace vehicles within the definition. By their very nature, aerospace vehicles pose a question as to whether they should be governed by air law or by the law of outer space. The Commentary says that the international practice is reflected in the provision.[20] However, it is pertinent to note here that there is no such accepted international practice in this regard. Several theories are proposed by scholars on the applicable law for aerospace objects, but without any consensus.[21]

This issue is further compounded by the fact that the Commentary uses the Karman line as the legitimate threshold for the definition of the space object.[22] First and foremost, this is conflicted by the provisions of the Model Law which is silent with respect to the agreement with the Karman line and thus no presumption in its favor can be made. Second, aerospace vehicles with the capacity to use airlift as well as gravitation for the purpose of motion create a problem in the operation of the definition. Admittedly, the Karman line has been compromisingly accepted as the threshold, but the enforceability concerns in municipal jurisdictions due to

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[19] ILA Model Law, Art 2. "The term 'space activity' includes the launch, operation, guidance, and re-entry of space objects into, in and from outer space and other activities essential for the launch, operation, guidance and re-entry of space objects into, in and from outer space."

[20] Hobe, *supra* note 12, at 575 & 576.

[21] YanalAbulFailat, *Space Tourism: A Synopsis on its Legal Challenges*, 1 IRISH L. J. 120, 147-51 (2012).

[22] Hobe, *supra* note 12, at 575 & 576.

the varying 'content' as interpreted by states of the Karman line would make it even more pressing to have a non-conflicted definition of a 'space object.' The idea of a case-to-case determination of what constitutes a space activity, although *prima facie* problematic in light of possible arbitrariness in decision-making, appears more attractive on deeper examination. This is especially true if the authorization procured demarcates a venture as a space activity after receiving the full proposal from the concerned parties.

Shifting the focus to the definition of 'space object,' the definition of what constitutes a space object becomes pertinent, especially in light of the obligation of registration under Article 10 of the Model Law.[23] With the inclusion of 'component parts' of space object and its launch vehicle, and without a line between whether and to what degree the component parts of the space object would have to be registered, it becomes cumbersome to comply with the obligation of registration in the proper sense. On the one hand, although registration of every component part is advisable, it would not be pragmatic, but on the other hand, the non-registration of component parts would fall afoul of the legislation. Under international law, the meaning of component parts as well as the requirement of registration could be left open to be decided by the state practice.[24] However, under a municipal law this cannot be the case. The sovereign imposition of a state would mandate all actors undertaking activities under the sovereignty of the enacting state to adhere to all provisions of the sovereign. With an ambiguous definition of space object, compliance may become a problem, reducing transparency and safety of space ventures, and increasing the chance of litigation. Litigation, in turn, would dissuade private space actors from undertaking space activities under that state's jurisdiction.

The provisions on scope of application, and definitions of 'space activity' and 'space object' also bank on the determination and demarcation of 'outer space', since they make either explicit or

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[23] ILA Model Law, Art. 2. "The term 'space object' refers to any object launched or intended to be launched into outer space, including its component parts as well as its launch vehicle and parts thereof."

[24] As per the present practice, the one of the States makes a single registration of the space object as a whole with respect to each launch. Zhao Yun, *Revisiting the 1975 Registration Convention: Time for Revision?*, 11 AUSTRALIAN J. INT'L L. 106, 115 (2004).

implicit reference to 'outer space' in the text. However, the Model Law fails to provide any decisive criterion or guideline for the determination of outer space. Current practices at the international level are also divided between the spatialist and functionalist approaches,[25] as well as case-by-case determinations of applicable law.[26] In the wake of this, the provisions on scope of application and the definition of 'space activity' and 'space object' suffer from lack of clarity.

III. SUPERVISION AND AUTHORIZATION

Articles 3 to 6 of the Model Law pertain to the authorization, conditions of licensing, supervision, and the revocation of the license. The commentary states that the Model Law leaves it open for states to decide the structure, organization, and mandate of the National Space Authority.[27] However, it argues that other states are interested to know the internal setup of a state in question, and therefore, states should have the regulatory powers of the authorizing body within the ambit of the legislation.[28]

Article 3 states that "[a]ll space activities are subject to authorization. Authorization shall be granted by the minister (e.g. the competent minister or authority)." Article 4 goes on to elaborate the conditions of authorization.[29] The problem with such a

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[25] *Supra* note 13.

[26] Australia follows spatialist approach in its national legislation by providing a minimum limit of 100 km from the mean sea level for the application of its space law. *See* Art. 8 of Space Activities Act 1998. UNCOPUOS has resolved that the application of space law has to be determined on case-by-case basis instead of trying to find a solution to the problem of demarcation of outer space from airspace. M. Rothblatt, *Are Stratospheric Platforms in Airspace or Outer Space*, 24(2) J. SPACE L. 107, 109 & 110 (1996).

[27] Hobe, *supra* note 12, at 578.

[28] *Id*., at 579.

[29] ILA Model Law, Art. 4. "(1) Authorization shall be granted under the following conditions:
(a) The operator is in a financial position to undertake space activities;
(b) The operator has proven to be reliable and to have the required technical knowledge;
(c) The space activity does not cause environmental damage to the Earth and outer space in accordance with article 7;
(d) The space activity is undertaken in such a manner as to mitigate to the greatest possible extent any potential space debris in accordance with article 8;
(e) The space activity is compatible with public safety standards;
(f) The space activity does not run counter to national security interests;

blanket provision of authorization of all space activities can be demonstrated by an illustration. There is a launch, where the launching States are 'A' and 'B,' both presumably have adopted the Model Law. Assuming that the facility is owned by one state and the launch is procured by another state, then authorization may have to be taken from both states. Continuing the same analogy as used above to Articles 3 and 4, the regulations and stipulations of one authorizing state may vary from one authorizing state to another, creating conflict. Particularly, concerns of national security could be problematic in this circumstance. Conflicting regimes may lead not only to a frustration of the activity, but also dis-incentivize private space actors from conducting space activities at all. Varying compliance standards may also increase the cost of undertaking a venture, cutting down on the profit any private space actor would earn.

The multiplicity of jurisdictions also poses a problem with respect to the power of supervision provided for in Article 5.[30] Sensitive issues associated with space activities— trade secrets, technological knowhow, etc.—have always been kept confidential by the states as well as private players involved in space ventures. In the event of a multiplicity of jurisdictions to supervise space activities, the efforts of space actors to retain confidentiality could pose significant disputes. The power to supervise could also bring to the fore the question of liability apportionment between the launching States *inter se*. It is amply clear under the Liability Convention that all launching States would jointly and severally be liable for any damage resulting from the space activity.[31] The Liability Con-

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(g) The space activity does not run counter to international obligations and foreign policy interests of XY;
(h) The operator has complied with ITU Regulations with regard to frequency allocations and orbital positions;
(i) The operator complies with insurance requirements as determined in article 12.
(2) In order to prove fulfillment of the conditions mentioned in paragraph (1), the operator should submit appropriate documentation and evidence (as specified in an implementing decree/regulation).
(3) The authorization may contain conditions and requirements."

[30] Id. at Art. 5. "All space activities are subject to continuing supervision by the ministerial authority. Details of such shall be laid down in an implementing decree/regulation."

[31] Liability Convention, Art. V(1). "Whenever two or more States jointly launch a space object, they shall be jointly and severally liable for any damage caused."

vention also provides for apportionment of liability between the launching States without affecting the rights of victim states.[32] However, the interplay between the provision on supervision under the Model Law and the apportionment of liability under the Liability Convention may result in conflicting arguments. On the one hand, it may be argued that between the launching states, the supervising state would have to bear a significantly higher burden of liability. On the contrary, the supervising state may argue that it did not have exclusive supervision and control over the private space actor, since other states are also exercizing/entitled to exercise supervisory powers under Article 5. This potential for conflict would mandate the inclusion of a provision within national law, stipulating that the state should negotiate *a priori* a liability-sharing regime with other states in case of any launch falling within the ambit of joint launching.

Significant problems exist even with the power to revoke licenses,[33] since Article 6 of the Model Law does not provide for the consequences of such revocation. If the noncompliance of the licensee with certain conditions is post-facto discovered, failure to account for the consequences under the Model Law brings forward several critical questions: (a) Would the revocation of a license force the licensee to transfer the space object? (b) If the space actor is carrying on an activity of national interest, how would the cessation of the activity be undertaken? (c) In a case of revocation, would the state be liable to compensate the private actor? (d) In a situation wherein authorization is granted from multiple states, whether the state that has revoked the license is bound to compensate other states? Would such a foreign state be entitled to claim compensation from the state of nationality and territory (assuming they are the same) of the private space actor? There-

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[32] Id. at Art. V(2). "A launching State which has paid compensation for damage shall have the right to present a claim for indemnification to other participants in the joint launching. The participants in a joint launching may conclude agreements regarding the apportioning among themselves of the financial obligation in respect of which they are jointly and severally liable. Such agreements shall be without prejudice to the right of a State sustaining damage to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable."

[33] ILA Model Law, Art. 6. "The respective authority may withdraw, suspend or amend the authorization, when either the conditions of article 4, paragraph 1, or the specific requirements of article 4, paragraph 3, are not observed."

fore, in the absence of clarity on these counts, the revocation of licenses would produce impractical results.

IV. ISSUES RELATING TO ENVIRONMENTAL OBLIGATIONS

The next issue pertains to Articles 7 and 8, which deal with environmental protection and mitigation of debris. Article 7[34] poses two problems. The first problem relates to the definition of environmental damage.[35] It would be up to the state to determine the threshold of environmental damage by providing it in the definition section. The second problem concerns the sphere of application of Article 7, which expressly mentions the Earth and outer space as well as any parts thereof without providing the threshold of environmental damage. The over-arching question is that, if there are only limited environmental obligations under Article IX of the Outer Space Treaty[36] and Article 7 of the Moon Agreement,[37] should the state adopt more stringent norms than those required under the treaty provisions?

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[34] ILA Model Law, Art. 7. "(1) Space activities shall not cause environmental damage to the Earth and outer space or parts thereof, either directly or indirectly.
(2) An environmental impact assessment is required before the beginning of a space activity.
(3) Details of the environmental impact assessment shall be laid down in an implementing decree/regulation.

[35] Threshold of environmental damage differs from State to State depending on the level of awareness, economic developments, technological factors etc."

[36] Outer Space Treaty, Art. IX. "In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose."

[37] The Moon Agreement, Art. 7(1). "In exploring and using the moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties shall also take measures to avoid harmfully affecting the environment of the earth through the introduction of extraterrestrial matter or otherwise."

Moreover, Article 7 of the Model Law mandates the requirement of an environmental impact assessment before the beginning of any space activity. However, it leaves the details of the environmental impact assessment to be developed by the concerned state in the form of a separate regulation. On a negative note, in the absence of uniformity in the environmental impact assessment procedures in different parts of the world, the true purpose for requiring an environmental impact assessment may be lost in the present era of commercialization. Any space actor could simply go in search of a state with less rigorous requirements for environmental impact assessments to carry out its space activities. Reciprocally, some states would likely try to adopt a minimalist approach to its environmental impact assessment requirement in order to promote more and more commercial space activities.

Towards the mitigation of space debris, Article 8 of the Model Law attempts to provide a best efforts clause.[38] However, Article 8 leaves the efforts undertaken by any private space actor contentious. What threshold would be applied to adjudge these best efforts? Would it be based on the capacity of the private space actors? If that is the case, it would be unfair for those private space actors who have the capacity to do so, seeing as they would incur significantly more costs than smaller entities. Furthermore, Article 8 refers to the existence of particular international standards for the mitigation of space debris. However, there is no such international standard available to which the applicable states have consented. Though the UNCOPUOS and the Inter-Agency Space Debris Coordination Committee (IADC) have developed debris mitigation guidelines,[39] they are not binding on the states. Failing

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[38] ILA Model Law, Art. 8. "(1)Space activities should be carried out in such a manner as to mitigate to the greatest possible extent any potential space debris in accordance with article 4(d).
(2) The obligation under paragraph 1 includes the obligation to limit debris released during normal operations, to minimize the potential for in-orbit break-ups, to prepare for post-mission disposal, and to avoid in-orbit collisions in accordance with international space debris mitigation standards."

[39] The most recent UNCOPUOS Space Debris Mitigation Guidelines are that of 2010. *See* UNCOPUOS Space Debris Mitigation Guidelines, *available at* http://orbitaldebris.jsc.nasa.gov/library/Space%20Debris%20Mitigation%20Guidelines_COPUOS.pdf (visited Mar. 27, 2016). IADC's most recent Space Debris Mitigation Guidelines are that of 2007. *See* IADC Space Debris Mitigation Guidelines 2007, *available at*

the existence of an accepted standard on debris mitigation, Article 8 is rendered ambiguous.

On the other hand, there exist some solutions for addressing issues raised by Articles 7 and 8. First of all, the states must realize that the provisions on environmental protection are very weak under the space treaties. With an ambitious plan to expand space activities, the issue of environmental protection cannot be kept in isolation. Such neglect on the part of the states would cost dearly in terms of our future. Hence, a direct obligation to protect the environment must be entrenched in the Model Law with clarity concerning its scope and definition. Though such an effort may result in going beyond the obligations under the current space treaties, it is absolutely essential in light of the context and magnitude of the problem. Vague provisions creating a mere moral obligation to conduct environmental impact assessments for the protection of the environment are grossly insufficient. Further, specific technical standards may be prescribed in the Model Law as minimum standards to be adopted by the states to ensure that space debris is mitigated. In case the private space actor fails to mitigate or subsequently clean up the debris it creates, the state concerned should be compelled to accumulate the required funds for the purpose of cleaning the debris. These funds could be gathered in the form of operational taxes imposed upon private space actors as well as from the fines collected under Article 14 of the Model Law.[40] Such a model in relation to nuclear liability has been successful in the United States.[41]

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http://orbitaldebris.jsc.nasa.gov/library/IADC_Mitigation_Guidelines_Rev_1_Sep07.pdf (visited Mar. 27 2016).

[40] ILA Model Law, Art. 14. "Any breach of the obligations set out in the present law is punishable with a fine of ##,####. The carrying out of space activities and the transfer of space activities without authorization from the authority, granted pursuant to articles 3 and 9, is punishable with an amount not lower than #,###."

[41] The nuclear liability fund in the United States, which is known as Price-Anderson Fund, is created by the contribution of nuclear operators under the Price-Anderson Act 1957. *See* Elizabeth J. Wilson and Sara Bergan, *Managing Liability: Comparing Radioactive Waste Disposal and Carbon Dioxide Storage*, *in* Geological Disposal of Carbon Dioxide And Radioactive Waste: A Comparative Assessment 263, 279 (Frence L. Toth ed., 2011).

V. REGISTRATION AND TRANSFER OF SPACE ACTIVITY/OBJECT

Articles 9 and 10 of the Model Law deal with the transfer of a space activity/object[42] and registration of the space object,[43] respectively. The first problem that arises here is that the law is unclear as to who would furnish the necessary information to the national registry; and therefore, who has the obligation to register. The Commentary states "respective information from the operators" must be provided, which leaves the question of what information has to be provided subject to the discretion of each operator connected with single space activity.[44] Moreover, the term operator has not been used in any of the space treaties and therefore, there is a lack of international consensus about the meaning of "operator of a private space activity." Though the Model Law vaguely defines "operator" as "a natural or legal person carrying

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[42] ILA Model Law, Art. 9. "The transfer of a space activity and/or a space object to another operator is subject to prior authorization by the competent authority. Authorization will be granted under the conditions laid down in article 4."

[43] Id. at Art. 10. "(1) A national register is hereby established for the registration of space objects. The authority (namely the competent minister, preferably the same as in article 3) shall maintain the national space register.
(2) Subject to paragraph 3 of this article all space objects for which XY is the launching State according to article 1 of the Convention on Registration of Objects Launched into Outer Space of 1974 shall be registered in the national register.
(3) If there are two or more launching States in respect of any such space object, the agreement among them according to article II, paragraph 2 of the Convention on Registration of Objects Launched into Outer Space shall determine which is to be the State of registry for that particular space object.
(4) The following information should be entered into the national register:
- Name of the launching state or states (name of a private launching entity: natural or legal person),
- Registration number of the space object,
- Date and territory or location of the launch,
- Basic orbital parameters including nodal period, inclination, apogee and perigee,
- General function of the space object.
(5) Additional information and information in accordance with the Registration Convention and/or the United Nations Registration Practice Resolution as specified in an implementing decree/regulation shall also be included in the national register.
(6) The information contained in paragraph 1 shall be made available to the Secretary-General of the United Nations as soon as possible.
(7) Any relevant change with regard to the information mentioned in paragraph 1 should be registered in the national register. The Secretary-General of the United Nations shall be informed accordingly."

[44] Hobe, *supra* note 12, at 588-91.

out space activities," it fails to identify the person responsible for the registration of space objects, seeing as the term "space activity" includes a plethora of activities. Thus, the ultimate result with regard to the registration of space objects is chaos.

The problem with a multiplicity of jurisdictions also plays a role in this issue. Unlike launching States, there can only be one state of registration under Article VIII of the Outer Space Treaty and Article II of the Registration Convention. Though Article 10(3) of the Model Law, while reinforcing Article II of the Registration Convention, does contemplate the situation of how one determines the state of registry amongst two or more joint launching States, it may only be useful in cases concerning state sponsored space activities. In the case of private space activities, the possibility of achieving such an agreement to determine the state of registry cannot always be expected. Hence, operators may have difficulty in identifying which is the appropriate state for registration. Because space activities involve sensitive technology as well as national security interests, it becomes all the more pertinent for operators to identify the appropriate state that can receive information about their space activities.

In addition to concerns regarding registration, the transfer of space objects under Article 9 poses some practical difficulties. The provision stipulates the requirement of prior authorization by the '*competent authority*;'[45] however, in the cross-border transfer of a space object, it is not clear as to which state's competent authority must issue prior authorization. Would it be from the state of transferor or that of transferee? Clarification on this is absolutely required in the wake of Article 14 of the Model Law, which imposes fines on the transfer of space activities without authorization by the competent authority. Moreover, Article 9 stipulates the conditions laid down under Article 4 are a prerequisite for authorization. This only serves to further confuse the nature of these conditions and additional requirements[46] upon which the initial authorization was granted to the transferor. If those conditions and additional requirements continue, questions would arise as to

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[45] Emphasis added.

[46] Additional requirements may be imposed by the authorizing state under Article 4 (3).

the enforceability of them in the transferee's state in case of cross-border transfers.

It is also pertinent to note here that the Model Law imposes minimum restrictions on the transfer of space activity. Understandably, this approach is used to incentivize the private players to increasingly resort to commercial space activities. However, such an unbridled discretion on transfer may be detrimental to national interests. Due to the significance of certain commercial space ventures in rendering some essential public services or security in the states, the transfer of such space activities to other states might cause serious prejudice to the public in general. Therefore, transfer of space activities needs to be properly weighed and balanced by taking into consideration public and private interests. This is why the UNIDROIT Space Protocol,[47] in the exercise of remedies under its provisions, imposes restrictions on the transfer of satellites contrary to the interests of national security and public services under Articles XXVI and XXVII, respectively.

Transfer of the space object/space activity also brings forward some important questions under the space treaties. As per Article VIII of the Outer Space Treaty, the state of registry shall exercise jurisdiction and control over the space object and the personnel thereof.[48] In the event of transfer of a satellite from the state of registry to another state, the debate arises as to which among the two shall exercise jurisdiction and control after the transfer.[49] This situation would be further complicated in the cases wherein the transferee's state does not fall within the definition of 'launching State' and thereby, is not entitled to register the space object.[50]

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[47] Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets 2012, *available at* http://www.unidroit.org/english/conventions/mobile-equipment/spaceassets-protocol-e.pdf (visited Mar. 27, 2016).

[48] Art. VIII: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body."

[49] It is important to note here that the wording of Art. VIII of the Outer Space Treaty, "…*shall retain jurisdiction and control*…" shows that exercise of jurisdiction and control is not only a right but also a duty of the state of registration.

[50] 'State of registry' as defined under Art. I(c) of the Registration Convention is "… a launching State on whose registry space object is carried in accordance with Article II." Therefore, the state of registry must essentially be a launching state.

In addition to the problems in terms of exercise of jurisdiction and control, similar kinds of problems can also be seen in terms of liability of the state(s) after the transfer. Since under the Outer Space Treaty and Liability Convention, the launching State is liable to pay compensation for any damage caused by the space activity, blame attribution between the transferor's state and transferee's state would be a common phenomenon in the cases wherein the damage is caused by the space objects after transfer.

To resolve the conundrum, Article 9 needs to be revised and the foreign player should be asked to enter into a contract with the transferor's state undertaking to adhere to the conditions stipulated in the initial authorization. An alternate method would be to insert a clause for agreement between the transferor's state and transferee's state to authorize the transferee's state to impose new conditions and requirements after the transfer. In such a case, a clear hierarchy of operation of law is created and hence there arises no problem of enforcement of conditions and requirements. This would also help in taking into consideration the national security and public service interests of the transferor's state in cases of cross-border transfer of space activities. Moreover, every transfer of the space object/activity should be made conditional upon the clarifications on jurisdiction and control as well as liability issues arising after the transfer.

VI. LIABILITY, RECOURSE AND INSURANCE

Articles 11 and 12 of the Model Law address the aspects of liability, recourse, and insurance. Though Article 11[51] indirectly recognizes the liability of the launching state(s) under the Liability Convention, it provides the state(s) with the right of recourse against the operator of space activity. It also suggests the possibility of right of recourse be limited to a certain amount. The Commentary stipulates the need for a balance between the objectives of incentivization of the private space actors as well as the public

[51] ILA Model Law, Art. 11. "(1) When XY has paid compensation to third parties for damage caused by a space activity in fulfillment of its international obligations, the Government is entitled to recourse against the operator.
(2) The recourse of the Government against the operator may be limited to a certain amount."

purpose of the state.[52] Towards this, it considers the limitations on liability of private space actors as desirable. Although such a move might be suitable for governments of developed states that are capable of withstanding such residual financial liability, it might not be a just proposition from the perspective of developing countries. Undoubtedly, the developing countries would find difficulty in limiting the liability of the operator, as it would burden their limited state funds. Consequently, the developed states that are in a position to afford such privilege may have an unfair advantage to attract/divert private space investments.

At the 2012 IISL conference, Hamid Kazemi, HadiMahmoudi, and Ali Akbar Golroo presented a paper titled "Towards a new international space liability regime alongside the Liability Convention 1971."[53] The authors argued that a new treaty on private international space law should be modeled on private international air law. Thus, it would always be desirable to shift the liability for the damage caused by the private space activities to the concerned private player under suitable mechanism. Requiring a state to incur the burden of liability, either fully or partially, for private space activities is not appropriate since it would amount to a situation of compromising the public good in order to uplift the private good.[54]

Article 12 of the Model Law requires private space actors to procure insurance up to a certain financial limit.[55] However, this provision is not applicable with respect to governmental space

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[52] Hobe, *supra* note 12, at 594 & 595.

[53] Hamid Kazemi, HadiMahmoudi and Ali Akbar Golroo, *Towards a New International Space Liability Regime Alongside the Liability Convention 1971*, *in*PROCEEDINGS OF THE FIFTY-FIFTH COLLOQUIUM ON THE LAW OF OUTER SPACE 263-73 (2012).

[54] Sandeepa Bhat B. and P. Ishwara Bhat, *Legal Framework of State Responsibility and Liability for Private Space Activities*, *in*SPACE LAW IN THE ERA OF COMMERCIALISATION 131, 146 (Sandeepa Bhat B. ed., 2010).

[55] ILA Model Law, Art. 12. "(1) The operator carrying out a space activity should be insured to cover damage caused to third parties up to the amount of… (to be established by national law).
(2) The obligation of paragraph 1 does not apply when the Government, as such, carries out a space activity.
(3) The authority may waive the obligation to insure when
(a) The operator has sufficient equity capital to cover the amount of his/her liability;
(b) The space activity is not a commercial space activity and is in the public interest.
(4) The details of the content and conditions of the insurance shall be laid down in implementing a decree/regulation to that effect."

activities carried on under sovereign functions. Further, the provision provides for the waiver of the requirement to procure insurance in two specific occasions: (a) when the operator has sufficient equity capital to cover the amount of their liability; and (b) when the space activity is not a commercial space activity and is in the public interest. However, both the conditions of waiver have their own limitations. First, in case of equity capital, what can be done if the equity capital, which is based on the market conditions, depreciates over the period of time is not answered by the provision. Second, neither 'commercial space activity' nor 'public interest' can be defined in precise terms. Though there is an attempt to define 'commercial space activity' in the Model Law,[56] the definition fails to clarify if the 'revenue' or 'profit' mentioned therein is confined to direct monetary benefits or whether it would also extend to other benefits. Thus, the insurance provision needs to be refined to remove these ambiguities.

In addition to the above-discussed concerns in the provisions, the Model Law has also failed to address several issues, which it should have addressed. These issues are presented in the following section of this article.

VI. ISSUES UNADDRESSED IN THE MODEL LAW

A. De-militarization

An important aspect that has not found a place in the Model Law is a provision requiring and mandating private space actors to carry on activities in accordance with the objective of peaceful purposes. Article IV of the Outer Space Treaty prohibits weaponization of outer space, establishment of military bases, installations, and fortifications, testing of weapons, and conduct of military maneuvers on the Moon and other celestial bodies.[57] The pro-

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[56] ILA Model Law, Art. 2. "Commercial space activity: A space activity for the purpose of generating revenue or profit whether conducted by a governmental or by a non-governmental entity."

[57] Outer Space Treaty, Art. IV. "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations

vision also requires the use of the Moon and other celestial bodies exclusively for peaceful purposes. However, the vague wordings of Article IV of the Outer Space Treaty open up several questions concerning the demilitarization of outer space. These questions relate to the determination of the meaning of peaceful purposes, the application of such a norm to outer space, the possibility of testing weapons in outer space, the permissibility of placing conventional weapons in outer space, and so on.[58] Considering the fact that demilitarization has been a crucial element of several General Assembly resolutions, it is imperative that national space legislation must ensure that the peaceful purposes provision is reflected and clarified in it. The added importance of deweaponization mandates a separate provision warranting not only cancellation of licenses, but also penalties for breach.

In 2009, in the Fourth Committee Report dealing with demilitarization, the delegate of Sweden on behalf of the European Union stated "[w]hile additional legally binding multilateral commitments had been proposed against military threats, finding ways of making progress in the short term, and against all types of threats, was essential."[59] The delegate of Pakistan also agreed with this statement.[60] The Cuban delegate stated that "[t]he current space legislation was insufficient to prevent an arms race in space. The World Disarmament Conference, as the only international forum on disarmament, must play the main role in a multilateral agreement on the prevention of an arms race in space, in all forms."[61] Among other notable contributors, the Kazakhstan delegate supported the draft resolution on International Coopera-

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and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited."

[58] *See generally* John B. Gantt, *The Concept of "Peaceful Purposes"/"Peaceful Uses" in the Exploration and Use of Outer Space – Some Practical Examples*, *in* Proceedings of Forty-Sixth Colloquium on The Law of Outer Space 107, 107-12 (2004); (*See also* Jonathan Halpern, *Anti-Satellite Weaponry: High Road to Destruction*, 3 B. U. INT'L L. J.167-208 (1985)).

[59] Debating Outer Space Cooperation, Fourth Committee Hears Growing Number of Actors in Outer Space Could Risk Security of Space Assets, Limit Scope of Peaceful Uses (Oct. 21, 2009), *available at* http://www.un.org/press/en/2009/gaspd433.doc.htm.

[60] *Id*.

[61] *Id*.

tion in the Peaceful Uses of Outer Space, prepared by Colombia, Chile, and Mexico.[62] The Chinese representative recalled that China had jointly tabled a draft treaty with the Russian Federation on the prevention of weapons and use of force in outer space.

Although consensus seems to be growing at the international level as to the demilitarization of outer space, in practice it can be observed that it has not been applied. Therefore, national space legislation may try to deal with the situation by imposing an obligation on private players to not get involved in military space activities. Particularly, what is required is the regulation of private military corporations and dual use satellites. In addition, other shortcomings of Article IV of the Outer Space Treaty, including its applicability in outer space, may be resolved through the implementation of national space legislation. The Russian space legislation,[63] for example, has relatively better provisions on demilitarization, which may be useful for incorporation in the Model Law. It essentially prohibits orbiting, deploying, and testing of nuclear weapons and any other kinds of weapons of mass destruction in outer space. Moreover, the use of the Moon and other celestial bodies for military purposes is also forbidden.[64] Though it does not prohibit other military uses of outer space, such military uses are only allowed to be carried out by the Ministry of Defense of the Russian Federation.[65] Hence, private space actors are not permitted to be involved in any military space activity under the laws of Russian Federation.

B. Property Rights and Resource Exploitation

The Model Law is silent on the issue of private property rights in outer space. While the non-appropriation principle is one of the fundamental principles of the Outer Space Treaty,[66] questions have been raised regarding its applicability to private space actors. One of the major contentions of the asserters of celestial

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[62] *Id*.

[63] Law of Russian Federation "About Space Activity," Decree No. 5663-1 of the Russian House of Soviets.

[64] *Id*., Art. 4 (2).

[65] *Id*., Art. 7.

[66] Outer Space Treaty, Art. II. "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."

property rights is that there is only a prohibition on 'national appropriation,' but the right of the individuals to claim property rights is not restricted by such a provision.[67] Though Article 11(3) of the Moon Agreement places an embargo on private property rights,[68] the Moon Agreement has limited application due to ratification by very few states.[69] Based on these arguments, which are against the spirit of the space treaties, several individuals have asserted their claims on the Moon and other celestial bodies, as well as started selling the parts of them.[70]

Though the international community condemns such claims, instances are growing in the absence of appropriate legal actions. Therefore, there is a growing opinion on the requirement of dealing this problem at the national level by the States.[71] In this regard, the Board of Directors of International Institute of Space Law has issued a statement in 2004, which reads as follows:

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[67] Alan Wasser and Douglas Jobes, *Space Settlements, Property Rights, and International Law: Could a Lunar Settlement Claim the Lunar Real Estate it Needs to Survive?*, 73 J. AIR L. & COM. 37, 49 & 50 (2008).

[68] "Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or nongovernmental organization, national organization or nongovernmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof."

[69] Only seventeen States have ratified the Moon Agreement. *See* Committee on the Peaceful Uses of Outer Space, Status of International Agreements relating to activities in outer space as at 1 January 2017 (Mar. 23, 2017), *available at* http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2017_CRP07E.pdf.

[70] Reference can be made to Dennis Hope's business of selling the parts of the Moon and other celestial bodies as well as to the claims made by Gregory Nemitz and Sylvio Langevin. *See*<www.lunarembassy.com> and <http://www.duhaime.org/LawFun/LawArticle-1613/Quebec-Man-Claims-Solar-System-Loses-in-Court.aspx>*See also Nemitz*v. *United States* 2004 WL 3167042.

[71] Prof. Frans von der Dunk, for example, has criticized the business of Dennis Hope, and insisted for appropriate action in the municipal level. He states that "Whether that means it's [the sale of extra-terrestrial property] fraud and such a claim is null and void under national law, would basically be up to any national legal system to determine. It does mean, however, that under international law the U.S. government should unequivocally make clear that these practices are not based on any sound legal premise." (*See* Robert Roy Britt, *Lunar land Grab – Celestial Real Estate Sales Soar*, *at* http://www.rense.com/general48/sour.htm (visited Apr. 1, 2016)); (*See also*Virgiliu Pop, Who Owns the Moon? 18 (2008)).

> …to comply with their obligations under Articles II and VI of the Outer Space Treaty, States Parties are under a duty to ensure that, in their legal systems, transactions regarding claims to property rights to the Moon and other celestial bodies or parts thereof, have no legal significance or recognised legal effect.[72]

In light of the above excerpt, it is necessary to have a provision in the Model Law prohibiting the claim of property rights in outer space and on celestial bodies. In the absence of such a provision, we will witness a lateral expansion of conflicting property claims in the near future. In addition, the Model Law is silent on the related issue of resource exploitation in outer space. This issue is equally important to address, as many commercial space operations in the near future will be directed towards the exploitation of valuable space resources.[73] Conflicts are bound to occur in the absence of legal regulation of exploitation.[74] The Model Law needs to incorporate modalities for authorizing resource exploitation based on established principles of sustainable development and also provide clarity concerning the entitlements of private space actors to the bounties of nature.

C. Emergency Assistance

The Rescue Agreement sets the international norms on emergency assistance in case of space accidents. However, it does not provide detailed procedure on the discharging of obligations in furtherance of emergency assistance. Hence, it is important for national space legislation to detail emergency assistance procedures. In addition, there is some confusion arising from the interpretation of the Rescue Agreement, which was drafted in the era

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[72] *See*'Statement by the Board of Directors of the International Institute of Space Law on Claims to Property Rights Regarding The Moon and Other Celestial Bodies', *at* http://www.iislweb.org/docs/IISL_Outer_Space_Treaty_Statement.pdf (visited Apr. 1, 2016).

[73] Helium – 3 is predicted to be one of the major resources for future exploitation, which is available in abundance on the Moon. Richard B. Bilder, *A Legal regime for the Mining of Helium-3 on the Moon: U.S. Policy Options*, 33 FORDHAM INT'L L. J. 243 (2010).

[74] Fabio Tronchetti, *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*, 36 J.SPACE L. 489, 515 (2010).

of state-oriented space activities, and therefore, is unsuitable to the present era of private commercial space activities. One of the major problems is the absolute obligation under the Rescue Agreement on the state of unintended landing to search and rescue the space object's personnel without any guarantee for expense reimbursement.[75] This obligation stems from the principle regarding astronauts as envoys of mankind stipulated under Article V of the Outer Space Treaty. However, in the present era of commercialization, manned space missions are primarily for furthering individual commercial interests, and not associated with the common interests of mankind. Hence, in cases where personnel on board a private space object are stranded as a result of an unintended landing, it is the private space actor who should bear the costs of rescue.

In the case of space objects, the obligation of the state of unintended landing to recover the space object or its component parts is contingent upon a request from the launching State.[76] In the event of recovery, the recovering state may seek to have its recovery costs reimbursed from the private space actor or the state that launched the space object under Article 5(5) of the Rescue Agreement.[77] Furthermore, without clarity as to the rights and obligations arising out of Article 5 of the Rescue Agreement, problems may also arise with the transfer of space objects. This can be better illustrated with an example: private space actor 'A' operating in State 'X,' which is the state of launching and registry, transfers its satellite to another actor 'B' in State 'Y.' Presumably, State 'Y' is not connected to the launch of the satellite in any manner. Subsequent to the transfer, the satellite makes an unintended landing in the territory of State 'Z.' Under the Rescue Agreement, State Z would be mandated to recover the satellite only at the re-

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[75] Rescue Agreement, Art. 2 states "If, owing to accident, distress, emergency or unintended landing, the personnel of a spacecraft land in territory under the jurisdiction of a Contracting Party, it shall immediately take all possible steps to rescue them and render them all necessary assistance."

[76] *Id*, Art. 5(2) states "Each Contracting Party having jurisdiction over the territory on which a space object or its component parts has been discovered shall, upon the request of the launching authority and with assistance from that authority if requested, take such steps as it finds practicable to recover the object or component parts."

[77] Id, Art. 5(5) states "Expenses incurred in fulfilling obligations to recover and return a space object or its component parts under paragraphs 2 and 3 of this article shall be borne by the launching authority."

quest of State X, the sole launching State in this example. As State Y is not the launching State, it would mean that private space actor 'B' would essentially be left with no remedy. This is because the Rescue Agreement mandates the launching authority (in this case State 'X') to bear the cost of recovery. However, as the interest in the satellite has been transferred from State 'X' to State 'Y,' the former would have no interest in claiming the satellite. Thus, the private space actor 'B' is essentially left at the mercy of State 'X' for recovery of its satellite. This major concern in the treaties needs to be addressed through an appropriate provision in national space legislation that mandates search and rescue—as can be seen in Korean space legislation.[78]

D. Other Incidental Issues

In addition to the three issues discussed above, there are several desirable aspects that could yet be included in the Model Law. First, the Model Law requires norms to regulate space tourism. With space tourism being the next fascination of human beings, states cannot ignore the manifold issues arising out of space tourism, which are different from that of other commercial space activities.[79] Norms need to be incorporated in national space legislation regarding issues such as special authorization, supervision, emergency assistance, codes of conduct for tourists in outer space, environmental protection, etc. Informed consent and safety standards are the two of the most important aspects to be delved into in detail in respect of space tourism.

Second, in the wake of UNIDROIT's[80] failure to develop a separate regime on space financing,[81] it is desirable for the Model

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[78] Korean space legislation mandates the rescue and recovery of both personnel and space objects in case of emergency landing. Arts. 22 and 23 of the Space Development Promotion Act 2005 of the Republic of Korea deal with the obligations to return the personnel and space object respectively.

[79] *See generally* Stephan Hobe, *Legal Aspects of Space Tourism*, 86(2) NEB. L. REV. 439-58 (2007).

[80] International Institute for Unification of Private Law (UNIDROIT) is established with the objective of harmonizing and coordinating private laws, especially commercial laws, of different states to achieve uniformity. *See* http://www.unidroit.org/about-unidroit/overview (visited, Apr. 8, 2016).

[81] UNIDROIT has developed a two-tier system to govern private space financing in the form of Convention on International Interests in Mobile Equipment 2001 (2307 U.N.T.S. 285) and Protocol to the Convention on International Interests in Mobile

Law to address the significant aspects of space financing. Currently, private investors in space activities face a dilemma with respect to a plethora of issues, such as: jurisdiction and applicable law, recognition of their interest under the applicable law, applicable rule of priority in the return of investments, status of return of their investments during insolvency of debtors, etc. Such an atmosphere is not conducive to the growth of beneficial private space ventures, an activity requiring huge investments.[82] Therefore, it is significant for a state that intends to promote commercial space activities to build the confidence of creditors in space investments via national space legislation.

Finally, the intellectual property regime in outer space, especially relating to inventions, needs clarification. Investors in research and potential intellectual property in space, which has become possible with the establishment of the International Space Station,[83] would essentially search for a much anticipated patent protection in space. However, there is no international intellectual property law to grant such protection. More importantly, there is no separate law to deal with the infringement of patented inventions in outer space.[84] Hence, it is up to the states to clarify the increasing number of issues relating to space inventions to prevent the dearth of investments in space inventions. Incorporating the provisions in the Model Law to set standards in this regard is significant for the purpose of establishing uniformity.

VIII. CONCLUSION

One cannot disagree with the fact that the Model Law for national space legislation is a commendable work by the scholars who took part in drafting it. It certainly stands as a positive con-

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Equipment on Matters Specific to Space Assets 2012. However, the system has failed to come into force due to disagreement of private investors. Anjanette H. Raymond and Abbey Stemler, *When Baby Steps Just Won't Work: Small Farmers are our Best Hope Reducing Food Insecurity and we are not Doing Enough*, 35(2) NW. J. INT'L L. & BUS. 335, 358 (2015).

[82] *See* Mark J. Sundahl, The Cape Town Convention: Its Application To Space Assets And Relation To The Law of Outer Space 6 (2013).

[83] It is a joint venture of United States, Russia, Canada, Japan and European Space Agency. *See for details* https://www.nasa.gov/mission_pages/station/main/index.html (visited, Apr. 8, 2016).

[84] Sandeepa Bhat B., *Inventions in Outer Space: Need for Reconsideration of the Patent Regime*, 36(1) J. SPACE L. 1, 6 & 10 (2010).

tribution of the twenty-first century towards the regulation of commercial space activities. However, the authors are of the view that there is sufficient scope for fine-tuning the Model Law to suit the present day requirements of the developed and the developing world alike. The shift from state-oriented space activities to private sector-oriented space activities require a move from traditional space treaty provisions to tailor-made national space legislation in order to deal with the challenges of private space activities. The Model Law fails to adopt such a change within this mindset, which is reflected in the fact that emerging concerns like space tourism, space financing, and space inventions, amongst others, have not found any place in it.

It is understandable that everything cannot be covered by one national space legislation. Hence, supplementary norms need to be developed in the form of rules and regulations over a period of time in correlation with growing experience in the field of private space activities. But this should not be a reason for refraining from experimentation with new methods of addressing emerging concerns that have already come to the forefront. Because space technology is developing at a rapid speed, and consequently, the nature of space activities is changing, we have little time to lag behind in adopting suitable norms. Hence, expanding the horizons of space law at the national level is not only desirable, but also necessary so we need not repent for our present failure in the future.

LEGAL AND REGULATORY CHALLENGES TO LEVERAGING INSURANCE FOR COMMERCIAL SPACE

Andrea J. Harrington[*]

I. OVERALL CONSIDERATIONS

A. Introduction

When a private entity seeks to place a satellite in orbit, the two greatest expenses in pursuing this goal are obvious and heavily considered: the cost of the satellite itself, and the cost of the launch. There has been a great deal of discussion and literature regarding the issues of satellite cost, such as the impact export controls have on efficient international development and cooperation, and the need to find less costly launching solutions, such as reusable vehicles and cheaper fuel. What is not often discussed, however, is the third greatest expense for private entities: insurance, which is the most important means for risk management (both for governments and the private sector, particularly given the assignment of liability under the international space law regime). A launch insurance policy alone can cost anywhere from 7% to 20% of the insured value of a satellite. While large companies with significant financial backing can "self-insure" their satellites, this is not an option for smaller or emerging companies. In order for the private space sector to innovate and expand, insurance costs must be taken into consideration. An efficient capacity increase in the space insurance industry would benefit not only

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those private entities seeking insurance, but also the industry itself.

In Part I, this Article explores the issues inherent in the offering, procurement, and handling of traditional areas of space insurance (pre-launch, launch, and on-orbit), including first, second, and third party liability, for the purpose of providing public policy and regulatory explanations and recommendations. The international space law regime is presented as a context for the overall analysis and discussion. This paper includes analysis of the impact of ITARs, State liability for private space actors, and liability waivers on the provisioning of insurance for space enterprises to aid companies in navigating the legal and regulatory environment. This discussion also includes the individual U.S. State Spaceflight Liability and Immunity Acts that have been implemented by several of the major U.S. commercial spaceport states.

In Part II, this Article focuses on the issues particular to insuring suborbital or hypersonic vehicles. This discussion includes an introduction to such vehicles and their unique characteristics, an evaluation of air law and aviation insurance as relevant to these types of space activities, and safety considerations that may be relevant under the international air law regime. Finally, Part III offers concluding thoughts and recommendations for moving forward.

The space insurance industry emerged as a separate field of insurance in 1965. Then, the first pre-launch and on-orbit insurance for a commercial satellite was issued, while the first launch insurance was provided in 1968.[1] It is amazing to think that a mere eight years after the first launch of any artificial satellite (*Sputnik*, launched by the government of the U.S.S.R.) insurance was being provided for a satellite on a commercial basis. Since then, there has been significant growth and evolution of the industry. Communication satellite problems, spacecraft and launch failures, increasing space debris, and cyclical periods of high solar energy all contribute to space insurance being considered a "high risk" field of insurance. The increase in the number of private actors in the space industry as well as the rapid development of space laws are indicators of growth in the commercial space sec-

[1] Rod Margo, *Some Aspects of Insuring Satellites*, 10 INSURANCE LAW JOURNAL 555 (1979), 556.

tor. As early as 2008, the insured value of the in-orbit insured satellite fleet alone was USD 17.5 billion.[2] There has been an ongoing growth in entrepreneurial space activity. In 2009, the estimated total investment to the spaceflight industry was USD 1.46 billion. Of this investment, government contribution made up only 15%. In 2010, of the almost 1,000 operational satellites in orbit, only 175 commercial satellites were insured.[3] As of 2015, the space insurance market covers approximately 205 satellites orbiting the Earth with a value of approximately $26 billion.[4]

"The most successful launch insurance policy ever negotiated at least for a satellite service provider was 7% of the insured value for the satellite and launch vehicle. The typical cost of launch insurance today will likely range from 15% to 20% of the insured value."[5] This high cost of insurance and relatively low capacity of the market acts as a barrier to entry in the space industry for emerging companies. In an era when motivations for space activities are being re-evaluated, and while private companies are encouraged by such programs as the X Prize to participate in space activities, it is critically important that the insurance industry be ready and able to provide the necessary coverage to support the space industry.

The United States Congress acted in 1988 to deal with the space insurance problem, by requiring cross-waivers of liability in space activities. "Prior to the passage of the 1988 Amendments, this country's private commercial space launch industry faced virtual shutdown because commercial launchers incurred huge liability risks and were unable to procure insurance at any price."[6] Though this approach was able to reverse the degradation of the space industry in the United States, it did not solve the problem of the limited availability and expense of insurance. While it rendered the participation in space activities possible without the burden of insurance, it is unquestionable that the availability of

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[2] Chris Kunstadter, *Space Insurance: Why it Matters*, ISPCS 2013 (2013). Pdf.

[3] ORG. FOR ECON. CO-OPERATION AND DEV., THE SPACE ECONOMY AT A GLANCE 2011, (2011). 66, 31.

[4] Scott Ross, *Risk Management and Insurance Industry Perspective on Cosmic Hazards* in HANDBOOK OF COSMIC HAZARDS AND PLANETARY DEFENSE (J.N. Pelton & F. Allahdadi, eds. 2015) at 1096.

[5] JOSEPH N. PELTON, SATELLITE COMMUNICATIONS (2011). 82.

[6] Martin Marietta Corp. v. INTELSAT, 763 F.Supp. 1327, 1330 (D. Md. 1991).

reasonably priced, comprehensive insurance would encourage further growth and development.

"Insurance for space activities has evolved over many years through the collaboration of aerospace clients, brokers, and the underwriting community worldwide. The goal of that work was to provide flexible forms of insurance for a volatile class of exposure, which was not yet quantified by loss data."[7] In general, the space insurance market is a particularly unbalanced market, with a few accidents resulting in significant financial consequences.[8] Given its importance to the success of the commercial space industry, it requires special attention.

B. Types of Insurance

i. Liability Insurance

Generally speaking, there are three main types of liability insurance – first, second, and third party. The party to contract for space insurance will be the one bearing the risk of loss.[9] "Similar to most commercial air transport insurance contracts, the space insurance policy is usually underwritten in syndicate where each individual underwriter assumes a percentage of the risk."[10] First party insurance covers losses sustained by the insured. In the case of space operators, claims are generally for total or partial loss of a spacecraft (including constructive total loss) or for delay in deployment. This insurance can cover, among other issues, physical damage, faulty design, ground operator mistake, inadequate testing, or performance reduction, depending on the policy wording.[11] Generally, a loss will be covered if the status of the satellite fulfills the "loss" definition in the insurance contract and the satellite or a portion thereof cannot be used for its intended purpose.[12] The sums insured can range from as little as USD 10 million to as

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[7] Piotr Manikowski, *The Columbia Space Shuttle Tragedy: Third-Party Liability Implication for the Insurance of Space Losses*, 8 RISK MANAGEMENT AND INSURANCE REVIEW 141, 142 (2005).

[8] GABRIELLA CATALANO SGROSSO, INTERNATIONAL SPACE LAW (2011). 479.

[9] Philippe Montpert, *Space Insurance in* CONTRACTING FOR SPACE 283, 286 (2011).

[10] Ruwantissa Abeyratne, *Synergies and Problems in Outer Space Insurance and Air Transport Insurance*, 30 TRANSP. L. J. 189, 191 (2003).

[11] Montpert, *supra* note 9, at 285.

[12] *Id.* at 286.

much as USD 450 million.[13] Damages paid between the late 1970s and early 1980s on these insurance policies were over USD 850 million, but the total premiums collected and retained were only USD 445 million; as a result, in the period following this spike in claims, the cost of insurance rose by 20-30%.[14] Thankfully, since the 1990s, insurers have achieved a satisfactory premium-to-damage ratio.[15]

Insurance for second party liability has thus far been less relevant in the space arena, as it would cover passenger liability. As paid spaceflight participant voyages have not yet commenced, this is an emerging area of space insurance. It bears similarities to insurance for passenger liability in aviation, for example. Commercial operators can require spaceflight participants to maintain a certain level of insurance in order to participate,[16] which would be a wise move going forward. This issue is discussed further in Part III.

Third party insurance is the insurance that covers damage to third parties; those individuals and companies who are not in contract or relationship with the insured. No third party liability claims have been made in over two hundred commercial launches licensed in the U.S. since 1989.[17] Aside from the *Cosmos 954* negotiation between Russia and Canada, the only third party liability claim made worldwide was in the amount of one million USD for ground contamination in Kazakhstan as a result of a failed Proton launch in 2007.[18] Thus, this is a low probability area of insurance with high potential losses.

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[13] *Id.* at 287.

[14] Sgrosso, *supra* note 8, at 474.

[15] *Id.* at 477.

[16] Pamela Meredith and Marshall Lammers, *Commercial Spaceflight: The 'Ticket to Ride'*, 25 NO. 1 AIR & SPACE LAW. 4, 7 (2012).

[17] Matthew Schaefer, *The Need for Federal Preemption and International Negotiations Regarding Liability Caps and Waivers of Liability in the US Commercial Space Industry*, 33 BERKELEY J. INT'L L. 223, 232 (2015).

[18] Montpert, *supra* note 9, at 284.

ii. Insurance Phases

Space insurance policies are often referred to as "all risk" policies, though critically, they are not "all loss" policies.[19] There are three main "phases" of space insurance policies – pre-launch, launch, and in-orbit (or "life") insurance. Pre-launch insurance is designed to cover risks from the beginning of the program (or the effective date of the policy). Risks that are covered include incidents during satellite construction or during the integration of its systems, transportation, storage, and placement on the launch vehicle and launch pad. It is possible to also insure a risk of launch delay as part of the pre-launch insurance policy. [20] Generally, this phase of insurance ends upon first ignition of the launch vehicle or at the point when the launch process becomes irreversible.[21]

The highest premium cost and riskiest phase of insurance is the launch phase. This portion of the policy will be in effect from three to six months and includes placement of the satellite in its correct orbit and preparation of the satellite for its operational activities. The in-orbit phase commences at the end of the satellite operational capacity assessment. Generally, policies are negotiated on a year-to-year basis for the operational life of the satellite. There can be partial or total loss under in-orbit insurance, depending on whether or not the satellite can still perform a significant portion of its intended function. Partial losses can occur where some, but not all transponders are functioning.[22] The percentage of premium rate for each phase is determined by the probability of failure in that phase.[23]

C. The Impact of Export Controls

Insureds are under a strict contractual obligation to provide technical and non-technical data in the form of underwriting information; failure to provide this information can result in the

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[19] Stephen Tucker, *Some Strategic Defense Initiatives Toward Preventing U.S. Space Insurance Related Disputes and Litigation*, 21 J. SPACE L. 123, 126 (1993).

[20] Sgrosso, *supra* note 8, at 491-492.

[21] Montpert, *supra* note 9, at 283.

[22] Sgrosso, *supra* note 8, at 492-493.

[23] Montpert, *supra* note 9, at 283.

denial of a claim.[24] Not only are technical details required by the insurer in order to initially underwrite the policy, but space insurance policies typically contain a material changes condition requiring that the insured notify the insurer of any material changes; failure to notify would result in lack of coverage in a case where the change led to a loss.[25]

Satellites and related technologies have generally fallen under the set of regulations known as the International Traffic in Arms Regulations (ITARs), which are administered by the U.S. Department of State,[26] though the National Defense Authorization Act of 2013 has authorized the U.S. President to move satellite technologies from the ITAR list to the Commerce Control List (CCL).[27] Items that are on the CCL are subject to the less restrictive Export Administration Regulations (EARs), which are administered by the Department of Commerce and which require a license to export. President Obama undertook an initiative to revise the export control regime, clarifying those items that are included on the list and those that could be moved to the CCL.[28] Under Department of Commerce rules, companies can determine themselves whether their activity is exempt from licensing, unlike with regard to ITARs.[29] Revisions have been made to Category IV of the U.S. Munitions List (subject to ITARs), which includes launch vehicles.[30]

Exporting, in the context of ITARs, is defined broadly and includes not only physically sending or taking an article beyond the borders of the U.S., but also transferring control or ownership (including on-orbit transfer), and notably disclosing technical data to foreign persons (in the U.S. or elsewhere, including oral or visual disclosure).[31] The Directorate of Defense Trade Controls can issue

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[24] Montpert, *supra* note 9, at 285.

[25] Tucker, *supra* note 19, at 128.

[26] U.S. DEP'T OF COMMERCE & FED. AVIATION ADMIN., INTRODUCTION TO U.S. EXPORT CONTROLS FOR THE COMMERCIAL SPACE INDUSTRY 3 (2008), https://www.faa.gov/about/office_org/headquarters_offices/ast/media/intro to us export controls.pdf.

[27] National Defense Authorization Act for Fiscal Year 2013, U.S. PUB.L. 112-239.

[28] 79 Fed. Reg. 22740 (2013).

[29] Matthias Creydt and Kay-Uwe Horl, *Export Control Issues in Space Contracts in* CONTRACTING FOR SPACE 292 (2012).

[30] 79 Fed. Reg. 34 (2013).

[31] 22 C.F.R. § 120.17 (2016).

authorizations in the form of licenses, agreements, or exemptions for exports.[32] Any launch of U.S. satellite technology from a non-U.S. territory or involving non-U.S. entities or personnel, will require compliance with ITAR requirements; this includes participation in multinational launch consortia. The respective ITARs and EARs must be followed, and the FAA will verify appropriate licensing before a launch license is provided.

There are not many insurers worldwide that maintain specialized space risk departments. Those that do are based in the U.S., U.K., France, Italy, Switzerland, and Germany.[33] Export controls also apply to technical data furnished to insurers, causing serious difficulty obtaining quotes for insurance premiums and obtaining reinsurance.[34] Where such a significant proportion of total cost of a project is dedicated to insurance premium, barriers to both price and policy shopping are highly undesirable. Furthermore, with the shifting U.S. export control regulations, consistent monitoring is necessary for efficient and effective compliance.[35]

D. State Liability

Space law is a functional classification of those rules of international and municipal law governing outer space.[36] With regard to space risks, "underwriters are at least clear that the assessment of exposure for operations in outer space should be done on the basis of the Liability Convention."[37] Therefore, it must be noted that in the regime established by the Outer Space Treaty and Liability Convention, Launching States[38] are responsible and liable for the space activities of their nationals.[39] In international law, "[r]esponsibility is the necessary corollary of a right. All

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[32] 22 C.F.R. § 120.1 (2014).

[33] Montpert, *supra* note 9, at 286.

[34] Creydt and Horl, *supra* note 29, at 293.

[35] *Id*.

[36] BIN CHENG, *STUDIES IN INTERNATIONAL SPACE LAW* 383 (1997).

[37] Margo, *supra* note 1, at 565.

[38] Convention on International Liability for Damage Caused by Space Objects art. I, Oct. 9, 1973, 24 U.S.T. 2389, 961 U.N.T.S. 187.

[39] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. VI, VII, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

rights of an international character involve international responsibility. If the obligation in question is not met, responsibility entails the duty to make reparation."[40]

The Liability Convention is an elaboration of Article VII of the Outer Space Treaty,[41] which has, in conjunction with the State responsibility requirements of Article VI, become part of customary international law.[42] Article VII states:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.

Liability arises under the Article VI of the Outer Space Treaty in the sense that such liability is imposed as a secondary obligation flowing from the attribution of space activities to the State.[43] Importantly, Article VI states, in relevant part, that:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.

This provision subjects States to responsibility for the activities of their nationals in outer space, including the authorization

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[40] Spanish Zone of Morocco Claims, Report 111 (1924) 2 U.N.R.I.A.A. 614 at 641.

[41] Ram S. Jakhu, *Legal Issues Relating to the Global Public Interest in Outer* Space, 32 J. SPACE L. 31, 52; Cheng, *supra* note 36, at 636.

[42] FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW: A TREATISE* 71 (2009).

[43] Ricky J. Lee, *The Liability Convention and Private Space Launch Services – Domestic Regulatory Responses,* 31 ANN. AIR & SP. L. 351, 359 (2006).

and supervision of such activities. With regard to the Liability Convention,

> An assessment of the terms of Articles 3 and 7 of the 1967 treaty makes it clear that international law is generally relevant to the liability of states for launching space objects and for the space activities resulting from those launches. Because international law is applicable to such conduct, it is important to identify some international principles concerning space activity that do not derive from formal treaties.[44]

States are responsible for their internationally wrongful acts.[45] **"**Any violation by a State of any obligation, of whatever origin, gives rise to State responsibility.**"**[46] In international law, the breach of treaty obligations is just such a violation. In accordance with the holding in the *Chorzów Factory* case, there are three elements of liability in international law: a legal obligation owed by a State, an act by the State which breaches that obligation, and an apparent link between the wrongful act and the damage caused.[47] A failure of authorization and continuing supervision of a private space activity in and of itself constitutes a cause of responsibility under international law and Article VI of the Outer Space Treaty.[48] The applicable standard in this situation would be a due diligence standard.[49] Once that standard is met, a State**'**s responsibility kicks in when the breach is committed, therefore it does not matter when the act or omission is discovered for the purposes of incurring responsibility.[50]

The *Corfu Channel* case also established the 'knew or should have known' international legal standard for liability.[51] This is both the general fault standard in customary international law, and presumably the standard that would be applied for fault liability under Article III of the Liability Convention, which states:

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[44] CARL Q. CHRISTOL, *SPACE LAW: PAST, PRESENT, AND FUTURE* (1991), 212.

[45] Corfu Channel Case (U.K. v. Alb.) 1949 I.C.J. 4, 23-24 (Apr. 9).

[46] Rainbow Warrior Case (New Zealand v. France) 20 R.I.A.A.A. 217, 251(1990).

[47] *Factory at Chorzów* (Germany v. Poland), P.C.I.J. Series A. No. 17. 47 (1928).

[48] Bin Cheng, *Article VI of the 1967 Space Treaty Revisited: "International Responsibility", "National Activities", and "The Appropriate State"*, 26 J. SPACE L. 7, 13-14 (1972).

[49] *Id.* at 15.

[50] *Id.*

[51] *Corfu Channel, supra* note 45, at 22-23.

> In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.

For the purposes of international space law, "the term liability is often used specifically to denote the…obligation to make reparation for any damage caused, especially in the form of monetary payment."[52]

Given this regime, "[s]ervice providers must therefore take out risk coverage and pay insurance premiums, also covering the State's share of international liability; the costs incurred are then transferred to service users."[53] Additionally, an absolute liability standard will be applied to damage caused by a space object on the surface of the Earth or to an aircraft in flight.[54] This is, in fact, where damage is most likely to be caused by a sub-orbital craft, given the limited time (if any) they will spend in proximity to other space objects. It is important to consider, however, that damage caused to the surface of a Launching State or to an aircraft registered therein, will be subject to the laws of that State, rather than the international regime. That said, if they should cause damage to a space object of another State (and both the identity of the space object and cause of the occurrence determined), liability would be allocated on a fault basis.[55] There has been no case law decided on the basis of the international space law treaties.[56] It is worth noting that the Liability Convention has been used only once since its inception: it was referenced by Canada in the diplomatic exchanges resolving the *Cosmos 954* crash in the Northwest

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[52] Cheng, Bin, "Article VI of the 1967 Space Treaty Revisited: 'International Responsibility', 'National Activities', and 'The Appropriate State'" 26 J. SPACE L. 7, 9-11 (1972).

[53] Sgrosso, *supra* note 7, at 485.

[54] *Liability Convention*, *supra* note 38, art II.

[55] *Id*, art III.

[56] Tanja Masson-Zwaan, *Liability and Insurance for Suborbital Flights,* in PROCEEDINGS OF THE 5TH IAASS CONFERENCE 3 (2009).

Territories, which resulted in a multi-million dollar payment by the USSR to Canada for damages.

Liability under this space law treaty regime is unlimited. Domestic laws can provide for caps or limits for the different parties involved, as well as minimum insurance requirements, thus implying that the State is committed to assume the remainder of the unlimited liability beyond those limits.[57] Insurance can be taken out for an operator's 'peace of mind' or in order to comply with certain national legislation, and can include related organizations or States as coinsured. "The insurance industry can help in managing private investment risks against property, financial and liability losses. The insurers, however, need to make use of particularly careful, anticipatory risk valuations, competent inspectors, and highly specialized know-how in pricing and claims handling."[58] Insurers will create a 'risk map' to assess the severity of a possible occurrence and its probability in order to set the price at which they are willing to accept the risk.[59] Unfortunately for those seeking insurance for space activities, they are generally on the far right of such a map, leading to volatile, reactive, and high insurance rates.[60] For example, in late 2001 Munich Re (a major space insurer) announced a rate increase of 50% for launch insurance and 75% for on-orbit insurance.[61] In a different kind of example, the estimated total damage from the *Columbia* space shuttle tragedy is USD 3 billion,[62] though NASA only received USD 500,000 in claims for property damage.[63] Third party liability insurance is generally relatively inexpensive to acquire, particularly given that governments are sometimes included as joint in-

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[57] *Id.*

[58] Lovier Schöffski and Andre Georg Wegener, *Risk Management and Insurance Solutions for Space and Satellite Projects*, 24 THE GENEVA PAPERS ON RISK AND INSURANCE. ISSUES AND PRACTICE 203(1999), *citing* P.J. Blassel, *Space Projects and the Coverage of Associated Risks* 10 THE GENEVA PAPERS ON RISK AND INSURANCE. ISSUES AND PRACTICE 36, 51-83 (1985).

[59] Masson-Zwaan, *supra* note 56 at 4.

[60] *Id.* at 5.

[61] Jeff Foust, *Insurance woes may hurt space industry*, SPACEFLIGHTNOW.COM (2001), http://spaceflightnow.com/news/n0111/07insurance/.

[62] Manikowski, *supra* note 7, at 141.

[63] *Id.* at 148.

sureds.[64] As you can see from the *Columbia* example, it is not uncommon for most damage sustained to be first party damage.

E. U.S. Liability & Waivers

Aerospace companies in the U.S. continue to cite commercial enterprises of foreign governments and use of industrial policy to continue to justify the favorable U.S. government-industry risk-sharing regime in U.S. launch law,[65] which includes mandatory cross-waivers of liability, insurance and financial responsibility requirements, and conditional catastrophic indemnification.[66] Liability for space activities is addressed at the national level in the U.S. through the Commercial Space Launch Act.[67] A three-tier liability regime requires that a licensee maintain insurance or be able to self-insure for the Maximum Probable Loss (MPL) up to USD 500 million, adjusted for inflation. MPL calculations have been as low as USD 3 million and as high as USD 268 million.[68] Congress can allocate funds to indemnify the licensee for the amount between the MPL and USD 2 billion (as adjusted for inflation after January 1, 1989), and the licensee will be liable for any amounts in excess of the inflation-adjusted USD 2 billion.[69] Additionally, cross-waivers of liability must be maintained between the licensee and all commercial entities that are involved in the activity, including contractors and subcontractors, as well as between those parties and the U.S. government for amounts in excess of the mandated insurance coverage.[70] According to FAA calcula-

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[64] Masson-Zwaan, *supra* note 56, at 5.

[65] Joanne Irene Gabrynowicz. *One Half Century and Counting: The Evolution of U.S. National Space Law and Three Long-Term Emerging Issues*, 4 HARV. L. & POL'Y REV. 405, 410-412 (2010).

[66] Michael Mineiro, *Assessing the Risks: Tort Liability and Risk Management in the Event of a Commercial Human Space Flight Vehicle Accident*, 74 J AIR L & COM 371, 392 (2009).

[67] 51 U.S.C. § 50901 (2015).

[68] Schaeffer, *supra* note 17, at 235, 236, 241.

[69] 51 U.S.C. §§ 50914-50915 (2015). As of 2012, the inflation-adjusted amount is approximately $2.7 billion; *Necessary Updates to the Commercial Space Launch Act,* U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON SPACE 3 (2014); citing *Testimony before the Science, Space, and Technology Committee,* U.S. GOV'T ACCOUNTABILITY OFF. 5 (2012), http://www.gao.gov/assets/600/591391.pdf>.

[70] 51 U.S.C. §§ 50914-50915 (2015).

tions, there is less than a one in ten million chance of a loss exceeding the required insurance and triggering U.S. government liability.[71]

Until the Commercial Space Launch Competitiveness Act was signed into law in November 2015, the cross-waiver of liability provisions specifically excluded spaceflight participants with regard to the commercial operator, though they required a waiver of liability from the spaceflight participant to the federal government.[72] Under the exclusion, spaceflight participants could potentially sue operators, and operators could sue manufacturers for indemnification of amounts paid to such participants.[73] The 2015 change is effective through 2025, at which point spaceflight participants will once again be excluded unless further legislative action is taken.

Though individual U.S. states cannot have laws inconsistent with federal law, the Commercial Space Launch Act does grant the authority to states to implement supplemental legislation that adds onto or is more stringent than the provisions of the Act.[74] As regulation of the space industry by individual states has not been pre-empted, state and local legislation is permitted to the extent that it does not conflict with federal regulation.[75] Several U.S. states have undertaken legislative activity with the intention to attract space tourism. Such state law incentives include: offering of spaceport incentives intended to leverage existing facilities, establishment of space authorities, creation of favorable tax regimes, and implementation of industry-favorable liability regimes.[76] Virginia pioneered Spaceflight Liability and Immunity Acts for spaceflight participants (or simply "participants" as these acts universally call them) in 2007.[77] Since then, Florida, California, Texas,

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[71] Schaeffer, *supra* note 17, at 242.

[72] 51 U.S.C. § 50914(b) (2015); 14 C.F.R. § 401(2015); 51 U.S.C. § 50902(21) (2015).

[73] Mineiro, *supra* note 66, at 397.

[74] Commercial Space Launch Activities Act, 51 U.S.C. § 50919 (2010); Mineiro, *supra* note 66, at 381.

[75] Patricia Margaret Sterns & Leslie I. Tennen, *State and Municipal Regulation of the Aerospace Industry in the United States*, in NATIONAL REGULATION OF SPACE ACTIVITIES 467-468 (Ram S. Jakhu ed., 2010).

[76] Gabrynowicz, *supra* note 65, at 420.

[77] Spaceflight Liability and Immunity Act, Va. H.B. 3184, § 8.01-227.8 & § 8.01-227.9 (2007) [hereinafter VA Spaceflight Act].

New Mexico, and Oklahoma have followed suit.[78] Though these acts are preempted for the ten year period between 2015 and 2025 by the Commercial Space Launch Competitiveness Act, they are still on the books and will likely come into play as the space tourism industry grows after 2025. The content of these acts is remarkably similar, though there are a few notable differences of which to be aware. All of the acts specify that, if the procedures of the act are followed, a spaceflight entity will not be liable for a participant injury resulting from the risks of spaceflight activities.[79] Liability waivers are based on the principle of *volenti non fit injuria*; there is no injury to one who consents.[80] A liability waiver is a contract modifying the rights of parties under tort law, and is generally upheld in the U.S. with regard to adventure activities in circumstances where it has been properly drafted and consented to by a participant, though some states will not enforce these contracts on public policy grounds.[81] "[I]t is generally agreed that the liability waiver: (1) must not violate public policy; (2) must have been procured through adequate consideration; (3) must contain clear and unambiguous language; and (4) the signatory must have the capacity to contract."[82] Generally speaking, these waivers cannot include gross negligence or recklessness.[83] Some courts have held such waivers against public policy where a public duty is involved,[84] which would not be the case with regard to space tourism.

These forms, however, are not always accepted or enforceable in other jurisdictions, and thus may not provide a useful model

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[78] Spaceflight Informed Consent Bill, Fla. S.B. 2438 (2008) [FL Informed Consent]; Spaceflight Liability and Immunity Act, 7 Ca. Civ. Code § 2210 (2012) [CA Spaceflight Act]; Limited Liability for Space Flight Activities Act, 4 Tex. Civ. Prac. Ch. 100A (2011) [TX Spaceflight Act]; Spaceflight Informed Consent Act, N.M. S.B. 240 (2013) [NM Informed Consent]; Spaceflight Liability and Immunity Act, 3 Okla. Stat. § 351 (2013) [OK Spaceflight Act].

[79] VA Spaceflight Act, *supra* note 77; FL Informed Consent, *supra* note 78; CA Spaceflight Act, *supra* note 78; NM Informed Consent, *supra* note 78; OK Spaceflight Act, *supra* note 77.

[80] Suzen M. Grieshop Corrada, *Liability Waivers in the United States Travel and Adventure Sports Industry*, INT'L TRAVEL L. J. 156 (2006).

[81] *Id.* at 156-157.

[82] *I*d. at 157.

[83] *Id.* at 158.

[84] JOHN O. SPENGLER & BRUCE B. HRONEK, LEGAL LIABILITY IN RECREATION, SPORTS, AND TOURISM 69 (2011).

moving forward with regard to the development of national or international space regulation. Waivers are useful in that they "efficiently shift the risk to those participants who are explicitly willing to bear the risk of unforeseeable accidents, and leaves the risk of foreseeable accidents to those (the space flight companies) who are able to take measures to prevent them."[85]

II. SPECIFIC CONSIDERATIONS FOR SUBORBITAL AND HYPERSONIC VEHICLES

A. What are suborbital vehicles and why are they different for insurance purposes?

The development of sub-orbital and hypersonic vehicles for space tourism, scientific research, and ultimately point-to-point transportation, is in its early stages and holds the possibility of great advancements for mankind. It raises some unique legal and regulatory questions, however, given the lack of a specific regime and the difficulty with simply classifying these sorts of vehicles wholesale. Of commercially operated transportation industries, aviation is the most technologically similar to the operation of human spaceflight vehicles.[86]

It is particularly difficult to insure the first five launches of a new launch vehicle.[87] With the large number of entities making a foray into the hypersonic or sub-orbital arena, there are a number of new sub-orbital "launch" vehicles entering the market. Some of these vehicles, however, operate more similarly to aircraft than to a traditional rocket-based space launch vehicle.

"From its very inception, mankind's attempts to overcome the forces of gravity by putting heavier-than-air craft into flight have been fraught with a very high level of risk."[88] For an airline, in-

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[85] Christopher D. Johnson, *The Texas space flight liability act and efficient regulations for the private commercial space flight era*, 92 ACTA ASTRONAUTICA 226, 233 (2013).

[86] Mariagrazia Spada, *Human Spaceflights Will Extend Regulatory and Legal Framework Governing Civil Aviation*, in Proceedings of the IEEE Aerosapce Conference 2 (2006), http://ieeexplore.ieee.org/document/1655735/.

[87] Jeff Foust, *Insurance woes may hurt space industry*, SPACEFLIGHTNOW.COM (2001), http://spaceflightnow.com/news/n0111/07insurance/.

[88] YAW OTU MANKATA NYAMPONG, INSURING THE AIR TRANSPORT INDUSTRY AGAINST AVIATION WAR AND TERRORISM RISKS AND ALLIED PERILS 17 (2013).

surance costs are typically less than 2% of annual budget,[89] while an average launch plus one year policy on a space object would cost approximately 15% of the insured sum.[90] Aviation rates are around 0.5%, whereas rates are more like 10% for space coverage[91] (not taking into account the 'plus one year').

Types of spaceplanes can include: supersonic spaceplanes, hybrid aerospace systems that can both function on rocket engines like a spacecraft and on more traditional aircraft engines depending on phase of flight, and multistage aerospace planes with aircraft that launch the space vehicles.[92] "[A]eronautics principles and aircraft jet propulsion are the safest and more reliable solutions to timely reach the outer fringes of air space" which also benefit from proven and experienced technologies.[93]

> In suborbital space tourism, the hybrid activities and the lack of legal framework make it difficult for the sector to apply standard rules for aviation or space insurance. The full range of risks has not yet been identified. Moreover, standards, policies, liability, insurance and procedures to minimize and cover risks, still have to be developed. It has also been a very difficult task for underwriters to work out solutions for this new market. Design and equipment of suborbital vehicles are not yet technologically mature enough to achieve reasonable reliability and commercial sustainability.[94]

It is difficult for both primary and reinsurers to devise an insurance program that is both reasonably calculable for the insurer and affordable to the insured, given the constantly changing landscape of technological developments, the small number of insurable events, the relatively high loss occurrence, and the high limits reflecting potentially large losses.[95] With the small number of test flights yet achieved, the statistical risk is challenging to assess

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[89] *Id,* at 39-40.

[90] Sgrosso, *supra* note 8, at 474.

[91] Tanja Masson-Zwaan, *supra* note 56, at 6.

[92] Sgrosso, *supra* note 8, at 280-289.

[93] Denis Bensoussan, *Space tourism risks: A space insurance perspective*, 66 ACTA ASTRONAUTICA 1633,1635 (2010).

[94] Ana Cristina van Oijhuizen Galhego Rosa, *Aviation or space policy: New challenges for the insurance sector to private human access to space*, 92 ACTA ASTRONAUTICA 235 (2013).

[95] Schöffski and Wegener, *supra* note 58, at 209.

and this difficulty can lead to higher premiums and lower capacity in short term.[96] The ambiguity premium charged to account for unpredictability resulting from the insurer ambiguity in rating these sorts of risks adds to the cost of obtaining insurance.[97] One substantial problem in comparing suborbital or hypersonic transportation to aviation is the stark difference in reliability statistics between space and aviation activities: passenger space travel endeavors are targeted to one fatal accident per 50,000 flights, while civil airliner reliability statistics are at least as good as one in two million.[98]

> There is a consensus among operators, brokers and the insurance markets that maiden flights will be uninsurable and that premiums will remain very high until commercial spacecrafts produce 5 to 15 flights without accident. At this point only the amount of data available to underwriters will allow an adequate assessment of the reliability of the vehicles…[99]

In order to acquire financing, the operator would often need to have an insurance policy already in place, which would be remarkably difficult to obtain given the technological uncertainty at that stage.[100] This creates another substantial hurdle in order to enter the suborbital or hypersonic market.

Defining the insurable risks is the most difficult task, given the complexity of the activity. Some of the factors include: the variety of actors, risks, and phases; the potential property damage both on Earth and in space; and the variety of insurance markets involved (which can include aviation, space, and marine).[101] In an insurance policy, "Hull" would refer to all the equipment integrated into the vehicle, including of course the hull itself, as well as electronics and machinery.[102] It consists of all risks of physical loss or damage to the craft except loss of use, delay, consequential loss, wear and tear, mechanical breakdown, war, strikes, riots,

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[96] Rosa, *supra* note 94, at 238.
[97] Nyampong, *supra* note 88, at 54.
[98] Bensoussan, *supra* note 93, at 1637.
[99] *Id.* at 1637-1638.
[100] Schöffski and Wegener, *supra* note 58, at 210.
[101] Rosa, *supra* note 94, at 236.
[102] Bensoussan, *supra* note 93, at 1635.

civil commotion, or radiation.[103] In terms of the lead vehicle (for example, Virgin Galactic's *WhiteKnight*), would the hull risk be considered an aviation risk or a space risk?[104]

In addition, some significant differences between jet propulsion and suborbital craft are propulsion mode, re-entry technology, redundancy scheme, safety devices, vehicle handling, and procedures for ground maintenance.[105]

> *Before the separation,* the combined aircraft/space vehicle has the characteristics of an aircraft in terms of technical functions, flight pattern and maneuverability. While connected, it also derives support in the atmosphere from the reactions of the air.
>
> *After the separation,* the space vehicle does not satisfy the criteria of the above-mentioned definition of an aircraft. Once the space vehicle is separated from the aircraft, it is being launched vertically like a rocket and does not derive support in the atmosphere.[106]

In terms of similarities, though, aviation insurance also lacks the substantially large number of insureds to benefit from the Law of Large Numbers, a structure utilizing actuarial principles based on data from the full range of past experiences.[107] Granted, the smaller numbers available with regard to space activities is even more striking than with regard to aviation. That said, the space insurance market currently possesses a narrower range of risk coverage as compared to aviation insurance, which would potentially be able to govern a market for suborbital space tourism given the lack of an otherwise applicable regime for this activity.[108]

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[103] *Id.* at 1635.

[104] *Id.* at 1634.

[105] *Id.* at 1635.

[106] Rosa, *supra* note 94, at 238 *citing* Stephan Hobe, *Future High-Altitude Flight – An Attractive Commercial Nice, Scenario 2 – Air Launch*, FLACON PROJECT REPORT 4 (2007).

[107] Nyampong, *supra* note 88, at 22, 42. The number of insured aircraft worldwide is similar to the number of vehicles registered in any medium-sized North American or European city.

[108] Rosa, *supra* note 94, at 240.

B. Liability in Air Law

While Part I. Section D. provides an overview of liability in space law, this section provides a discussion of private international air law liability rules, including the Warsaw Convention and Montreal Convention and protocols. It is important to note that national law governs national flights, which would therefore also be the case for suborbital travel.[109]

The 1929 Warsaw Convention, with 152 States Parties, revolutionized liability for commercial aviation.[110] Fundamentally, the Convention instituted a reversal of the burden of proof,[111] allowing the burgeoning industry freedom to grow with a less oppressive liability regime for international air travel. Liability was limited for damage to persons, cargo, or luggage, except insofar as willful misconduct or the equivalent thereof could be proven.[112] Thus, litigation with regard to this Convention largely centered on whether or not the liability limits could be breached.

Subsequently, the Montreal Convention modernized the regime created by Warsaw. This Convention, which entered into force in 2003, now has 111 parties.[113] It effectively removes the liability cap for passenger death or injury, limiting liability only if the carrier can prove they have not been negligent.[114] The movement from a limited to unlimited liability scheme in aviation followed on from developments in the law of the sea.[115] When the industry matured, the balance was shifted in favor of the consumer.[116] "It was considered that unlimited liability actually encourages parties to settle their disputes, instead of going to court arguing for or against willful misconduct, trying to break the limits

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[109] Masson-Zwaan, *supra* note 56, at 2.

[110] The Convention for the Unification of Certain Rules Relating to International Carriage by Air, Oct. 12, 1929, ICAO Doc. 7838, 9201, 137 L.N.T.S. 11 (1933), 49 Stat 3000 (1929).

[111] *Id.*

[112] *Id.* art 22, 25.

[113] The Convention for the Unification of Certain Rules for International Carriage by Air, May 28, 1999, ICAO Doc 9740 [hereinafter Montreal Convention].

[114] *Id.* art 21.

[115] Masson-Zwaan, *supra* note 56, at 2.

[116] *Id.*

imposed under the Warsaw system."[117] Thus, there are reasons to favor either a limited or unlimited liability regime.

The Rome Convention sets forth a liability regime for damage to third parties (neither the carrier nor those in contract with the carrier) resulting from the operation of aircraft. This Convention limits liability on the basis of aircraft weight.[118] Unfortunately, largely due to issues with adjusting the liability caps for inflation, the Rome Convention has only 49 parties,[119] and is missing significant aviation players like the United States.[119] The General Risks Convention is an attempt to modernize the Rome regime in a form that will be more acceptable to a greater number of States. It caps strict liability for the carrier also based on aircraft weight, but like the Montreal Convention, it only applies if the operator can prove it was not negligent. It has not yet obtained sufficient ratification to enter into force.[120]

While the Warsaw Convention does not require compulsory insurance, the Montreal Convention does.[121] Compulsory insurance tends to focus on second and third party losses, and thus fails to address first party losses that can be sustained by a carrier.[122] Under the Rome Convention, a State can require a foreign operator to carry insurance for damage that could be caused in the State's territory and which would be addressed by the Convention, but it is possible for a guarantee to be given by the contracting State of registration that it will not claim immunity from a suit, in lieu of requiring that the carrier acquire insurance.[123] The General Risks Convention, which has yet to enter into force, would provide for strict liability for third-party damage (due to death, bodily injury, mental injury, and property damage) to an aircraft opera-

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[117] *Id.*

[118] Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, Art. 11, Oct. 7,1952, 310 U.N.T.S. 182 [hereinafter Rome Convention].

[119] Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, signed at Rome on 7 October 1952, ICAO, http://www.icao.int/secretariat/legal/List%20of%20Parties/Rome1952_EN.pdf.

[119] *Id.*

[120] Convention on Compensation for Damage Caused by Aircraft to Third Parties, Art. 4, May 2, 2009, ICAO Doc 9199 [hereinafter General Risks Convention].

[121] *Montreal Convention*, *supra* note 113, art. 50.

[122] Nyampong, *supra* note 88, at 59.

[123] *Rome Convention*, *supra* note 118, art. 15(c).

tor.[124] This convention also requires insurance or a guarantee of ability to cover liability, and can be required to produce proof thereof.[125]

The hazardous nature of space activities is clear, and on that basis, State responsibility and liability for damage caused by space objects is reasonable and possibly desirable. That said, limiting the liability of operators both reduces the financial barriers to entry into the space arena, and reduces the cost of insurance necessary to safeguard companies from potential financial ruin in the case of damage. From this perspective, limiting liability for suborbital or hypersonic operators, who are largely operating in airspace, could substantially improve the viability of the industry.

C. Safety in Air Law and the Chicago Convention

The International Civil Aviation Organization (ICAO), in accordance with the Chicago Convention, promulgates safety standards for international civil aviation.[126] Article 44 of the Chicago Convention calls upon ICAO to ensure safe, regular, efficient, and economical air transport.[127] Article 37 provides a commitment to collaborate to obtain uniformity in areas which will improve or facilitate air navigation.[128] "International air transport operates within an extremely complex legal network that is based on air services agreements between national governments and on rules and regulations made by the ICAO…and IATA (International Air Transport Association)."[129]

Annex I to the Chicago Convention defines aircraft as follows: "Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface." This would inherently rule out craft that are only rocket powered and do not have glider capabilities (because a traditional rocket-powered craft cannot derive any support from the air – reactions against the Earth's surface are irrelevant in this

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[124] *General Risks Convention*, *supra* note 120, art. 3.

[125] *Id.* at art. 9.

[126] Convention on International Civil Aviation, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295.

[127] *Id.* at art 44.

[128] *Id.* at art 37.

[129] Spada, *supra* note 86, at 1.

analysis), but could include many, if not most of the hybrid aerospace vehicles under development today. (It is worth noting that the term "space object" is not specifically defined in any of the relevant space conventions.) While attempting to suddenly implement the strict licensing, technical, and other safety guidelines on space endeavors would be unnecessarily burdensome on the industry; it would be possible to create a similar safety regime specifically applicable to this manner of suborbital or hypersonic craft, thereby increasing risk management and reducing premium.

With sufficient development and testing, it may even be possible to apply some of the Chicago Convention annexes to these activities without significant modification. For reference, the existing annexes to the Chicago Convention regulate the following: personnel licensing, rules of the air, meteorological service for international air navigation, aeronautical charts, units of measurement to be used in air and ground operations, operation of aircraft, aircraft nationality and registration marks, airworthiness of aircraft, facilitation, aeronautical telecommunications, air traffic services, search and rescue, aircraft accident and incident investigation, aerodromes, aeronautical information services, environmental protection, security to safeguard international civil aviation against acts of unlawful interference, the safe transport of dangerous goods by air, and safety management.

In general, "the obligation to maintain air navigation and communication systems/services may extend beyond the territory of the contracting States proper and well into the territory of neighboring States without necessarily violating the sovereign rights of the other State."[130] This overlap in services can help to ensure safety of both aviation and space operators who may be utilizing the airspace of a region, and combining services particularly for aviation and suborbital or hypersonic travel produces benefits in terms of safety and risk management, as well as efficient operation of air space.

With regard to space, "[s]afety procedures and devices could range from traditional cabin pressurisation and protection, g-constrained trajectories to more innovative concepts like pressure suits, helmets, internal and external airbags, ejection capsule and

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[130] *Id.* at 3.

parachutes."[131] Generally, one effective way to further develop space travel passenger services would be through substantial collaboration with the aviation industry, which would help to improve their commercial viability.[132] The aviation industry has a time-tested understanding of safety standards and best practices that can lay the groundwork for similar standards with regard to space. "Accepted levels of vehicle safety and public risk will be identified for commercial space vehicles. Based on these safety and risk levels, some space vehicles will be evaluated for safety in a manner similar to that performed for commercial aircraft."[133] When standards are applied to space travel in the manner they are applied to aviation, it should serve to lower insurance premiums due to increased confidence in the industry and risk management on the front end.

D. Aviation Insurance

Now that private international liability law and public international safety rules have been discussed with regard to the aviation side of the house, it is possible to compare aviation insurance to space insurance under the relevant space legal regimes. In order to assess the applicability of aviation insurance to suborbital and hypersonic activities, it is necessary to define the term. "Although a formal definition of aviation insurance is elusive, the phrase generally refers to the insurance of risks associated with the manufacture, ownership, leasing, operation and maintenance of aircraft, as well as the operation of aviation facilities on the surface of the earth and in outer space in the not too distant future."[134] In fact, even "satellite operations are considered by insurers to be of an aviation nature[.]"[135]

It is also important to assess the purpose of such insurance. "Insurance coverage in the air transport industry carries the same objective as space insurance in that risk management is the over-

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[131] Bensoussan, *supra* note 93, at 1637.

[132] Spada, *supra* note 86 at 3, *citing* P. Collins & Y. Funatsu, *Collaboration with Aviation- The Key to Commercialization of Space Activities*, SPACEFUTURE.COM (2000), http://spacefuture.com/archive/collaboration_with_aviation_the_key_to_commercialisation_of_space_activities.shtml.

[133] Spada, *supra* note 86, at 6.

[134] Nyampong, *supra* note 88, at 39.

[135] Margo, *supra* note 1, at 565.

arching purpose of insurance contract. A risk entails four possible responses from the person at risk: acceptance, elimination, reduction, and transfer."[136] Aviation insurers use a variety of risk rating factors to set rates for third party insurance, including: geographical area of operation, essential nature of the product or service being insured, the jurisdiction, the type of aircraft, local turnover volume, quality control system and procedures, contractual terms, prior claims, and market conditions.[137] Meanwhile, rates for passenger insurance are determined by factors such as the type of aircraft, flight duration, liability regime, and so forth.[138]

"Similar to most commercial air transport insurance contracts, the space insurance policy is usually underwritten in syndicate where each individual underwriter assumes a percentage of the risk."[139] Also, similarly to commercial aviation insurance, the only types of losses that will be typically excluded from coverage under a launch policy would be those resulting from war, ASAT weapons, confiscation, radioactive material, electromagnetic or radiofrequency interference, and intent.[140]

III. RECOMMENDATIONS AND CONCLUDING THOUGHTS

Some have suggested that longer-term or higher government indemnification caps provided by the U.S. government would serve to foster the development of the U.S. commercial space industry. However, "there is no indication from the insurance industry that rates would be significantly impacted by the US government agreeing to take on additional third party liability for a prolonged period of time."[141] Given the low probability of triggering the existing government indemnification limits cited by the FAA,[142] this change seems it would be an unnecessary one to strive for where other reforms are so critically needed. Modifications to export control regimes that impact the ability to shop for insurance and to provide sensitive technical data to insurers are a

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[136] Abeyratne, *supra* note 10, at 199-200, citing Rod D. Margo, *Risk Management and Insurance*, 17 ANNALS AIR & SPACE L. 59, 80 (1992).

[137] Masson-Zwaan, *supra* note 56, at 4.

[138] *Id.*

[139] Abeyratne, *supra* note 10, at 191.

[140] Schöffski and Wegener, *supra* note 58, at 205.

[141] Schaeffer, *supra* note 17, at 240.

[142] See text accompanying FN 71.

much higher priority with regard to legal impediments in the insurance and liability regime. Export control regulations are only effective when States cannot obtain the restricted supplies from third States;[143] when they can, the intended purpose of said restrictions is eroded, as is the relevant national industry. In this case, those individuals, entities, and States wishing to procure technologies with restrictive or complicated export controls from the U.S., can turn to other technologically advanced or launch-capable States, rendering the U.S. export controls ineffective and counter-productive to the national space industry.

Though this article has focused on issues of space law (and to a lesser degree, air law), it is not to be forgotten that there is a large body of well-developed insurance law that likewise applies to the space insurance industry and will be applied in the case of contractual disputes surrounding a contract for space insurance. To that end, there is an opportunity to echo a series of insurance recommendations made by Stephen Tucker over twenty years ago that are still relevant today. Simply put, imprecise or ambiguous language is to be avoided, proof of loss requirements must be understood and adhered to by insureds, insureds should focus efforts to mitigate any losses that would be covered under the policy, and insureds must update the insurer with any information pertinent to the policy through its life.[144]

For suborbital and hypersonic flights, it is possible that three types of insurance (first, second, and third party risks) could be handled differently from each other.

> Insurance for operators' liability vis-à-vis passengers (second-party liability) will likely be placed on the aviation market, which has vast experience in this field, of course with necessary adaptations. Insurance for operators' liability vis-à-vis third parties could be placed on either the space or the aviation insurance market, as both markets have experience and capacity in this field. Similarly, hull risks and personal accident insurance will be developed, using the experience of both markets…[145]

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[143] Creydt and Horl, *supra* note 29, at 291.

[144] Tucker, *supra* note 19, at 139.

[145] Masson-Zwaan, *supra* note 56, at 7.

It would be logical to provide passenger insurance in a framework similar to that of aviation, given the similarities in carriage, albeit at an appropriate rate for space travel rather than air travel.

The insurance concerns of this unique area bridge both space and aviation, with elements of both fields. Certain innovations, such as annual rather than per-flight hull insurance, are critical to the success of the industry, and only make sense, given the fact that the spacecraft in question are reusable, unlike their expendable counterparts, which are sensibly insured for their only flights.

> [R]ealistically suborbital space tourism needs to have an insurance premium of less than 1%, or the costs to fly needs to increase. The hull of the aircraft will be insured on an annual basis rather than on a per-flight basis. Commercial satellites launches are insured on a single, per-launch basis, for which rates are approximately 10% of the insured value. As a result, from the economic viewpoint there is very little interest from the space insurance sector in insuring space tourism, because the revenue is likely to be minimal…Underwriting the hull of the rocket through the aviation markets will result in far lower premium rates for the risk than if the risk were underwritten through the space insurance market.[146]

Given the financial considerations, it would be almost absurd to provide insurance for a suborbital reusable horizontal take-off and landing craft in the same manner as one would provide insurance for a vertical take-off expendable rocket.

The provision of insurance is essential, regardless of whether we term suborbital and hypersonic flights as space, aviation, or some form of hybrid aerospace activity. With regard to both space and aviation activities,

> states can be called upon to be responsible for ensuring that both these critical areas are covered for risks so that continuity of the services they render are assured…both industries are 'brittle' and, therefore, susceptible to catalysts of market failure…States should play the role of initiator and regular of

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[146] Rosa, *supra* note 94, at 240 *quoting* that author's interviews with Neil Stevens, legal counsel of the Atrium Space Insurance Consortium (15, 19, 21, 26 & 29 July 2010).

> insurance to the extent of ensuring that insurance is available rather than actually providing it.[147]

Finally, the ability to leverage communication, navigation, surveillance, and decision support systems is key to creating a modernized airspace system; the integration of space and aviation operations will be key to ensuring the provision of efficient service to all users.[148] Thus, a liability and insurance regime that is supportive of this integration is essential to the safe operation of both aviation and suborbital activities. It is up to the States, both individually and in cooperation, to provide a regulatory environment that makes space insurable.

Though this article has not focused extensively on issues of safety, it has addressed liability waivers that are in place in the U.S., in addition to its main focus, which has been liability insurance. "It should become evident that neither waivers of liability nor liability insurance policies taken out…neither wholly negate nor fundamentally disrupt the calculations that space flight entities should take in deciding how to evaluate risk and safety."[149] It is in the best interests of spaceflight entities, as rational actors, to ensure a reasonable degree of safety, even where such options as waivers and insurance exist. The idea that the availability of such tools will inherently or automatically create a moral hazard that would lead to the erosion of safety standards is flawed.

To conclude, it is critical to note that commercial entities will generally prefer legal frameworks that provide the greatest degree of legal certainty, leaving less for the courts to decide if a dispute should arise[150] and therefore protecting their investments. Thus, for both insurers and regulators, legal certainty (stopping short of over-regulation) is a laudable goal.

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147 Abeyratne, *supra* note 10, at 209-210.

148 Spada, *supra* note 86, at 2.

149 Johnson, *supra* note 85, at 233.

150 Michael Gerhard and Kamlesh Gungaphul-Brocard, *The Impact of National Space Legislation on Space Industry Contracts*, in CONTRACTING FOR SPACE 63-64 (Lesley Jane Smith & Ingo Baumann, eds. 2012).

INSTITUTIONAL COST OF INTERNATIONAL SPACE LAW

S.G. Sreejith[*] *& Yugank Goyal*[**]

I. INTRODUCTION: CONTEMPORANEITY IN INTERNATIONAL SPACE LAW

What is the temporal and intertemporal value of the perception that International Space Law (ISL) helps humanity explore and exploit the terrestrial abundance of Earth and the infinite spaces beyond it for itself and its progeny? One should keep in mind before ruling on the temporal appropriateness of the said proposition that in modernity, ISL has espoused the dialect of liberal markets. And so, the explorations and exploitations discussed therein have as their goal optimal utilization of the consumer demand in a market under competitive conditions. Then again, what if the market in question is a "non-existing market" and competitive conditions are fictional competitive conditions?[1] After all, according to some, space is a plenary extension of human micro-consciousness to a spatio-temporal vastness where the universal mind of humanity is found; space is in no way meant to be commercially exploited. Whatever the epistemological skepticism of space-idealists is, in fact, the ISL has a rich body of knowledge that affirms that there is

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[1] A non-existing market is a meta-space of empty representations. That is to say, the animate object and the inanimate symbols there cannot be existentially quantified.

a real space market somewhere out there working under strict regulatory conditions.[2] There are claims that that market is a liberal market, albeit a catallaxy, which has spaces of representation for both private players and states so that they pursue their preferences through a well-planned decentralized system of knowledge (market strategies).[3] There are also claims that the normative architecture of ISL, a Cold War relic, has a certain sufficiency in terms of meeting the challenges of the space market, which is a typical liberal market (as it were) of quantum uncertainties. Gerardine Goh affirms:

> While Article VI of the Outer Space Treaty has been considered one of the strongest recognition of the commercial utilization of space within the general framework of international space law, when read with the other provisions of the Outer Space Treaty there is no doubt that such commercialization was conceived with utmost regard to these founding principles of space law.[4]

An optimism also permeates ISL with an assumption that carrying out commercial space activities in a liberal market does not forsake the guiding aspiration of keeping all space activities peaceful.[5] However, such optimism is little informed about the fact that players in the liberal market are not morally-enlightened, altruistic welfare seekers. Rather, they are rational, utilitarian, and unwilling to let their games fall to sub-optimal levels—a strategy often mistaken for dutiful observation of the golden law: that all activities in outer space shall be for peaceful purposes and shall be peacefully carried out.[6]

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[2] *See* e.g., H.L. VAN TRAA-ENGELMAN, COMMERCIAL UTILIZATION OF OUTER SPACE (1993).

[3] *See & Cf.* RACHEL S. TURNER, NEO-LIBERAL IDEOLOGY: HISTORY, CONCEPTS AND POLICIES 120-22 (2000).

[4] GERARDINE GOH, DISPUTE SETTLEMENT IN INTERNATIONAL SPACE LAW: A MULTI-DOOR COURTHOUSE FOR OUTER SPACE 161 (2007).

[5] *See* VAN TRAA-ENGELMAN, *supra* note 2 at 2.

[6] *See* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967 (hereinafter, "Outer Space Treaty"). Indeed, there is a certain aura to the various international legal instruments on outer space such that tributes have been copiously paid to them on their aspiration to liberate humanity from space wars, e.g., the Outer Space Treaty as the Magna Carta of Space, 1963, Declaration on the Peaceful Uses of Outer Space as "instant customary law", and so on and so forth.

Aligned with the *telos* of optimism and its aspiration for the peaceful use of outer space, are efforts to generate a Global Public Interest (GPI) in space — a task aimed at the consolidation of all rules, principles, and founding aspirations of ISL for bringing contemporary relevance to ISL.[7] In such a GPI, no state, regardless of its own interests, shall act contrarily to the "spirit and letter" of ISL already codified in various legal instruments.[8] Only when all national interests are aligned under the international rule of law, which *the corpus juris spatialis* will guarantee *mutatis mutandis*, will the GPI be realized.[9] However, aligning the national interest of self-interested states is easier said than done, let alone consolidating those interests. But ISL finds it appropriate and expedient to aggregate varied national self-interests through international judicial enforcement and transnational institutions.[10]

However, if contemporaneity, as stated above, is characterized by the rule of liberal states, then the utility of the GPI project will be much less so — both the fineness of optimism and the quality of the proposals therein have nothing more than a conceptual value. In fact, it is less likely that rational liberal states participate in transnational institutions because such states, contrary to what the GPI project relies on, are not motivated by communitarian normative considerations, but by concerns about costs, such as the equilibrium costs and transaction costs that any institution-based cooperation would impose.[11]

Such and similar claims and assumptions, as the above said ones of ISL, are prone to mistrust for a few reasons. For instance, there is an overestimation about the intertemporal relevance of space treaties which ranges from confirmations of their sufficiency to suggestions for hermeneutically extending the scope of the treaties. Whatever plausibility such a move may have, its very conventionality misrepresents the role of law in liberal markets. In other words, contrary to what ISL considers, the role of law in liberal

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[7] *See generally* Ram Jakhu, *Legal Issues Relating to the Global Public Interest in Outer Space* (2005), http://drum.lib.umd.edu/bitstream/1903/7916/1/jakhu.pdf.

[8] *Id*. at 68.

[9] *Id*. at 69.

[10] *Id*. at 68-69.

[11] *See* Barbara Koremenos, Charles Lipson & Duncan Snidal, *The Rational Design of International Institutions*, in, THE RATIONAL DESIGN OF INTERNATIONAL INSTITUTIONS 1, 21-23 (Koremenos *et al.* eds., 2001).

markets is not to provide a normative structure of self-governance for players, but to create a regulatory climate to protect and maintain market conditions. A system as normatively rigid as ISL, no matter its comprehensiveness or the communitarian welfare it can maximize, often has disincentives for the players in the market. This is especially true given the fact that the "shared expectations," which patterned normative behavior generates, and the ethical considerations normative systems have espoused "to keep law in touch with life," disturb the self-interest of the players.[12] Both, seen from any angle, are antithetical to the realization of self-interest of states.

If that is the state of play for ISL, does its splendidly normative architecture carry any more significance than an artifact of diplomacy? We would say it carries significance, but not the type of significance as with the Kelsenian unevaluable norms of a normative system — their un-evaluability comes from the intrinsic rationality of norms.[13] This is true because the normative architecture and the norms therein can be infused with meanings suiting the demands of liberal markets. Such semantic and theoretical revolution has happened elsewhere and has been the trend in the epistemic neighborhood of ISL. For example, a treaty in a liberal market is not, as generally believed, a means for collective action by generating normative commitments among states, but "a focal point" — an information base around which states cooperate.[14] Again, state interest is, as conventionally understood, neither a maximization of public good nor the promotion of state welfare, but simply a "state's preferences about outcomes."[15]

On balance, the inter-temporality of ISL very much depends on its legal consciousness—that of the communitarian normativity of Kelsenian social systems or the rational pragmatism of liberal markets. Because legal consciousness is the perceptual experience of law with regard to prevailing legal standards, if that experience is temporally limited, there can be no intertemporal application of

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[12] BRONWEN MORGAN & KAREN YEUNG, AN INTRODUCTION TO LAW AND REGULATION: TEXTS AND MATERIALS 38 (1971).

[13] The intrinsic rationality of norms is the leitmotif of Kelsen's general theory of law. *See generally* HANS KELSEN, GENERAL THEORY OF LAW AND THE STATE (1945).

[14] *See generally* JACK GOLDSMITH & ERIC POSNER, LIMITS OF INTERNATIONAL LAW (2006).

[15] *Id.*

ISL. However, if the experience of law transcends a given contemporaneity, and if that is particularly the case of ISL, ISL qualifies as a candidate to contend for temporal appropriateness in a temporality where the normative base of law is under constant challenge.

We argue that ISL has not transcended time and is not qualified to contend for temporal appropriateness because ISL has an obsessive status quo bias, which imposes costs on actors in outer space, rendering them to hopelessly cling to a non-temporal normative structure. We take a diagnostic approach to the issue. Hence, we analyze the impact of costs on ISL and its functioning. For this, we divide the costs ISL imposes into structural costs and functional costs *sensu lato*. Under structural costs we look at the costs imposed by the normative framework of space law—the space treaties—which, due to its temporal fixations of a Cold War past and a desire to positivize authority and control of outer space, has led to problems with incentives. Under functional costs, we carry the argument forward to show that any cooperation under the existing treaty framework would not result in the production of public good, rather, by imposing costs like positive externality on potential actors, it has created the loss of a functional community and coordination possibilities for investments in outer space.

In light of ISL imposing costs, we take the counteractive stance that there shall be strategic reduction to the cost of ISL. That is to say, if market considerations have eclipsed the communitarian aspirations of ISL, as is widely rumored, and if space commercialization is really meant to be actualized, highest priority should be for a reconsideration of ISL in terms of the temporal relevance of its legal architecture. Part II is an exercise in that regard. Though we realize that ISL has created a coordination problem among the space players, which is the cause of inaction in commercial space activities, we do not suggest exploding the architecture of ISL, but rather, rethinking, and to the extent possible, realigning the conceptual foundations of ISL recalling the emergence of liberal markets. In Part III, we provide theoretical guidance and strategic inputs for such a realignment of the foundations and a recovery from the coordination problem, which includes suggestions for the creation of focal points in space treaties and for striking an asymmetric equilibrium among state parties to the space treaties. In Part IV we illustrate our proposed strategies with the examples of private

property rights in space, discovery of helium 3, and the equitable distribution of space benefits.

Finally, a word on our methodology. We engage with a close-reading method coupled with adopting a rational choice model in economics to analyze space law, a discipline whose epistemological substance and utility have been subject to a few normative and ethical catechisms. In interpreting and evaluating the texts of space treaties through close reading, we locate their economic blind spots and focus on the lack of allocative efficiency imposing considerable impact on the motivations of relevant actors in the market for space exploration. Focusing on allocative efficiency and means to improve it, first we have problematized the state of play in space law to estimate the economic and social costs of space law. Second, we have employed the rational choice model of state behavior to demonstrate the constructive possibilities left in space treaties. We do this at two levels: first, by adopting a game theory approach to understand the frames of motivations embedded in the legal architecture; and second, by using neoclassical standardized theory of externality and the problem of collective action. Our proposals for improving allocative efficiency are by no means radical or revolutionary. Rather they are custom solutions for economic problems. However, the simplicity of our approach itself is the newness. The freshness of our approach lies in our modelling of the complex issues of space law along the lines of straightforward imagination of using economic analysis and optimizing those proposals to achieve a different equilibrium in space law and policy, which encourages actors to engage in the game, rather than continue in the status quo of no action.

II. STRUCTURAL COSTS: COSTS OF SPACE TREATIES

Law in its rule form, whether as treaties or domestic legislation, in a liberal market is epiphenomenal to state interest and power. But in a normative system like the ISL, law is in fact the sub-structure through which all socio-political transactions occur. While the form of law therein is that of rules, its substance is public morality, both of which are hardly of any utility in liberal market-oriented societies. What market societies, in fact, require in terms of law are rules that stabilize market conditions and promote and

legitimize economic self-interests, cutthroat competitions, and similar practices.[16] Rules of that genre cannot be normative *per se* because rules of a normative character constrain behavior, which is antinomous to the very concept of market societies. Rather, rules a market requires shall have information essential to help actors make free choices—choices that would in turn help them to maximize payoffs and become better off as the stability of the market is maintained.

Transforming rules, rules of ISL for that matter, into an integrated information-architecture is easier said than done. First and foremost of the difficulties in this regard is the normative character of the rules of ISL, which is less malleable for a free-choice based system. Second, the generality characteristic to space treaties and the suitability of that rule-generality to market societies pose functional challenges. Both difficulties impose costs on actors. Before outlining the problem, let's see the nature of rules in a market-oriented society.

Generality of rules *per se* is not an iniquity in a market (though most often specificity is a desirable norm), because the market desires a certain level of generality. Sun-Ki Chai argues that under generality, actor-expectations remain uniform which would otherwise be a simple aggregate of non-transparent, assorted expectations.[17] But market actors, in terms of their strategic choices, certainly would prefer that they leave less scope for predictions by other actors. Hence, actors adopt certain levels of parsimony in what may be called the "theoretical obviousness" of their strategies. In fact, it is nothing but a choice optimization on the part of actors. However, such parsimony and the resulting specificity do not generally frustrate the constitutive scope of generality in the market. That is to say, generality in market-oriented societies is in the form of assumptions about the basic nature of actors and not about the conditions in which actors design their strategies.[18] The latter is subject to subjective, parsimonious choices of actors. Even if there

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[16] *Cf.* A. JAVIER TREVINO, THE SOCIOLOGY OF LAW: CLASSICAL AND CONTEMPORARY PERSPECTIVES 58 (1996).

[17] SUN-KI CHAI, CHOOSING AN IDENTITY: A GENERAL MODEL OF PREFERENCE AND BELIEF FORMATION 10 (2001).

[18] *Id.*

is incompatibility between general actor-expectations and the outcomes of specific choices of actors, there is no incompatibility between the core assumptions about the actors and the specific behavior of those actors.[19]

When there is incompatibility between general actor-characteristics and specific actor-choices, rational players can still make predictions about the outcome of actor-behavior by "understanding ordered preferences of individual actors who populate a specific institution or political sphere [that is, the actors who adopt specific strategies that are incompatible with the generalized actor-expectations in the market] and the formal rules by which these preferences are combined. In this approach preference + rules = policy outcomes."[20]

The equation (*preference* + *rules* = *outcomes*) is sustained by the *constant* "core assumption about the nature of actors". And to the extent that the nature of actors is egoistic, self-interested, and utilitarian, there is at least a chance that any assessment of actor preferences can go wrong. When actor-preferences are assessed in the light of rules which provide information on the strategic climate in the market, irrespective of the specificity in actors' strategies, predicting policy outcomes becomes possible.

In the case of ISL it is affected by the generality of the treaty regime, as Lotta Viikari puts it,

> [T]he lowest-common-denominator problem easily results in treaty provisions which remain on such a general level that the instrument in question can be considered ineffective . . . At worst, generality in formulations can make it difficult to ascertain the exact meaning of agreed treaty provisions.[21]

In the Outer Space Treaty, actor-expectations including assumptions about the actor-behavior border on communitarian idealism, setting as the ultimate goal of all space activities the "realization of the interest of all mankind."[22] And as far as actor-behavior

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[19] *Id.*

[20] Bryand D. Jones, Graeme Boushey, & Samuel Workman, *Behavioral Rationality and the Policy Processes: Toward a New Model of Organizational Information Processing*, in HANDBOOK OF PUBLIC POLICY 49, 51 (B. Guy Peters & Jon Pierre, eds., 2006).

[21] LOTTA VIIKARI, THE ENVIRONMENTAL ELEMENT IN SPACE LAW: ASSESSING THE PRESENT, AND CHARTING THE FUTURE 212 (2009).

[22] Outer Space Treaty, art. 1, U.N., 1967.

is concerned, states shall cooperate, provide mutual assistance and international consultation, and not extend any claims of sovereignty over any part of outer space. Actors are also expected to be altruistic and equitable in the distribution of benefits derived from the exploration and exploitation of outer space.[23] There is nothing unusual about this type of a position considering the system in question is composed in a normative fashion, because law commonly uses altruism in its normative scheme as a qualitative agent to spread its dictates across its intersubjective actors. Besides, in regulating a domain that is as security-sensitive and potentially commercial as outer space, anything less than the normative power of law cannot provide stability. Goh opines that "the most apposite foundation [for ISL] is the normative standard of law" which shall be well-supplied by procedures because "in order to inspire conviction in the peaceful and equitable use of outer space resources . . . [there shall be] the delicate equilibrium between normative legal principles and the interest of participating actors."[24]

Presently in its normative form and structure, ISL requires actors in space to shape their preferences and make their respective choices as determined by certain normative preconceptions that best suited the Cold War geopolitics. True, during the Cold War, ISL had a political utility: an ability to resist the geopolitics of superpower rivalry. At that point in time, the normative requirement to restrain from freely pursuing one's preferences—be that the military uses of outer space or unilateral use of force—helped establish stability and order. Also, the altruistically-cut actors, other than superpowers, who had an unconditional willingness to be part of a common interest in space, helped generate a universal consciousness which dedicated space to the whole of mankind. Most of the state positions (we shy away from calling them state choices) were tailor-made to suit the pre-set normative goals of ISL. Indeed, ISL then had a temporal appropriateness. However, such appropriateness was obtained by limiting ISL to a "minimum scope," perhaps a "minimum presence," necessary for law for any political organization.

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[23] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 11, U.N., 1979.

[24] GOH, *supra* n. 6 at 359.

However, those shall not be the modalities of law if contemporaneity in ISL, as said earlier, is the rule of liberal market-oriented societies wherein egoistic, payoff-driven, self-interested actors abide. Such actors, mostly states, are not altruistic peace-seeking entities which can be normatively aligned, for they do not "slip into" norms as moral entities do and even if they follow norms they follow them as strategy for maximizing utility. What rational states prefer to have in a treaty is a multilateral framework of cooperation which "at least in prospective terms, [give] each adherent [ ] a benefit that is at least as great as it would receive if it did not receive in the treaty."[25] Hence a treaty shall have the scope for choice optimization that can make the member states better off.

The generality of space treaties should have been providing higher scope for choice optimization for the member states. However, irrespective of the generality in terms of their scope, the space treaties have a closedness in terms of what Hannah Ginsborg calls "associative dispositions" which are the sub-perceptions treaties generate and which states make use of for optimizing their choices. For example, the general perception the Outer Space Treaty generates is that space and other celestial bodies shall be used for free, peaceful uses. Additionally, it generates certain sub-perceptions — associative dispositions, so to speak. For example, Article IV says:

> The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.

In this article, we see the following:

General perception: Free and peaceful uses of outer space, the Moon and other celestial bodies

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[25] JOEL P. TRACHTMAN, THE ECONOMIC STRUCTURE OF INTERNATIONAL LAW 128 (2008).

Sub-perception 1 (exclusivity): The Moon and other celestial bodies shall be used by all States Parties to the Treaty *exclusively for peaceful purposes*.

Sub-perception 2 (Restricts/forbids military uses): The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies *shall be forbidden*.

Sub-perception 3 (limited permission): The use of military personnel for scientific research or for any other peaceful purposes *shall not be prohibited*. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies *shall also not be prohibited*.

Article VI says:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

In this article, we see the following:

General perception (state responsibility): As in international law, state responsibility can be attributed to states for internationally wrongful acts *vis-à-vis* space activities.

Sub-perception (automatic state responsibility — wrong or no wrong): *States Parties to the Treaty shall bear international responsibility for national activities in outer space*, including the Moon and other celestial bodies whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.

As seen from the above examples, in fact, it is not the generality of free and peaceful uses of outer space that is supposed to be of utility to the states in optimizing their choices but the open-endedness of the sub-perceptions, be it regarding a *non-aggressive* military testing (as regulated by Article IV) or a *less-inclusive* state responsibility for activities in space (as per Article VI). However, the sub-perceptions of Articles IV and VI have a closedness that military uses of outer space are not permitted *per se* (rather it is open to hermeneutical final-say) and states are made to bear international responsibility irrespective of whether there is a breach or whether the act is imputable to the state. Rather, it stands all-inclusively attributed.

In such closedness states find it difficult to optimize choices to maximize payoff. Although general perception of the treaty gives states space for rational decision-making it is hardly of any use for the rational states because maximizing expectable preference-satisfaction, as the Outer Space Treaty offers, is not rational choice *per se*.[26] There is simply no gain for the actors in such choices.

In a scenario as described above, rational states fall into *n*-player prisoners' dilemma (PD). In an *n*-player PD, normatively designed rules are less likely to be obeyed by states, leading to a collective self-harming as in the tragedy of the commons.[27] If not for such an unfavorable outcome, states parties would at a minimum lapse into coordination problems due to symmetrical equilibriums the generality of space treaties have provided. This is best illustrated in Volunteers' Dilemma games (VD). Space players in the international arena find themselves in a coordination problem that has restricted action from players, which has a cost-imposing effect on space law.

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[26] Michael A. Slote, *Beyond Optimizing: A Study of Rational Choice* 47 (1989).

[27] GOLDSMITH & POSNER, *supra* n. 13 at 148. Prisoner's Dilemma is one of the most famous games in Game Theory of mathematics. For basic overview, *see* ANATOL RAPOPORT & ALBERT M. CHAMMAH, PRISONER'S DILEMMA: A STUDY IN CONFLICT AND COOPERATION (1965); *See also* Robert Axelrod, *The Evolution of Strategies in the Iterated Prisoner's Dilemma*, in GENETIC ALGORITHMS AND SIMULATED ANNEALING 32 (Lawrence Davis, ed., 1987)

III. ADDRESSING STRUCTURAL COSTS

First, to address the coordination problem in space, states can rely on focalness or focal points, that is, a rationalization on the basis of past encounters which states parties can perceive as right.[28] Even then if there is a cluelessness as to the past or way forward, as in the case of space treaties, imagination and intuition will take control of the situation. Second, the equilibrium set by the space treaties, and the coordination problem caused thereby, can be overcome by creating scope for more asymmetrical interaction among the states. However, creating scope for asymmetrical interaction, if not rationally regulated and poised, has the risk of unleashing power plays in space. It is in light of such threats of sub-optimal outcomes that cost-reduction strategies—a project of a rational choice model of ISL—needs to be fashioned.

A. Focal Points in Space Treaties

As we have seen, the coordination problem in space is not caused by the absence of common interest among the parties, but due to the lack of a stable equilibrium resulting from the closedness of space treaties. The states parties are, much like the prisoners in a PD game, trapped in a dilemma of restricted choices given by the detective, and would otherwise want to free themselves.[29] Rational players however, would prefer situations where there are no information asymmetries, and where they can overcome the problems posed by PD-type situations. Richard H. McAdams points out that the coordination problem would not have a stalling-effect if, instead of the closed information of confessing or not confessing with varied consequences for failed-coordination, the detective could ask the prisoners "*If you give the same alibi as the other suspect, I will believe you both and set you both free; but if you give no alibi or different alibis, you go to prison.*"[30] In this case the common interest is optimized, though coordination still remains a challenge for want of prior communication between the prisoners.[31]

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[28] Jacob K. Goeree, *Coordination Games*, in ENCYCLOPEDIA OF COGNITIVE SCIENCE (2000); THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT 58, 59 (1960).

[29] *See* Richard H. McAdams, *Focal Point Theory of Expressive Law*, 86 VA. L. REV. 1649, 1655 (2000).

[30] *Id.*

[31] *Id.*

The ideal way to address the coordination problem caused due to an absence of communication is the creation of focal points. The concept of focal points is best explained by Thomas Schelling: Focal points are "some clue for coordinating behavior," they are focal points, indeed, for "each person's expectation of what the other expects him to expect to be expected to do."[32]

Finding the key, or rather finding a key — any key that is mutually recognized as the key becomes *the key*—may depend on imagination more than on logic, it may depend on analogy, precedent, accidental arrangement, symmetry, aesthetic or geometric configuration, caustic reasoning, and who the parties are and what they about each other.[33]

The key to focal points is thus the "right kind of expectations" among the players.[34] "Once expectations are aligned there is no difficulty 'solving' the game and achieving what is the best outcome for […] players."[35] Presently, space treaties fail to align right expectations among the parties facing the coordination dilemma. The only mutual state expectation space treaties generate is to maintain outer space for peaceful purposes and thereby make every state better off. (The presumption is that states are better off in peaceful inaction). Further, the nature of the players as described in the space treaties is that of altruistic, utility-sharing, peace-seeking entities. Such an understanding goes against the possibility of the development of commercial deals in space which are inherently rational in their origin and intentions.

Now the question is how can focal points—right expectations—be created for actors in space? It may be noted that, there can be no preset focal points because focal points are what players agree upon. It is also possible that players may not agree on what is seemingly a focal point.[36] Yet, it is quite plausible to think that space treaties can become the focal points for coordination, as McAdams asserts, "law is one means of creating a focal point, and therefore, one means of achieving coordination . . . law has several features that make it particularly suitable for this purpose."[37] Law is as

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[32] SCHELLING, *supra* note 27 at 57.

[33] *Id*.

[34] McAdams, *supra* note 28 at 1657.

[35] *Id*.

[36] KAUSHIK BASU, BEYOND THE INVISIBLE HAND (2011).

[37] McAdams, *supra* not2 28 at 1663.

qualified as any third party communication, the ideal solution for any coordination problem.

However, law can also obtain coordination by imposing sanctions, which is more or less the case with space treaties, e.g., states' behavior is regulated in space by the automatic attribution of state responsibility (Art. VI of the Outer Space Treaty) including obliging the state "to make full reparation for the injury caused by the internationally wrongful act" (in the case of space law, "international wrongfulness" is inessential).[38] But sanctions as focal points go against the liberal sentiment that players are rational actors who make free yet rational choices as against the normatively subdued welfarist actor bound to the preconceived "justness" of law. Moreover, we need to recall that imposing normative restrictions to the otherwise free choices of actors in outer space, has secured the status quo of peace and order in space, while pushing into a coordination problem. A commentator echoes this sentiment in a foreign policy perspective: "The negative consequences of the status quo in space are clear. If the U.S. and the international community do not change how they manage this space domain, the future of space exploration is bleak."[39]

If space treaties have to become focal points they need to recommend behavior rather than prompting non-behavior. Non-behavior is identical to inaction in the face of uncertainty regarding alternative outcomes. As Philippe C. Schmitter explains, the normative actors' dilemma is a "reluctance to give up acquired goods, the attachment to existing loyalties, the security of established cultural symbols, and/or the belief in prevailing normative standards"[40] such that actors find themselves in what Kaushik Basu calls "the suffocating control," the "legal snare" that prompts inaction.[41]

One way to build focal points that can overcome the coordination problem created by emphasis on negation, as in the case of space treaties according to McAdams, is "labeling." Labeling is

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[38] Art.31, Draft Article on the Responsibility of States for Internationally Wrongful Acts.

[39] Lance K. Kawane, *History of Space Policy*, MANUSCRIPT SUBMITTED TO THE UNITED STATES ARMY WAR COLLEGE 20 (2012), http://www.dtic.mil/dtic/tr/fulltext/u2/a561292.pdf.

[40] Philippe C. Schmitter, *A Prolegomenon to a Theory of Interest Politics*, ,http://www.mpifg.de/pu/mpifg_book/mpifg_bd_57/kap13.pdf.

[41] BASU, *supra* note.35.

when law provides a common knowledge or taxonomy of possible asymmetries in cases of inaction by the players. Providing common knowledge on asymmetries would help, as an incentive would, to nudge actors in a coordination dilemma.

In labeling, "law works by making focal the asymmetry the law embodies," however, asymmetries may be many and players may not investigate into all asymmetries.[42] In such cases, law focuses on the most prominent asymmetry so that existing equilibrium is upset, leaving it to the players to further strategize on other asymmetries. This type of focalness in law can be best illustrated by the United Nations Conventions on the Law of the Sea, 1982 (UNCLOS), which can be an instructive lesson for ISL.

Part XI of UNCLOS has been a contentious component of the Law of the Sea (LOS) because it established a common heritage of mankind (CHM)-based regime for the exploration and exploitation of the resources of the sea much to the discontent of developed states, which wanted a market-based regime for the commercial exploration and exploitation of the seas.[43] Any effort to globalize the seas was not acceptable to developing states. However, the status quo prevailed as if a default option and the CHM clause embodied in Art. 136, the provision for equitable allocation of the resources of the seas embodied in Art. 140 of UNCLOS, and the effort to institutionalize such allocation (Art. 160) had pushed states into an *n*-player coordination problem, reinforcing the status quo. The problem prevailed until the changes were made to Part XI because the normative positivism of CHM gave states zero scope of optimizing their preferences.[44]

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[42] McAdams, *supra* note 28 at 1709.

[43] Common Heritage of Mankind (CHM) has been a polemical component in the negotiations leading to the United Nations Convention on the Law of the Sea, 1982 (UNCLOS) as well as the Moon Treaty, 1979. In the negotiating fora, state positions never converged on CHM, particularly on the equitability the doctrine aimed to set in the allocation of resources of the sea and the moon. For details on the said split, *see e.g.* KEMAL BASLAR, THE CONCEPT OF THE COMMON HERITAGE OF MANKIND IN INTERNATIONAL LAW (1998).

[44] To ascertain this coordination dilemma, *see generally* MARKUS G. SCHMIDT, COMMON HERITAGE OR COMMON BURDEN? THE UNITED STATES POSITION ON THE DEVELOPMENT OF A REGIME FOR DEEP SEA-BED MINING IN THE LAW OF THE SEA CONVENTION (1989).

In 1994, the Agreement for the Implementation of Part XI of UNCLOS was adopted in order to help states overcome the coordination problem by operationalizing UNCLOS. It was a widely known fact at that time that the 1994 Agreement is prejudicial to the interests of developing states. It is true that the Agreement creates an asymmetry, which was seen as a normative power influence by the developed states. However, from a purely analytic standpoint, the asymmetry in UNCLOS was a nudge for states to act out of the inertia which status quo brought with it. Interestingly, the 1994 Agreement while imploring the states parties to UNCLOS to partake in the exploration and exploitation of the seas, provides—labelling—common knowledge about the asymmetries, e.g., the preamble of the 1994 Agreement states that the CHM is reaffirmed, yet the socio-political realities within which the UNCLOS has to function may be different. Further the Agreement aims to institutionalize seabed mining (through the International Seabed Authority), ensuring market-model public and private participation. The above provisions in the preamble of the Agreement articulate the status quo and statement of desire to overcome the coordination dilemma. Further,, in stating the production polices of the International Seabed Authority, the Agreement signals asymmetries and provides a strategy-set to play out a pure-strategy equilibrium:

> (b) The *provisions of the General Agreement on Tariffs and Trade*, its relevant codes and successor or superseding agreements shall apply with respect to activities in the Area [seabed and subsoil thereof];

However, the signaling of the type that the mighty multilateral trading system—which has innumerable asymmetries—will apply to seabed mining, might pose a second level coordination problem as players would find it difficult to investigate into each possible asymmetry.[45] In such cases, not only do they have to incur costs for investigating into asymmetries, but they will also have negative payoffs for failed strategies. Quite naturally, they will prefer to retain the status quo, causing another level of coordination problem.[46]

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[45] *See* McAdams, *supra* note 28 at 1707-09.

[46] *Id*.

In such situations law creates focal points to "make focal the asymmetry the law embodies."[47] Look at the Agreement again,

> (c) In particular, there shall be no subsidization of activities in the Area except as may be permitted under the agreements referred to in subparagraph (b). Subsidization for the purpose of these principles shall be defined in terms of the agreements referred to in subparagraph (b); (d) There shall be no discrimination between minerals derived from the Area and from other sources. There shall be no preferential access to markets for such minerals or for imports of commodities produced from such minerals, in particular: (i) By the use of tariff or non-tariff barriers; and (ii) Given by States Parties to such minerals or commodities produced by their state enterprises or by natural or juridical persons which possess their nationality or are controlled by them or their nationals.[48] (emphasis added)

In this case, law has "destabilized" the status quo, by addressing the coordination problem first by labelling the asymmetries and then by avoiding the second level coordination problem, which might have arisen due to labelling, by creating a focal point for the asymmetries.[49] In fact, what law has done here is create new possible equilibria.[50] McAdams points out that once new possible equilibria are created "evolutionary processes could drive the behavior to one of these new equilibria," which can be aided by the focal power of law.[51] The Agreement, in the context of seabed mining, has created such a focalness by institutionalizing the most optimal equilibria (to prevent market failures) in the form of dispute settlement mechanisms and economic assistance.[52]

The LOS model has sufficient motivational material and reasons to prompt ISL to rationally relook at the space treaties, for the

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[47] *Id*. at 1709.

[48] Convention on the Law of the Sea, United Nations Division for Ocean Affairs and the Law of the Sea, Dec. 10, 1982, Agreement Relating to the Implementation of Part XI of the Convention, Annex § 6, http://www.un.org/depts/los/convention_agreements/texts/unclos/closindxAgree.htm.

[49] *See* McAdams, *supra* note 28 at 1709.

[50] *Id*. at 1710.

[51] *Id*.

[52] *See* Convention on the Law of the Sea, Annex §§ 6, 7. See also Lisa L. Martin, *An Institutionalist View: International Institutions and State Strategies*, INTERNATIONAL ORDER AND THE FUTURE OF WORLD POLITICS 78, 83 (T.V. Paul & John A. Hall, eds., 1999).

causal reasons of a coordination problem for both LOS and ISL are distributional problems. However, more than a structural overhauling, what is required for ISL is a change in perceptions towards (and leitmotif of) space treaties. A few considerations in this regard are provided below.

B. Broader Scope for More Asymmetrical Interaction

As part of a larger reorganization of ISL, one plausible approach to overcoming the problem of *n*-player prisoner's dilemma is to make space treaties provide scope for more asymmetrical interaction between state parties. In present form, space treaties only have means for symmetrical interactions. A risk of such interactions is that each party will try to control the equilibrium. For example, Art. 11(5) of the *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies 1979* (hereinafter the Moon Treaty) provides for the establishment of an international regime for the exploration and exploitation of the natural resources of the Moon:

> States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.

In the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS), a set of states including Argentina, Brazil, Chile, Indonesia, Mexico, Nigeria, and Venezuela asserted that by virtue of Art. 11(5) an international regime for the equitable sharing of the benefits from lunar resources *inter alia* must be established because such a regime can bring economic profits, and a means for the equitable sharing of such profits, taking into consideration the need of least developed countries.[53] Opposing such a claim, the Soviet Union asserted that an international regime of the nature which the Third World states demand has the risk of creating an organization of supra-state nature and a statist internationalism, both of which are unfavorable to the socialist ideals which

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[53] CARL Q. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 293-94 (1982).

the Soviet Union cherishes.[54] This is a typical case of states making use of a symmetrical equilibrium exercising control, what may be called "competitive symmetry," resulting in a coordination problem caused by the mutual domination by states.[55]

The symmetrical equilibrium has also put players in a Volunteers' Dilemma whereby players do not see any payoffs in volunteering out of the status quo. Given the public good nature of the benefits accruing from outer space, the Moon and other celestial bodies, the Volunteers' Dilemma is likely to be serious, as strong players fear a free ride and weak players fear rivalrous behavior by strong states, turning outer space into a private good.[56]

One way to overcome this problem is for the space treaties to create scope for asymmetric equilibrium whereby one state or group of states has dominance and control. In the case of LOS, the linking with the multilateral trading system known for its competitive asymmetries has destabilized the inertia that was a result of status quo as equilibrium. If seen from a normative moralist perspective, a conscious upsetting of equilibrium, as LOS has done through the 1994 Agreement, can be subject to criticism. On the other hand, if international law is seen as "a focal point that states gravitate toward as they make rational decisions regarding strategy in light of strategies selected by other states," the status quo of ISL would get the new matrix of a Nash Equilibrium.[57]

However, in ISL the Nash Equilibrium has not turned out to be the best possible outcome, i.e., outcomes ISL have obtained are only minimally Pareto optimal. Hence, ISL shall facilitate players to play out of the Nash Equilibria. A way to do this is for the space treaties to broaden the scope for asymmetric interactions among the states parties. Asymmetric interactions are possible in hierar-

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[54] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its One Hundred and Sixty-Fourth Meeting, A/AC.105/PV.164, pp.8-11 (1976).

[55] STEPHEN W. LITTLEJOHN & KATHY DOMENICI, COMMUNICATION, CONFLICT, AND THE MANAGEMENT OF DIFFERENCE 135 (2007).

[56] *See* PATRICK A. MCNUTT, THE ECONOMICS OF PUBLIC CHOICE 238-40 (2d. 2002).

[57] Jens D. Ohlin, *Nash Equilibrium and International Law*, 96 CORNELL L. REV. 869, 876 (2011).

chically organized systems, which are driven by established identities and shared goals.[58] However, in order to avoid a dominant-player takeover of the system controls, which hierarchically-ordered systems are highly prone to, Dan E. Miller, albeit in a societal context, recommends that in hierarchically coordinated systems, "[t]he interaction continually must be monitored, with new sequences of acts regularly introduced at a pace that maximizes superordinate control and minimizes [...] subordinate thought."[59]

Jun-Zhou He *et al* argue that another way to nudge the players out of a Volunteers' Dilemma is to focus on "super rational players," who "rather than simply seeking the best payoff for themselves […] pursue the strategy that maximize expected utility when employed by all players.[60] The response to such a situation is to have an assurance on the production of the common good, which is akin to shared identities and goals by all players.[61] However, as in the case of hierarchies, in the super-rationality framework too, there is possibility for the strong player to defect.[62] However, the probability of defection is less when the cost of volunteering is kept below the common benefits. Projected reputational gains can cut volunteering costs, prompting players to volunteer. Incentives like subsidization can also reduce volunteering cost. Then again, monitoring and dispute settlement mechanisms can regulate and balance appropriation by the strong players.

Such asymmetric interactions, however, cannot be created and response possibilities explored (those discussed above) explored in a balanced communitarian legal framework such as ISL. ISL's treaty framework needs to recognize the post-liberal economic rationality of state parties if ISL's ambition of commercialization of outer space is to be realized. Although researchers have explored the scope for market concerns in ISL vis-à-vis the existing framework of ISL, they have more or less hermeneutically extended the

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[58] For such inputs in a social parlance, *see* Dan E. Miller, *Social Construction of Hypnosis*, in SYMBOLIC INTERACTION: INTRODUCTION TO SOCIAL PSYCHOLOGY 351, 353-55 (Nancy J. Herman & Larry T. Reynolds, eds., 1995).

[59] *Id*. at 353.

[60] Jun-Zhou He et al., *Asymmetric Interaction Paired with a Super-rational Strategy Might Resolve the Tragedy of the Commons without Requiring Recognition or Negotiation*, 5 SCI. REP. 2 (2015).

[61] *Id*.

[62] *Id*. at 4.

scope of ISL from crude communitarianism to commercial applications. The question shall not be whether to extend the scope of space treaties to a market. Rather, the question shall be how and to what extent ISL can be modified in order to reduce the various costs it imposes. The considerations made above can form the beginning of a renewalist project for ISL.

IV. FUNCTIONAL COSTS: THE COSTS OF COOPERATION

It appears that ISL's treaty framework is less contemporaneous in liberal market societies. Whereas normatively ISL is a robust regime, realistically speaking what is seemingly ISL's normative perfection is in fact a structural flaw. We argued above that observance of the rule-guidance provided by such a framework would impose costs on actors. However, irrespective of its insufficiency in regulating market conditions, ISL has established a certain cooperation therein by means of its treaty framework, though such cooperation is nonfunctional due to the coordination problem. Below we illustrate how certain contemporary space applications that have the potential to lift the space market are foiled by the structural inappropriateness of ISL. We also suggest why one needs to return to the considerations made above for reforming ISL, with a few cases in point.

A. Private Property in Space

If part of the reason ISL does not recognize or even encourage considerations of private property in outer space is because enforcement and governance of property rights cannot take place without a sovereign,[63] then there is merit in exploring this issue here. When people have an option to cooperate (in respecting property rights) or not, and when cooperation is costly, they will choose not to cooperate even when social welfare for the society as a whole increases under cooperation. The analytical tool of PD is again very effective to understand this. Having referred to it earlier, it makes it all the more important to contextually illustrate its scope.

Consider two players Ronald and Richard, who have property on the Moon. They can choose to respect the other's property, or

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[63] Alexander W. Salter & Peter T. Leeson, *Celestial Anarchy: A Threat to Outer Space Commerce*, 34 CATO J. 581 (2014).

adopt a strategy to appropriate it. Their payoffs are higher in the second strategy. Ronald would not want his property to be appropriated by Richard, but he does not know what Richard would choose to do. Richard also has the same misgiving. In this uncertainty, both would imagine the worst and try to appropriate. If that happens, the social welfare/surplus goes down. The figure below explains this stylistically. Here, $0 < P < Q < R$, and $(Q + Q) > (P + R)$. In other words, when both the players respect each others' property rights, the total social payoff is the highest, but it is the lowest when they do not (when only one respects while the other does not, the individual payoff of the one respecting is lower than when both respected and that of the appropriator is higher). This is an example of what happens when, due to non-cooperation, the players end up choosing a strategy that makes both of them collectively worse off.[64]

		Richard	
		Respect	Appropriate
Ronald	Respect	Q,Q	P,R
	Appropriate	R,P	0,0

Enforceable property rights are unsustainable indeed. If there is a sovereign, then both Ronald and Richard would be compelled to respect each other's rights. Fact finding and litigation processes for matters dealing with outer space however difficult, do not make sense in a sovereign-less engagement. Although in a repeat interaction mode, PD could be averted because trust assumes central importance at that stage,[65] and often property rights could be self-enforcing as well, it does not assure us that private property endowments in outer space will be costless. How to draw an initial distributional matrix and what happens if property rights in (the unending) outer space trigger political tensions on Earth—given the blood-stained human history attributed largely to our obsession with property—are some inconvenient questions starkly posed.

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[64] See RAPOPORT &. CHAMMAH, *supra* n. 27. .

[65] For experimental proof, *see* James Andreoni, & John H. Miller, *Rational Cooperation in the Finitely Repeated Prisoner's Dilemma: Experimental Evidence,* 103 ECONOMIC J. 570 (1993).

Hence, Article II of the Outer Space Treaty, categorically precludes any possibility of cultivating private property rights in space:

> 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.

The idea of restraining private property in outer space is indeed welcome for a variety of other reasons. The principle of *res communis* in international law is a powerful impetus, and justifiably important in its scope and need, which is articulated in Art. 1 of the Outer Space Treaty:

> The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.
>
> Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.
>
> There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation.

If we look at it from an environmental perspective, the idea is powerful indeed. What humans have done on our own little blue planet, as (dis)regards its environment, is horrendously disastrous. If the entire 4.6 billion years of Earth's age is compressed into 46 years, then humans have taken the last few minutes to destroy the planet's ecosystem, wiping out forests, cleaning thousands of species from it forever, heating the planet up and exhausting its resources. If private property emerges institutionally in outer space, a repeat show may ensue. The problem of space debris in form of uncontrolled parts of human-launched objects in space, drifting aimlessly polluting the pristine outer space is an inconvenient case-

in-point.[66] The freeness of natural and cultural gifts of mankind to mankind is needed to reflect our commitment to each other, and to recognize our value systems. There could be little denying that sovereign-less celestial bodies are a reason we still view outer space in a poetic sense.

B. Discovery of Helium-3 and Need for a New View on Space Exploration

Now couple the legal framework with the discovery of helium-3 on the surface of the Moon, which is a clean, non-radioactive energy source promising a clean power for our industries for thousands of years.[67] If the legal framework does not grant private property rights, how can we make use of helium-3 that will only help us alleviate our environmental sins?[68] Advanced approach to controlled fusion reaction can very effectively employ helium-3 in helium-3 power plants.[69] With lower capital and operating costs, less complex and smaller size, absence of radioactive fuels and most importantly, no air or water pollution, humanity's atonement to its nature without having to deal with uncomfortable questions on intergenerational equity may be near.[70] Further, presence of water ice recently discovered on the Moon—frigid craters at both lunar poles—is offering more promise for future generations.

It is no wonder that in 2007, 31 years after the last landing on the Moon, Google Lunar X Prize was announced, which promises

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[66] *See generally* Pamela L. Meredith, *Legal Implementation of Orbital Debris Mitigation Measures: A Survey of Opinions and Approaches*, 6 AM. U. INT'L L. REV. 203 (1991).

[67] See for e.g., Steve Almasy, *Could the Moon provide clean energy for Earth?* Available at http://edition.cnn.com/2011/TECH/innovation/07/21/mining.moon.helium3/, 21 July 2011. See also, for an old scientific analysis, Wittenberg, L. J., Santarius, J. F., & Kulcinski, G. L. (1986). Lunar source of 3 He for commercial fusion power. Fusion Science and Technology, 10(2), 167-178.

[68] Of course, the Moon's surface has many other precious minerals that will only exacerbate our hunger for commercialization. Those minerals and metals from the Moon, we keep aside from this discussion.

[69] Almasy, *supra* n. 67. See also, *Mining the Moon,* available at http://www.popularmechanics.com/space/moon-mars/a235/1283056/

[70] There are alternative views as well, which show that helium-3 power plants may not be as easy to operate. Regardless, scientific community sees helium-3 as a very powerful answer to power generation without radioactive and environmental concerns.

$30 million to privately-funded spaceflight teams to compete to successfully launch a robotic spacecraft that can land and travel on the Moon's surface, sending data and images back to the Earth.[71] Two teams have already secured contracts for launch, and by 2017, the show has to happen. The world watches in amazement, oblivious to the host of legal and economic questions that will be thrown open after the successful launch. This could only be the beginning of a whole new world of planetary exploitation.

Given the pace of technology, the odds of celestial exploitation are not low. This is a point of inflexion, and it is imperative that legal architecture assumes more agility with the times, lest the triangular tensions in law, policy and practice become too unwieldy. The tremors of tension between privacy policy, freedom of speech and internet practice are still being felt in many countries. Nation states need to accept the fact that lunar mining and celestial exploration are ideas whose time have come. And in no uncertain terms, before it gets too late, they have to get together to identify possibilities which restrain unsustainable mining, and encourage that common heritage of mankind be nurtured.

The drafters of the Outer Space Treaty obviously did not have an imagination about how valuable celestial bodies would become for economic purposes. Their ideas hovered around prohibiting employing celestial bodies for establishing military bases or using outer space for carrying weapons, which is noteworthy. But the fact that lunar mining and other such economically useful ventures could motivate celestial missions was not foreseen. ISL today does not support the establishment of these enterprises. In the present architecture, orders of global governance leaves outer space as common property—global commons. So while no part of the Moon or other celestial bodies can be appropriated by any state, indeed any state can conduct operations there for peaceful purposes. After all, Google Lunar X Prize is encouraging private missions.

But we know that since Hardin's 1968 seminal piece, the tragedy of the commons has become an intellectual-household term.[72] If a property belongs to no one, it falls into disrepair eventually. Again, the problem of space debris comes to mind, where because outer space belongs to no one, there is little incentive to clean it up.

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[71] *See* LUNAR XPRIZE, http://lunar.xprize.org/about/overview.

[72] Garret Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

The story of environmental pollution is a case in point too. If outer space remains as a common property, there is a chance that nation states and their representatives will dig up the celestial bodies beyond repair (if such a term could be used), and we will be the center of oscillating packets of mutilated and destroyed celestial bodies.

ISL attempts to enable nation states to engage with celestial bodies, with careful caveats. For instance, Article 11 of the Moon Treaty lays down a strict prohibition of owning any part of the Moon even while installing stations and structures on it. Interestingly, to govern the exploitation of natural resources on the Moon, it provides for establishing an international regime. It also, while allowing states to conduct scientific explorations on the Moon, mentions that nation states involved in doing so must, "*take measures to prevent the disruption of the existing balance of [the Moon's] environment*,"[73] which reflects international commitment toward ensuring mistakes made on the Earth are not repeated on the Moon.

In particular, the Agreement allows for "use of the Moon anywhere on or below its surface," by any state party. Further, the state parties have unrestrained use of the Moon. Article 8, paragraph 2 states:

> For these purposes States Parties may, in particular: (a) Land their space objects on the Moon and launch them from the Moon; (b) Place their personnel, space vehicles, equipment, facilities, stations and installations anywhere on or below the surface of the Moon. Personnel, space vehicles, equipment, facilities, stations and installations may move or be moved freely over or below the surface of the Moon

This means, that the Agreement, and in general the body of ISL, encourages the exploration of the Moon and other celestial bodies for peaceful purposes. Mining clearly is one such purpose. The hope of article 7 (environmental concerns) dilutes our fears, at least in the beginning.

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[73] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 7, para 1, U.N., 1979.

C. The Clause on Equitable Distribution of Benefits

Yet, why have we not seen any manned mission to the Moon or any major installation of mining activities on the Moon since the Moon Treaty came into force? In other words, if ISL generally does not discourage utilizing the Moon and other celestial bodies for peaceful purposes, why have we not seen such utilization being done?[74] Google Lunar X Prize is one unique model, and even that is private in nature. What discourages nation states to engage with outer space for commercial purposes?

Certain clauses discourage the possibility of peacefully mining (for say helium-3) without attracting economic implications afterwards. Article 11, para 7 mentions:

> The main purposes of the international regime to be established shall include: (a) The orderly and safe development of the natural resources of the Moon; (b) The rational management of those resources; (c) The expansion of opportunities in the use of those resources; (d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the Moon, shall be given special consideration

Notice sub-clause (d) which indicates that benefits derived out of resources in celestial bodies will be 'equitably' shared. Not only do the interests of countries which have assisted directly or indirectly with exploration of the Moon need special considerations while distributing the proceeds of the exploration, but the interests of developing countries also need the same special considerations. In other words, if people go to the Moon and find a sizeable quantity

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[74] Investments required for mining extraterrestrial objects are unimaginably large, and hence few. But there have been modest efforts in this direction. Luxembourg's Asteroid Mining Initiative and USA's passing of US Commercial Space Launch Competitiveness Act are interesting cases of mining asteroids and offer unique window to observe such motivations. See, Michael Sainato, *Luxembourg's Asteroid Mining Initiative could boost space exploration*, available at http://observer.com/2016/06/luxembourgs-asteroid-mining-initiative-could-boost-space-exploration/, 6 August 2016. See also, the US Congress website with details on passing of the Act, https://www.congress.gov/bill/114th-congress/house-bill/2262/text

of helium-3, they need to *equitably* allocate some of it for other countries which helped them in exploration as well as developing countries who had no role to play in it, if such countries demand. The question is whether anyone will undertake this voyage.

However, the idea of equitable allocation is welcome. Because developing countries lack the resources to exploit the proceeds from exploring the Moon themselves, it is unfair for space powers not to share the bounty with developing countries. In 1979, when the Agreement was drafted, all that the drafters had in mind, were mines and minerals that could be profitably exploited. However, if we look at the developments in discovery of elements like helium-3, sharing these elements makes even more sense given the inability of developing countries to fund alternative sources of energy while they move on the industrial highway. Because developing countries in the 21st century are some of the biggest emitters of greenhouse gases, helium-3 will be more effective if is offered to them.

The problem with this argument is that countries will not undertake risky and expensive operations of mining the Moon, on the prospects of finding helium-3 alone. They would want to extract all that is available. Assuming environmental considerations are taken care of by article 7, they need to be suitably incentivized to undertake those operations. In the present framework, where they are expected to share all of their exploration byproducts with developing countries, prospects of states exploring and mining the Moon are quite bleak. As rational actors, states necessarily need incentives, which the present structure of ISL does not provide.[75]

Even the Outer Space Treaty 1967 pushes these perspectives. Here, nation states that are launching missions to the Moon or other celestial bodies must consider requests of observation by other states. Article 10 mentions,

> In order to promote international co-operation in the exploration and use of outer space, including the Moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to

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[75] Even the Agreement treats nation states as rational actors. Art. 11, para. 7, cl. (b) mentions that the purpose of international regime is "rational" management of the resources.

> be afforded an opportunity to observe the flight of space objects launched by those States.

The information is also not supposed to be private. Indeed, Article 11 mandates that all activities of states being conducted on the Moon or other celestial bodies must be disseminated to the world at large.

In order to promote international cooperation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities.

Further, Article 12 mentions that all equipment in outer space, regardless of who owns it, shall be available for other state parties, on a reciprocity basis.

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity.

These clauses have a chilling effect on states party to the Treaty. In 1967, this effect would have been invisible,[76] but today, its implications on exploring the Moon in particular are stark. Even if state parties strongly desire to behave in mutual cooperation with each other regarding activities in space, the Treaty does not allow private parties or non-governmental entities to operate without being explicitly authorized by the state. This means that the responsibility for any space activity lies with the state in which the launching entity is located.[77] Private parties need to fulfill the State responsibility set forth in the Treaty. Again, this kills private incentives.

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[76] In fact, there are reports that even though the American and Russian versions of their respective drafts differed in their scope being the Moon and celestial bodies, and the whole of outer space respectively, the real points of contention were access facilities on celestial bodies, reporting on space activities and use of military equipment in space exploration. *See*, http://www.state.gov/t/isn/5181.htm.

[77] Article 6 is categorical in this: "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty."

V. CONCLUSION

How do we then imagine an architecture of laws and treaties that favors exploitation of resources on the Moon without affecting the cause regarding equitable sharing of resources?[78] Due to the existing framework, nation states are desisting from operating on the Moon. With legal obscurity regarding title over mining products on the Moon, private firms are not willing to invest billions of dollars into this venture. We try to probe this further, and excavate possibilities in ISL which may enable private or state parties to be incentivized for undertaking mining operations on the Moon.

A. Cost-Reduction by Avoiding Nation-States Inertia

The two key instruments are the Moon Treaty 1979 and the Outer Space Treaty. The Moon Treaty offers the possibility of creating an international regime that will aid in appropriating governance of mining operations on the Moon. The Outer Space Treaty, on the other hand, is rather silent on governance mechanisms for sharing profits. Additionally, during its 39th session in 1984, the General Assembly adopted a Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, taking into Particular Account the Needs of Developing Countries. This Declaration spells out what the Moon Treaty has briefly touched upon and invokes COPUOS.

The Declaration is contained within the Annex to the resolution and has eight clauses. In general, the Declaration spells out the normative considerations that nation states with higher levels of capabilities in space exploration must engage in exploration efforts for the benefit of all mankind, and in particular, in the interest of the needs of the developing world. Capable states must not only support and promote space science and technology in developing

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[78] It is imperative that we mention our strong impulses in favor of environment. Until several months, we didn't undertake to write this article, because our own preference tends toward protecting the celestial environment, even if it comes to exhausting metals and minerals on Earth. Helium-3 however, changed our priorities. If helium-3 can be effectively utilized as a clean fuel, it will help avert environmental catastrophe on our planet. For every favorable statement towards mining on the Moon therefore rests crucially on our belief that helium-3 is our redemption to what we have done to our planet; and in no way we intend to offer any justification for exploitation of the Moon's surface for mining.

nations, but also ensure that their activities are for the general development of mankind, and especially those in poor parts of the world. Importantly, the Declaration does not mention anywhere the need for equitable sharing of benefits derived from resources on the Moon which is clearly stipulated in Article 11 of the Moon Treaty.

Hence, if someone expresses some concerns on the lack of uniformity or a missing sense of certainty in ISL, there is a reason for it. In cases where cost of uncertainties can go up to billions of dollars, the uncertainty is as good as unsaid prohibition.

B. Reconsidering the Considerations

The fact that COPUOS was invoked in the 1984 Declaration becomes important here. Set up by the General Assembly in 1959, COPUOUS was instrumental in the creation of five treaties and five principles of outer space law. COPUOUS played a very important role in articulating a commitment to the global principle of peace and a commitment to alleviate the Cold War fears that outer space would become another venue for superpowers to exercise their strength. Given the iniquitous economic architecture of the world at the time (which has not changed since then), the fearful expectation that all of outer space's resources would be exploited by a select few nations wasn't unfounded. COPUOS was sensitive to these considerations, and hence, the five treaties reflect the Committee's unanimous priorities.

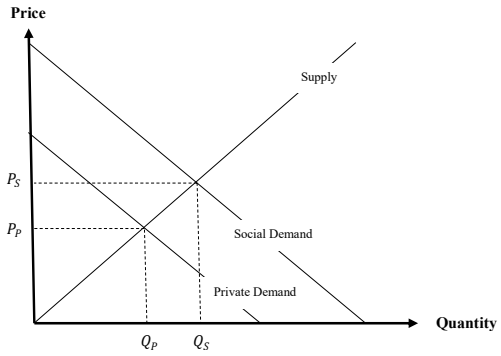
It is important that the Legal Subcommittee of COPUOS frames appropriate structure for incentivizing environmentally sensitive and ethical employment of mining operations. Given the cost implications, such a structure hinges on nation states' willingness to engage in mining operations. Once that hurdle is passed, which is likely, then nation states will need a form of credible commitment.[79] A firm (represented through the nation state it belongs to) will make investments toward mining the Moon only if it is assured of a credible commitment from the international community that their proceeds will not be appropriated later. In our case, Article 11 of the Moon Treaty militates such commitments. If the firms

[79] We borrow the term credible commitment from scholarship on regulatory governance. See Brian Levy & Pablo T. Spiller, *Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Telecommunications Regulation*, 10 J. L. ECON. & ORG. 201 (1994).

are bound by international treaties to equitably allocate byproducts of exploration to developing countries, then *ex ante* they will not make this investment in the first place.

This problem is compounded by the fact that there are several countries that have the technical and financial capacity to make such investments and to engage in space exploration. The economic idea of positive externality is useful to explain this. When the social benefit of an activity is higher than the private cost, the activity will still not be undertaken because the cost is concentrated and the benefit thinly diffused. Thus, a firm that wants to engage in mining helium-3 on the Moon in accordance with the Moon Treaty may still not undertake the activity because the costs are all private despite the social benefits such an activity could bring. The benefit to the firm itself is thin because the benefits are shared equitably with developing nations. The activity will not take place. Governments need to subsidize activities that have positive externality, like education or vaccination. But here, because governments themselves behave as rational actors, they will recede from making any such intervention.

The graph below summarizes this point. The private demand of the activity is lower than the public demand. Hence, the actual equilibrium quantity (x axis) goes down and the activity does not take place.



Further, as Mancur Olson reminded us in 1965, members of a large group with thinly diffused benefits are incentivized to wait for others to perform the activity that produces the benefits.[80] So among those developing countries that are beginning to possess the requisite financial and technical capacity to explore outer space, celestial bodies and the Moon, no one wants to take the lead because free riding is costless.

The Legal Subcommittee of COPUOS has to take the lead in designing an institutional architecture which helps bypass Article 11 of the Moon Treaty (above, we have provided certain inputs in this regard). The Moon Treaty can be the starting point because it mandates that an international regime governs rational exploitation. This regime is what COPUOS has to create. We present three possible key considerations for the structure of equitable allocation regarding helium-3 specifically. First, the structure should ensure that the proceeds of helium-3 are given to nation states in payments that cover the costs of exploration for investors. Second, the structure should ensure that sharing is organized in a manner that takes into account the need for helium-3 in states that use and depend on fossil fuels because of a lack of available, affordable renewable sources of energy in their lands. Third, the structure should ensure that premiums are paid by user states who need helium-3 do not lead to reduction in their emissions.

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[80] *See* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (1965).

The Moon Treaty is one of the weakest in the ISL, which may ease organizing the structural addendum. We also think the problem with Article 11 of the Moon Treaty must have become clearly visible early on because only 13 states have signed the Moon Treaty while 103 have signed the Outer Space Treaty. The 1984 Declaration also does not echo many elements of the Moon Treaty. For practical purposes, the Moon Treaty is hardly invoked in international discourse on laws of the global commons of space. This may also be the reason that even though the Moon Treaty recommended the creation of an international regime, it has yet to see the (Moon) light of day.

C. By Way of Stock Taking

We attempted to unearth nuances in ISL and to recommend a more diverse view of agreements and treaties to find a favorable legal framework. With 50 years elapsed since the Outer Space Treaty was drafted, there is little tangible and commercial movement in that direction. Much of this stagnation can be credited to unclear and conservative laws. The Cold War era produced an environment wherein being even remotely liberal in areas beyond human control (like outer space) was risky. But with reductions in transaction costs every day, and a faster pace in technological progress, laws must be aligned with changing times to ensure humans behave appropriately while outer space becomes a victim of celestial lawlessness.

In this article, we set out to explore the costs that ISL imposes, which in turn render ISL structurally and functionally inappropriate in contemporary times. We first argued that by examining the contemporaneity in ISL, the diminishing relevance and utility of normative structures in the liberal market society are brought to light. Because ISL is such a normative structure with a highly formalized governance system, we found that it promotes stagnation among states so that a state's expectations and relations cannot adapt to changing socio-economic conditions. In doing so, ISL has singularized state interactions and negotiations. While consistency of functional patterns has kept transaction costs to a minimum, it has also reinforced the status quo among space players.

Second, we argued that in the wake of the commercialization of outer space, there were concerns that the scope of ISL could not

regulate or facilitate commercial utilization of outer space. We proposed many formulas within the positivist framework of in order to broaden the scope of space treaties, which ranged from hermeneutically broadening the scope of the treaties to proposing a comprehensive space treaty that *inter alia* addresses commercial concerns in space. Viewing space treaties from a rational choice perspective sheds light on the nature and function of international agreements, particularly space treaties from the perspective of rational market players. We argue that the perspectives on law and context need change more than the law needs a structural overhaul.

Third, we have specified how ISL's treaty structure imposes costs on state parties. And by doing so, it provides theoretical guidance on how the cost-reduction of ISL can be achieved through treaty-design improvement and strategic reasoning. We have attempted to refine the general pessimistic perception prevalent in ISL circles about a regime improvement with the line of the law of the sea.

Fourth, we have illustrated the manner in which ISL's present architecture disables productive engagement by humans with space exploration. Such exploration is an idea whose time has come, but the inertia of nation states (which is largely a result of a conflicting set of ideas embedded within ISL) prevents such ideas from being realized. This article shows that combatting this inertia requires us to reimagine the frame in which ISL is positioned and to redesign its provisions to develop an incentive structure within ISL treaties.

STUDENT ARTICLE

"IT'S DANGEROUS BUSINESS . . .": THE POSSIBLE EFFECTS OF THE SPACE RESOURCE EXPLORATION AND UTILIZATION ACT OF 2015 ON PLANETARY DEFENSE

*Marshall D. McKellar**

"The question to ask is whether the risk of traveling to space is worth the benefit. The answer is an unequivocal yes, but not only for the reasons that are usually touted by the space community: the need to explore, the scientific return, and the possibility of commercial profit. The most compelling reason, a very long-term one, is the necessity of using space to protect Earth and guarantee the survival of humanity."

~ William E. Burrows[1]

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[1] William Burrows, *Space and Civilization*, WSJ (Feb. 3, 2003), http://www.wsj.com/articles/SB1044239185574792064 (last visited Jan. 14, 2017).

I. INTRODUCTION

As of the early twentieth century, Science fiction has provided an endless stream of films, television, and books imagining the hypothetical first discovery of extraterrestrial biological materials by mankind. The (now cliché') plot tends to begin with initial jubilation by the discoverers, followed by in-depth testing of the mysterious material, and of course, the inevitable eradication of the crew, colony, or planet by a suddenly deadly alien lifeform. The humans involved are almost always on either a deep-space mining mission or building new human settlements in outer space. The idea of mankind entering outer space as colonizers and entrepreneurs has been a staple of our collective imagination for many years; however, what once existed only in our imagination is now quickly approaching reality, expedited by the desire of governments and private entities to push human commercial industry into outer space.

There are now a host of private companies preparing to conduct space transportation and space-resource utilization, hoping to mine comets, asteroids, and even the moon for valuable resources. In November of 2015, gasoline was added to the fire of these hopes when the President signed into law the U.S. Commercial Space Launch Competitiveness Act (CSLCA),[2] opening the floodgates for commercial space resource utilization by United States citizens. Similarly, Luxembourg recently became the first European State to consider legislation granting its citizens the right to commercially utilize space resources.[3] This emerging legislation is a major victory for companies like Deep Space Industries[4], Bigelow Aerospace[5], and Planetary Resources[6]; however, it remains unclear what effects the

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[2] U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 10101 (2015) [hereinafter the CSLCA].

[3] *Luxembourg's New Space Law Guarantees Private Companies the Right to Resources Harvested in Outer Space in Accordance with International Law*, GOUVERNEMENT.LU (Nov. 11, 2016), http://www.gouvernement.lu/6481433/11-presentation-spaceresources.

[4] *Asteroid Mining: An unlimited future for all mankind*, DEEP SPACE INDUS., https://deepspaceindustries.com/mining/ (last visited Nov. 5, 2016).

[5] *B330*, BIGELOW AEROSPACE, http://www.bigelowaerospace.com/b330/ (last visited Nov. 29, 2016).

[6] *Our Technology Today, Enables The Vision Of Tomorrow,* PLANETARY RESOURCES, http://www.planetaryresources.com/technology/#technology-overview (last visited Nov. 5, 2016).

2015 CSLCA will have on the defense of our planet from (now commercially incentivized) private companies mining extraterrestrial materials. Is the current legal framework for these activities prepared to handle it?

For decades NASA has implemented mandatory planetary protection policies—based on the Committee on Space Research's (COSPAR) planetary protection guidelines—for every NASA mission.[7] In fact, all members of the Outer Space Treaty are also members of COSPAR.[8] For example, NASA, Roscosmos, JAXA, and ESA have all adopted COSPAR's guidelines into their state practice. However, do the same standards that apply to NASA's space resource-related missions also apply to commercial entities under the CSLCA? Although NASA (a government entity) has clearly defined guidelines for planetary protection and contamination control, the CSLCA does not make any mention of these guidelines in relation to the private sector. Nor does it directly indicate an intent to identify protection specific regulations in the future. The Act merely states that the president shall—within 180 days after the date of enactment—submit to Congress a report that specifies "the authorities necessary to meet the international obligations of the United States, including authorization and continuing supervision by the Federal Government; and recommendations for the allocation of responsibilities among Federal agencies for the activities described . . ."[9] Completely absent from this act is any mention of environmental protection measures relating to space resource utilization, or how the Government will go about regulating the commercial space resource industry in a way that ensures the security of the space environment and the Earth itself.

Although the President's Executive office did provide a report in April 2016, it contains no language directly addressing the need

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[7] *Mission Requirements*, NASA: OFFICE OF PLANETARY PROTECTION, https://planetaryprotection.arc.nasa.gov/requirements (last visited Nov. 10, 2016). More information about the origin's and function of COSPAR will be provided later in this article.

[8] *Members*, COSPAR, https://cosparhq.cnes.fr/about/members (last visited Nov. 15, 2015).

[9] 2015 Space Act, 51 U.S.C. § 51302(a)(3) (2015).

to develop measures for planetary defense or possible contamination.[10] This creates a potential for future confusion and uncertainty regarding not only the need for private companies to conduct space-mining activities responsibly, but also the Government's responsibility to oversee the activities of non-governmental entities in accordance with the Outer Space Treaty. Furthermore, a new Commander-in-Chief has entered office whose space policies will undoubtedly differ significantly from that of the previous administration. Although this author believes space-resource utilization is an essential aspect of humanity's future endeavors—and survival—in space, many uncertainties now exist as to how the Government will regulate commercial space mining in a way that not only ensures the United States' compliance with its international treaty obligations, but also protects the Earth from possible contamination by haphazardly collected extraterrestrial materials.

In order to address these uncertainties, this article first provides a brief analysis of the Space Resource Exploration and Utilization Act of 2015—which grants American citizens the right to sell, possess, own, transport, or use "any asteroid resource or space resource" obtained "in accordance with applicable law[.]"[11] Next, it assesses the legality of space resource utilization by summarizing the arguments both for and against this controversial activity. Finally, this article argues that the framework for commercial space resource utilization (provided by the CSLCA) is capable of neither fulfilling the United States' international treaty obligations nor protecting the security of the Earth's environment, and should be supplemented by COSPAR'S planetary protection guidelines as implemented by NASA.

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[10] John P. Holdren, Office of Science and Technology Policy, *Letter submitted in fulfillment of a reporting requirement contained in the U.S Commercial Space Launch Competitiveness Act (Public Law 114-90, herein referred to as "the Act"), signed into law November, 25th, 2015* (2016) [hereinafter the Presidential Report].

[11] CSLCA, 51 U.S.C. § 51303 (2015).

II. SPACE RESOURCE UTILIZATION

A. Why mine celestial bodies?

Before attempting to parse the various legal arguments for and against space-mining, one must ask why governments and private entities are even attempting to pursue these expensive and complicated activities? The answer is fairly simple: between the Moon and some nearly 1,400 asteroids in a close proximity to Earth, there is a virtually infinite supply of both valuable minerals and humanity's most sacred resource: water.[12] The Moon alone contains massive amounts of accessible aluminum, iron, silicon, hydrogen, manganese, chromium, potassium, oxygen, and the highly sought after Helium-3 (a potential fuel for fusion power reactors).[13] Both oxygen and hydrogen are abundant throughout the lunar regolith, providing essential components for the creation of rocket fuel. These materials are essential for the construction and support of future lunar bases, orbital space stations, and deep-space exploration missions.[14]

In fact, Helium-3 is believed capable of eventually replacing fossil fuels on Earth, "[i]t has been estimated that twenty-five tonnes of Helium-3 can provide all the power that the United States needs in a year."[15] Furthermore, NASA has confirmed that near-Earth asteroids are massive depositories of minerals and water, creating incredible potential for both Earth-based commercial development and the future of space exploration;

> It has been estimated that the mineral wealth resident in the belt of asteroids between the orbits of Mars and Jupiter would be equivalent to about 100 billion dollars for every person on Earth today. Whereas asteroids are rich in the mineral raw materials required to build structures in space, the comets are rich resources for the water and carbon-based molecules necessary to sustain life . . . It seems likely that in the next

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[12] Fabio Tronchetti, *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*, 39 J. SPACE L. 493-95 (2010).

[13] *Id.* at 493-94.

[14] *Id.*

[15] *Id.* at 495.

> century when we begin to colonize the inner solar system, the metals and minerals found on asteroids will provide the raw materials for space structures and comets will become the watering holes and gas stations for interplanetary spacecraft.[16]

With the inevitable evolution of mankind into an interplanetary species quickly approaching, it only follows that entrepreneurial entities around the world would begin laying the foundation, both legally and technologically, for extraterrestrial resource mining.[17]

B. The 2015 CSLCA

However, despite the apparent practical and industrial potential of space-mining, there stands a decades old argument regarding the status of space resources that hinges on the nature of outer space itself. Are the mineral and water resources imbedded in celestial bodies available for exploitation by mankind, or does international law bar their commercial utilization under the principle of non-appropriation? At the center of this argument—at least, for United States citizens—is title IV of the 2015 U.S. Commercial Space Launch Competitiveness Act, also known as the Space Resource Exploration and Utilization Act of 2015. The CSLCA explicitly provides that

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.[18]

Furthermore, it requires the President of the United States to

> (1) facilitate commercial exploration for and commercial recovery of space resources by Unite States citizens;

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[16] *Near-Earth Objects as Future Resources*, NASA, http://neo.jpl.nasa.gov/neo/resource.html (last visited Nov. 21, 2016).

[17] *Asteroid Mining: An unlimited future for all mankind*, DEEP SPACE INDUS., https://deepspaceindustries.com/mining/ (last visited Dec. 15, 2016).

[18] CSLCA, *supra* note 10.

> (2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and
>
> (3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.[19]

Without question, this unprecedented Act is intended to officially jumpstart the long-awaited space-resource industry, fronted by and for the benefit of United States citizens. "The act has the unquestionable merit of placing extraterrestrial mining at the center of the legislative and diplomatic agenda of States and to, thus, "force" the international community to address the regulatory challenges associated with it."[20] Although it is undisputed that the United States has the sovereign authority to pass legislation allowing its citizens to utilize space resources, there is uncertainty as to whether said legislation complies with the U.S.'s international treaty obligations.[21] Seeing as this Act is the first of its kind, there exists a great deal of debate concerning whether the Act (Title IV specifically) is in compliance with some fundamental principles of the Outer Space Treaty.[22]

1. Arguments against the CSLCA

Article II of the Outer Space Treaty establishes that "[o]uter space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use

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[19] *Id*. at § 51302.

[20] Fabio, Tronchetti, *Title IV – Space Resource Exploration and Utilization of the US Commercial Space Launch Competitiveness Act: A Legal and Political Assessment*, 41 AIR & SPACE L. 143, 154 (2016).

[21] *Id*.

[22] Gbenga Oduntan, *Who owns space? US asteroid-mining is dangerous and potentially illegal*, THE CONVERSATION (Nov. 25, 2015), http://theconversation.com/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal-51073.

or occupation, or by any other means."[23] According to some scholars, this "principle of non-appropriation" is a "cardinal concept on which the entire system of space law is based"[24] and is generally accepted as a rule of international customary law.[25] According to the Vienna Convention on the Law of Treaties, "[a] treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose."[26] Therefore, what does "appropriation" mean and how should it be interpreted within the Treaty? According to the Merriam-Webster Dictionary, "appropriate" means, "to get or save (money) for a specific use or purpose," or "to take or use (something) especially in a way that is illegal, unfair, etc."[27]Although Article II of the Outer Space Treaty does not specifically refer to the resources contained on/in celestial bodies, there is a strong argument that "the prohibition against national appropriation should be understood as including not only sovereign but also property rights over extraterrestrial natural resources."[28] This is evidenced by the use of "appropriate" rather than a more narrow term such as, "annex."[29] Had the drafters intended Article II only to preclude colonial-style annexation of celestial bodies, could they not have used the narrower term?

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[23] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Art. II, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[24] Fabio Tronchetti, *Non-Appropriation Principle as a Structural Norm of International Law: A New Way of Interpreting Article II of the Outer Space Treaty*, 33 AIR & SPACE L. 277, 279 (2008).

[25] FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW – A TREATISE 54, 180 (2009). Articles I-IV of the Outer Space Treaty are all generally considered to have attained the status of customary international law.

[26] Vienna Convention on the Law of Treaties, Art. 31, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention]. Although the Vienna Convention was drafted and ratified after the Outer Space Treaty and does not apply retroactively, its principles of treaty interpretation are generally accepted as customary international law.

[27] *Simple Definition of APPROPRIATE*, MERRIAM-WEBSTER, http://www.merriam-webster.com/dictionary/appropriating (last visited Nov. 22, 2016).

[28] Tronchetti, *supra* note 21, at 146.

[29] *Annex*, CAMBRIDGE DICTIONARY, http://dictionary.cambridge.org/us/dictionary/english/annex. "to take possession of an area of land or a country and add it to a larger area, usually by force."

This argument is further strengthened by the lack of any significant international agreement, treaty, or consensus on the legality of exploiting space resources for commercial purposes.[30] Although Article 11 of the Moon Agreement does address space-resource utilization, this Agreement is neither binding on the United States, nor considered customary international law.[31] Furthermore, there are those who argue that the very nature of commercial space-resource mining is inconsistent with Article I of the Outer Space Treaty, which states that, "the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."[32] Although it would hardly be reasonable to interpret this Article as requiring the equal distribution of space-resource related benefits evenly across the entire planet, "it, at the least, calls for utilization of outer space that may be, in a way or in another, beneficial to the largest number of States/people."[33]

However, the exact meaning of "carried out for the benefit and in the interest of all countries" or "province of all mankind" is ambiguous at best. Nonetheless, this language is often equated (often times by government authorities) with other terms like *res communis*, *res nullius*, "global commons," *res extra commercium*, and "common pool resources;" however, none of these words or phrases actually exist in the U.N. space treaties.[34] In fact, the word "common" is only used twice in the space treaty regime: 1) "common interest" in the Outer Space Treaty's preamble,[35] and 2) "common

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[30] *Id*. at 151.

[31] Agreement Governing the Activities of States on the Moon and other Celestial Bodies, Art. 11, Dec. 5, 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 [hereinafter Moon Agreement]. Only 17 States have actually ratified the Moon Agreement and none of the world's major space-faring nations are among them; *see Agreement governing the Activities of States on the Moon and Other Celestial Bodies*, UNITED NATIONS, https://treaties.un.org/Pages/showDetails.aspx?objid=080000028003b946.

[32] Outer Space Treaty, art. I.

[33] Tronchetti, *supra* note 21, at 152.

[34] Henry R. Hertzfeld, Brian Weeden, Christopher D. Johnson, *How Simple Terms Mislead Us: The Pitfalls of Thinking about Outer Space as a Commons*, 2015 PROC. INT'L INST. SPACE L. 533, 536 (2015).

[35] Outer Space Treaty, at Preamble.

heritage of mankind" in article 11 of the Moon Agreement.[36] Neither of these examples refer to the sharing of resources or a prohibition against the utilization of space resources. In fact, the use of "common heritage of mankind" in Article I immediately precedes paragraph 2 of the Article, which states that, "outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States . . ."[37] Regarding the notion of a "commons" as it relates to Article I of the Outer Space Treaty, a group of scholars write,

> [I]n the world of the law of outer space, fortunately, we have in the Outer Space Treaty Art. I, which guarantees the "freedom of any nation to access, explore and indeed use outer space." (art. I) Furthermore, there is a logical contradiction in this discussion about outer space being treated as a commons. If a commons needs a sovereign government to grant the open territory to the use of all people, it is that government that has to oversee, regulate, and enforce that charter. Art. II of the OST prohibits national sovereignty in outer space Thus, it is an area without government. Even if all nations regard outer space as a "commons," it is a very different concept from any commons that has been established in the past. There is no real legal precedent, no true means of oversight or enforcement, and therefore should not be confused with any of the many ways that concept has been applied to the territory or oceans of the Earth.[38]

Although arguments against the legality of commercial space-resource utilization are often well-founded and rooted in sound interpretations of the Outer Space Treaty, there exists a legitimate alternative interpretation of the Treaty language, steadily moving the international community towards accepting the legality of limited property rights in outer space.[39] Unsurprisingly, the very language employed by the CSLCA's dissenters is also the foundation for legal arguments by its proponents.

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[36] Moon Agreement, art. 11.

[37] Outer Space Treaty, art. I.

[38] Hertzfeld, Weeden, Johnson, *supra* note 35, at 547.

[39] *Position Paper on Space Resource Mining*, INT'L INST. OF SPACE L. 1-3 (2015), *available at* http://www.iislweb.org/docs/SpaceResourceMining.pdf [hereinafter IISL Position Paper].

2. Arguments for the 2015 Space Act.

As previously discussed, the non-appropriation principle is derived primarily from Articles I and II of the Outer Space Treaty.[40] However, the language of these two Articles is also the starting point for advocates of space-resource utilization. This alternate interpretation of the Treaty language (currently championed by the United States and Luxembourg) emphasizes that Article II does not expressly prohibit the appropriation of space resources, nor does Article I expressly exclude the utilization of space resources from a State's right to freely explore and use the Moon and celestial bodies.[41] In fact, many scholars claim the "province of all mankind" is not the physical realm of outer space but the act itself of exploring and utilizing it; "this subtlety seems all too often lost on those whom believe that space (both void space and celestial bodies) somehow belongs to humanity. Rather, the exploration and use of space (both void space and celestial bodies) is free to be explored and used by states parties to the treaty."[42]

Advocates of this approach often compare their ideology to the Law of the Sea, which allows States/individuals to fish in international waters, keep the fruit of their labor, and use it for commercial benefit without having "appropriated" the high seas.[43] This school of thought finds a manifestation in the CSLCA, which was drafted with a firm belief that, though outer space is not subject to the sovereignty of any State and is not available for appropriation, "States are entitled to use its resources so long as their activities do not involve any claim over outer space areas and until such activities do not prevent others to do the same[.]"[44] The CSLCA attempts to clarify the United States' intent to remain wholly consistent with the Outer Space Treaty by stating, "'[i]t is the sense of Congress that by the enactment of this Act, the United States does not

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[40] Tronchetti, *supra*, notes 21, 27.

[41] Guoyu Wang & Yangzi Tao, *Who Owns the Natural Resources on Asteroids?,* 2015 PROC. INT'L INST. SPACE L. 549, 554 (2015).

[42] Hertzfeld, Weeden, Johnson, *supra* note 35, at 537.

[43] FRANS VON DER. DUNK & FABIO TRONCHETTI, HANDBOOK OF SPACE LAW 789 (2015).

[44] Tronchetti, *supra* note 25, at 281, *citing* Outer Space Treaty, art. IX. This article demands that "States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, in including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty."

thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body."[45] As previously described, the stated purpose of the Act is to facilitate the commercial exploration of outer space, discourage government barriers to these activities, and promote the execution of these activities in accordance with international obligations.[46]

Although there are those who criticize the United States' unilateral action granting its citizens a right to commercially utilize space resources,[47] much of the current dialogue amongst scholars praises the Act as progressive in encouraging space exploration for all States,

> [f]rom the perspective of the economics of law, a rule is to be judged from whether it grants positive incentives. Apparently, in the time of early human exploration and use of outer space, the right incentives should be to encourage countries to actively explore and use outer space and to promise the development of human cognition. However, if inappropriate emphasis is added on "for the benefit and in the interests of all countries" or "use on the basis of equality" and even using them as prerequisite for the freedom to explore and use outer space, it would reduce the enthusiasm of states greatly.[48]

Incredibly important to this conversation is the recent position paper by the International Institute of Space Law validating the 2015 Space Act. The paper first recognized that, "it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies is prohibited," yet it also recognized that "it is less clear whether this Article also prohibits the taking of resources."[49] Seeing as the act "pays respect to the international legal obligations of the United States," the IISL concludes that, "in view of the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that

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[45] CSLCA, 51 U.S.C. § 51303 (as amended).

[46] *Id*. at § 51302.

[47] Tronchetti, *supra* note 21, at 144.

[48] Wang & Tao, *supra* note 42, at 556.

[49] IISL Position Paper, supra note 40, at 2. The IISL is made up of highly qualified publicists from over forty countries, whose objectives include cooperating "with appropriate international organizations and national institutions in the field of space law and carrying out of tasks for fostering the development of space law"; *see Overview*, IISL, http://www.iislweb.org/about.html (last visited Dec. 13, 2016).

the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty."[50]

Although the CSLCA is still in its infancy—and likely years away from practical application—its bold objectives and initial positive reception by international scholars will likely have a longstanding domino effect on the space industry (e.g. Luxembourg's new space legislation);[51]

Through the recognition of private property rights over space resources and the commitment of the US government to support the rights and interests of the space mining industry, the CSLCA aims at creating a legal environment supportive of space mining ventures and, thus, also capable of attracting the required technological and financial investments.[52]

Because of the United States' position as a leading space authority, the CSLCA is destined to have transformative effects on the future of space exploration and utilization. The act has thus far been passed by Congress, signed by the President, and defended by experts, scholars, and international legal organizations. The legal climate surrounding space-resource utilization is undeniably changing, paving the way for a surge in funding, technological development, and novel business models for private space-mining activities. Assuming the act's sound legal foundation, one must now direct attention to the aforementioned inevitable surge in space activities, and whether the Act is sufficient to ensure the United States' compliance with *all* of its international treaty obligations, specifically those outlined in Article IX of the Outer Space Treaty.

III. HARMFUL CONTAMINATION AVOIDANCE AND PLANETARY PROTECTION

Although article IX of the Outer Space Treaty is perhaps most famous for establishing the notion of "due regard," it also requires States to ensure their space activities protect both the space environment and the Earth,

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[50] *Id*. at 3.

[51] *Supra*, note 4.

[52] Tronchetti, *supra* note 21, at 148.

> States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.[53]

Therefore, the United States is obligated to ensure that the space activities of its nationals do not harmfully contaminate either outer space or the Earth's fragile environment. Seeing as the United States is solely responsibility under article VI of the Outer Space Treaty to authorize and oversee the space activities of its nationals, the need for clear and thorough legislation becomes paramount. As briefly described earlier in this article, the CSLCA is lacking necessary elements to satisfy its article IX obligations and requires additional amendments and/or clarification. COSPAR has already developed thorough guidelines for the purpose of avoiding harmful contamination of the space/Earth environment. In fact, these guidelines have already been implemented and expanded by NASA, and are mandatory for all NASA missions. In order to ensure the United States' compliance with its treaty obligations—including the protection of Earth's environment—NASA's planetary protection policies should become mandatory for all activities conducted under the 2015 Space Act.

A. The 2015 Space Act's Insufficiencies Regarding Planetary Protection

As previously mentioned, the CSLCA is lacking virtually any direct reference to planetary protection or harmful contamination avoidance. According to one NASA report, "contamination" is "the act of depositing chemical, biological or physical material" onto artifacts or sites in such a way that it "reduces its historical, engineering, or scientific value."[54] Although the act itself does not directly address the issue of contamination avoidance, it does provide for

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[53] Outer Space Treaty, art. IX.

[54] *NASA's Recommendations to Space-Faring Entities: How to Protect and Preserve the Historic and Scientific Value of U.S. Government Lunar Artifacts*, NASA 8 (2011), https://www.nasa.gov/sites/default/files/617743main_NASA-USG_LUNAR_HISTORIC_SITES_RevA-508.pdf.

the submission of a previously mentioned presidential report.[55] This report was issued by the Executive Office of the President's Office of Science and Technology Policy on April 4, 2016, proposing amendments to the 2015 Space Act and a very basic framework for the process of overseeing future commercial endeavors (including resource utilization).[56] Like the CSLCA, the Presidential Report's language is extremely vague and lacks any direct reference to contamination avoidance or planetary defense. However, to its credit, the Presidential Report recognizes the United States' obligation to "serve a range of public policy interests, including public safety, safety of property, national security, and foreign policy."[57] Furthermore, the Presidential Report admits that, "[w]hile existing licensing frameworks provide clear means to address certain aspects of these activities, they do not, by themselves, provide the United States Government with a straightforward means to fulfill its treaty obligation to ensure the conformity of these activities with the provisions of the Outer Space Treaty."[58] Nevertheless, the actual provisions recommended by the Presidential Report in order to fulfill its treaty obligations fall short due to ambiguity;

> [T]he Administration does not seek to establish a comprehensive regulatory framework for the type of outer space activities described . . . Instead, the proposed legislation is intended to establish a process no more burdensome than is necessary to enable the United States Government to authorize these pioneering space activities in conformity with its treaty obligations, and to safeguard core public interests, such as national security.[59]

The actual amendment to the CSLCA—as proposed by the Presidential Report—introduces the term "Mission," and defines it as, "the operation of a space object, with or without human occu-

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[55] CSLCA, *Supra*, note 10.

[56] John P. Holdren, Office of Science and Technology Policy, *Letter submitted in fulfillment of a reporting requirement contained in the U.S Commercial Space Launch Competitiveness Act (Public Law 114-90, herein referred to as "the Act"), signed into law November, 25th, 2015* 1 (2016) [hereinafter the Presidential Report].

[57] *Id*. at 1-2.

[58] *Id*. at 3.

[59] *Id*. at 4.

pants, in outer space, including on the Moon and other celestial bodies." Next, it provides the framework for "Mission Authorization," a vague and lengthy vetting process by which an array of government agencies review proposed commercial space missions in order to determine whether they would comply with the United States' interests;[60]

> The Secretary of Transportation, in coordination with the Secretary of Defense, the Secretary of State, the Secretary of Commerce, the NASA Administrator, the Director of National Intelligence, and such other appropriate United States Government departments and agencies as the Secretary deems appropriate, is authorized to grant authorizations for missions in outer space. The Secretary shall grant such authorizations to the extent consistent with the international obligations, foreign policy and national security interests of the United States, and United States Government uses of outer space, with such conditions as the Secretary, in coordination with Secretary of Defense, the Secretary of State, the Secretary of Commerce, the NASA Administrator, the Director of National Intelligence, and other appropriate departments and agencies, deems necessary for compliance with United States international obligations, preservation of the foreign policy interests and national security of the United States, and protection of United States Government uses of outer space.[61]

The above litany of government agencies (seemingly in no particular order) is as ambiguous as it is disjointed. Granted, the Presidential Report does expressly state that agencies (like NASA) shall only grant mission authorizations consistent with treaty obligations and national security interests; however, what exactly are these interests and how are these agencies to go about protecting them? The Report makes no specifications, discloses no methods or processes, and creates more uncertainties than answers.

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[60] *Id.* at 6.
[61] *Id.*

B. COSPAR's Planetary Protection Guidelines

The Committee on Space Research was first established in 1958 by the International Council for Science "as an interdisciplinary scientific body concerned with the progress on an international scale of all kinds of scientific investigations carried out with space vehicles, rockets and balloons."[62] It is comprised of forty-one national scientific institutions (including the vast majority of space-faring nations) and thirteen international scientific unions.[63] COSPAR first established a set of planetary protection guidelines in 1967—as a direct response to the obligations established by Article IX of the Outer Space Treaty—and have reviewed/updated them on a yearly basis in order to remain current with contemporary science and exploration.[64] These guidelines are then integrated, expanded, and implemented by space agencies around the world, including NASA, ESA, JAXA, and Roscosmos.[65] COSPAR summarizes its policy objective as follows:

> Although the presence of life elsewhere in the solar system may be unlikely, the conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized. In addition, the Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a spacecraft returning from an interplanetary mission. Therefore, for certain space mission/target planet combinations, controls on contamination shall be imposed in accordance with issuances implementing this policy.[66]

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[62] *Space Research (COSPAR)*, ICSU, http://www.icsu.org/what-we-do/interdisciplinary-bodies/cospar/ (last visited Nov. 29, 2016).

[63] *Members*, COSPAR, https://cosparhq.cnes.fr/about/members (last visited Nov. 15, 2015). For the purposes of this article, "space-faring nation" includes any nation that regularly has access to/conducts activities in outer space, whether manned or unmanned.

[64] ANDREA BELZ & PAT BEAUCHAMP, STRATEGIC MISSIONS AND ADVANCED CONCEPTS OFFICE, JPL-D-72365, ASSESSMENT OF PLANETARY PROTECTION AND CONTAMINATION CONTROL TECHNOLOGIES FOR FUTURE PLANETARY SCIENCE MISSIONS 6 (2011), *available at* http://solarsystem.nasa.gov/docs/PPCCTECHREPORT3.pdf [hereinafter JPL Report].

[65] *Id*. at 6-7.

[66] *COSPAR Planetary Protection Policy*, COSPAR 1 (2005), http://w.astro.berkeley.edu/~kalas/ethics/documents/environment/COSPAR%20Planetary%20Protection%20Policy.pdf (last visited Nov. 10, 2016) [hereinafter the COSPAR Guidelines].

These "controls" are organized according to five categories, ranging from simple probe flyby missions to Earth return missions. For the sake of brevity, this article will only address category V (Earth return) missions, seeing as they have the greatest capacity to directly affect Earth's environment. Within category V are two sub-categories: "unrestricted" and "restricted Earth return."[67] "Unrestricted Earth return" is reserved for "solar system bodies deemed by scientific opinion to have no indigenous life forms . . . [and] have planetary protection requirements on the outbound phase only."[68] On the other hand, "restricted Earth return" demands "the absolute prohibition of destructive impact upon return, the need for containment throughout the return phase of all returned hardware which directly contacted the target body or unsterilized material from the body, and the need for containment of any unsterilized sample collected and returned to Earth."[69] Furthermore, "[i]f any sign of the existence of a nonterrestrial replicating entity is found, the returned sample must remain contained unless treated by an effective sterilizing procedure."[70]

In order to distinguish between restricted and unrestricted Earth return missions, the COSPAR Guidelines ask a series of questions concerning the mission's target celestial body: are liquid water, "metabolically useful energy sources," or life supporting organic matter present, has the target body never experienced sufficient temperatures or radiation to sterilize possible life forms, and has the Earth never been exposed to meteorites of "material equivalent to a sample returned from the target body?"[71] If the answer to any of these questions is yes, the mission must follow procedures for a "restricted Earth return."[72]

To ensure compliance with these guidelines, COSPAR recommends, that for each individual mission, States provide detailed information concerning their "procedures and computations used for planetary protection," including the estimated bioburden at launch, probable composition of bioburden, methods used to control biobur-

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[67] *Id*. at 2.
[68] *Id*.
[69] *Id*.
[70] *Id*.
[71] *Id*. at 9.
[72] *Id*.

den, the organic inventory of all impacting or landed spacecraft, intended minimum distance from the target body, orbital parameters, end of mission disposition of the spacecraft and its components, and the "use of the best available clean room technology, comparable with that employed for the Viking missions, for all missions to the outer planets and their satellites."[73]

Furthermore, if during the course of a category V mission circumstances change so as to affect the safe return of samples from a target body, "the sample to be returned shall be abandoned, and if already collected the spacecraft carrying the sample must not be allowed to return to the Earth or the Moon."[74]

C. NASA's Planetary Protection Guidelines

As previously described, the world's major space agencies, including NASA, have adopted COSPAR's guidelines as their own, expanding them to ensure planetary protection and contamination avoidance for every mission.[75] In a report on planetary protection procedures by the Jet Propulsion Laboratory (JPL), NASA confirms the probability of extraterrestrial life and the need to adequately prepare for the challenge of interacting with a vastly unexplored space environment;

> In the last twenty years, our exploration of the solar system has revealed previously unknown extraterrestrial environments, both current and ancient, in which life could conceivably survive and even thrive. Simultaneously, we have a deeper understanding of the diversity of habitable environments on our own planet, supporting the opportunistic nature of living systems able to exploit nearly any energetically favorable chemistry. In addition, sample return from potentially habitable planetary environments presents new challenges as we face an increased need for containment systems that protect the native biosphere. These goals—protecting the scientific integrity of sites on planetary bodies for future research, as well as

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[73] *Id.* at 3. NASA defines "Bioburden" as the "abundance of microorganisms" on spacecraft, spacecraft components, or within cleanroom facilitates, *see Mission Requirements*, NASA: OFFICE OF PLANETARY PROTECTION, https://planetaryprotection.arc.nasa.gov/requirements (last visited Nov. 10, 2016) [hereinafter NASA Mission Requirements].

[74] *Id.* at 5.

[75] JPL Report, *Supra* note 65.

> safely returning extraterrestrial samples to Earth—jointly motivate the field of planetary protection. Planetary protection has policy elements, as it encompasses international agreements governing extraterrestrial research, as well as implementation challenges in the procedures developed to satisfy these top-level requirements. This dual policy-implementation nature of planetary protection makes technology-planning exercises particularly formidable.[76]

The JPL Report promotes implementing COSPAR's planetary protection policies from the ground up, integrating contamination control measures into the very fabric of systems engineering, personnel education/training, and mission planning,[77]

> [T]he elements of contamination control and planetary protection that are critical to mission planning, science, and hardware design must be a fundamental part of the systems engineering and must be addressed at the earliest stages of the mission to ensure proper flow-down of requirements and cost-effective mission planning. An adequate approved materials/parts list that can accommodate both contamination control and planetary protection considerations should be developed. Integrated modeling tools should be developed to aid systems engineers and designers for future work, particularly in the form of risk assessments for forward- and back-contamination.[78]

Although far too extensive to address in depth within this article, the full scope of NASA's planetary protection guidelines include exhaustive specifications for clean rooms and microbial barriers, object cleaning and sterilization methods, methods for the prevention of recontamination, bioburden assay methods, and methods for preventing the impact and contamination of solar system bodies.[79] The process begins as the very first pieces of a space object are assembled and continues throughout its eventual mission and (possible) return to Earth.

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[76] JPL Report, *supra* note 65, at 4.

[77] *Id.* at 1-2.

[78] *Id.* at 2.

[79] NASA Mission Requirements, *supra* note 74.

D. Planetary Protection as a Facet of International Law

Although the above mentioned processes are only a few of the specifications included in the Guidelines, these alone would provide a much needed safety buffer for space-resource utilization missions conducted by private entities under the CSLCA. It is this author's position that COSPAR's Guidelines, as currently implemented by NASA, should be integrated into the CSLCA as mandatory requirements for every "mission" conducted under the authority of the act. However, even if not expressly integrated, the Guidelines have arguably become part of customary international law. The Statute of the International Court of Justice (ICJ) establishes that international customary law is "evidenced by a general practice that is accepted as law."[80] This two prong system for proving something is customary—showing both state practice and *opinio juris*—is further explained in *Nicaragua v. U.S.*, where the ICJ held that,

> for a new customary rule to be formed, not only must the acts concerned "amount to a settled practice," but they must be accompanied by the opinion juris *sive necessitatis*. Either the States taking such action or other States in a position to react to it, must have behaved so that their conduct is "evidence of a belief that this practice is rendered obligatory by the existence of a rule of law requiring it."[81]

As previously shown, the COSPAR Guidelines were drafted by representatives of over forty space-faring nations and thirteen international scientific unions as a direct response to the legal obligations imposed by article IX. Furthermore, they are implemented (almost universally) as state practice by the vast majority of space-faring nations.[82]

Even if the COSPAR Guidelines were not backed by state practice or *opinio juris*, the precautionary principle of international law alone would necessitate further clarification and/or amendments to the CSLCA. The precautionary principle is a "guiding principle" in international law, "[i]t's purpose is to encourage—perhaps even

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[80] Statute of the International Court of justice art. 38, 59 Stat. 1031.

[81] *Case Concerning Military and Paramilitary Activities in and Against Nicaragua (Nicaragua v. U.S.), 1986 I.C.J. 4. 108-09 (June 27), quoting* North Sea Continental Shelf Cases (F.R.G. v. Den./F.R.G. v. Neth.), 1969 I.C.J. 3, 44 (Feb. 20).

[82] *Members*, COSPAR, *supra*, note 64.

oblige—decisionmakers to consider the likely harmful effects of their activities on the environment before they pursue those activities."[83] This principle has been incorporated into a host of international treaties; notably, the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, which became the first treaty in the history of the U.N. to achieve universal ratification (197 countries).[84] The very nature of the Montreal Protocol is precautionary agreement to protect the Earth's environment from potentially harmful substances;

> *Recognizing* that world-wide emissions of certain substances can significantly deplete and otherwise modify the ozone layer in a manner that is likely to result in adverse effects on human health and the environment . . . *Determined* to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge . . .[85]

As evidenced by COSPAR's Guidelines, NASA's implementation of those Guidelines, customary international law, and the precautionary principle, the United States has a responsibility to bequeath its longstanding planetary protection measures to the quickly developing private sector. In order to ensure planetary protection, fulfill its international treaty obligations, and comply with international customary practice, the United States must supplement and clarify the ambiguous language of the CSLCA so as to prevent the unintentional authorization of under-regulated missions involving potentially hazardous extraterrestrial materials.

IV. CONCLUSION

Although some in the space-resource utilization industry may decry specific planetary protection guidelines as contradictory to

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[83] James Cameron, Juli Abouchar, *The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment*, 14 B.C. INT'L & COMP. L. REV. 2 (1991).

[84] Montreal Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987, 26 I.L.M. 1550 (1987) [hereinafter Montreal Protocol]; For ratifications, *see Status of Ratification*, UNEP, http://ozone.unep.org/sites/ozone/modules/unep/ozone_treaties/inc/datasheet.php.

[85] Montreal Protocol, preamble.

the CSLCA's intent that processes be "no more burdensome than is necessary,"[86] the future of both commercial and scientific involvement with outer space depends on establishing and maintaining consistent contamination avoidance practices. In addition to helping scientists understand the origin of life sustaining materials on celestial bodies, "strong practices in planetary protection will be critical to guaranteeing the quality of returned science and returning samples safely to Earth."[87] Although the CSLCA is a legitimate exercise of the United States' right to authorize and oversee the space activities of its nationals, special care must be given to the many effects and consequences space-resource utilization will inevitably entail. Not to mention, the commercial success of utilizing space resources will largely depend on one's ability to conduct these activities in a safe and cooperative manner. As a world leader in the exploration of outer space, the United States is in a unique position to set trends, reinforce core values, and help protect our planet's future. If the CSLCA is a first step towards attaining an unprecedented level of space exploration and utilization, should we not put our best foot forward? By amending the CSLCA to include the COSPAR Guidelines, the Act would not only continue a longstanding precedent established by NASA, but also ensure U.S. adherence to international treaty obligations, compliance with international custom, and the protection of planet Earth.

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[86] Presidential Report, *supra* note 11, at 4.

[87] JPL Report, *supra* note 65, at 1.

COMMENTARY

MODERN ETHICAL DILEMMAS STEMMING FROM PRIVATE ONE-WAY COLONISATION OF OUTER SPACE

Dorte Jessen[*]

I. INTRODUCTION

Recently, a group of academics from the pure and social sciences met in London to discuss political philosophy in relation to governance in outer space, particularly how to embrace and harness the reflexive element of political dissent, while maintaining both liberty, political stability and security in an extreme extra-terrestrial environment.[1] While this may appear premature to some, parts of contemporary society is already embracing one-way interplanetary colonisation in the not too distant future.

Through the case study of Mars One – a one-way trip to Mars - this article sets out to analyse if a reflexive social learning process is taking place in Europe, and to what degree society *is equipped to develop* appropriate governance systems to guide our behaviour as human beings in outer space.

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[1] ULRICH BECK, RISK SOCIETY: TOWARDS A NEW MODERNITY (1992).

A theoretical arch will be established, building on *Social Learning Theory* and the concept of *symbolic loading*,[2] along with *Adult Infantile Narcissism*[3] and *Technological Adolescence*[4], underpinned by Beck's *Risk Society*.[5] This article argues that that whereas only limited reflexivity is detected, social learning *is* occurring. Only this time it is spearheaded by 'laymen' rather than scientific experts.

It will be concluded that while the UN 1967 Outer Space Treaty[6] may not be an ideal solution, for the time being, it represents the broadest international consensus.

II. MARS ONE – A PRODUCT OF CONTEMPORARY SOCIETY?

Mars One is a Dutch not-for-profit foundation that intends to establish a permanent human settlement on Mars by 2027 by sending people on a one-way trip to the red planet. The endeavour will be funded by releasing broadcasting rights to an associated reality TV show, sponsorships, crowdfunding, and revenues from intellectual property.[7] The first four people are envisaged to land on Mars in 2027.[8]

There is no mention of the legislative framework upon which Mars One is basing its activities in the literature or online resources. They do, however, have two space law experts amongst their advisors.[9] Given that there are still ten years until any actual space activities would take place, no licence is required for the time

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[2] Brian Wynne, *Nuclear Debate at the Crossroads*, 79 NEW SCIENTIST 1114, 349-351 (1978).

[3] PETER DICKENS & JAMES S. ORMROD, OUTER SPACE AND INTERNAL NATURE: TOWARD A SOCIOLOGY OF THE UNIVERSE 609-626 (2007).

[4] EDGAR D. MITCHELL & ROBERT STARETZ, OUR DESTINY: A SPACE FARING CIVILIZATION?, A ONE WAY MISSION TO MARS: COLONIZING THE RED PLANET 47 (2011).

[5] BECK, *supra* note 1.

[6] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, U.N., Jan. 27, 1967, 610 U.N.T.S. 8843 [Outer Space Treaty].

[7] *How are the astronauts prepared?,* MARS ONE, http://www.mars-one.com/faq/selection-and-preparation-of-the-astronauts/ how-are-the-astronauts-prepared (last visited Feb. 8, 2015)

[8] *Id*.

[9] Mars One's team of advisors include Ms. Masson-Zwaan, former President of the International Institute of Space Law (IISL) and Mr. Sridhara Murthi, adviser to the Prime Minister of India and Vice President of the IISL; *Mission Advisory Board*, MARS ONE, http://www.mars-one.com/about-mars-one/advisers (last visited May 21, 2017).

being. Authorisation and licencing would depend on the launching state.[10]

III. ONE-WAY MISSION TO MARS

The idea of a manned mission to Mars is not new. What is new, is that technology is now advanced to a level comparable to the difficulty of going to the Moon in 1969.[11] What is also new, is the concept of a privately funded *one-way* mission to Mars, as opposed to a government funded return venture through the likes of NASA, to whom the idea of a one-way mission is politically untenable, thus completely unthinkable.[12] Ideally, in a democracy, this represents also the consensus of society.

The truth is, the sooner we get people to Mars – even if there is not a return ticket for the time being – the sooner we will start being able to return from Mars. But does that mean that we should?

IV. CLASSIC PATTERNS OF GOVERNANCE IN A LATE-MODERN SOCIETY

Governance contains a connotation of social control legitimised in a democratic (capitalist) society,[13] and is applied in a very broad sense not only to include associated with political structures, but also the conduct of children, souls, and communities.[14] Simply put, to govern is to structure the possible field of action of others.[15] *Society* in this context will be limited to a 'western' society. As a natural progression of Plato[16] and Foucault, *behaviour* it will be defined as collective acceptable behaviour compelled by *voluntary conduct* with a *mutual sense of duty and obligation*.

On this basis, it can be concluded that ethical and moral structures are inherent within governance frameworks, thus begging the question: Which legal framework?

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[10] Outer Space Treaty, *supra* note 6.

[11] Robert Zubrin, *Human Mars Exploration: The Time is Now*, 12 J. COSMOLOGY 12, 17-25 (2010).

[12] C.A. Carberry, Artemis Westenberg & Blake Ortner, *The Mars Prize and Private Missions to the Red Planet*, 12 J. COSMOLOGY 4081-4089, pp. 321-332 (2010).

[13] MITCHELL DEAN, GOVERNING SOCIETIES: POLITICAL PERSPECTIVES ON DOMESTIC AND INTERNATIONAL RULE (Open University Press, 1st ed. 2007).

[14] Michel Foucault, *The Subject and Power*, 8 CRITICAL INQUIRY 4, 777-795 (1982)

[15] *Id*.

[16] PLATO, REPUBLIC (Benjamin Jowett trans., Barnes and Noble 2004).

V. GOVERNANCE: FORMING AS IT IS NEEDED?

The 1967 UN Outer Space Treaty remains the key international governance foundation, broadly sanctioned globally; upholding the principles of free space exploration for the benefit of all mankind. The overarching principles in the Outer Space Treaty have formed the basis for four additional treaties; the Moon Agreement undeniably being the most important one in relation to Mars colonisation, as it includes provision for establishing an international regime and to govern the exploitation of resources as this becomes feasible.[17] The Outer Space Treaty also formed the basis for five guiding principles adopted by the United Nations,[18] all developed in step with the *technological* progress,[19] thus suggesting that governance, to some extent, is developing as it is needed. Meanwhile, human settlement in outer space is yet to forge the necessity for a firm governance structure. In relation to the development of space law, the question is whether it is happening fast enough to keep pace with technological developments, and what will be its bearing when it comes to our *actual* conduct in outer space.

The driver in an industrial late-modern society is capital, and lots of it. Financial and commercial sustainability will likely be the determining factors of the success of private space exploration. Despite Article 11 of the Moon Agreement articulating the equitable sharing of benefits with special consideration of developing countries,[20] there is controversy surrounding the issue of proceeds generated in space. There is concern that the treaty presumes that the peoples (nations) of the world are pledging to operate and behave differently in the space environment than they have been accustomed to on Earth, rendering the treaty highly idealistic and anti-

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[17] *Space Law Treaties and Principles*, UNOOSA (2013) http://www.unoosa.org/oosa/en/SpaceLaw/treaties.html.

[18] Vladimir Kopal, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, (2008), legal.un.org/avl/pdf/ha/tos/tos_e.pdf.

[19] *Space Law Treaties and Principles*, *supra* note 17.

[20] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, U.N., Dec. 5, 1979, 1363 U.N.T.S. 3.

capitalist.[21] Considering that asteroid mining enterprises are beginning to form, they may represent the next addition to space law with scholars observing that an element of 'industry self-imposed' governance structure may complement the current legislative framework.[22] Notwithstanding the risk of amplifying the prevailing societal power structures[23] this development of more creative and nimble solutions, through what is fundamentally *spontaneous hybrid regimes*, including private and public partnerships, is reassuring.

There is a clear distinction in public versus private risk, especially when looking at types of risk, such as risk of bankruptcy, thus stranding global citizens in space, wherein levels of radiation (which rather bears the traits of a hazard) naturally would be the same, no matter the launch entity. Regardless of the type of risk, the UN would still be the right body to govern and legislate these risks under Article VI of the Outer Space Treaty, obliging states to authorise national space activities, hereunder licensing.[24]

It can be argued that the legal frameworks for space formed so far, have focused on *technologies* and to a reasonable extent formed as they were needed. But as the European Science Foundation (ESF, 2013) has persistently raised[25] – and what this article aims to argue – with private space exploration just around the corner, what about the *humanities*?

VI. THE DIALECTICS OF HUMANITIES, CAPITALISM AND THE UNIVERSE

Ironically, despite the fact that Mars One is a non-profit organisation, given that the launch of Mars One is envisaged to be financed to a large extent through a TV reality show,[26] capitalism

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[21] Bill Sulzman, *International Law and Space*, GLOBAL NETWORK AGAINST WEAPONS AND NUCLEAR POWER IN SPACE, http://www.space4peace.org/slaw/ slaw.htm (last visited Jan. 25, 2015).

[22] Paul B. Larsen, *Asteroid legal regime: Time for a Change?*, 39 J. SPACE L. 2, 275-326 (2014).

[23] Oran R. Young, *Regime Dynamics: The Rise and Fall of International Regimes*, 36 INT'L ORG. 2, 277-297 (1982).

[24] Outer Space Treaty, *supra* note 6.

[25] ESF – European Science Foundation, *Humans in outer space (HiOS)* (2013), available online at: http://www.esf.org/hosting-experts/scientific-review-groups/humanities-hum/strategic-activities/humans-in-outer-space.html.

[26] MARS ONE, *supra* note 7.

will be launched into *outer* space. Parker recognises that the paradox of having capitalists in space[27] is embodied in Max Weber's retort to capitalism, observing that 'the pursuit of wealth, stripped of its religious and ethical meaning, tends to become associated with purely mundane passions, which often actually give it the character of sport.'[28]

Essentially, the means become the end, and playing the game becomes the purpose; a profane voyage in the pursuit of spiritual enlightenment.[29] This aimlessness is further compounded by the emergence of an *Adult Infantile Narcissism* personality type predominantly in the West, where many of the most economically and socially dominant individuals are failing to adequately grow up.[30] Although this personality trait is at its extreme, elements from this hyper-rich elite and affluent society are developing a cosmic elite with narcissistic characteristics, taking to the universe as yet another object to be dominated.[31] This will inevitably become a catalyst for aspiration, perhaps even to some Mars One shortlisted candidates.

No doubt, as evidenced by the advances within space industry and space tourism, the pro-space movement the 'NewSpace Revolution,'[32] which seems less concerned with the impact on nature and increase in the associated risks, has gained more traction than those in opposition, particularly in terms of access to media. Naturally, this is not a surprise, given the space industry is the embodiment of progress and technological capability, and an undeniably distinctly virile industry. In addition to capturing the allure of adventure, this industry is backed with the vast availability of capital, political influence, and scientific, academic institutions.

Meanwhile, on the other hand are social interest groups – in many cases more traditional activists – with far less access to funding – continuously raising concerns of the side-effects of capitalism,

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[27] Martin Parker, *Capitalists in space*, 57 SOC. REV. 1, 83-97 (2009).

[28] MAX WEBER, TALCOTT PARSONS, & R.H. TAWNEY, THE PROTESTANT ETHIC AND THE SPIRIT OF CAPITALISM (1930).

[29] Parker, *supra* note 27.

[30] DICKENS & ORMROD, *supra* note 3.

[31] *Id*. at 622

[32] Rick Tumlinson, *Apollo's Children and the NewSpace Revolution*, HUFFINGTON POST, July 22, 2011, http://www.huffingtonpost.com/rick-tumlinson/apollos-children-and-the-b906500.html.

along with their deep concern of the use of space for military purposes, such as Global Network Against Weapons and Nuclear Power in Space (2015) and the Institute for Security and Cooperation in Outer Space (ISCOS).[33]

In between are organisations, which to some extent capture the essence of both sides of the spectrum. One example is the Institute of Noetic Sciences (IONS), founded by former US astronaut Edgar Mitchell, promoting both the advance of space exploration and science, and advocating strongly for expanding the horizon with a higher collective consciousness for the benefit of nature.[34]

Conscious that the contribution of the humanities will be essential to the future of space exploration, in 2007 the European Science Foundation (ESF), the European Space Agency (ESA) and the European Space Policy Institute (ESPI) through their 'Humans in Outer Space (HiOS) – Interdisciplinary Odysseys' advocated for strengthening the profile of social science disciplines such as law, philosophy, ethics, culture, art and psychology.[35] It is pertinent to note that at this point in time, ESA and the Royal Society UK, do not have any formal structured expertise in the area of humans in space.

While the importance of the HiOS cause found extensive academic support, the financial interest abated after three years. While understandable, this is concerning.

As we stand on the threshold of becoming a space faring civilisation, Sagan reflects on our global problems, with its vast national antagonisms, nuclear arsenals, rising populations, increased disparity between the poor and the prosperous, food and resource shortages, and the impact on natural environment – a system it seems to some, destined to collapse.[36] Meanwhile, Mitchell and Staretz argue that an element of our long-term survival depends on the ability of humanity to prevail over the obstacles and perils of

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[33] *The Treaty*, INSTITUTE FOR SECURITY AND COOPERATION IN OUTER SPACE, www.peaceinspace.com/index.php/the-treaty (last visited Jan. 22, 2015).

[34] *History*, INSTITUTE OF NOETIC SCIENCES, http://noetic.org/about/history (last visited May 21, 2017).

[35] J. WORMS, J. SWINGS, N. WALTER & R. WEEHUIZEN, SPACEROAD: A SOCIAL SCIENCES AND HUMANITIES-BASED RATIONALE FOR HUMAN SPACE EXPLORATION, (2010).

[36] Carl Sagan, *The Quest for Extraterrestrial Intelligence*, ART OF MAKING (2011), http://www.artofmaking.com/2011/03/the-quest-for-extraterrestrial-intelligence-by-carl-sagan/.

exploration. So far, the rewards have always far exceeded expectations, even if we were never able to predict the magnitude and range of the risks nor the extent of the benefits.[37] Nonetheless, they raise the importance that ethics and morality rest within humanity, as nature takes no moral sides.

Nature remains available for exploitation for good and for evil. For instance, one of mankind's many discoveries, is how to unleash energy stored within atoms. This knowledge has been used for peaceful purposes such as generating electricity as well as for weapons of mass-destruction. In other words, our morals, values and ethics have not kept pace with our technological prowess.[38] This renders us subject to live through an unstable era of *Technological Adolescence*,[39] without a dependable assurance that we as a human race can command these powerful technologies without the risk of self-destruction.

Self-discipline is likely to be the prerequisite to continue to evolve ethically and technologically.[40] This adds a familiar element of purity of the conquest,[41] as it bears witness to the absence of a sound *ethical* governance system to guide us through this unstable technological adolescence. After all, although morals are there to constrain *our* behaviour, values still boil down to how effective we are at influencing the behaviour of others.[42]

VII. TRIAL WITHOUT ERROR WRAPPED IN COLLECTIVE ANXIETY

Wynne poses the ever-relevant question, of whether collective participation can keep the pace that decision making in complex advanced technology demands, and if not, who deserves priority? What is the appropriate balance between process and product?[43] Or perhaps in this context it is better framed as: 'what is the appropriate balance between process and *progress.'* One side asserts that historically progress has been favoured in what can hardly be described as a balanced debate, albeit with more and more strains of

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[37] MITCHELL & STARETZ, *supra* note 4.

[38] *Id.* at 55.

[39] *Id.*

[40] *Id.*

[41] IMMANUEL KANT, CRITIQUE OF PURE REASON (1999).

[42] Martyn J. Fogg, *The Ethical Dimensions of Space Settlement*, 16 SPACE POL'Y 3, 205-211 (2000).

[43] Wynne, *supra* note 2.

a reflexive collaboratory approach.[44] Nonetheless, when reflexivity is both limited *and* late, even if providing at least the differing viewpoints a chance to be heard, it is only a matter of time before it will be drowned out by the capitalist stampede.[45] Meanwhile, the camp in favour of progress interprets the same reality with impatience and almost disdain for an apparent lack of vision for progress. Which may seem unfair, as they are more likely to have political influence to further their agenda.

There is a balance to be struck here. Ethical and moral guidance need to be inherent within the governance framework, but not to the extent that it stifles progress. Progress and conscience *can* advance together, while maintaining the moral imperative.[46] The key will likely be found in the propensity to accept risk[47] in what is likely to become a collective application with tacit consent of the *precautionary principle*, or as dubbed by some environmentalists 'trial without error.' The biggest concern is that it ignores the most dangerous source of error; the unexpected.[48] In relation to space exploration, that is a considerable factor. The difficulty rests within reaching consensus on if or when catastrophe strikes. While one side wishes to stop the experiment, the other is pushing on to see what might be learned from pushing ahead. The question is, which bias is the safest?[49] Safety comes from use, with pioneers suffering the costs of premature application. For the most part, technologies become safer over time, and needless to say the second generation cannot learn from the first generation, if there is none.[50]

One of the elements that will ensure a continuous reflexive society is a strong balanced multi-faceted debate. Driven by a deep collective anxiousness and fueled by methodical scepticism in an increasingly aware public,[51] it will pave the road for a collaboratory and participatory process with broad participation empowered even

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[44] CHRISTOPHER HOOD & DAVID K.C. JONES, ACCIDENT AND DESIGN: CONTEMPORARY DEBATES IN RISK MANAGEMENT (UCL Press, 1st ed. 1996).

[45] WEBER, PARSONS, & TAWNEY, *supra* note 28.

[46] RALPH NADER, UNSAFE AT ANY SPEED: THE DESIGNED-IN DANGERS OF THE AMERICAN AUTOMOBILE, (1965).

[47] JOHN ADAMS, RISK (1995).

[48] A. Wildavsky, *Trial and Error Versus Trial Without Error, in* RETHINKING RISK AND THE PRECAUTIONARY PRINCIPLE 22, 22-45 (Butterworth-Heinemann 1st ed., 2000).

[49] *Id.* at 3.

[50] *Id.* at 35

[51] BECK, *supra* note 1, at 49.

at grass roots level. This constant dynamic tension is needed to govern these decisions as we fare into unchartered territories of private exploration of outer space.

VIII. SOCIAL LEARNING IN AN ADOLESCENT RISK SOCIETY?

The social cognizance of the complexity of space activities is growing exponentially, and there is general agreement that it is important. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) acknowledges the increasing demand for regulatory structures,[52] while the European Science Society cautions that space law 'will become urgent.'[53] Then why doesn't the European Space Agency have a department to deal with humans in space, either from a natural science or a social science point of view? More understandably perhaps, neither does the Royal Society, UK, which has otherwise been known to provide scientific and ethical guidance to the public with the development of new technologies. Why is it not gaining traction? Could it be that the 'softer' social sciences indeed *are* moving forward, but compared to technology developing at neck-break speed and governance moving at a notoriously diffident stride, it has simply not been possible to detect the modest advance of the social sciences? All going to plan, there are still ten years until Mars One will have 'space activities.' In relative 'space years,' that is right around the corner.

Determining whether society is equipped to govern this development, one indicator is whether social learning is taking place. The ideal collaborational environment is a complex public debate built on antagonisms with strong incentives to promote rival values where opposing forces are deliberately juxtaposed.[54] It is clear that only limited reflexivity and collaborationism seems to be occurring.

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[52] *Report on the United Nations/Thailand Workshop on Space Law on the theme "Activities of States in outer space in the light of new developments: meeting international responsibilities and establishing national legal and policy frameworks,"* (Nov. 2010) U.N. COMM. ON THE PEACEFUL USES OF OUTER SPACE, http://www.unoosa.org/pdf/reports/ac105/AC105_989E.pdf.

[53] Agnieszka Lukaszczyk, *Interdisciplinary Odysseys: The ESF/ESA/ESPI Vienna Conference on Humans in Outer Space*, 24 SPACE POL'Y 1, 50-52 (2008); *What is Mars One's funding model?*, MARS ONE, http://www.mars-one.com/faq/finance-and-feasibility/what-is-mars-ones -funding-model (last visited Jan. 27, 2015).

[54] HOOD & JONES, *supra* note 44.

This is unlikely to change, as the polarised debate is rooted in extremely opposing ideologies with very little middle ground, being either passionately for or against opening up space. Add to that the natural bias towards progress driven by aerospace industry resources and political influence.

Even if there is a public debate, it is not perceived to be transparent, nor balanced. In the case of Mars One it is experienced to be more of a multi-way communication with an either deliberately non-risk averse demographic or one that is ignorant of the real risk, than that of an informed debate. It can be argued that the debate and the media attention on the topic are not a balanced, informed dialogue by a long shot, nor are they prioritising risk communication – *au contraire*.

It can also be argued that the topic of a one-way mission to Mars is not really what is being discussed or promoted in the public domain. It is rather the contemporary phenomenon that private space exploration *is* possible. It is within reach for anyone – not only a cosmic elite. It is an expression of technological advance forging its way ahead, not only symbolically loaded,[55] but perhaps even symbolically *saturated* in the sense that the argument seems to have long left the realm of rational deliberation and reductionist logic based on the concrete implications and merits of the case at hand. It has entered a realm where the project is evaluated on its *symbolic* value, becoming the product of long-held assumptions, preferences and prejudices of what it represents for the industry [or ideology] as a whole.[56]

Mars One represents not only a nimble Dutch non-profit enterprise, with a vision to settle humans in outer space, but also whether society has the right and the prowess to do so and, as it would appear, ruffling a few feathers in the process. In a contemporary late-modern industrial risk society,[57] driven by a collective degree of adolescent immaturity and individualism,[58] the collective signature of the contemporary phenomenon will be heavily biased in favour of progress. Add to that, the element of capitalism through the broadcasting rights to a TV reality show or through extraction

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[55] Wynne, *supra* note 2.

[56] *Id.* at 349-350.

[57] BECK, *supra* note 1.

[58] DICKENS & ORMROD, *supra* note 3.

of minerals as auxiliary activities, risk is bound to be accepted in the name of the greater good, likely under the precautionary principle. In this culture and at this time, it would seem that the establishment is lagging behind, while a nimble private industry is forging ahead.

Not attempting to reignite the nature versus nurture debate, it can be argued that Mars One is a product of its time – not the other way around. It is a small non-profit foundation, which mobilised 202,586 future astronauts overnight, but the 202,586 adventurous, non-risk averse, receptive individualists needed to exist. These are 202,586 people for whom the idea of leaving Earth, never to come back, seemed a reasonable proposition. One cannot burden Mars One with that. Never mind commercial or technical viability, Mars One has tested and proven their concept for *social viability*. If anything, Mars One leveraged the *convergence* available to them. This includes a technological convergence and accessibility through the privatisation of the aerospace industry[59] as well as convergence in popular culture saturated with social media, multiple realities, sci-fi, influential celebrities and early adopters signing up with Virgin Galactic for brief sub-orbital flights.[60] Mars One both uses and forms part of the texture of contemporary society, so far without much competition.

Building on the theories of adult infantile narcissism and technological adolescence[61] and the dynamics unfolding in the symbolically loaded debate, a budding concept of S*ocietal Self-Esteem* may be emerging. Societal self-esteem is the idea that the collective culture has a life of its own, a value system with a consciousness. One that thrives in the reflexivity of the risk society, perhaps even outgrows its transient anxiety.[62] It is the sum of all what all individuals are doing. It is closely linked to social learning theory and the dynamics unfolding in a heavily symbolically loaded debate, in this case heavily stacked in favour of the NewSpace agenda.

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[59] J. Stuart, *Outer Space Politics,* The Government Department Hot Seat, (Jan. 2, 2012) LONDON SCH. ECON., http://www.lse.ac.uk/website-archive/newsAndMedia/video-AndAudio/channels/theHotSeat/player.aspx?id=1349.

[60] *Exploring Space Makes Life Better On Earth*, VIRGIN GALACTIC, http://www.virgingalactic.com/why-we-go/ (last visited Nov. 4, 2015).

[61] MITCHELL & STARETZ, *supra* note 4.

[62] BECK, *supra* note 1.

It can be argued that, to some extent, select demographics are afforded more influence in the collective narrative, which in turn becomes a testament to societal self-esteem; the voice and consciousness of an era. For instance, when 202,586 members of the general public – in this case, many of whom are well-adjusted, well-educated younger people from western industrial societies - are seeking to leave the surface of the Earth, never to return. The question is: what does that say about the current state of society, if anything? It seems that the development of a collective maturity or a common self-esteem is the natural progression, one that would guide the social and technological evolution consciously, hopefully towards stability with less risk of self-destruction.

Thus, it is argued that elements of social learning are unfolding, although this time, the tables are turned. This time it is the public – represented by a small group of enthusiasts – either in favour of space progress, or the more cautious flank who advocates for establishing a common platform, in unison pleading for the establishment to catch up. In this sense, Mars One – along with its contemporaries – be it for or against, is spearheading the discussion, compelling it to become part of the strategic priorities within the establishment. This follows the Wynne tradition of social learning, and it is suggested here that the collective *voice* that is societal self-esteem, which ever its intonation, is what is driving the heavily symbolically loaded public debate. This time it is occurring from a nimble vantage point, spurring on the establishment to catch up, which in a way is 'reverse' social learning, in that typically technological progress has been spearheaded by science and experts.[63] This time however, the 'layman' is in the lead, shaping the agenda, be it motivated by adventure, escapism, seeking a sense of purpose, or simply predestined evolution.

IX. CONCLUSION: GOVERNANCE, RISK AND SOCIAL LEARNING

The current legislative framework under the Outer Space Treaty was written in a different time and outlines the intent of a harmonic collaboration based on ideals we have not been able to uphold on Earth. Along with the Moon Agreement, these overarching principles are based on an ideological premise of international

[63] Wynne, *supra* note 2.

peace collaboration and equal global distribution of wealth. However, this does not resonate with the reality of living in a reflexive late-modern industrial society,[64] by and large driven by capitalist interests and financial sustainability. In other words, the governance *foundation* seems robust, even if it is ideological, bordering on the collectively naïve.

The concern, therefore, is how to operationalise this robust treaty, without losing the heart and spirit in which it was written, while harnessing the technological progress and tenacity. Perhaps there is too much focus on the material at hand, and a whole different level of abstraction is needed in order to tackle these modern ethical dilemmas: one that has evolved to capture the technological prowess as well as the human and spiritual factor. Suffice to say, although the current regulatory framework and the treaties developed under the UN Committee on the Peaceful Uses of Outer Space, may not be an ideal solution, for the time being, it represents the highest level of international consensus.

With the introduction of two new major parameters: i) private space exploration and ii) humans in outer space, possibly as permanent settlers; the legal and social infra-structure and society's capacity to *grow and learn* will have to go into hyper-drive if it is to catch up with the standing of the technological potential. We may still have decades, if not a century, before this occurs. We could also wake up tomorrow and realise that the long wait is over.

Therefore, it is comforting that institutional inter-governmental self-imposed hybrid legislative regimes have been developing as they were needed in response to technological progress and international collaboration in space; occasionally with a creative, but sound interpretation of the UN framework in the collective interest of progress. This is an important indicator in the question of whether society is equipped to develop suitable governance frameworks when it comes to humans in outer space. Given that the foundation, principles and diplomatic infrastructures are available, in theory society is equipped to develop suitable governance frameworks for humans in space. In reality, it is doubtful, or at least doubtful that it will occur in time.

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[64] BECK, *supra* note 1.

Timeliness is not so much associated with the potential annihilation of the world as we know it, contamination and depletion of resources,[65] for which we may have another 1,000 years,[66] but rather associated with the ramping technological progress within space exploration. It is not unlikely that within a decade or two, technology will have resolved any outstanding obstacles to send humans on what could conceivably be a one-way trip to Mars, at least initially. Ethics aside, there are compelling technological reasons to start with a one-way trip. No doubt, the first generation going would be taking far greater risks, than the generations that will come after them,[67] but that is often how evolution works.

As with any new technological advancement, to maintain a stable development, it is important that society and its risk frameworks are developing at the same pace. Ideally, guided by a reflexive social learning process.[68] The analysis found, that indeed a social learning process is taking place heavily symbolically loaded.[69] The level of reflexivity, however, is modest, and not surprisingly, heavily biased in favour of progress. The advancement of this ultimate frontier is unlikely to be slowed down due to the ethical deliberations of a conscious public, especially with the limited collaboratory strength. At best, the precautionary principle of deploying mitigating measures, while accepting enormous and unknown risk, will be applied. One can hope it is prohibitively expensive, if only for a little bit longer, allowing for a more balanced socio-technological evolution. But if it is technically feasible, eventually money will not be an issue. Even if Mars One does not raise sufficient funding by their milestone deadlines, this does not mean that another entity will not.

The analysis also detected a reversal of the roles, in the sense that traditionally scientific experts have been in the lead, communicating with the public with varying degrees of authority. This time, however, it would appear that a small demographic from the general public is taking the lead. Whether progress is spearheaded by

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[65] *Id.*

[66] *Stephen Hawking's Warning: Abandon Earth or Face Extinction*, (2015) BIG THINK, http://bigthink.com/dangerous- ideas/5-stephen-hawkings-warning-abandon-earth-or-face-extinction.

[67] Wildavsky, *supra* note 48.

[68] Wynne, *supra* note 2.

[69] *Id.*

a cosmic elite,[70] early adopters, a nimble renegade space foundation motivated by escapism, is less important. The substance that is generated is not.

The 2007 ESF Humans in Outer Space project, elevating the social sciences onto the space agenda, can be viewed in its own right as an attempt to vanguard society towards a future, which will hold humans in outer space. Although these activities may be only a decade away, a long-term visionary approach is required to mobilise support. Perhaps the project was premature, as it did not yield the results and find the support it had hoped for. This is concerning. Meanwhile, European sovereign states such as the Netherlands are hosting ventures such as Mars One, contemplating inter-planetary colonisation within a decade.

Well-intentioned visionary scholars faced numerous challenges in elevating the humanities onto the public space agenda most likely for two reasons. First, it does not offer a tangible, viable financial proposition, therefore it is not sustainable in a capitalist society, and second, it is not sexy. You cannot sell it. Or at the very least, it is a hard sell. Whether we like it or not, and whether there is cringing, tongue-in-cheek or mild admiration, all bottled up in good old-fashioned hypocrisy, Mars One with their sleek design, media-savviness, and, let's face it, sex-appeal, may be what is needed to elevate the humanities – if not into outer space - then at least back onto the international agenda. Perhaps this is their role; that of ***vanguard***. In that light, it is not important whether they make it there or not, but that they pave the road for the ones that will.

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[70] DICKENS & ORMROD, *supra* note 3.

BOOK REVIEWS

ROY GOODE, CONVENTION ON INTERNATIONAL INTERESTS IN MOBILE EQUIPMENT AND PROTOCOL THERETO ON MATTER SPECIFIC TO AIRCRAFT OBJECTS: OFFICIAL COMMENTARY (THIRD EDITION) (UNIDROIT, 2013)

Review by Haley Grantham

Since November 2001, the *Cape Town Convention on International Interests in Mobile Equipment and Aircraft Protocol* has been in force. The third edition of the Official Commentary was written in response to issues raised by a large number of transactions governed by the two instruments, by operation of the International Registry, and the complex declarations system laid down for Contracting States,[1] which were not addressed in prior commentary editions. The commentary aims to be an authoritative guide to the Convention and Aircraft Protocol and is the result of extensive consultations with negotiating governments and participating observer organizations.[2] Sir Roy Goode served as Chairman of the UNIDROIT Study Group that initiated the project that led to the Convention and the following Protocols. This experience made him distinctively qualified to prepare the Official Commentary.

During the closing ceremonies at the Cape Town diplomatic Conference, twenty participating States signed the Convention and Aircraft protocol,[3] giving credence to its importance in the private commercial law arena. In 2013, just twelve years later, 56 States and the European Union had ratified or acceded to the Convention.

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[1] Professor Sir Roy Goode, Convention on International Interests in Mobile Equipment and Protocol Thereto on Matter Specific to Aircraft Objects: Official Commentary (Third Edition) (International Institute for the Unification of Private Law, 2013).

[2] *Id.*

[3] *Id.*

Of these 56 States, 50 had ratified the Aircraft Protocol.[4] The expedited ratification by several States demonstrates the Convention and Protocol's importance in standardizing transactions involving movable property across international borders. Since Cape Town, the Convention has come to be known as one of the most formidable private commercial law projects of its time; thereby making a commentary such as this imperative to reduce legal uncertainties caused by differing national laws.

The well-structured organizational flow of the third edition of the Official Commentary coupled with Goode's unique insight accomplish its strive to be a paramount secondary source for States, creditors, debtors, conditional sellers, and conditional buyers alike. His in-depth explanations of each article of the Convention and the Aircraft Protocol are straightforward and insightful—clearing up possible queries concerning the original text. The Commentary is broken into five parts: Part 1 is a brief history of the Convention and Aircraft Protocol, Part 2 is a review of the Convention, Part 3 is a review of the Aircraft Protocol, Part 4 is an annotation of the Convention on Intentional Interests in Mobile Equipment, and Part 5 is an annotation of the Protocol to the Convention on International Interest in Mobile Equipment on Matters Specific to Aircraft Equipment.

This history of the Convention and Aircraft Protocol given in Part 1 lives up to its title of being brief. Goode details the primary points of how the process to write, present, and ratify the two instruments unfolded with precision detail and no unnecessary additives. He then proceeds to meticulously review the Convention in Part 2, covering points such as what equipment the Convention encompasses, the relationship between the Convention and the Protocol, and the interpretation of the text. This includes an explanation as to why the three Protocols on Aircraft Equipment, Railway Stock, and Space Assets are necessary in conjunction with the Convention. This being because the Convention is not equipment specific and only includes "objects." Part 3 goes into the same detail concerning the Aircraft Protocol, even going so far as to detail the relationship between these two instruments and other Conventions. The intense detail provided by Goode in these sections gives

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[4] *Id.* at 4.

the reader more than a mere glimpse of how the Convention and the Aircraft Protocol function in the reality of transcontinental commerce of mobile equipment.

Parts 4 and 5 act as a secondary source to the Convention and the Aircraft Protocol. It provides the original text of the Convention and the Protocol along with comments regarding interpretation and application, and definitions of terms. For States and the other entities, this commentary serves as a crucial tool when registering these types of agreements between parties – clearing up potential gaps caused by translation barriers.

For those who deal in aircraft equipment to which this Convention and Protocol apply, this Official Commentary is a must have on their bookshelf. Goode's thoroughness in his coverage of the topic leaves no stone unturned and very few questions left unanswered. Without it, one is likely to make an inessential error due to differing national laws and language interpretations, which are exhaustively covered in the commentary. However, if one is looking for a more general overview of the Convention and Protocol, this book will be of little help. It reads more analogously to a treatise and is an unmatched secondary source to the two original texts. The guidance given by Goode in this commentary is critical for the future success of international interest in financing different categories of mobile equipment.

Although Goode is thorough in his analysis of the primary texts, the indexes in the beginning of each part references the outlined sections to paragraph numbers rather than to page numbers. In future editions, it would be beneficial for readers to have both references – page numbers and paragraph numbers – to make ultimate use of the commentary. The index being outlined by paragraph numbers makes referencing to certain sections in the text cumbersome. While this is merely a formatting critique, it would help future users optimize their use of the commentary.

Being tasked with providing an Official Commentary to furnish a more fluid understanding of the Convention and Protocol in conjunction with one another, Goode has yielded an unparalleled source for all those who deal in these types of agreements. His commentary on the original text is diligent and allows those required to register their transactions a way to feel confident going forward in their registrations.

ROY GOODE, OFFICIAL COMMENTARY ON THE CONVENTION ON INTERNATIONAL INTERESTS IN MOBILE EQUIPMENT AND LUXEMBOURG PROTOCOL THERETO ON MATTERS SPECIFIC TO RAILWAY ROLLING STOCK (SECOND EDITION) (UNIDROIT, 2013)

Review by Nathaniel Celeski

Written by Professor Sir Roy Goode, this *Official Commentary on the Convention of International Interests in Mobile Equipment and Luxembourg Protocol Thereto on Matters Specific to Railway Rolling Stock* is the 2014 incarnation of the first edition by the same name published in 2008 by the International Institute for the Unification of Private Law (UNIDROIT). This Commentary is parsed into five distinct sections. In Part I, Goode lays a brief, but proper foundation of the history of the Convention of International Interests in Mobile Equipment (hereafter the "Convention") and the Luxembourg Protocol. In Part II and Part III, Goode reviews the Convention and the Luxembourg Protocol. Part IV is an Article-by-Article annotation of the Convention, followed by Part V; a similarly detailed analysis of the provisions of the Luxembourg Protocol. This Commentary seeks to thoroughly explain the nuts and bolts of both the Convention and the supporting Luxembourg Protocol, but it also enhances the reader's understanding of why both documents are fundamentally necessary to achieve the objectives of facilitating the financing and leasing of mobile equipment, specifically dealing with railway rolling stock.

Professor Sir Roy Goode CBE, QC has over 30 years of experience in legal academia, and is a leading scholar and authority on commercial law, so it is fitting he authored this Commentary dissecting the components of the Convention and Luxembourg Protocol as it relates to private transactional law. After introducing the Convention and Luxembourg Protocol in Parts I-III, Goode takes an

Article-by-Article approach to his analysis, first by way of the Convention, and then the Luxembourg Protocol in Parts IV and V respectfully. Goode primarily stays within the perimeters of both documents, and does not derail to other sources outside of the text in his analysis, but he does briefly touch on other international conventions, namely to give context to his subject matter. Goode's research is clearly comprehensive as he touches on some aspect of each provision of the Convention and Luxembourg Protocol while engaging in incredibly focused analysis of what the language means. The purpose of this Commentary is to expand on and explain the actual language of the Convention and Luxembourg Protocol, and to provide a detailed look at how the provisions apply in practice. Goode fulfills this purpose seamlessly. Goode provides insightful illustrations targeted at applying the meaning of the provisions to help clarify potential questions or misunderstandings of the law. This direct application of the law following the detailed analysis helps cement the readers understanding of the provisions. Goode's prose is easy to follow, and the way he divides his analysis into small bits, makes understanding otherwise complex international legal instruments completely manageable.

This Commentary is written for practitioners, as it provides a deep analysis of the provisions of both the Convention and the Luxembourg Protocol. This step-by-step, orderly analysis, especially in Parts IV and V, will significantly help a lawyer trying to understand the language and meaning of both the Convention and the Luxembourg Protocol. An international attorney might use this Commentary as a means of clarifying their understanding of how a single provision applies, but each annotated provision equally involves the level of depth necessary to gain a complete understanding of both documents. Goode's Commentary is clearly a major contribution to an admittedly narrow field in a niche practice area. Beyond stepping into the minds of the drafters of the Convention and Luxembourg Protocol, this Commentary provides comprehensive insight into the meaning and application of the provisions of these documents.

ROY GOODE, CONVENTION ON INTERNATIONAL INTERESTS IN MOBILE EQUIPMENT AND PROTOCOL THERETO ON MATTERS SPECIFIC TO SPACE ASSETS: OFFICIAL COMMENTARY (UNIDROIT, 2013)

Review by Marshall D. McKellar

From beginning to end, Professor Goode's commentary on the Convention on International Interests in Mobile Equipment (Convention) and its accompanying Protocol on Matters Specific to Space Assets (Space Protocol) acts as telescope, introducing readers to the material on a broad scope via his table of convention articles, introduction, and convention history. Goode then gradually transforms a telescope into a microscope via his review and subsequent commentary sections.

Seeing as the Convention's purpose is to "provide a stable international legal regime for the protection of secured creditors, conditional sellers and lessors of aircraft objects, railway rolling stock and space assets through a set of basic default remedies and the protection of creditors' interests by registration in an international Registry, thus securing priority and protection in the event of the debtor's insolvency," the need for a detailed companion to the complex subject matter of the Convention becomes paramount. Goode's work satisfies this need and more. In addition to interpreting the anatomy of the Convention/Space Protocol, Goode essentially maps its DNA, subjecting every minute detail to vigorous study. The commentary is broken into five parts: Part 1 is a brief history of the Convention and Space Protocol, Part 2 is a review of the Convention, Part 3 is a review of the Space Protocol, Part 4 is an annotation of the Convention on International Interests in Mobile Equipment, and Party is an annotation of the Protocol of the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets.

Goode's work begins with a painstakingly detailed table of both the convention and space protocol articles. The table contains each article in chronological order, its subject matter, which sections include its commentary and review, and which other articles are directly associated with it. Combined with its chronological chapter headings and wonderfully accurate descriptions, this table immediately equips readers with an invaluable tool for quick and efficient identification of specific material for in-depth study of the convention/protocol.

In order to help initiate readers to the complexities of the Convention and its protocols, Goode next provides a pointed history of the convention's decades-long formation, detailing the events leading to its earliest developments, specific working groups, sister documents, and ratifications. For any student of the Convention, this historical background provides a helpful understanding of the Convention's past, present, purpose, and applicability in international law.

The subsequent Review sections—for both the convention and the space protocol – provide readers with a comprehensive subject-by-subject analysis of the entire body of work. Goode's conversational approach and descriptive language is both refreshingly professional and vividly clear, introducing readers to foundational aspects of the Convention/Protocol, including its underlying principles, proper interpretation, definitions, sphere of application, and everything from appropriate procedures to priority of competing assignments. These sections not only provide insight into the broad meaning of the treaty language, but also reveal to readers the context and background of each individual subject matter. In essence, one not only sees the stone, but the mountain from which it was cut, and how it was transported from the quarry.

For example, Goode's review section of the space protocol brilliantly informs readers by first introducing them to distinctive features of space financing, its major sources of law, and the influence of earlier protocols. Next, it tapers the funnel further by explaining to which assets the convention is meant to apply and what its proper application looks like in practice.

The commentary sections continue to laser focus, taking apart both the treaty and the space protocol one article at a time in careful

detail, providing explanations and interpretations for both the articles as a whole and their specific wording. The commentary is crafted in a way that is accessible to both experts and neophytes. If the review sections provide a context for the stone, Goode's commentary analyzes the different grains, textures, and sediments that make up the stone itself.

Seeing as both the Convention and its space protocol have been ratified by over fifty countries, and "recognizing the continuing development of the international commercial space industry and contemplating the expected benefits of a uniform and predictable regiment governing interests in space assets and in related rights and facilitating asset-based financing of the same," it becomes paramount that the contents of the convention and the space protocol are approachable by students, industry denizens, and lawmakers alike. Goode's commentary effectively satisfies this need, creating a portal through which readers may explore the convention with ease and efficiency. Not to mention, the appendices contain the convention and the space protocol, as well as a comprehensive list of additional documents related to its formation, development, and application. As a whole, this commentary is an invaluable resource for students of international law, space law, and those who have either monetary or intellectual interests in mobile equipment from around the globe and beyond.

One is hard pressed to find an aspect in which Goode's commentary falls short in either scope or substance. Indeed, it will surely stand as a pillar—if not the foundation—of study for the Convention/Space Protocol for many years to come. Scholars wishing to make substantial contributions to the analysis and interpretation of the Convention certainly have their work cut out for them in light of Goode's accomplishment. His commentary is an essential addition to any library concerned with international law, space law, finance, or mobile equipment.

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