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## Project Khepri: Asteroid Mining Project. Final Policy Report

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# **Project Khepri: Asteroid Mining Project**

## **Final Policy Report**



**August 26 2022**

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## ABSTRACT

Much like outer space, our legal system consists of many unknowns. This is especially true for new developments in emerging technologies, particularly those related to the exploration, exploitation, and utilization of space resources. The recently developed technical feasibility of space mining has advanced ahead of existing international space treaties. While certain articles of the major UN treaties can be interpreted to adapt to the utilization of space resources, most of these provisions were not originally designed to be applied to a space mining regime.

Keeping in mind this context, this paper sets out the current international law landscape, including the areas which require further development, and provides guidance and recommendations for governments, international communities, and private actors interested in space resources. To this end, the existing international legal framework is summarized by detailing the significance of the United Nations Space Treaties, the role of customary international law, relevant principles, environmental law, the role of the Committee on the Peaceful Uses of Outer Space and previous attempts to govern areas known as *res communis*. Next, Canadian and United States national law is outlined, including relevant aspects of Canadian national mining law.

The paper continues on to analyze various approaches to developing a legal framework for space resource extraction and provides recommendations for industry, national and international actors. Given the widespread support at UN discussions, and years of private actors' development and involvement in related projects, the necessary societal desire for space mining regulation is present. To work towards enabling space mining, it is suggested that industry set aside a portion of profits to later be used for the 'benefit of all' and work with the Canadian government. At a national level, it is recommended that Canada consider passing national legislation similar to that passed by the United States, Luxembourg, the United Arab Emirates, and Japan. Finally, it is recommended that Canada continue to cooperate through international fora to develop non-legally binding principles, otherwise known as 'soft law' to contribute to a bottom-up approach.

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## LIST OF ABBREVIATIONS:

<b>Abbreviation</b>	<b>Full Description</b>
CMMP	Canadian Minerals and Metals Plan
COPUOS	Committee on the Peaceful Uses of Outer Space
CSA	Canadian Space Agency
ICJ	International Court of Justice
IISL	International Institute of Space Law
ISA	International Seabed Authority
LSC	Legal Subcommittee
MAC	Mining Association of Canada
OST	Outer Space Treaty
SDG	Sustainable Development Goals
SPACE	Spurring Private Aerospace Competitiveness and Entrepreneurship Act
SRU	Space Resource Utilization
STSC	Scientific and Technical Subcommittee
TSM	Towards Sustainable Mining
UAE	United Arab Emirates
UN	United Nations
UNGA	United Nations General Assembly
UNCLOS	United Nations Convention on the Law of the Sea

## CHAPTER 1: INTRODUCTION

This paper is the result of research undertaken from May to August 2022 by Brianna Miklaucic and Aaron Groh, prepared for the Khepri Project, and under the supervision of Professors Oosterveld and Steyn of the University of Western Ontario, Faculty of Law.

It has been predicted that the first trillionaire will be funded through asteroid mining.<sup>1</sup> Scientists have discovered evidence that asteroids contain precious metals, minerals and water, and the Moon contains water ice that could be turned into jet fuel. With this potential for economic and scientific success, it is no wonder that the private sector and major tech companies have taken interest in space mining.

This potential has also sparked much legal debate amongst scholars and states. Private actors' plans to mine asteroids raise questions of compatibility with existing international law. While the Outer Space Treaty contains relevant guiding principles, it does not address resource extraction expressly, leaving it up to interpretation as to how these principles apply. For example, there is debate as to whether the non-appropriation principle, that prohibits national appropriation and claims of sovereignty, applies to recovery of space resources. Further adding to tensions are States passing national law and others, such as Russia and China, being adamant that it is in conflict with existing law.<sup>2</sup> However, these States are beginning to change their tune for fear of being left behind.<sup>3</sup>

For space mining to be feasible from a legal perspective, there needs to be a framework governing the activity. Even with States moving towards a consensus that resource extraction is not in conflict with existing international law, there are still many uncertainties to be addressed. How this legal framework will be developed, and what it will look like when it is remain points of contention among States and scholars alike.

This paper will outline the existing international and national law, analyze various proposals to address the gaps in space law and provide recommendations on three levels: industry, national and international. Space mining is coming, and this is an opportunity for Canada to make a distinct contribution to the development of international and domestic space resources law, given the industry-leading nature of Canadian mining law. Canada can help the international community to come to consensus on the legal framework necessary for a healthy and sustainable space mining sector.

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<sup>1</sup> Andrew Glester, "The Asteroid Trillionaires" (11 June 2018), online: *Physics World* <<https://physicsworld.com/a/the-asteroid-trillionaires/>>.

<sup>2</sup> Thomas Cheney, "Reactions to the U.S. Space Act 2015: Statements at COPUOS" (21 April 2016), online: *SlideShare* <<https://www.slideshare.net/thomcheney1991/reactions-to-the-us-space-act-2015-statements-at-copus>>.

<sup>3</sup> University of Nebraska-Lincoln, "NE Space Law Week – Artemis Accords: International Partner and Industry Cooperation and International Space Norms" (6 October 2020) at 44m:10s – 44m:50s, online: <<https://mediahub.unl.edu/media/14612>>.

## CHAPTER 2: EXISTING INTERNATIONAL LEGAL FRAMEWORK

The current framework governing space law consists of large gaps regarding mining extraterrestrial resources. There is no widely accepted international law expressly addressing the subject and there is uncertainty as to whether unilateral domestic acts of states supporting asteroid mining are in conflict with existing international law, such as the Outer Space Treaty (OST). This section will provide a summary of the existing international legal framework.

International space law can be described as a branch of public international law governing space-related activities. It is comprised of both ‘hard’ (binding) and ‘soft’ (non-binding) law in the form of treaties, customary law, UN declarations, general principles, international agreements, and rules and regulations of various international organizations.

In the early stage of the development of international space law, the UN Committee for Peaceful Uses of Outer Space (COPUOS) drafted various UN declarations and resolutions that were not legally binding but did have political force. These declarations and resolutions are predominantly of historical interest, as they were later codified in treaties, though they are useful as an indication of customary international law. Resolution 1721(XVI)B of 1961 is an exception, as it discusses the principle of registration and is still relevant for states that did not ratify the Registration Convention.

Beginning with the OST of 1967, COPUOS shifted to creating legally binding treaties. The first four treaties received widespread acceptance; however, the 1979 Moon Agreement was met with opposition. With the relative failure of the Moon Agreement to secure ratifications from major spacefaring states, and the growth in the membership of COPUOS, the period of creating legally binding treaties came to an end. COPUOS returned to a focus on adopting non-legally binding UN resolutions to continue to develop space law.

Outside of COPUOS, international space law has been developed most recently by international organizations, groups of states, and influenced by private entities. Relevant legal regimes include regulations of international space organizations, regimes governing major space projects and multilateral and bilateral agreements.

### 1 THE UN SPACE TREATIES

COPUOS has concluded five international space treaties; the OST of 1967, the Rescue Agreement of 1968, the Liability Convention of 1972, the Registration Convention of 1976, and the Moon Agreement of 1984.<sup>4</sup> This section will focus on addressing the legal implications of the two relevant treaties to asteroid mining: the OST and the Moon Agreement.

#### 1.1 THE OUTER SPACE TREATY

The OST is widely considered to be the foundation of international space law.<sup>5</sup> It is also the most accepted space treaty with 111 countries being party to it (including all major spacefaring

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<sup>4</sup>“Space Law Treaties and Principles” (last visited 27 June 2022), online: *United Nations Office for Outer Space Affairs*

[<sup>5</sup> Frans von der Dunk & Fabio Tronchetti, \*Handbook of Space Law\* \(Cheltenham, UK: Edward Elgar Publishing, 2015\) at 49 \[\*Handbook of Space Law\*\].](http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html#:~:text=These%20five%20treaties%20deal%20with,with%20space%20activities%20and%20the>.”</a></p></div><div data-bbox=)

nations) and an additional 23 signatories.<sup>6</sup> At the time of adoption, commercial exploitation of extraterrestrial resources was not considered a real and relevant possibility and thus the concept was not expressly addressed in the text of the treaty.<sup>7</sup> Whether extraterrestrial mining is prohibited by the OST has since become the source of extensive debate. While none of the treaty's provisions mention space resources directly, some are relevant to the issue.

Article I 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” and that it shall be “free for exploration and use”.<sup>8</sup> Most experts would agree that freedom of use includes the extraction and use of natural resources;<sup>9</sup> however, there is considerably less consensus on what is meant by “for the benefit and interest of all states”. Unilateral actions by states such as the USA, Luxembourg, United Arab Emirates (UAE) and Japan have neglected to address this principle, leading to criticism by delegates at COPUOS and legal scholars.<sup>10</sup> Delegates have argued that the only way to be in compliance with this principle is through a multilateral approach and that a ‘first come, first serve’ ideology is not desirable or in keeping with the spirit of the treaty.<sup>11</sup> While there have been calls for international cooperation to achieve a global consensus on the interpretation of Article I, one has yet to be reached.

Article II establishes the non-appropriation principle, generally accepted as creating a ‘global commons’ in space.<sup>12</sup> Traditional means of acquiring territory, sovereignty, or rights over land in space are prohibited under Article II. There are differing interpretations as to what Article II means for extracting minerals.

Some commentators argue that, since outer space belongs to all, natural resources also belong to all. A regime governing resources under this interpretation would be international and similar to the 1982 Convention on the Law of the Sea (discussed below), requiring some form of benefit sharing and international oversight. Others argue that, as outer space is a global commons or an area recognized as *res communis omnium*, all states are entitled to extract resources for their own benefit, similar to the high seas.<sup>13</sup> In areas recognized as *res communis*

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<sup>6</sup> “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies” (last visited 27 June 2022), online: *United Nations Office for Disarmament Affairs* <[https://treaties.unoda.org/t/outer\\_space](https://treaties.unoda.org/t/outer_space)>.

<sup>7</sup> *Handbook of Space Law*, *supra* note 5 at 777.

<sup>8</sup> *Treaty on Principles governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) [*Outer Space Treaty*].

<sup>9</sup> Stephan Hobe, “Adequacy of the Current Legal and Regulatory Frame Relating to the Extraction and Appropriation of Natural Resources” (2007) 32: *Annals of Air & Space L* 115 at 116-20.

<sup>10</sup> *Report of the UN COPUOS Legal Subcommittee*, UNOOSAOR, 55<sup>th</sup> Sess, UN Doc A/AC.105/1113 (2016) [*55<sup>th</sup> Session COPUOS Legal Subcommittee Report*]; *Report of the UN COPUOS Legal Subcommittee*, UNOOSAOR, 62<sup>nd</sup> Sess, UN Doc A/74/20 (2019); Stephan Hobe & Philip de Man, “The National Appropriation of Outer Space and its Resources” (27 March 2017), online (pdf): *United Nations Office for Outer Space Activities* <<https://www.unoosa.org/documents/pdf/copuos/lsc/2017/symp-08.pdf>>; Jose Monserrat Filho “Developing Countries and the Exploitation of Space Resources” (27 March 2017), online (pdf): *United Nations Office for Outer Space Activities* <<https://www.unoosa.org/documents/pdf/copuos/lsc/2017/symp-07.pdf>>.

<sup>11</sup> *55<sup>th</sup> Session COPUOS Legal Subcommittee Report*, *supra* note 10.

<sup>12</sup> Frans von der Dunk, “Asteroid Mining: International and National Legal Aspects” (2017) 26: *Mich St Intl L Rev* 83 at 86 [*Asteroid Mining: International and National Legal Aspects*].

<sup>13</sup> *Ibid* at 93.



*omnium*, such as the high seas, exhaustible natural resources are treated as *res nullius* and belong to no one, until extracted.<sup>14</sup> The exception is areas that have been declared as the common heritage of humankind, like the deep seabed in the 1982 Convention on the Law of the Sea.<sup>15</sup>

Some scholars have argued that the use of the term ‘national appropriation’ in Article II does not include private actors, and therefore private actors are not bound by this provision.<sup>16</sup> This interpretation has been criticized for various reasons, with the main criticisms being that allowing private appropriation would go against the spirit of the treaty, and Article VI creates international responsibility for states for national *and* private actions in space.<sup>17</sup>

Various states and institutes have interpreted the non-appropriation principle as allowing resource extraction. The United States, through passing of the 2015 Commercial Space Launch Competitiveness Act, has interpreted it this way.<sup>18</sup> The International Institute of Space Law (IISL) has taken a similar position; that as it is not expressly prohibited, the article can be interpreted as allowing the extraction of resources.<sup>19</sup>

Article VI creates state responsibility for private actors in space and requires state “authorization and continuing supervision” of those private actors.<sup>20</sup> Esteemed space law scholar Von der Dunk, in *Asteroid Mining: International and National Legal Aspects*, interprets this clause as “requiring a national scheme for licensing private space operators and subjecting them to relevant obligations and procedures”.<sup>21</sup> Article IX requires states to ensure that their activities in space do not cause harmful interference with other the activities of other states.<sup>22</sup>

Article VII is elaborated by the 1972 Liability Convention and creates liability for launching states for damage caused by space objects, including those from private actors.<sup>23</sup> The following are the criteria to which a state can fall under to be considered a launching state; “(i) a State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space objects is launched.<sup>24</sup> When more than one state meets these criteria, they are jointly and severally liable.<sup>25</sup> It is commonly understood that states are liable for the damage caused by the activity of non-government entities, if the state fulfils at least one of the

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<sup>14</sup> Alexandre Kiss, “The common heritage of mankind: utopia or reality?” (1985) 40: L in the Intl Community 423.

<sup>15</sup> Martin Svec, “Outer Space, An Area Recognized as *Res Communis Omnium*: Limits of National Space Mining Law” (2022) 60: Space Policy at 3 [*Outer Space, An Area Recognized as Res Communis Omnium*].

<sup>16</sup> *Handbook of Space Law*, *supra* note 5 at 779.

<sup>17</sup> *Ibid* at 780.

<sup>18</sup> *US Commercial Space Launch Competitiveness Act*, 51 USC § 10101 (2015) [*US SPACE Act*].

<sup>19</sup> “Position Paper on Space Resource Mining” (20 December 2015), online (pdf): *International Institute of Space Law* <<https://iislweb.space/wp-content/uploads/2020/01/SpaceResourceMining.pdf>>.

<sup>20</sup> *Outer Space Treaty*, *supra* note 8, art VI.

<sup>21</sup> *Asteroid Mining: International and National Legal Aspects*, *supra* note 12 at 87.

<sup>22</sup> *Outer Space Treaty*, *supra* note 8, art IX.

<sup>23</sup> *Ibid*, art VII.

<sup>24</sup> *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, 961 UNTS 187 art I (entered into force 1 September 1972).

<sup>25</sup> *Ibid*, art V.

previously mentioned criteria.<sup>26</sup> (Recall that Article VI of the Outer Space Treaty creates this state responsibility.) With this in mind, states often use national legislation to require state authorization of space activities and to require the purchase of insurance to cover the risk of liability.

## 1.2 THE MOON AGREEMENT

The Moon Agreement is the only treaty to expressly address the exploitation of natural resources.<sup>27</sup> Although ratified by only 18 states (none of which are a major spacefaring state), those states are bound by it and the legal implications are different than for those not bound by it.<sup>28</sup>

One of the most controversial aspects of the Moon Agreement is the provision indicating that the Moon, celestial bodies, and their resources are the “common heritage of mankind”.<sup>29</sup> The treaty does not specify how this principle is to be implemented, though it does provide the following in Article 11(7):<sup>30</sup>

*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.*

What is meant by an equitable sharing of the benefits is unclear. What is clear is that parties to the Moon Agreement cannot create national law on Moon resource development unilaterally, but must instead wait for the creation and implementation of an international regime as the rights to natural resources are vested in humankind as a whole and cannot be alienated.<sup>31</sup>

While the Moon Agreement was ultimately unsuccessful due to the lack of acceptance, it contains provisions and principles that are relevant. Article 11 states that an international space regime and procedures for governing extraterrestrial exploitation of space resources should be established.<sup>32</sup> Unlike the principle of the ‘common heritage of mankind’ contained in the same

<sup>26</sup> Armel Kerrest, “The Concept of the ‘Launching State’ in Commercial Launch Ventures” in Jan Wouters et al, *Commercial Uses of Space and Space Tourism: Legal and Policy Aspects*, (Cheltenham: Edward Elgar, 2017) 3 at 13.

<sup>27</sup> *Agreement Governing the Activities of States on the Moon and other Celestial Bodies*, 18 December 1979 1363 UNTS 3 Preamble (entered into force 11 July 1984) [*Moon Agreement*].

<sup>28</sup> “Agreement governing the Activities of States on the Moon and Other Celestial Bodies” (27 June 2022), online: *United Nations Treaty Collection* <[https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtmsg\\_no=XXIV-2&chapter=24&clang=\\_en](https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtmsg_no=XXIV-2&chapter=24&clang=_en)> [*Moon Agreement Treaty Collection*]. Note that Artemis Accord member Australia has ratified, and France has signed, the Moon Agreement.

<sup>29</sup> *Ibid.*

<sup>30</sup> *Ibid.*, art 11(7).

<sup>31</sup> *Outer Space, An Area Recognized as Res Communis Omnium*, *supra* note 15 at 4.

<sup>32</sup> *Moon Agreement*, *supra* note 28, art 11.

article, the need for a regulatory regime was widely accepted by spacefaring nations, demonstrating the willingness of states to accept an international regulatory body.<sup>33</sup>

Article 1(1) provides that “the provisions of this Agreement relating to the Moon shall also apply to other celestial bodies within the solar system, other than the earth, except in so far as specific legal norms enter into force with respect to any of these celestial bodies”.<sup>34</sup> This principle could allow for a legal regime to be developed that deviates from the Moon Agreement, including the ‘common heritage of mankind’ concept.<sup>35</sup>

## 2 CUSTOMARY INTERNATIONAL LAW

As well as considering treaties governing activities in space, it is important to examine customary international space law. Unlike treaties that are typically binding only on states that have ratified, customary law is binding on *all*.<sup>36</sup> There are two notable exceptions to this universal binding nature: the persistent objector norm and the localized rule. In the *Fisheries Case (United Kingdom v Norway)*, the International Court of Justice (ICJ) found that a particular customary international law “would appear to be inapplicable as against Norway inasmuch as she has always opposed any attempt to apply it to the Norwegian coast”.<sup>37</sup> In the *Right of Passage Over Indian Territory Case*, the ICJ found “no reason why long continued practice between the two states accepted by them as regulating their relations should not form the basis of mutual rights and obligations between the two states”.<sup>38</sup>

It is important to understand how customary international law emerges. The ICJ in the *North Sea Continental Shelf Cases* describes customary law as deriving from two elements: 1) evidence of it being the settled practice by states, and 2) *opinio juris* “a belief that this practice is rendered obligatory by the existence of a rule of law requiring it”.<sup>39</sup>

While treaties and customary international law are clearly distinct, a customary law can be identical to the terms of a treaty provision.<sup>40</sup> This is the case for various Articles of the OST that are *also* customary law.

The response to the launch of Sputnik 1 in 1957 began the emergence of various principles that would become customary international law. The USSR had not requested permission from other states to launch Sputnik 1 or to allow it to circle above various states in outer space, and yet, no state objected to it. In not acting, states accepted that outer space was not subject to sovereignty and was instead an area similar to a *res communis omnium*. This principle of non-appropriation was later codified in the OST, along with the principle of freedom of use and for the common interest of all. Along with being customary law and codified in a treaty, some

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<sup>33</sup> Priyank D Doshi, “Regulating the Final Frontier: Asteroid Mining and the Need for a New Regulatory Regime” (2016) 6:1 Notre Dame J of Intl & Comparative L 189 at 207.

<sup>34</sup> *Moon Agreement*, *supra* note 28, art 1(1).

<sup>35</sup> *Asteroid Mining: International and National Legal Aspects*, *supra* note 12 at 90.

<sup>36</sup> *Vienna Convention on the Law of Treaties*, 23 May 1969 1155 UNTS 331 art 34 (entered into force 27 January 1980).

<sup>37</sup> *Fisheries Case (United Kingdom v Norway)*, [1951] ICJ Rep 116 at 131.

<sup>38</sup> *Right of Passage Over Indian Territory (Portugal v India)*, [1960] ICJ Rep 6 39.

<sup>39</sup> *North Sea Continental Shelf Cases (Federal Republic of Germany v Denmark and Federal Republic of Germany v The Netherlands)*, [1969] ICJ Rep 3 at par 77.

<sup>40</sup> *Ibid* at para 71.

scholars have suggested these foundational principles have reached the status of *jus cogens*; a fundamental and overriding principle of international law.<sup>41</sup>

As mentioned above, Articles VI and VII of the OST govern state responsibility and liability.<sup>42</sup> The obligation under Article VI on states to authorize and continually supervise non-state entities is increasingly being implemented by states through adoption of national legislation and regulations governing space activities.<sup>43</sup> As no state has expressly protested and due to the increasingly widespread practice, some scholars have suggested this obligation has become a part of customary international law and is applicable to *all* states.<sup>44</sup> This is significant as it would mean that all states can be held responsible for any space activities by private or public actors after establishing a link between them.

Similarly, scholars have suggested that the obligations under Article VII governing international liability of a launching state may also amount to customary international law.<sup>45</sup> States have adopted national regulations addressing launching state liability that typically include licensing and insurance requirements.

Customary international law is an important category of space law. As various states joined COPUOS over time, it became increasingly difficult for the international community to negotiate binding treaties, the last one to enter force being the Moon Agreement of 1979.<sup>46</sup> Instead, there has been a shift towards developing ‘soft law’<sup>47</sup> – non-binding principles that may eventually become customary law through the development of state practice and *opinio juris*. Therefore, customary international law is the route through which key contemporary issues are and will be governed.

### 3 LEGAL PRINCIPLES

In addition to binding law, there are various ‘soft-law’ principles that are relevant to space mining. The UN General Assembly (UNGA), following the end of the treaty making period, passed what are known as the five declarations and legal principles. In addition, there are various resolutions adopted by the General Assembly and other documents that are relevant.

#### 3.1 UN DECLARATIONS AND LEGAL PRINCIPLES

The most relevant of UNGA’s five declarations and legal principles is the first and the final that emphasize the significance of the principles enshrined in the OST and the importance of international cooperation. The first of the five, the Declaration of Legal Principles<sup>48</sup>, contained various principles that should guide exploration and use of outer space that would later be

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<sup>41</sup> Ram Jakhu & Steven Freeland, “The Relationship Between the Outer Space Treaty and Customary International Law” (2016) SSRN Electronic Journal at 6 [*The Relationship Between Outer Space Treaty and Customary International Law*].

<sup>42</sup> *Outer Space Treaty*, *supra* note 8, art VI & VII.

<sup>43</sup> *Handbook of Space Law*, *supra* note 5 127-204.

<sup>44</sup> *The Relationship Between Outer Space Treaty and Customary International Law*, *supra* note 41 at 8.

<sup>45</sup> *The Relationship Between Outer Space Treaty and Customary International Law*, *supra* note 41 at 9.

<sup>46</sup> *Moon Agreement*, *supra* note 28.

<sup>47</sup> Steven Freeland, “For Better or for Worse? The Use of ‘Soft Law’ within the International Legal Regulation of Outer Space” (2011) 36: *Annals of Air & Space L* 409.

<sup>48</sup> *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, GA Res 1962(XVIII), UNGAOR, 18<sup>th</sup> Sess, Supp No 15, UN Doc A/RES/18/1962.

codified in the OST and the treaties that followed. The final is the “Benefits Declaration”<sup>49</sup> that focuses on international cooperation. Principles include states determining all aspects of their participation, emphasis on space faring nations promoting and foster international cooperation and strengthening of COPUOS in its role as a forum for the exchange of information.

The middle three include the “Broadcasting Principles”<sup>50</sup>, governing the use by states of artificial earth satellites for broadcasting, the “Remote Sensing Principles”<sup>51</sup>, regulating remote sensing of Earth from space and the “Nuclear Power Sources Principles”<sup>52</sup>, relating to the use of nuclear power in space.

### 3.2 RELATED RESOLUTIONS ADOPTED BY THE GENERAL ASSEMBLY

Resolution 1721 A and B (XVI)<sup>53</sup> emphasized the importance of international cooperation in the peaceful uses of outer space, that exploration and use should be for the benefit of all, and that the UN should provide a primary forum for cooperation.

Resolution 59/115<sup>54</sup> discusses the application of the concept of the “launching state”. It recommended that States implement national laws authorizing and providing for continuing supervision, submit information on their current practices regarding space objects ownership to COPUOS, and that COPUOS provide states with relevant information and assistance in developing national space law.

Resolution 62/101<sup>55</sup> provides recommendations for states regarding registering space objects. It is recommended that states become party to the Registration Convention, provide information to the Secretary-General on the registration of space objects such as the geostationary orbit location and basic orbital parameters and specifications to achieve complete registration and supervision of space objects.

### 3.3 SPACE DEBRIS MITIGATION GUIDELINES

The Space Debris Mitigation Guidelines<sup>56</sup> provides recommendations to minimize the harm to space as an environment and the risk poised to spacecraft and satellites in Earth orbit. The guidelines are as follows: limit debris released during normal operations, minimize the potential for break-ups during operational phases, limit the probability of accidental collision in orbit, avoid intentional destruction and other harmful activities, minimize potential for post-

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<sup>49</sup> *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*, GA Res 51/122, UNGAOR, 51<sup>st</sup> Sess, Supp No 49, UN Doc A/RES/51/122 (1996).

<sup>50</sup> *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*, GA Res 37/92, UNGAOR, 37<sup>th</sup> Sess, Supp No 51, UN Doc A/RES/37/92 (1982).

<sup>51</sup> *Principles Relating to Remote Sensing of the Earth from Outer Space*, GA Res 41/65, UNGAOR, 41<sup>st</sup> Sess, Supp No 53, UN Doc A/RES/41/65 (1986).

<sup>52</sup> *Principles Relevant to the Use of Nuclear Power Sources in Outer Space*, GA Res 47/68, UNGAOR, 47<sup>th</sup> Sess, Supp No 49, UN Doc A/RES/47/49 (1992).

<sup>53</sup> *International Cooperation in the Peaceful Uses of Outer Space*, GA Res 1721(XVI), UNGAOR, 16<sup>th</sup> Sess, Supp No 17 (1961).

<sup>54</sup> *Application of the Concept of the “Launching State”*, GA Res 59/115, UNGAOR, 59<sup>th</sup> Sess, Supp No 49, UN Doc A/RES/59/115 (2004).

<sup>55</sup> *Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects*, GA Res 62/101, UNGAOR, 62<sup>nd</sup> Sess, UN Doc A/RES/62/101 (2007).

<sup>56</sup> United Nations Office for Outer Space Affairs, *Space Debris Mitigation guidelines of the Committee on the Peaceful Uses of Outer Space* (United Nations, 2010).

mission break-ups resulting from stored energy, and limit the long-term presence and interference of spacecrafts and launch vehicles in low-Earth orbit after their mission.<sup>57</sup>

## 4 INTERNATIONAL MINING LAWS

International terrestrial mining laws, while not directly applicable to space mining, can provide context and important lessons on what has and has not been successful in the past. To this end, insight can be gleaned from the types of principles, governance structures, and modes of evolution of international regimes.

### 4.1 UN CONVENTION ON THE LAW OF THE SEA

The 1982 Convention on the Law of the Sea (UNCLOS) Part XI, amended by the 1994 New York Agreement,<sup>58</sup> is the international regime governing deep seabed mining.<sup>59</sup> Similar to the Moon Agreement, UNCLOS includes a provision indicating that deep seabed resources are the “common heritage of mankind”.<sup>60</sup> Further, Part XI of UNCLOS established the International Seabed Authority as the regulatory body for exploiting deep seabed minerals.<sup>61</sup>

Under the original provisions of Part XI, in order to exploit deep seabed minerals, a company would have to apply for a license from the Authority and request permission to mine two locations of equal value, one to be mined by the applicant company and the other to be reserved for the commercial arm of the Authority.<sup>62</sup> In addition, applicants were required to pay an initial fee of \$500,000 US and an annual fee of \$1 million US.<sup>63</sup> To ensure that the resources would benefit all, in addition to the fees, the Authority could at any time require a state to transfer mining technology to developing states that was not available through the open market, on fair commercial terms.<sup>64</sup> Decisions made by the Authority were based on a ‘one state, one vote’ policy, resulting in developing states having considerable influence within the Authority.<sup>65</sup>

Before the New York Agreement, Western states pressed for the creation of an alternative before UNCLOS came into force as the Convention wasn’t viewed as commercially friendly. The Reciprocating States Regime was adopted and was based on each state adopting similar national legislation to regulate deep seabed mining, beginning with the United States Deep Seabed Hard Mineral Resources Act of 1980.<sup>66</sup> In coming years, Germany,<sup>67</sup> the United Kingdom,<sup>68</sup> France,<sup>69</sup> and Italy<sup>70</sup> passed similar acts. Under this regime, companies must apply to a license from their state, pay a levy, and commit to not interfere with the activities of other states. While developed states had considerable dislike for Part XI of the Convention and had

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<sup>57</sup> *Ibid* at 2.

<sup>58</sup> *Agreement relating to the Implementation of Part XI of the UN Convention on the Law of the Sea of 10 December 1982*, 28 July 1994, 33 ILM 1309 (entered into force 28 July 1996) [*New York Agreement*].

<sup>59</sup> *United Nations Convention on the Law of the Sea*, 10 December 1982, 1883 UNTS 397 (entered into force 16 November 1994) [*UNCLOS*].

<sup>60</sup> *Ibid*, art 137.

<sup>61</sup> *Ibid*, art 156(1) and 157(1).

<sup>62</sup> *Ibid*, art 8.

<sup>63</sup> *Ibid*, annex III art 3(1) and 13(2).

<sup>64</sup> *Ibid*, art 144.

<sup>65</sup> *Ibid*, art 159 and 161.

<sup>66</sup> *Deep Seabed Hard Mineral Resources Act*, 30 USC § 1401 (2002).

<sup>67</sup> *Act on the Interim Regulation of Deep Seabed Mining*, 20 ILM 393 (1981), 21 ILM 832 (1982).

<sup>68</sup> *Deep Sea Mining (Temporary Provisions) Act*, 20 ILM 1219 (1981).

<sup>69</sup> *Law on the Exploration and Exploitation of Mineral Resources of the Deep Sea-Bed*, 21 ILM 808 (1982).

<sup>70</sup> *Law on the Exploration and Exploitation of Mineral Resources of the Deep Seabed*, 24 ILM 983 (1985).

adopted this alternative, there was a growing consensus that one universal system was needed to govern the deep seabed.<sup>71</sup>

In 1994, the New York Agreement was adopted by the UN General Assembly, amending Part XI of UNCLOS. The following changes were made: decision-making mechanisms gave states an impact proportionate to their economic interest and involvement there is no mandatory technology transfer; there is no subsidization in favour of particular states; new procedures were created to specify timetables for the approval of proposed exploration plans; and the parallel system requiring states to request two locations was abandoned.<sup>72</sup> Notably, the United States never ratified UNCLOS, even after the amendment.<sup>73</sup>

What lessons can we take away from UNCLOS? It is significant that both developed and developing states came to consensus that an international regime was ideal for governing mining in international areas (i.e., the deep seabed). Further, the amendment was significant for two reasons; it included an interpretation of the ‘common heritage of mankind’ principle that was in keeping with a free-market approach and was able to better balance the interest of developing and developed states.

## 4.2 THE ANTARCTIC TREATY SYSTEM

After various countries claimed sovereignty rights over parts of Antarctica and other states refused to recognize those claims, the Antarctic Treaty was enacted in 1959.<sup>74</sup> It is the foundation of the Antarctic Treaty System that has allowed for peaceful scientific research and environmental protection. It embraced principles similar to the OST: international cooperation, freedom of exploration, and being in the interest of all humankind.<sup>75</sup>

The Antarctic Treaty divides member nations into Consultative and non-Consultative parties. To be considered a Consultative party, a state must have undertaken “substantial research activity” in Antarctica.<sup>76</sup> Consultative parties were involved in negotiations whereas non-Consultative parties were allowed to attend but were not a part of the decision-making process.<sup>77</sup>

As the Antarctic Treaty did not address the issue of exploiting minerals, the Convention on the Regulation of Antarctic Mineral Resources, also known as the Wellington Convention, attempted to rectify this.<sup>78</sup> Negotiations took place between Consultative Parties beginning in 1982 and ending in 1988. While the text of the treaty was adopted by the negotiators, the Convention never came into force.<sup>79</sup> Article 62 stated that, in order for it to come into force, all Consultative Parties had to ratify it, which France and Australia opted not to do. Instead,

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<sup>71</sup> *Handbook of Space Law*, *supra* note 5 at 795.

<sup>72</sup> *New York Agreement*, *supra* note 58 ss V, VI, I.

<sup>73</sup> “Law of the Sea” (04 July 2022), online: *United Nations Treaty Collection* <[https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg\\_no=XXI-6&chapter=21&Temp=mtdsg3&clang=\\_en](https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&clang=_en)>.

<sup>74</sup> *The Antarctic Treaty*, 1 December 1959, 12 UST 794 (entered into force 23 June 1963).

<sup>75</sup> *Ibid*, preamble.

<sup>76</sup> *Ibid*, art IX(2).

<sup>77</sup> *Ibid*, art IX(1).

<sup>78</sup> *Convention on the Regulation of Antarctic Mineral Resource Activities*, 2 June 1988, 27 ILM 868.

<sup>79</sup> *Handbook of Space Law*, *supra* note 5 at 805.

three years later, the Protocol on Environmental Protection to the Antarctic was adopted.<sup>80</sup> In relation the mining, the Protocol stated, “any activity relating to mineral resources, other than scientific research, shall be prohibited”.<sup>81</sup>

Even though it never entered into force, what can we take away from the Wellington Convention and the governance of mining in Antarctica? Firstly, the emphasis on protecting the environment is significant and it contains various principles that are relevant to exploiting extraterrestrial resources. Secondly, it shows mistakes that should be avoided.

Provisions in the Wellington Convention included strict procedures for ensuring environmental protection. Another principle worth consideration is the mechanism for dispute resolution under Chapter VI. It included a strong mechanism for settling disputes, including a choice between the International Court of Justice or the Arbitral Tribunal.

In considering its failures, the Convention lacked economic incentive for mining operators and the process of approving applications through consensus was a considerable barrier. As well, the decision-making process was lengthy and slow moving. Considering these barriers, it is clear that an effective regime would include economic incentives, a reasonable timeline, efficient decision-making processes, and a method to ensure developing countries can participate.

## 5 ENVIRONMENTAL LAW

A common theme between mining law and outer space law is a concern for the environment, shared by industry and scholars alike. Space activities have detrimental effects, which often take place after the launch phase, and can include amongst others, space debris, nuclear contamination, and cross-contamination.<sup>82</sup> The international community has attempted to stem the tide of increasing environmental detriments in space. 'Long-term Sustainability of Outer Space Activities' has been a consideration at multilateral talks since 2010, and in 2016, COPUOS agreed to a set of guidelines for the sustainability of space activities.<sup>83</sup> In 2019, a new working group was established by the Scientific and Technical Committee under the same name, who's recently released 2022 report includes a work plan which emphasizes new guidelines for sustainable space activities, raising awareness and building capacity, and sharing of experiences, practices, and lessons from voluntary implementation of the adopted guidelines.<sup>84</sup> However, these reports seemingly do not consider international environmental law, though there is an allowance for the STSC to request assistance from the LSC.<sup>85</sup> There is some concern amongst academics that believe that steps taken at a national level will both be insufficient, and result in competitive disadvantages from industry launching in those areas.<sup>86</sup> Fortunately, there are solutions to these issues.

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<sup>80</sup> *Protocol on Environmental Protection to the Antarctic Treaty*, 4 October 1991, 30 ILM 1455 (entered into force 14 January 1998).

<sup>81</sup> *Ibid*, art 7.

<sup>82</sup> *Handbook of Space Law*, *supra* note 5 at 717.

<sup>83</sup> “Long Term Sustainability of Outer Space Activities” (2022), online: <[Long-term sustainability of outer space activities \(unoosa.org\)](https://www.unoosa.org/documents/e/202201/Long-term_sustainability_of_outer_space_activities_unoosa.org)>.

<sup>84</sup> “Draft Report, Annex IV, Report of the Working Group on the Long-term Sustainability of Outer Space Activities” (18 February 2022), online: <[AC105\\_C1\\_LTS\\_L01E.pdf \(unoosa.org\)](https://www.unoosa.org/documents/e/202201/AC105_C1_LTS_L01E.pdf)>.

<sup>85</sup> *Ibid*.

<sup>86</sup> *Ibid* at 759.



Article III of the Outer Space Treaty provides as follows: "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding."<sup>87</sup> In theory, this allows for international environmental law principles to be applied to outer space and some scholars advocate that it should be adopted and used to modify outdated space laws. However, it is important to recognize that in practice, most environmental law treaties are designed with the earth's environment in mind.<sup>88</sup> With this mind, there are several principles relevant to space mining which can be addressed: due diligence, sustainable development (discussed above), and in turn, intergenerational equity, amongst others.

Rather than broadly stating that international environmental law applies to outer space law, the adoption and widespread acceptance of these principles into the international space law regime natively can provide much-needed protection for the space environment presently, and in future generations. The principle of due diligence has, in a roundabout way, already been incorporated into the Outer Space Treaty. Due diligence holds that States fulfill their due diligence obligations when the State in question, causing the harm, "takes all due care – all measures expected from a 'good government' acting in consideration of its international responsibilities – not to cause damage".<sup>89</sup> Likewise, Article IX of the OST holds that States must conduct space activities with "due regard to the corresponding interests of all other States Parties".<sup>90</sup> Some academics believe, perhaps optimistically, that this obligation can be extrapolated to imply an obligation to respect the interests of other States Parties not to endanger the environment of outer space and of the Earth through space activities.<sup>91</sup> There are references to due diligence throughout the Space Debris Mitigation Guidelines of UN COPUOS, the COSPAR Planetary Protection Policy, and the recently released US National Orbital Debris Implementation Plan.

A driving factor in sustainable development is intergenerational equity, which states that the current generation holds the earth in trust for future generations, who should be treated fairly and considered in environmental lawmaking.<sup>92</sup> Canada's mining regimen has long considered sustainable development in the creation of new laws, as discussed below. In outer space law, Canada has an opportunity to directly address these principles in the adoption of national law which draws from its current mining regimen, making way for a new international acceptance of international environmental laws regarding sustainability in outer space activities.

## 6 COPUOS

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<sup>87</sup> *Outer Space Treaty*, *supra* note 8, Article III.

<sup>88</sup> *Handbook of Space Law*, *supra* note 5 at 761.

<sup>89</sup> *Handbook of Outer Space Law*, *supra* note 5 at 762.

<sup>90</sup> *Outer Space Treaty*, *supra* note 8, Article IX.

<sup>91</sup> *Handbook of Outer Space Law*, *supra* note 5 at 762-763 (see footnote 226).

<sup>92</sup> Atapattu, S. (2007). *Emerging Principles of International Environmental Law*, Leiden, The Netherlands: Brill | Nijhoff. P 221.

COPUOS was created by the UN General Assembly in 1959 to govern the exploration and use of space for the benefit of all humanity.<sup>93</sup> The Committee was instrumental in the creation of all five space law treaties.<sup>94</sup> The Committee also has two subsidiary bodies - the Scientific and Technical Subcommittee and the Legal Subcommittee - both established two years after the creation of COPUOS.<sup>95</sup> While space resource utilization is still a relatively new topic, recent discussions at the Legal Subcommittee have led to the formation of the Working Group on Legal Aspects of Space Resource Activities.<sup>96</sup>

Established at the sixtieth session of the Legal Subcommittee in 2021, the Working Group, chaired by Andrzej Misztal of Poland and Vice-Chaired by Steven Freeland of Australia, has seen widespread support from the majority of member States to COPUOS. While there have been disagreements about the proposed work plan, it is clear that a discussion surrounding the potential legal models governing exploration and utilization of space resources is both wanted and needed. At the sixty-first meeting of the Legal Subcommittee in 2022, the scope of the Working Group was addressed, and a Work Plan was adopted. There are two notable entries in that work plan, beyond the ongoing research and consultations:

1. In 2023, arrangements are to be made for a dedicated international conference under the auspices of the United Nations, with the scope and topics to be addressed at a later date by member states.
2. In 2027, the finalization of a set of initial recommended principles for such activities for the consideration of and consensus agreement by the Committee, followed by possible adoption by the General Assembly as a dedicated resolution or other action.<sup>97</sup>

A conference on space resource activities will allow the international community to thoroughly gather the views of private industry and third parties, and give all states an opportunity to participate.

The final output of the Working Group was a topic of debate throughout the iterations of its Work Plan and mandate. Early versions of the Work Plan allowed for the Working Group to finalize a set of initial recommended principles, “*and if appropriate, practices*”.<sup>98</sup> This last phrase was removed in the final report, and was likely a compromise point for certain states. This entry in the Work Plan demonstrates that this Working Group is not the end of discussions surrounding space resource utilization. It is likely that, if the United Nations decides to propose

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<sup>93</sup> “Committee On the Peaceful Uses of Outer Space” (2022), online: United Nations Office for Outer Space Affairs <<https://www.unoosa.org/oosa/en/ourwork/copuos/index.html>>.

<sup>94</sup> *Ibid.*

<sup>95</sup> *Ibid.*

<sup>96</sup> “Working Groups of the Committee and its Subcommittees” (2022), online: United Nations Office for Outer Space Affairs <<https://www.unoosa.org/oosa/en/ourwork/copuos/working-groups.html>>.

<sup>97</sup> “Five Year workplan and methods of work for the Working Group on Legal Aspects of Space Resource Activities, with participation of developing countries encouraged” (2022), online: Working Group on Legal Aspects of Space Resource Activities <<https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html>>.

<sup>98</sup> “Proposal on five-year workplan for the working group established under the Legal Subcommittee agenda item entitled “General exchange of views on potential legal models for activities in the exploration, exploitation, and utilization of space resources” (25 August 2021), online: Committee on the Peaceful Uses of Outer Space <[https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.unoosa.org%2Fdocuments%2Fdoc%2Fcopuos%2Fspace-resources%2FWG\\_Chair\\_and\\_Vice-Chair\\_Proposed\\_Work\\_Plan\\_for\\_Circulation\\_to\\_States\\_Members.docx&wdOrigin=BROWSELINK](https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.unoosa.org%2Fdocuments%2Fdoc%2Fcopuos%2Fspace-resources%2FWG_Chair_and_Vice-Chair_Proposed_Work_Plan_for_Circulation_to_States_Members.docx&wdOrigin=BROWSELINK)>.

any action, such as a dedicated resolution or treaty, discussions will continue far past the five-year mandate of the Work Plan. Furthermore, this entry in the Work Plan also demonstrates the inherent fragility of its structure; the sensitive and challenging global geopolitical situation, and the need for COPUOS to have full consensus on all decisions and recommendations, create a strenuous set of circumstances for the potential output of the Working Group. It is for this reason, amongst others, that the adoption of national legislation in the interim might be a worthwhile consideration.

The Working Group has not yet produced any tangible discussions or documents. However, its creation signals the introduction of a more widespread, multilateral discussion on the potential legal models to govern space resource activities. It will be worth following the Working Group as it progresses through its five-year Work Plan, as it is likely that its final recommended principles will greatly influence future models.

## 7 ARTEMIS ACCORDS

The Artemis Accords<sup>99</sup> are the most recent space-related multilateral agreements, headed by the United States of America, and originally signed by seven other States, Canada included.<sup>100</sup> They have now been signed by twenty-two States in total, with the most recent signatory being Saudi Arabia on July 14, 2022. The intent of the Accords is to establish a common set of principles, guidelines, and best practices to enhance space exploration.<sup>101</sup> There are 13 primary sections, as follows:

1. Purpose and Scope
2. Implementation
3. Peaceful Purposes
4. Transparency
5. Interoperability
6. Emergency Assistance
7. Registration of Space Objects
8. Release of Scientific Data
9. Preserving Outer Space Heritage
10. Space Resources
11. Deconfliction of Space Activities
12. Orbital Debris
13. Final Provisions

Given that the United States spearheaded the Accords, it is unsurprising that Section 10, on space resources, does not contain many provisions or recommended practices. The United States has long been against the pre-emptive formation of any governing body for space

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<sup>99</sup> “The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets and Asteroids for Peaceful Purposes” (13 October 2020), online (pdf): *NASA* <Artemis-Accords-signed-13Oct2020.pdf> [*Artemis Accords*].

<sup>100</sup> “Nasa, International Partners Advance Cooperation with First Signings of Artemis Accords” (30 October, 2020), online: <<https://www.nasa.gov/press-release/nasa-international-partners-advance-cooperation-with-first-signings-of-artemis-accords>>.

<sup>101</sup> *Artemis Accords*, *supra* note 99.

resources.<sup>102</sup> In Section 10, the signatories to the Accords affirm that the extraction of space resources does not inherently constitute national appropriation, an important reference to Article II of the OST. The Signatories also commit, in keeping with previous international obligations, to “informing the UN Secretary-General, as well as the public and international scientific community, of their space resource extraction activities.”<sup>103</sup>

The Accords are also careful to indicate that there are non-financial benefits to space resource usage, and related scientific data. The preamble notes that signatories recognize the “global benefits of space exploration and commerce”,<sup>104</sup> and Section 10, Space Resources, notes that the “utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations”. These provisions may stem from, or provide insight into, the OST’s “for the benefit of all” stipulation. It is likely that many States do not wish to see financial benefit sharing, and the release of scientific data, alongside a general understanding that space resource use benefits all, may be enough to be considered beneficial to all without financial incentives. Interestingly, however, Section 8 on Release of Scientific Data does not apply to private sector operations unless such operations are being conducted on behalf of a Signatory to the Accords. This stipulation may allow more protections, particularly from the international patent regime, for private actors wishing to step into the space commercialization sector.

The Artemis Accords are a step forward in the development of space mining law, and are an important recognition of the need for further guidance. They also help in understanding different signatory states’ interpretations of Article II of the OST, which has long been a topic of debate. Finally, they note the non-fiscal benefits of outer space exploration with commercial partners, which may factor into a final decision regarding the interpretation of the “for the benefit of all” statement in the OST.

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<sup>102</sup> “Statement by Emily Pierce, U.S. Representative to the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space” (28 March 2015), online: United Nations Office for Outer Space Affairs, Legal Subcommittee 2022 <15\_USA\_28\_March\_PM.pdf>.

<sup>103</sup> *Artemis Accords*, *supra* note 99.

<sup>104</sup> *Ibid.*

## CHAPTER 3: NATIONAL LAW

Over the last decade, four States – Japan, the United States, UAE, and Luxembourg) have developed national legislation relating to space resource extraction and utilization. These pieces of legislation have been controversial, with some States, notably the Russian Federation, Austria, and Venezuela, opposing their creation. Venezuela seems particularly opposed to their existence, stating that the current national frameworks have been created to complement legal loopholes and the lack of clarity of current legal instruments.<sup>105</sup>

While there may be concerns regarding, for example, their compatibility with the non-appropriation principle of the OST, these laws all defer to the States' respective obligations under international law above all else. The US Commercial Space Launch Competitiveness Act reads: "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."<sup>106</sup> Similarly, Luxembourg's Law of 20 July 2017 on the Exploration and Use of Space Resources states that an authorized operator may explore or use space resources in accordance with Luxembourg's international obligations.<sup>107</sup>

### 8 CANADA

Canada has not yet addressed its plans regarding a national space mining law. However, it is an important time to consider doing so, as the adoption of well-considered national legislation

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<sup>105</sup> "Declaración de la República Bolivariana de Venezuela en el 61° Período de Sesiones de la Sub-Comisión de Asuntos Jurídicos de la Comisión sobre la Utilización del Espacio Ultraterrestre con Fines Pacíficos" (last visited 10 July 2022), online:

<[https://www.unoosa.org/documents/pdf/copuos/lsc/2022/Statements/15\\_Venezuela\\_28\\_March\\_PM.pdf](https://www.unoosa.org/documents/pdf/copuos/lsc/2022/Statements/15_Venezuela_28_March_PM.pdf)>.

<sup>106</sup> *US Space Act*, *supra* note 18.

<sup>107</sup> "Law of 20 July 2017 on the exploration and use of space resources" (20 July 2017), online: <[Law of 20 July 2017 on the exploration and use of space resources. - Legilux \(public.lu\)](#)>.

on space resources could play an important role in the development of international law on this issue and could signal to Canadian private industries that there is public sector support for their ventures.

On the industry side, it is important for private actors to convey to the government the legal guidance on space resource extraction that they most need, so that such feedback forms part of the government's considerations for space resource legislation. They have already been doing so: from October 2020 to March 2021, the Canadian Space Agency (CSA) consulted with Canadians at large, particularly those with a stake in space resource utilization (SRU) and space exploration, and the thematic elements of the discussion mirror many of the recommendations we put forth.<sup>108</sup> Many participants in the report not only supported SRU, but also called for an update of Canada's regulatory space framework.<sup>109</sup> Given the rapidly developing technical landscape of space exploration, the need for national framework is clearly present. Regarding specifically SRU framework elements, industry representatives requested that Canada's national laws recognize that property rights may be held in extracted space resources. While the Artemis Accords indicate that signatories agree that the non-appropriation principle of the OST does not eliminate the possibility for property rights in space resources, it does not state that signatories inherently acknowledge these property rights.

Overall, in these consultations, many stakeholders stressed the importance of timely national and international guidance on SRU.<sup>110</sup> They also recognized that, if Canada adopted national legislation on SRUs, it could become a leader on this issue within international fora such as COPUOS.

## 9 UNITED STATES

The United States was the first country to pass national law regarding space resource utilization. The *US Commercial Space Launch Competitiveness Act*,<sup>111</sup> often referred to as the *Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act*, has several important recognitions regarding SRU, and it may provide insight into potential avenues for the development of Canada's national legislation in the area. While the act is broad, Title IV – Space Exploration and Utilization has three primary sections, all of which have the potential to become recognized and influential on a multilateral level.

§51302, Commercial exploration and commercial recovery,<sup>112</sup> reiterates the US position of encouraging and facilitating commercial exploration of space, stating that The President shall facilitate commercial exploration and recovery of space resources, and discourage government barriers to these commercial ends.<sup>113</sup> Besides ideation and stating of principles, this section also mandates that a report be undertaken which specifies the authorities necessary to meet international obligations of the US, and provide recommendations for the allocation of

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<sup>108</sup> “What We Heard report: Consultation on a framework for future space exploration activities” (30 July 2021), online: Government of Canada <<https://www.asc-csa.gc.ca/eng/astronomy/Moon-exploration/what-we-heard-report-consultation-framework-future-space-exploration-activities.asp>>.

<sup>109</sup> *Ibid.*

<sup>110</sup> *Ibid.*

<sup>111</sup> *US SPACE Act*, *supra* note 18.

<sup>112</sup> *Ibid.*

<sup>113</sup> *Ibid.*

responsibilities among federal agencies. While Canada does not share the same structure of government as the United States, it would likely benefit from a similar study.

§51303, Asteroid resource and space resource rights,<sup>114</sup> is the section which has drawn most of the international attention. The primary purpose of this section is to allow a US citizen to be entitled to asteroid resources (defined as a space resource found on or within a single asteroid, which includes water and minerals) in accordance with applicable law, which includes the international obligations of the United States. Thus, like other national laws, the allowance of property rights is deferential to the international legal framework. It is therefore possible for international obligations to supersede the allowance in this section, disallowing property rights over space resources, if international law develops in that manner. (However, as noted in this report, it is more likely that the COPUOS Working Group on Space Resources will move in the direction of supporting SRU within limits.)

The final portion of the Act is Sec. 403, Disclaimer of Extraterrestrial Sovereignty. This short paragraph carves out the US position on the non-appropriation principle, stating that "the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body." Thus, it is the position of the US that non-appropriation does not exclude property rights over extracted resources.

These three sections – on commercialization standards, property rights, and non-appropriation disclaimers - form the basis of the US framework. All of these themes would also need to be considered under a Canadian approach to SRU, in addition to other areas which warrant regulation, include launching restrictions, sustainable development, and insurance oversight. In coming to a Canadian position on all of these issues, Canada could become an international leader. In that process, Canada should consider where and how Canadian national mining law can inform its approach.

## 10 CANADIAN NATIONAL MINING LAW

Canada is already a leader in the mining sector.<sup>115</sup> The industry leader in potash production, Canada is also ranked amongst the top five in several other critical minerals and metals, including aluminum, diamonds, gold, uranium, and others, with a value of \$55.5 billion in 2021.<sup>116</sup> Beyond economics, Canada is also a global leader in sustainability; the Mining Association of Canada's (MAC) *Towards Sustainable Mining* (TSM) standard is a globally recognized sustainability program, mandatory for all MAC members and their Canadian operations.<sup>117</sup> It has been adopted by national mining chambers globally, including Australia, Norway, Spain, and others. This leadership has the potential to extend to the space resource extraction sector, particularly through the adoption of a comprehensive national framework. This framework can draw from Canadian mining law in three primary areas - environmental

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<sup>114</sup> *Ibid.*

<sup>115</sup> "Canada a Global leader in mining exploration, innovation and diversity: PwC report" (last accessed 24 July 2022), online: <<https://www.pwc.com/ca/en/media/release/canada-a-global-leader-mining-exploration-innovation-diversity-pwc-report.html>>.

<sup>116</sup> "Canadian Mineral Production Information Bulletin" (July 2022), online: Natural Resources Canada <<https://www.nrcan.gc.ca/science-data/science-research/earth-sciences/earth-sciences-resources/earth-sciences-federal-programs/canadian-mineral-production/17722>>.

<sup>117</sup> "Towards Sustainable Mining" (2022), online: The Mining Association of Canada <<https://mining.ca/towards-sustainable-mining/>>.

protection, health and safety regulations, and the future of Canadian mining law - keeping specific SRU considerations in mind.

As discussed, Canada's leadership in the mining sector includes sustainable development standards. Environmental protection can only be achieved with significant forethought to how human activities affect the environment at hand; in this case, the space environment. The TSM principles flow through Canadian mining regulations both provincially and federally, and mandate a number of requirements for the mining life cycle, many of which can be applicable to asteroid mining. These include environmental assessments<sup>118</sup>, prohibitions against the discharge of effluence into the environment,<sup>119</sup> permits and ongoing authorization,<sup>120</sup> and commitments towards mine closures.<sup>121</sup>

Looking to the above cited regulations, there are steps which can be taken to enhance the sustainability of SRU activities. Assessments should be undertaken prior to launch, and should consider the amount of minerals taken from a given resource location, how the extracted minerals will alter the trajectory of an asteroid, the result of the debris left over from the mining process, and more. Launch authorization should also be considered; though the launching state is inherently responsible for the activities of private actors, a method for granting permits and authorization, after proper assessments have been completed, will assist in the formalization of a regulatory framework while granting stability for industry.

The second area in which Canada has an opportunity to lead SRU legal development is the intersection of space and health law, which often do not overlap at the international level. While subsidiary treaties to the OST mention the health of astronauts, there is little to be said about the intersection of health law and the commercialization of outer space. Though many of the current plans for space resource utilization revolve around remote robots extracting and transporting the resources, it is not clear whether humans will be able to, or required to, participate in space in some manner. Therefore, it is worth considering the contributions Canadian mining may have to health regulations and SRU. In Canada, these regulations are largely governed under the jurisdiction of the provincial legislatures; however, the TSM provides for five indicators under the Safety and Health Protocol which concern safety and health management at the facility-level.<sup>122</sup> These include: 1. Commitments and Accountability, 2. Planning and Implementation, 3. Training, Behaviour, and Culture, 4. Monitoring and Reporting, and 5. Performance. Furthermore, it may become necessary for training requirements to be put in place, similar to those implemented by the Medical Council of Canada<sup>123</sup>

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<sup>118</sup> *Impact Assessment Act*, SC 2019, c 28, s 1.

<sup>119</sup> *Metal and Diamond Mining Effluent Regulations*, SOR 2002-222.

<sup>120</sup> "Environmental Code of Practice for Metal Mines" (2009), online: Environment Canada <<https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/code-practice-metal-mines.html>>.

<sup>121</sup> "Mining in Canada: overview" (1 September 2020), online: Thomson Reuters Practical Law <[https://uk.practicallaw.thomsonreuters.com/w-019-6669?transitionType=Default&contextData=\(sc.Default\)&firstPage=true#co\\_anchor\\_a767177](https://uk.practicallaw.thomsonreuters.com/w-019-6669?transitionType=Default&contextData=(sc.Default)&firstPage=true#co_anchor_a767177)>.

<sup>122</sup> "Safety and Health" (9 December 2020), online: The Mining Association of Canada <<https://mining.ca/towards-sustainable-mining/protocols-frameworks/safety-and-health/>>.

<sup>123</sup> "Medical Council of Canada" (last accessed 23 July 2022), online: <[www.mcc.ca](http://www.mcc.ca)>.



Canada's future of mining already includes indications of SRU acknowledgement as a potential pillar of the economy. The Canadian Minerals and Metals Plan (CMMP)<sup>124</sup> is an insightful look into the direction Canada intends to go regarding SRUs, and supports the view that national legislation is needed. In fact, page 28 of the CMMP explicitly states the need for the federal government to "develop a policy approach for mining new frontiers (extreme climates, deep mining, offshore, space) to foster investment and economic development."<sup>125</sup> It further emphasizes the need to look to other States such as the US and Luxembourg, which are establishing themselves as early movers in SRU; this movement could attract industry, investment, and talent, and could put Canada at the forefront of the space mining discussions, signaling a Canadian position which welcomes innovation, and supports technology transfers between sectors, within a clear approach to sustainability.<sup>126</sup>

There are not many industries in which Canada is a world leader. However, when an opportunity such as this presents itself, it is on the Canadian government to prepare and accept the already internationally recognized calibre of mining law present nationally, and help extend that recognition to the tangentially related industry of space mining. The environmental protections and health and safety regulations of the Canadian mining industry are ripe for adapting to SRU activities, and given the already recognized need for legal guidance at a national level, the time is right for action.

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<sup>124</sup> "Canadian Minerals and Metals Plan" (March 2019), online:

<[https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP\\_The\\_Plan-EN.pdf](https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP_The_Plan-EN.pdf)>.

<sup>125</sup> *Ibid.*

<sup>126</sup> *Ibid.*

## CHAPTER 4: PROPOSALS FOR DEVELOPING SPACE MINING LAW

With pressure from the US Commercial Space Launch Competitiveness Act and the continuing development within the private sector, governing space mining has become an increasingly popular topic amongst states, private actors and within the COPUOS forum. While there are many different approaches to developing a legal regime and opinions on what this final regime should look like, there has been considerable consensus that some sort of governance is necessary.<sup>127</sup> This section will address some of the most prominent approaches, assessing the merits of each and the likelihood of success.

### 11 A NEW UN TREATY

One of the most prominent and classic approaches is creating a new international treaty. This could mean adopting and negotiating an entirely new treaty or attaching it to the OST, such as an Additional Protocol. There are various reasons this approach is attractive; it would provide clear binding rules, would be inclusive of all member states of COPUOS and would have legitimacy.

The Vancouver Recommendations on Space Mining, published by the Outer Space Institute, support this approach.<sup>128</sup> These recommendations consider analogous regimes, recommends multilateral negotiations for an international regime and considers “the unilateral adoption of

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<sup>127</sup> Ian Christen & Christopher Johnson, “Putting the White House executive order on space resources in an international context” (27 April 2020), online: *The Space Review* [*Putting the White House Executive Order in Context*].

<sup>128</sup> “Vancouver Recommendations on Space Mining” (April 2020), online (pdf): *Outer Space Institute* <[http://www.outerspaceinstitute.ca/docs/Vancouver\\_Recommendations\\_on\\_Space\\_Mining.pdf](http://www.outerspaceinstitute.ca/docs/Vancouver_Recommendations_on_Space_Mining.pdf)>.

national legislation to be an inadequate response to the need to ensure that Space mining, wherever and whenever it occurs, does so in a safe and sustainable manner”.<sup>129</sup>

The Outer Space Institute also issued an open letter to the President of the UN General Assembly in August 2020 on the subject.<sup>130</sup> This letter detailed concerns about unilateral acts (such as the adoption of national SRU legislation) and the risk developing inconsistent domestic frameworks and marginalizing the input of developing states.<sup>131</sup> While not directly responding to unilateral acts, Professor von der Dunk expressed similar concerns, stating; “the worst-case scenario is a continuing fragmentation of the legal situation with certain countries going in one direction and others going in another”.<sup>132</sup> In support of implementing an international agreement, the letter continued to compare outer space to areas such as Antarctica and the high seas, which are all governed by international treaties that address resources.<sup>133</sup>

Professor von der Dunk calls the adoption of a new treaty the “optimum scenario”,<sup>134</sup> but is it realistic? The process of negotiating a new treaty has the potential to take decades and it is uncertain whether certain states, the private sector, and technology is willing to wait.<sup>135</sup> Further, treaties are challenging to amend and considering how quickly technology is advancing in this area, it would be difficult for the formal UN treaty making process to keep up with the constant developments (unless the treaty provided for some kind of regular update process that did not require treaty amendment). It is also important to consider the political reality that some states are unwilling to accept treaty obligations relating to space activities. Finally, the private sector (and civil society) would not have a seat at the decision-making table in a formal UN treaty negotiating process.

## 12 IMPLEMENTATION AGREEMENT FOR THE MOON AGREEMENT

A solution similar to the 1994 UNCLOS Agreement is an implementation plan for the Moon Agreement. There are considerable hurdles to this plan; the Moon Agreement is widely unpopular with no major spacefaring nation ratifying the treaty and it carries substantial political baggage.<sup>136</sup> Even so, some scholars and organizations are of the view that the Moon Agreement provides a logical way forward. With this in mind, the Space Treaty Institute published a Model Implementation Agreement for the Moon Agreement in 2021.<sup>137</sup>

The proposed Implementation Agreement is based on four organizing principles: the Agreement must be comprehensive and support all private activity; in exchange for private property rights, companies must accept public policy obligations; a governance process for

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<sup>129</sup> *Ibid* at 2.

<sup>130</sup> “International Open Letter On Space Mining” (August 2020), online (pdf): *Outer Space Institute* <<http://www.outerspaceinstitute.ca/docs/InternationalOpenLetterOnSpaceMining.pdf>> [*Open Letter*].

<sup>131</sup> *Ibid* at 1.

<sup>132</sup> *Asteroid Mining: International and National Legal Aspects*, *supra* note 12 at 100.

<sup>133</sup> *Open Letter*, *supra* note 130 at 1.

<sup>134</sup> *Asteroid Mining: International and National Legal Aspects*, *supra* note 12 at 100.

<sup>135</sup> Laura C Bird, “Soft Law in Space: A Legal Framework for Extraterrestrial Mining” (2022) 71:4 *Emory LJ* 802 at 826.

<sup>136</sup> *Moon Agreement Treaty Collection*, *supra* note 28.

<sup>137</sup> “Model Implementation Agreement for the Moon Treaty” (January 2021), online (pdf): *The Space Treaty* <<http://spacetreaty.org/implementationagreement.pdf>>.

making future decisions must be created; and this process must build upon and integrate current institutions and processes<sup>138</sup>.

While in favour of this agreement, Dennis O'Brien highlights some key challenges. First, there is no internationally recognized mechanism for granting property rights, and there is no consensus on what the non-appropriation principle means for space mining.<sup>139</sup> Second, while Article 11 of the Moon Agreement does not prohibit property rights, it does require international governance and granting of rights which would mean an international governing body would need to be established before mining begins.<sup>140</sup> Third, it contains the principle the 'common heritage of mankind' in Article 11.<sup>141</sup> Finally, one of the other controversial aspects of the Moon Agreement is Article 11.7, which requires some form of equitable sharing of the benefits of space resource extraction.<sup>142</sup> The Implementation Agreement defers a decision on whether or not this requires monetary sharing. Instead, States would create a governance process that would make this decision in the future.<sup>143</sup>

Would this plan work? There are various aspects of the Implementation Agreement that are viable. It balances interests of public and private actors appropriately and deals with the most pressing issue, regulation of mining, while deferring more controversial aspects that would need greater debate for later decision making. Further, the plan highlights that the principle of 'common heritage of mankind' does not have a legal definition and instead would be defined by the frame that the States choose to adopt.<sup>144</sup> However, the Moon Agreement carries significant political baggage that make it highly unlikely major spacefaring nations would ratify it in order to participate in the Implementation Agreement.

### 13 AMENDING THE OUTER SPACE TREATY

Similar to an implementation plan for the Moon Agreement, there are advocates for amending the OST as a means of addressing legal ambiguities. 'Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism'<sup>145</sup> proposes a two-component amendment: a domestic provision and an international provision.<sup>146</sup> The domestic provision would guarantee property rights on a first come, first serve basis to the State within its borders.<sup>147</sup> The international provision would focus on each ratifier of the OST guaranteeing private property rights in extracted minerals to the other OST state parties.<sup>148</sup>

There are many benefits to this proposal. First, resources have already been extracted under the OST in the past by states as samples for the purpose of scientific study rights and this did not

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<sup>138</sup> *Ibid* at 3.

<sup>139</sup> Dennis O'Brien, "Legal Support for the Private Sector: An Implementation Agreement for the Moon Treaty" (2020), 3:1 *J of Advances in Astronautics Sci & Tech* 49 at 50 [*Legal Support for the Private Sector*].

<sup>140</sup> *Ibid* at 52.

<sup>141</sup> *Ibid* at 52.

<sup>142</sup> *Outer Space Treaty*, *supra* note 8, art 11(7).

<sup>143</sup> *Legal Support for the Private Sector*, *supra* note 139 at 55.

<sup>144</sup> *Ibid* at 52.

<sup>145</sup> Kevin MacWhorter, "Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism" (2016), 40:2 *Wm & Mary Envtl L & Poly Rev* 645 [*Sustainable Mining*].

<sup>146</sup> *Ibid* at 672.

<sup>147</sup> *Ibid* at 672.

<sup>148</sup> *Ibid* at 673.

receive backlash from the international community.<sup>149</sup> The ambiguity is in if resources can be extracted by states and private actors for the purpose of commercial exploitation. By addressing this ambiguity and clearly allowing for private property rights in extracted resources beyond scientific samples, this proposal avoids creating a new treaty, provides support for the private sector and builds off of existing interpretations of space law.

Further, an amendment of this type could result in the move from mining on Earth to mining in space. This could be viewed as a benefit to the Earth environment, as it would decrease solid waste and destruction to ecosystems in concentrated areas.<sup>150</sup> This may be viewed as meeting the requirement “for the benefit of all mankind”, as it would have a positive environmental impact on Earth. However, if the mining in space is entirely for use in situ – such as mining asteroids for water or other minerals that are to be used to fuel spacecraft or to construct space structures.

As explained above, there is concern among some states about adopting a new treaty on space resources. There is similar concern among states with amending the treaty that is considered the foundation of space law.

## 14 BOTTOM-UP APPROACH

Beginning with discussions on terrestrial mining, there has been debate about a bottom-up versus a top-down approach. The proposals above reflect a top-down approach, focusing on using legally binding instruments and international governance. The bottom-up approach instead would evolve from the practice of states, organizations, and private actors. If these practices become widely accepted, they can become customary international law and/or be codified in an international treaty. Unlike the formal treaty making process, the bottom-up approach allows for development of non-binding soft law principles, guidelines, and standards to evolve towards consensus, and is far more flexible than a treaty.<sup>151</sup> This evolution can either be slow and eventual, almost immediate, or anywhere in between.

A notable example of a fast evolution from practice to legally binding international law is President Truman’s 1945 executive order proclaiming that the resources on the continental shelf contiguous to the United States belonged to the US.<sup>152</sup> Within five years, 30 additional states had made similar orders and a country’s exclusive right to resources on the continental shelf was recognized as customary international law.<sup>153</sup> This approach was then codified in the 1958 Convention on the Continental Shelf.<sup>154</sup> Another example is Sputnik, as discussed above,

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<sup>149</sup> See 16.3 16.3

<sup>150</sup> *Sustainable Mining*, *supra* note 145 at 647-649.

<sup>151</sup> *Putting the White House Executive Order in Context*, *supra* note 127.

<sup>152</sup> *Policy of the United States with Respect to the National Resources of the subsoil and Sea bed of the Continental Shelf*, 10 Fed Reg 12305 (1945).

<sup>153</sup> Alfred Analdia & Cristin Finnigan, “From the Truman Proclamation to the Artemis Accords: steps toward establishing a bottom-up framework for governance in space” (26 October 2020), online: *The Space Review* <<https://www.thespacereview.com/article/3932/1>>.

<sup>154</sup> *Convention on the Continental Shelf*, 29 April 1958, 499 UNTS 312 (entered into force 10 June 1964).

where the formation of customary international law on [say precisely what you mean here] was essentially immediate. In contrast to this quick evolution into custom, the practice of marine salvage began in ancient Greek and Roman civilizations, evolved into customary international law over hundreds of years, and was eventually codified by the 1989 International Convention on Salvage.<sup>155</sup>

Currently, there are various proposals and organizations contributing to a bottom-up framework. One important contributor is The Hague International Space Resources Governance Working Group, which adopted “Building blocks for the development of an international framework on space resource activities”.<sup>156</sup> The focus of the Building Blocks is not to provide a finished framework as, “the Working Group considered it neither necessary nor feasible to attempt to comprehensively address space resource activities in the building blocks”.<sup>157</sup> Instead, “space resource activities should be incrementally addressed at the appropriate time on the basis of contemporary technology and practices”.<sup>158</sup>

With this goal in mind, the Building Blocks proposes various principles and regulations that are designed to “lay the groundwork for international discussions on the potential development of an international framework”.<sup>159</sup> The objective of an international framework should “create an enabling environment for space resource activities” that is considerate of all parties’ interests. To achieve this, it is recommended that the framework should propose recommendations for national legislation, define the relationship between space resource extract an existing international law and promote best practices.<sup>160</sup> The Building Blocks continue to propose that an international framework should have principles that are consistent with international law (prevent disputes, promote sustainable technology), provide that there is international responsibility for space resource extraction, require supervision and authorization for non-government actors, define resource rights and safety zones and address methods of meeting the benefit-sharing requirement.<sup>161</sup>

NASA’s Artemis Accords could potentially further contribute to a bottom-up framework. The principles within the Accords are creating new modes of multilateral cooperation on details such as interoperability and safety on the lunar surface that have not been addressed before.<sup>162</sup> These could influence future practices among all spacefaring states.

Looking at UNCLOS and the ISA, the top-down approach took over 30 years to come into force and there has yet to be any commercial mining of the deep seabed. A bottom-up approach has the potential to more efficiently develop binding international law than the traditional formal treaty making process. While the evolution of customary international law is taking place, there are domestic principles and regulations that states can look to for guidance. Further,

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<sup>155</sup> *International Convention on Salvage*, 28 April 1989, 1953 UNTS 193 (entered into force 14 July 1996).

<sup>156</sup> The Hague International Space Resources Governance Working Group, “Building blocks for the development of an international framework on space resource activities” (12 November 2019), online (pdf): *Universiteit Leiden* <<https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht--en-ruimterecht/space-resources/final-bb.pdf>>.

<sup>157</sup> *Ibid* at 1.

<sup>158</sup> *Ibid* at 1.

<sup>159</sup> *Ibid* at 1.

<sup>160</sup> *Ibid* at 1.

<sup>161</sup> *Ibid* at 2-5.

<sup>162</sup> *Artemis Accords*, *supra* note 99.

a bottom-up approach allows for private sector, civil society, and academia to contribute to the framework.

## 15 COSMOPOLITAN NATIONAL APPROACH

In their article entitled ‘Breaking the Deadlock in the Space Mining Legal Debate’, Nikola Schmidt and Martin Svec propose “properly designed national legislation reflecting cosmopolitan ideals” to address gaps in the legal space resources framework.<sup>163</sup> Very similar to the bottom-up approach, this proposal focuses on the cosmopolitan ideals enshrined in the OST.

As there is no specific legal regime for space mining, scholars and States are left to interpret existing treaties and customary international law. One of the most difficult and controversial principles to interpret is Article I of the OST, that exploration and use of outer space shall be carried out for “the benefit and in the interest of all countries”.<sup>164</sup> The vagueness of this principle has allowed for various interpretations – with some arguing that it obliges developed states to share technology with developing states, others arguing that it requires sharing benefits equitably, and yet others arguing that every use of outer space that furthers scientific development and supports exploration meets the requirement.<sup>165</sup> Svec and Schmidt believe that the treaty does not limit the ways to comply with the principle and instead that it is left to the creativity of national legislation.

This flexibility in interpretations allows for each State to decide for itself how its national legislation and policies will contribute to the benefit of all. Svec and Schmidt propose one method: a redistribution of some of the space resource extraction profits toward the 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs).<sup>166</sup> These SDGs were agreed upon by the UN member states and address what are considered to be humanities’ greatest challenges.<sup>167</sup>

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<sup>163</sup> Nikola Schmidt & Martin Svec, “Breaking the Deadlock in the Space Mining Legal Debate” (2022) 10:2 *New Space* 115 at 115 [*Breaking the Deadlock*].

<sup>164</sup> *Outer Space Treaty*, *supra* note 8, art I.

<sup>165</sup> *Breaking the Deadlock*, *supra* note 163 at 118.

<sup>166</sup> *Ibid* at 124.

<sup>167</sup> “Do you know all 17 SDGs?” (last accessed 22 August 2022) online: *The United Nations* <<https://sdgs.un.org/goals>>.

## CHAPTER 5: FINAL RECOMMENDATIONS

The most promising method for developing an international framework for governing space mining is a bottom-up approach comprised of passing national legislation and cooperating internationally to create soft-law principles. This section will outline recommendations for industry and Canada at the national and international level.

### 16 INDUSTRY

While the legal framework continues to develop, industry can contribute by setting aside a portion of profits to later be used for the ‘benefit of all’ and cooperating with the Canadian government on national legislation and funding. Further, industry can continue to progress scientifically through testing towards mining Asteroid Bennu.

#### 16.1 ADDRESSING THE BENEFIT PRINCIPLE

In keeping with the cosmopolitan approach recommended to states, industry should take a proactive step and address how space mining can be for the benefit of all. While Article I of the OST is vague, leaving room for creativity to address how space mining could be for the benefit of all, the simplest step industry could take is to set aside a portion of any profits to be held in trust until there is an international body governing how those proceeds should be used (or clear international law that such a step is not needed).

It could, and has, been argued that Article I is fulfilled by any mission in space exploration because such missions benefit all by progressing science and technology.<sup>168</sup> Further, asteroid mining for water to be used as jet fuel and other minerals to be used *in situ*, could be seen as benefiting all as it would facilitate deep space exploration. Asteroid mining for minerals to replace terrestrial mining could also be interpreted as benefiting all due to the reduced environmental impacts on Earth.<sup>169</sup> On the other hand, Article I has also been interpreted by some developing countries as requiring developed countries to assist them or to share the benefits of mining.<sup>170</sup>

The vagueness of Article I has resulted in many different interpretations, and while all have merit, the ones in keeping with the spirit of the treaty are more likely to lead to consensus. Relying solely on a passive-benefit stance, such as all scientific development indirectly benefiting all, may leave industry exposed to after-the-fact claims of illegality, which is why it is safest to plan for this possibility by setting aside a portion of profits.

#### 16.2 CAN INDUSTRY DO IT ALONE?

While scholars and states debate what a legal regime should look like and how it should come about, industry is pushing forward. What if a legal regime is not in place when industry is ready

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<sup>168</sup> *Breaking the Deadlock*, *supra* note 163 at 118.

<sup>169</sup> *Sustainable Mining*, *supra* note 145 at 647-649.

<sup>170</sup> *Breaking the Deadlock*, *supra* note 163 at 118.



to begin mining? What would happen if a private actor unilaterally went to mine Bennu on its own? Who would stop them?

Article VI of the OST requires states to bear international responsibility for activities in space by both government and non-government actors.<sup>171</sup> This is a result of compromise between the US, which wanted space activities to be open to the private sector, and the Soviet Union, which wanted it to be restricted to states only.<sup>172</sup> While private actors can conduct activities in space, their actions are imputable to the state as if it were the states' own actions, unlike ordinary international law under which states are held responsible only vicariously for activities of private actors.<sup>173</sup>

Further, under Article VI, “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”.<sup>174</sup> While states have an obligation under the treaty to authorize and supervise all private actors' activities in space, it is up to States how they meet this obligation.<sup>175</sup> Most states opt to perform this function carefully due to the risk of liability under Article VI and the Liability Convention.

Article VI is usually understood, at a minimum, to require some sort of licensing and national regulations.<sup>176</sup> However, some individuals take a contrasting interpretation. Before the House Committee on Science, Space, and Technology, Subcommittee on Space, in 2017 Laura Montgomery, proprietor at Ground Based Space Matters and adjunct professor of space law at the Catholic University of America, testified that Congress should not regulate new commercial space activities.<sup>177</sup> She argued that Article VI imposes no international obligation as it gives discretion to the state to decide which activities it authorizes and supervises and further, that most obligations apply only to states and not to private actors.<sup>178</sup>

In response to this, John Goehring of the US Department of Defense stated that under Article VI, there is an affirmative obligation to authorize and supervise all space activities.<sup>179</sup> While he agrees with Montgomery that this obligation should not lead to micromanaging all activities in space, he claims that “activities such as launch, re-entry, operation and control of objects in orbit” must be overseen by states.<sup>180</sup> He points to a 2013 UN General Assembly resolution passed by consensus that provides “recommendations on national legislation relevant to the peaceful exploration and use of outer space”.<sup>181</sup> The resolution recommended that the scope of activities “targeted by national regulatory frameworks” may include the launch or re-entry of

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<sup>171</sup> *Outer Space Treaty*, *supra* note 8, art VI.

<sup>172</sup> Bin Cheng, “Article VI of the 1967 Space Treaty Revisited: ‘International Responsibility’, ‘National Activities’, and ‘The Appropriate State,’” (1998) 26:1 *J of Space L* 7 at 14.

<sup>173</sup> *Ibid* at 15.

<sup>174</sup> *Outer Space Treaty*, *supra* note 8, art VI.

<sup>175</sup> John S Goehring, “Properly Speaking, the United States Does Have an International Obligation to Authorize and Supervise Commercial Space Activity” (2018) 78 *The Air Force L Rev* 101 at 105 [*Properly Speaking*].

<sup>176</sup> *Ibid* at 106.

<sup>177</sup> US, *Regulating Space: Innovation, Liberty, and International Obligations: Hearing before the Subcommittee on Space Committee on Science, Space and Technology*, 115th Cong (2017) at 22 (Laura Montgomery).

<sup>178</sup> *Ibid* at 26-27 and 35-36.

<sup>179</sup> *Properly Speaking*, *supra* note 175.

<sup>180</sup> *Ibid* at 111-112.

<sup>181</sup> *Recommendations on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space*, GA Res 68/74, UNGAOR, 68th Sess, UN Doc A/68/423 (2013).

objects, operation of a launch or re-entry and control of space objects in orbit.<sup>182</sup> Second, the resolution also indicated that “conditions for authorization should be consistent with the international obligations of States”.<sup>183</sup> Lastly, it also recommended that the mechanism for state supervision does not need to be a regulatory scheme but could be “a more general reporting requirement”.<sup>184</sup>

For private actors in Canada, launch activities are regulated by the Canadian Aviation Regulations<sup>185</sup> and the Canadian Aeronautics Act.<sup>186</sup> Currently, the CSA does not have any launch system capabilities on Canadian soil.<sup>187</sup> Instead Canada relies on other countries to launch spacecraft, although Transport Canada has been working towards a framework for a launching regime and wants to become a launching state.<sup>188</sup>

Considering these requirements and Article VI, a private actor cannot launch a mining mission without the support of a launching state. Further, there are other reasons why industry actors should discuss their potential plans in the space mining sector with the Canadian government. This can assist in gaining guidance from the government about how best to move forward in keeping with Canada’s international obligations. Additionally, the CSA may be able to provide funding to assist with the development of technologies beneficial for all. Similar funding has been granted for past works, and it is likely that there will be more funding opportunities available in the future.<sup>189</sup> Furthermore, collaboration with the CSA allows for the Canadian government to better understand the current technical framework and feasibility of these projects, incentivizing the government to more thoroughly address the legal landscape in a timely fashion.

### 16.3 SCIENTIFIC DEVELOPMENT AND WHAT A DEMONSTRATION MISSION COULD ACHIEVE

While industry contributes to development of a framework, testing and research can continue. Unlike resource extraction for profit, there is consensus among the international community that collecting samples from celestial bodies and use of space for scientific development is in keeping with space law.

The Apollo Moon landing brought back 842 pounds of Moon rock and these samples are strictly controlled by NASA for the use of “research, education and public display”.<sup>190</sup> Since

<sup>182</sup> *Ibid* at 2.

<sup>183</sup> *Ibid* at 2.

<sup>184</sup> *Ibid* at 3.

<sup>185</sup> SOR/96-433.

<sup>186</sup> *Aeronautics Act*, RS 1985, c A-2.

<sup>187</sup> Marc Boucher, “Is Canadian Sovereignty at Risk by a Lack of an Indigenous Satellite Launch Capability?” (4 January 2011), online: *SpaceQ* <[https://spaceq.ca/is\\_canadian\\_sovereignty\\_at\\_risk\\_by\\_a\\_lack\\_of\\_satellite\\_launching\\_capability/](https://spaceq.ca/is_canadian_sovereignty_at_risk_by_a_lack_of_satellite_launching_capability/)>.

<sup>188</sup> Marc Boucher, “Canada Decides it Wants to be a Launching State” (29 October 2020), online: *SpaceQ* <<https://spaceq.ca/canada-decides-it-wants-to-be-a-launching-state/>>.

<sup>189</sup> “The Canadian Space Agency funds novel ideas for potential Moon infrastructure”. (3 June 2022) online: <[The Canadian Space Agency funds novel ideas for potential Moon infrastructure | Canadian Space Agency \(asc-csa.gc.ca\)](https://www.asc-csa.gc.ca/en/2022/06/03/the-canadian-space-agency-funds-novel-ideas-for-potential-moon-infrastructure)>.

<sup>190</sup> “Lunar Sample Allocation Guidebook” (September 2012) at 1, online (pdf): *NASA* <[https://www-curator.jsc.nasa.gov/lunar/sampreq/lunarallochndbk-jsc06090\\_revf\\_2012.pdf](https://www-curator.jsc.nasa.gov/lunar/sampreq/lunarallochndbk-jsc06090_revf_2012.pdf)>.

then, missions aimed at collecting samples such as NASA's OSIRIS-Rex,<sup>191</sup> Japan's Hayabusa2<sup>192</sup> and China's Chang'e 5 have not been challenged as violating international law. Further, NASA has solicited four private companies to collect lunar samples.<sup>193</sup> Test runs, tests in GEO, or a feasibility study for the purpose of scientific development conducted by industry will be in keeping with international law.

Further, there is opportunity for industry to influence international law with a demonstration mission. On September 10, 2020, NASA requested quotations from companies to go to the Moon, collect a sample of lunar regolith of between 50 to 500 grams<sup>194</sup>, and transfer property rights to NASA.<sup>195</sup> Private companies would not have to bring the sample back to Earth; instead, they would provide imagery of the collected sample, data to identify the location, and a transfer of ownership would happen in outer space.<sup>196</sup> Since then, NASA has announced that four companies have been selected for this task; Lunar Outpost, Masten Space Systems, ispace Europe, and ispace Japan.<sup>197</sup> These contracts total \$25,001, with the smallest proposed collection fee being \$1 by Lunar Outpost.<sup>198</sup>

The goal of this request is not monetary; it is to set a precedent for extracting and transferring space resources. On the subject, NASA Administrator Jim Bridenstine said "we're going to buy some lunar soil for the purpose of demonstrating that it can be done".<sup>199</sup> Further, with this venture, NASA is trying to "make sure that there is a norm of behavior that says that resources can be extracted and that we're doing it in a way that is in compliance with the Outer Space Treaty".<sup>200</sup>

What is the legal effect of NASA planning to purchase a sample from a private actor? NASA's plan is that this will establish "a critical precedent that lunar resources can be extracted and purchased from the private sector in compliance with Article II and other provisions of the Outer Space Treaty".<sup>201</sup> One interpretation is that NASA is trying to demonstrate that the private entities gain private property rights in the extracted sample which can then be transferred to NASA.<sup>202</sup> Another interpretation is that it would be the exchange of money for the *service* of extracting resources (as opposed to the exchange of money for the resource itself).<sup>203</sup> This latter interpretation is more likely to be in alignment with principles of the Outer

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<sup>191</sup> "Osiris-Rex" (last visited 15 July 2022), online: *NASA* <<https://www.nasa.gov/osiris-rex>>.

<sup>192</sup> "Hayabusa2, Japan's mission to Ryugu and other asteroids" (last visited 15 July 2022), online: *The Planetary Society* <<https://www.planetary.org/space-missions/hayabusa2>>.

<sup>193</sup> "NASA Selects Companies to Collect Lunar Resources for Artemis Demonstrations" (last visited 15 July 2022), online: *NASA* <<https://www.nasa.gov/press-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations>> [*NASA Selects Companies*].

<sup>194</sup> It is important to highlight that this is a *small sample* being removed.

<sup>195</sup> "NASA wants to buy moon rocks" (11 September 2020), online: *CNN Business* <<https://edition.cnn.com/2020/09/11/tech/nasa-lunar-resources-scn/index.html>>.

<sup>196</sup> "*NASA Selects Companies*, *supra* note 193.

<sup>197</sup> *Ibid.*

<sup>198</sup> *Ibid.*

<sup>199</sup> "NASA offers to buy lunar samples to set space resources precedent" (10 September 2020), online: *Space News* <<https://spacenews.com/nasa-offers-to-buy-lunar-samples-to-set-space-resources-precedent/>>.

<sup>200</sup> *Ibid.*

<sup>201</sup> "NASA's Lunar Exploration Program Overview" (September 2020) at 28-29, online (pdf): *NASA* <[https://www.nasa.gov/sites/default/files/atoms/files/artemis\\_plan-20200921.pdf](https://www.nasa.gov/sites/default/files/atoms/files/artemis_plan-20200921.pdf)>.

<sup>202</sup> This would be in line with US domestic law. For further information, see Chapter 3: National Law section 9 United States.

<sup>203</sup> Rossana Deplano, "The Artemis Plan: A Paradigm Shift in International Space Law?" (2022) 46:1 *J of Space L* at 23-24.

Space Treaty because NASA and other state entities have collected resource samples for scientific study before, which have subsequently been considered to be the property of the collecting state.<sup>204</sup> One unique aspect of the proposed NASA missions would be that the private sector is collecting the sample first, on behalf of the state entity. There is a potential second unique aspect: if the samples will be considered to be purely commercial, then this would be the first time such a commercial act has taken place. If the samples will they be studied for scientific purposes, then this would not be unique, given the space resource samples collected and studied for scientific purposes to date. While the collected regolith of NASA's current plan is being referred to as a 'sample', there is no indication of what it will be used for.

There is an opportunity to build on the precedent NASA is planning to set, but it is important to highlight key differences between collecting Moon rock samples and mining an asteroid. Firstly, the time, monetary investment, and technology required to extract water from an asteroid will be significantly different from that of collecting Moon rock. Luna 16, an uncrewed Soviet mission that was the first robotic probe to return a sample of lunar soil to Earth, took a total of twelve days.<sup>205</sup> In comparison, OSIRIS-REx launched on September 8, 2016 to collect a sample from Bennu and is not set to return to Earth until September 24, 2023, over seven years later.<sup>206</sup> This seven year mission is only to collect a sample from the asteroid and does not include the complexity of extracting water in space. Further, there is more potential for response and political unease as, while states collecting and owning scientific lunar and asteroid samples is not controversial, the extraction and ownership of water and minerals from celestial bodies by commercial entities is a controversial and active topic on an international scale.

Keeping all of the above in mind, CSA and NASA could build on NASA's precedent to further push the needle on space mining. The CSA and NASA could request quotations for a private actor to take an extracted water sample from an asteroid. Similar to the NASA Moon sample contracts, this could be interpreted as exchanging money for the *service* of extracting resources and thus less objectionable. Further, as only taking a small sample is recommended, this mission (characterized as a pilot or test run) would also be in line with international space law as it would be for scientific development and research. At the same time, if such a mission did not receive significant backlash, it could contribute to a legal framework that includes private actors. While the mission itself would only establish that private actors have the ability to carry out service contracts on behalf of states for the purpose of scientific study, it is a step towards a commercial space mining that could be built upon.

In addition to influencing international law, industry conducting pilot missions can contribute by demonstrating how close asteroid mining is to being a possibility and thus put necessary pressure on the international community to create regulations on space mining.

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<sup>204</sup> NASA's plan to purchase moon rock from private actors has not raised serious objection, likely because moon rocks have been in the property of NASA and the US government since returning some from the Apollo mission. See, "Lunar Sample Allocation Guidebook" (September 2012) at 1, online (pdf): NASA <[https://www-curator.jsc.nasa.gov/lunar/sampreq/lunarallochndbk-jsc06090\\_revf\\_2012.pdf](https://www-curator.jsc.nasa.gov/lunar/sampreq/lunarallochndbk-jsc06090_revf_2012.pdf)>.

<sup>205</sup> William Burrows, *This New Ocean: The Story of the First Space Age* (New York: Modern Library, 1999) at 432.

<sup>206</sup> "Mission Operations" (last visited 17 August 2022), online: OSIRIS-REx Asteroid Sample Return Mission <<https://www.asteroidmission.org/objectives/mission-operations/>>.

## 17 NATIONAL

National legislation on space resources may be controversial with some State actors, but can still provide much-needed security for the private sector, and can contribute to the development of soft law at an international level. It is worth noting that before Canada moves forward with national legislation, it would be beneficial for there to be an all-of-government process in place in order to align government (both federal and provincial), industry, academia and society. As described above, there are three primary elements which can be attributed to all current national approaches to space mining from other States: commercialization standards, property rights, and non-appropriation disclaimers. These elements, if adopted by additional states, can contribute to the international bottom-up approach. Furthermore, given Canada's internationally-recognized mining industry and regulations position Canada to be an industry leader on space resources environmental standards, health policies, and regulation. The adoption of a national law regarding space mining would provide security for the private sector, and can attract innovation, investment, and talent to Canadian industry.

In addition to providing regulations on commercialization standards, recognizing property rights domestically and a non-appropriation disclaimer, it is important for Canada to address how space resource extraction would be for the benefit of all, as per Article I of the OST. Past national legislation from the US and others has not addressed this aspect, resulting in criticism from the international community.<sup>207</sup> It is recommended that in the national legislation, Canada highlight the indirect benefits of space mining. These include potential environmental benefits from replacing terrestrial mining, enabling deep space exploration by rocket fuel in space, and facilitating construction by using minerals *in situ*.

In addition to highlighting the passive benefits, states have an opportunity to pass national legislation that would require a set tax or portion of profits to be collected from private companies and held in a national trust. This would allow for national control, regulation, and standardization. Legislation reflecting cosmopolitan ideals can provide security to industry actors while still ensuring that resource extraction is benefiting and “in the interest of all countries, irrespective of their degree of economic or scientific development”<sup>208</sup>, not just those that are advanced enough to prosper on their own.

## 18 INTERNATIONAL

Coupled with adopting national legislation, Canada should continue to cooperate through international fora to develop non-legally binding principles, otherwise known as ‘soft law’, to contribute to a bottom-up approach. While national legislation can contribute to a bottom-up approach, international coordination is needed to provide security regarding recognizing property rights internationally and to mitigate risks. Scholars advocating for this approach encourage States to engage in discussions through international fora, primarily COPUOS. The Working Group on Legal Aspects of Space Resource Activities is one such forum that “invites submissions from interested stakeholders in space resource utilization, including but not

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<sup>207</sup> *Supra* note 10.

<sup>208</sup> *Outer Space Treaty*, *supra* note 8, art I.

limited to, academia, civil society, public and private sector entities”.<sup>209</sup> The Working Group has released a five-year workplan that aims to finalize a set of initial recommended principles.<sup>210</sup> The Building Blocks discussed above were submitted as a working paper to the Working Group in 2020.<sup>211</sup> This forum is an excellent opportunity to develop soft law principles to guide States, academia, and the private sector.

Canada is already signatory to the Artemis Accords. As previously discussed, the Artemis Accords will likely be beneficial to the creation of soft law contributing to a bottom-up approach. The principles found therein have been adopted by some of the most influential spacefaring States, and will almost certainly, in some form, be addressed at an international, multilateral level. Many of the principles found in the Accords are reiterations and commitments to principles already found in the OST, and are largely beneficial to humankind, and the future sustainable development of outer space resources.

There are various principles and regulations that would be beneficial for the international community to consider. Some of the most pressing are regarding property rights, how SRU will be for the benefit of all, and regulations for resolving disputes and safely mining. Further, discussions at the international level provide an opportunity to correctly approach new challenges with information gleaned from past analogous regimes. From the Antarctic Treaty, the importance of environmental protection was significant and should be when considering space mining. In the case of UNCLOS, the International Seabed Authority (ISA) was tasked with creating the specific environmentally conscious measures, which ultimately can be summarized as environmental impact assessments to be completed during mining.<sup>212</sup> This is not enough to ensure sustainable development, and has drawn widespread criticism from academics.<sup>213</sup> Working towards the goal of establishing principles governing space mining that balances the need of public and private actors and are effective, the international community must not repeat the same mistakes seen surrounding UNCLOS, as it may halt SRU legal development or lead to detrimental environmental effects. Moving forward, the best way for the international community to govern space mining is through carefully thought through soft law principles that take into account the mistakes of past analogous regimes, the needs of both private and public actors and the ever-changing scientific field.

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<sup>209</sup> “Working Group on Legal Aspects of Space Resource Activities” (last visited 15 July 2022), online: *United Nations Office for Outer Space Affairs* < <https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html>>.

<sup>210</sup> *Ibid.*

<sup>211</sup> *Ibid.*

<sup>212</sup> “Recommendations for the guidance of contractors for assessment of the possible environmental impacts arising from exploration for marine minerals in the Area” (30 March 2020), online: International Seabed Authority Legal and Technical Commission <26ltc-6-rev1-en\_0.pdf>.

<sup>213</sup> See: Jennifer M Durden et al., “Environmental Impact Assessment process for deep-sea mining in ‘the Area’” (2018) 87 Mar.Pol’y 194. See also: Malcolm R Clark et al., “Environmental Impact Assessments for deep-sea mining: Can we improve their future effectiveness?” (2020) 114 Mar.Pol’y.

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