

# THE ARTEMIS PLAN: A PARADIGM SHIFT IN INTERNATIONAL SPACE LAW?

*Rossana Deplano\**

## ABSTRACT

The Artemis Plan is the current United States program for human space exploration. This article examines the extent to which the Artemis Plan is compatible with the Outer Space Treaty, especially in relation to space resource utilization. It shows that the normative underpinnings of the Artemis Plan rest on consolidated State practice initiated by the International Space Exploration Coordination Group in 2007. The latter introduced the concept of sustainable exploration, which requires the utilization of space resources in support of the goals of human exploration missions. By embracing the concept of sustainable exploration, the Artemis Plan encourages the development of a novel form of conduct in the application of the Outer Space Treaty without generating any new interpretation of its provisions. Consequently, current State practice supporting space resource utilization as part of sustainable exploration missions constitutes a subsidiary means of interpretation—not an authentic interpretation—of the Outer Space Treaty. By developing the concept of sustainable exploration as a legal construct with unique features, this article makes an original contribution to the international space law literature. It also shows that, by clarifying aspects related to space resource utilization (including property claims on space resources), the Artemis Plan contributes to the development of international space law. However, it does not represent a paradigm shift.

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\* Associate Professor in Law and Co-Director of the Centre for European Law and Internationalisation, University of Leicester (UK).

## I. INTRODUCTION

In September 2020, the United States (US) National Aeronautics and Space Administration (NASA) publicly released the *Lunar Exploration Program Overview* (Artemis Plan).<sup>1</sup> Aimed at strengthening American leadership in space exploration, the Artemis Plan's goal is to build a sustainable human presence on the Moon by the end of this decade through a series of long-term, potentially multi-year, missions.<sup>2</sup> Sustainable exploration missions are human exploration missions that do not require regular life support and logistic supplies from Earth. Space resource utilization is central to this model of exploration. For example, oxygen and hydrogen can be extracted from the Moon's soil to provide drinking water, serve as a radiation shield on the human habitats and produce propellant, which is essential for space travel.<sup>3</sup> If successful, the model of space exploration envisioned in the Artemis Plan will be adapted for the sustainable exploration of other destinations in the solar system, such as Mars.<sup>4</sup>

The adoption of the Artemis Plan raises far-reaching questions about the rights and duties of States under international space law by stating that the lawfulness of space resource utilization stems from its instrumental role in performing sustainable exploration missions. The Outer Space Treaty<sup>5</sup> – a treaty of principles which is widely recognized as the magna carta of outer space<sup>6</sup> – does not refer to either sustainable exploration or space resources. The Moon

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<sup>1</sup> See NAT'L AERONAUTICS & SPACE ADMIN., ARTEMIS PLAN: NASA'S LUNAR EXPLORATION PROGRAM OVERVIEW 9 (Sept. 2020), [https://www.nasa.gov/sites/default/files/a\\_toms/files/artemis\\_plan-20200921.pdf](https://www.nasa.gov/sites/default/files/a_toms/files/artemis_plan-20200921.pdf) [hereinafter Artemis Plan].

<sup>2</sup> *Id.* at 9.

<sup>3</sup> *Global Space Exploration Strategy: The Framework for Coordination*, INT'L SPACE EXPL. WORKING GRP. (May 2007), [https://www3.nd.edu/~cneal/Lunar-L/Global\\_Exploration\\_Strategy.pdf](https://www3.nd.edu/~cneal/Lunar-L/Global_Exploration_Strategy.pdf) [hereinafter ISECG Strategy].

<sup>4</sup> Artemis Plan, *supra* note 1, at 8.

<sup>5</sup> See Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (entered into force on Oct. 10, 1967) [hereinafter Outer Space Treaty].

<sup>6</sup> See Gennady M. Danilenko, *Outer Space and the Multilateral Treaty-Making Process*, 4 HIGH TECH. L.J. 217, 219 (1989) (arguing the Outer Space Treaty "provides the basis for all subsequent treaties and other legal instruments relating to outer space"); see also Vladlen S. Vereshchetin & Gennady M. Danilenko, *Custom as a Source of International Law of Outer Space* 13 J. SPACE L. 22 (1985) (arguing the Outer Space Treaty establishes the foundations of the international legal order in outer space).

Agreement,<sup>7</sup> which requires States to establish an international regime for the exploitation of the Moon's resources "as such exploitation is about to become feasible," has been ratified by only 18 States: none of which are spacefaring.<sup>8</sup> At the United Nations (UN) Committee on the Peaceful Uses of Outer Space (COPUOS), delegations remain divided as to the lawfulness of space resource utilization in the absence of a bespoke regime.<sup>9</sup> The literature is also divided into two camps: some scholars maintain that the exploitation of space resources is lawful under the Outer Space Treaty<sup>10</sup> while others reject the argument.<sup>11</sup> When fully implemented, the Artemis Plan will set a precedent for future interpretations of the Outer Space Treaty, unavoidably influencing the development of international space law in relation to space resource utilization.

Is the Artemis Plan a reinterpretation of the Outer Space Treaty? Does sustainable exploration represent a paradigm shift in international space law? This article examines the concept of sustainable exploration as formulated in the Artemis Plan and supported by State practice with a view to establishing the extent to which its governing principles conform with both the Outer Space Treaty and established theories of international space law. The article is divided into three sections. Section II provides a brief overview of the Artemis Plan and how its adoption has been received in the scholarly literature. Section III examines the concept of sustainable exploration, which the Artemis Plan endorses. It shows that, as a distinctive form of exploration, it is governed by a unique set of principles originating in State practice rather than treaty law. Taking stock of the analysis, Section IV evaluates the impact of the

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<sup>7</sup> Agreement Governing the Activities of States on the Moon and Other Celestial Bodies art. 11(5), Dec. 5, 1979, 1363 U.N.T.S. 22 [hereinafter Moon Agreement].

<sup>8</sup> Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcommittee on Its Sixty-First Session, *Status of International Agreements Relating to Activities in Outer Space as at 1 January 2022*, 10 U.N. Doc. A/AC.105/C.2/2022/CRP.10 (2022)[hereinafter Status of UN Agreements].

<sup>9</sup> See Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Eighth Session, U.N. Doc. A/AC.105/1203, at 32-36 (2019)[hereinafter LSC 2019 Report].

<sup>10</sup> See Stephen Gorove, *International Space Law in Perspective – Some Major Issues, Trends and Alternatives*, 181(3) *Recueil Des Cours* 374 (1983) (arguing that the non-appropriation principle does not apply to the resources of celestial bodies).

<sup>11</sup> See Steven Freeland & Ram Jakhu, *Article II*, in 1 COLOGNE COMMENTARY ON SPACE LAW I 44, 53-54 at ¶ 39 (Stephan Hobe, Bernhard Schmidt-Todd & Kai-Uwe Schrogl eds., 2009).

Artemis Plan on the development of international space law in relation to treaty interpretation and law-making. Section V provides some concluding remarks.

## II. OVERVIEW OF THE ARTEMIS PLAN

The document outlining the Artemis Plan is divided into three brief chapters. Chapter 1 describes sustainable exploration missions as “a globally unifying endeavor” requiring a robust participation from industry and international partnerships.<sup>12</sup> It recognizes that services provided by commercial actors, such as payload delivery and surface operations, are essential to meet the goal of sending humans back to the Moon.<sup>13</sup> Finally, it states that its mission design builds on the work of the International Space Exploration Working Group (ISECG), which is an international mechanism established in 2007 to foster international collaboration and coordination among space agencies in human exploration matters with a view to facilitating the sustainable human exploration of Mars by the 2030s.<sup>14</sup>

Chapter 2 details the three phases of the mission exploration architecture.<sup>15</sup> Artemis I, which is currently taking place, consists of a series of uncrewed missions to test the Space Launch System (SLS) rocket and return scientific lunar data.<sup>16</sup> Artemis II, scheduled for 2023, is the first SLS crewed mission; it will send four astronauts on a 10-day journey aboard the Orion capsule to test the trajectory for insertion into lunar orbit and reinsertion into high-Earth orbit.<sup>17</sup> Finally, Artemis III will send the first woman and the first person of color to the surface of the Moon in 2024, thus paving the way for future crewed lunar missions.<sup>18</sup> In order to enable a sustained human presence on the Moon beyond 2024, the operationalization of Artemis III requires the presence of a lunar orbiting space station (the Gateway) and a lunar base to conduct surface operations (the Artemis Base Camp).<sup>19</sup>

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<sup>12</sup> See Artemis Plan, *supra* note 1, at 11.

<sup>13</sup> See *id.* at 10.

<sup>14</sup> *Id.* at 12; ISECG Strategy, *supra* note 3, at 5.

<sup>15</sup> See generally Artemis Plan, *supra* note 1, at 15.

<sup>16</sup> *Id.*

<sup>17</sup> *Id.* at 15, 18-20.

<sup>18</sup> *Id.* at 15, 20.

<sup>19</sup> *Id.* at 20.

Chapter 3 states that the Artemis missions are simulations of future sustainable missions to Mars, which will require the exploitation of space resources to reduce the dependence on supplies delivered from Earth.<sup>20</sup> To that end, it envisions a robust participation from private commercial actors in the development and operation of the technology required for *in situ* resource utilization as well as the right of NASA to purchase the extracted resources, as needed, “in compliance with Article II and other provisions of the Outer Space Treaty.”<sup>21</sup> However, it does not elaborate on the details of the transaction, including the conditions for securing compliance with the Outer Space Treaty. Nor does it clarify whether the transaction entails property claims over space resources on the part of NASA or the commercial actors.

The Artemis Plan also includes the Artemis Accords, a set of 13 provisions delineating the framework of legal principles guiding the operations of the actors involved in the implementation of the Artemis missions, including space mining operations. Effectively, States wishing to enter into collaboration with NASA for the purposes of lunar exploration missions, as identified in the Artemis Plan, must commit in advance to abide by the principles set forth in the Artemis Accords. Section 1 thereof states that “[t]he principles set out in these Accords are intended to apply to civil space activities conducted by the civil space agencies of each Signatory.”<sup>22</sup>

Scholars have raised concerns about the compatibility of the Artemis Accords with international space law. Mosteshar writes that by creating property rights over space resources, the Artemis Accords extend the jurisdiction of the United States to outer space in violation of the principle of non-appropriation set forth in Article II of the Outer Space Treaty.<sup>23</sup> Therefore, as “a retrograde step undermining the Outer Space Treaty,” the Artemis Accords may create international friction and conflict, eventually endangering the principle of peaceful uses of outer space contained in Article IV of

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<sup>20</sup> *Id.* at 26.

<sup>21</sup> *Id.* at 29.

<sup>22</sup> The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids, § 1, NASA, <https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf> (last visited Sept. 15, 2022) [hereinafter Artemis Accords].

<sup>23</sup> Sa’id Mosteshar, *Artemis: The Distant Accords*, 42 J. SPACE L. 591, 598-99 (2020).

the Outer Space Treaty.<sup>24</sup> In addition, Tronchetti and Hao write that States which are simultaneously signatories of the Artemis Accords and parties to the Moon Agreement, such as Australia, are endorsing incompatible approaches to the exploitation of space resources.<sup>25</sup> Wright Nelson further argues that the Artemis Accords “mark the end of multilateralism in space lawmaking.”<sup>26</sup>

The scholarly reaction prompted by the adoption of the Artemis Accords raises far-reaching questions about the rights and duties of States under international space law. Yet, as formulated, such criticism downplays the significance of the Artemis Plan for the future of human space exploration and the development of international space law. By focusing exclusively on the Artemis Accords, it neglects the role they serve in implementing the sustainable exploration vision detailed in the Artemis Plan. At the same time, the absence of any conceptualization about the normative underpinnings of sustainable exploration in the Artemis Plan makes the Artemis Accords appear as the legal basis of the whole exploration project.

The Artemis Accords are an integral part of the Artemis Plan. They indicate “how” to implement the Artemis missions through partnerships. They acknowledge the lawfulness of space resource utilization under the Outer Space Treaty without providing a rationale for that. Conversely, the Artemis Plan clarifies “why” space resource utilization is lawful by presenting it as a necessary component of the concept of sustainable exploration. However, it does not elaborate on the latter other than stating that the Artemis Plan’s mission design reflects a multilateral effort.<sup>27</sup>

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<sup>24</sup> *Id.* at 602-603. See also Chris Borgen, *The Artemis Accords: One Small Step for Space Law?*, OPINIO JURIS (May 8, 2020), <http://opiniojuris.org/2020/05/08/the-artemis-accords-one-small-step-for-space-law/>. *Contra see* Rossana Deplano, *The Artemis Accords: Evolution or Revolution in International Space Law?*, 70 INT’L & COMP. L. QUART. 799 (2021) (arguing that the Artemis Accords conform with the Outer Space Treaty).

<sup>25</sup> Fabio Tronchetti & Hao Liu, *Australia’s Signing of the Artemis Accords: A Positive Development or a Controversial Choice?*, 75 AUSTRALIAN J. INT’L AFFAIRS 243, 244-46 (2021). See also Jack Wright Nelson, *The Artemis Accords and the Future of Space Law*, AM. SOC’Y INT’L L. INSIGHTS (Dec. 10, 2020), <https://www.asil.org/insights/volume/24/issue/31/artemis-accords-and-future-international-space-law> (arguing that “[i]t is unclear whether the Moon Agreement can coexist with the Accords” especially in relation to the issue of utilization of natural resources).

<sup>26</sup> *Id.* (also describing the Artemis Accords as “U.S.-led and privately negotiated”). For similar remarks, see Tronchetti & Hao, *supra* note 25, at 4.

<sup>27</sup> See Artemis Plan, *supra* note 1, at 12.

Originating in ISECG practice rather than treaty law,<sup>28</sup> the term sustainable exploration expounds the relationship between the legal entitlements and the practical needs of space actors engaging in human exploration missions. Entitlements derive from the provisions of the Outer Space Treaty, especially Article I, which establishes the freedom of all States to explore and use outer space. For example, the Artemis Plan recognizes that the Artemis missions must comply with the Outer Space Treaty.<sup>29</sup> Similarly, the Artemis Accords state that they operationalize the provisions of the Outer Space Treaty.<sup>30</sup> Needs are elements of the mission architecture essential to achieve the stated mission goal. For example, space resource utilization is a need, since it is essential to conduct long-duration missions without receiving regular supplies from Earth.<sup>31</sup> As a distinctive form of exploration, sustainable exploration is governed by a defined set of principles and the Artemis Plan should be interpreted in the light of such principles. They are detailed in Section III below.

### III. GOVERNING PRINCIPLES OF SUSTAINABLE EXPLORATION

In 2010, the ISECG concluded a study aimed at providing a model for designing multilateral architectures to enhance cooperation and coordination among space agencies.<sup>32</sup> Known as the Reference Architecture for Human Lunar Exploration, the document marks “the first time that a group of space agencies has worked closely together to create a conceptual definition of a complex

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<sup>28</sup> *Global Exploration Roadmap*, INT’L SPACE EXPL. WORKING GRP. (Jan. 2018), [https://www.globalspaceexploration.org/wordpress/wp-content/isecg/GER\\_2018\\_small\\_mobile.pdf](https://www.globalspaceexploration.org/wordpress/wp-content/isecg/GER_2018_small_mobile.pdf) [hereinafter GER 2018].

<sup>29</sup> Artemis Plan, *supra* note 1, at 29.

<sup>30</sup> Artemis Accords, *supra* note 22, at preamble.

<sup>31</sup> Artemis Plan, *supra* note 1, at 10; Artemis Accords, *supra* note 22, § 10(2) (“[T]he extraction and utilization of space resources... should be executed... in support of safe and sustainable space activities”); EUR. SPACE AGENCY, ESA SPACE RESOURCES STRATEGY (May 22, 2019), [https://sci.esa.int/documents/34161/35992/1567260390250-ESA\\_Space\\_Resources\\_Strategy.pdf](https://sci.esa.int/documents/34161/35992/1567260390250-ESA_Space_Resources_Strategy.pdf) (“in situ resource utilization offers the potential to locally derive what is needed for living and working in space”)[hereinafter ESA SPACE RESOURCES STRATEGY].

<sup>32</sup> INT’L SPACE EXPLORATION COORDINATION GROUP, REFERENCE ARCHITECTURE FOR HUMAN LUNAR EXPLORATION, (July 2010), <https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/ISECG-LunarReferenceArchitecture-July-2010.pdf> [hereinafter ISECG Reference Architecture].

human exploration mission scenario.”<sup>33</sup> Without using the term sustainable exploration, the Reference Architecture refers to core principles aimed at guiding the design of multilateral mission scenarios.<sup>34</sup> Such principles have been subsequently developed in the Global Exploration Roadmap,<sup>35</sup> where the term sustainable exploration appears for the first time: “The Global Exploration Roadmap reflects the international effort to define feasible and sustainable exploration pathways to the Moon, near-Earth asteroids, and Mars,”<sup>36</sup>

None of the ISECG documents, including the Global Exploration Roadmap, are binding.<sup>37</sup> However, they have been adopted by consensus<sup>38</sup> and are intended to influence the practice of the ISECG States by fostering collaboration to achieve shared goals.<sup>39</sup> Therefore, they are evidence of State practice.<sup>40</sup> In addition, following the adoption of the Global Exploration Roadmap, several States have published lunar space exploration programs aimed at enabling long-term, sustainable human exploration missions on the Moon and other celestial bodies.<sup>41</sup> For example, in addition to the US Artemis Plan, on June 16, 2021, China and Russia published their joint lunar exploration program, which includes a set of guidelines for international cooperation in the exploration of the Moon and, in

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<sup>33</sup> *Id.* at 3.

<sup>34</sup> *Id.*

<sup>35</sup> GER 2018, *supra* note 28.

<sup>36</sup> INT’L SPACE EXPLORATION COORDINATION GROUP, GLOBAL EXPLORATION ROADMAP, iii (Sept. 2011), [https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/GER\\_2011.pdf](https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/GER_2011.pdf) [hereinafter GER 2011].

<sup>37</sup> *Terms of Reference*, INT’L SPACE EXPLORATION COORDINATION GROUP, [https://www.globalspaceexploration.org/wordpress/?page\\_id=50](https://www.globalspaceexploration.org/wordpress/?page_id=50) (last visited Sept. 15, 2022) (“The adoption of these Terms of Reference does not create any legal obligations on the part of the ISECG Participating Agencies.”).

<sup>38</sup> *Id.* at section III.2.2 (“ISECG operates by consensus”).

<sup>39</sup> GER 2018, *supra* note 28, at 30 (“While this document does not create commitments of any kind on behalf of any of the participants, the Global Exploration Roadmap and the coordination that supports its development are important tools for achievement of a global, strategic, coordinated, and comprehensive approach to space exploration.”).

<sup>40</sup> Frans G. von der Dunk, *Customary International Law and Outer Space*, in RE-EXAMINING CUSTOMARY INTERNATIONAL LAW 346, 348 (Brian D. Lepard ed., 2017) (pointing out that “much ‘state practice’ consists of ‘paper practice’ rather than actual activities in outer space”).

<sup>41</sup> Jeff Foust, *NASA report outlines vision for long-term human lunar exploration*, SPACENEWS, (Apr. 3, 2020), <https://spacenews.com/nasa-report-outlines-vision-for-long-term-human-lunar-exploration/>.

perspective, Mars.<sup>42</sup> Similarly, the European Space Agency (ESA) has elaborated a Space Resources Strategy to explore celestial bodies in the solar system.<sup>43</sup>

The following subsections examine the principles governing sustainable exploration as they have emerged from the abovementioned instances of State practice and evaluate them against established theories of international space law.

#### A. *Exploration in Pursuit of Peaceful Purposes*

The first principle is the pursuit of sustainable exploration for peaceful purposes and through peaceful means. The Artemis Accords assert that all activities falling within its remit “should be for exclusively peaceful purposes.”<sup>44</sup> Similarly, the Guide for Partnership outlining the goals and structure of the proposed Sino-Russian lunar research station require international partners to conduct activities aimed at “the peaceful exploration and use of the Moon.”<sup>45</sup> The outcomes of sustainable exploration missions must also be peaceful.<sup>46</sup> For example, the ISECG Strategy states that sustainable space exploration must contribute to common peaceful goals.<sup>47</sup>

The principle of peaceful exploration strengthens the provision of Article IV(2) of the Outer Space Treaty that outlaws the use of the Moon and other celestial bodies for military purposes.<sup>48</sup> State practice further shows that this principle of peaceful uses of outer space has never been challenged, even before the adoption of the Outer Space Treaty.<sup>49</sup> Turning to scholarly literature on this notion, there are two schools of thought. Some argue that the principle of

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<sup>42</sup> *International Lunar Research Station (ILRS) Guide for Partnership*, CHINA NAT'L SPACE ADMIN., (June 6, 2021), <http://www.cnsa.gov.cn/english/n6465652/n6465653/c6812150/content.html> [hereinafter IRLS].

<sup>43</sup> ESA Space Resources Strategy, *supra* note 31.

<sup>44</sup> Artemis Accords, *supra* note 22, § 3.

<sup>45</sup> IRLS, *supra* note 42, at 2.

<sup>46</sup> Mohammad Saiful Islam, *The Sustainable Use of Outer Space: Complications and Legal Challenges to the Peaceful Uses and Benefit of Humankind*, 9 BEIJING L. REV. 235, 237 (2018).

<sup>47</sup> ISECG Strategy, *supra* note 3, at 23.

<sup>48</sup> *See also* Moon Agreement, *supra* note 7, art. III(1) (mirroring the provision of Article IV(2) of the Outer Space Treaty).

<sup>49</sup> WILFRED JENKS, SPACE LAW 45 (1965) 45 (arguing that “[n]o responsible statesman appears to have called into question the general principle of the exclusive dedication of space to peaceful and scientific purposes”).

peaceful uses entails a complete demilitarization of outer space.<sup>50</sup> Others, such as Ogunbanwo and Lachs, interpret the expression “peaceful uses” as meaning non-aggressive uses of outer space. They argue that the peaceful or non-peaceful nature of space activities depends on the purpose of the activity carried out, whether conducted by civilian or military personnel.<sup>51</sup>

Sustainable exploration missions are currently supported by space agencies in collaboration with private actors.<sup>52</sup> Hence, they do not envision to have any sort of military component embedded within the nature of their activities.<sup>53</sup> However, should future mission designs contemplate the involvement of military personnel, the aim of the exploration missions would remain peaceful.<sup>54</sup> Furthermore, this approach indicates that the exploration aims pursued by the Artemis Plan conform with the principle of peaceful uses of outer space contained in Article IV(2) of the Outer Space Treaty. Additionally, these principles also align with the Tokyo Principles for International Space Exploration, which COPUOS endorsed in 2018.<sup>55</sup>

### *B. Affordable Exploration*

The second principle of sustainable exploration is affordability. This principle stems from the recognition by States that no single space agency has sufficient economic resources to perform long-term human exploration missions beyond low-Earth orbit in their

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<sup>50</sup> Kai-Uwe Schrogl & Julia Neumann, *Article IV*, in COLOGNE COMMENTARY, *supra* note 11, 70, at 82 ¶ 45; BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 521 (1997).

<sup>51</sup> Ogunsola O. Ogunbanwo, INTERNATIONAL LAW AND OUTER SPACE ACTIVITIES 32 (1975); Manfred Lachs, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 97 (Tanja Masson-Zwaan & Stephan Hobe eds., 2010).

<sup>52</sup> Artemis Accords, *supra* note 22, § 2(1).

<sup>53</sup> Kanishka Singh, *Military Component in Draft Space Law Faces Opposition*, SUNDAY GUARDIAN LIVE, (Mar. 5, 2016), <https://www.sundayguardianlive.com/news/3578-military-component-draft-space-law-faces-opposition>.

<sup>54</sup> *Space2030: Space as a Driver for Peace—World Leaders Proclaim Innovative Space Diplomacy as the New Frontier for Peace on Earth*, SPACE.COM, (Sept. 26, 2018), <https://www.space.com/41940-space2030-space-as-a-driver-for-peace.html>.

<sup>55</sup> UNCOPUOS, Conference Room Paper by Japan, UN Doc. A/AC.105/2018/CRP.15, Annex II, at 4 (June 20, 2018) [https://www.unoosa.org/res/oosadoc/data/documents/2018/aac\\_1052018crp/aac\\_1052018crp\\_15\\_0\\_html/AC105\\_2018\\_CRP15E.pdf](https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_15_0_html/AC105_2018_CRP15E.pdf) (requiring that space exploration is conducted only for peaceful purposes).

entirety.<sup>56</sup> As a result, there are two aspects to this principle – namely, the collaborative nature of exploration missions (Subsection *i*) and cost considerations related to the feasibility of their implementation (Subsection *ii*).

### i. Collaborative Exploration Missions

Current sustainable exploration plans are collaborative in nature.<sup>57</sup> For example, the Artemis Plan envisions human exploration missions as a collective endeavor.<sup>58</sup> The entire Artemis Accords are a set of principles of cooperation in human space exploration and so is the Guide for Partnership of the Sino-Russian lunar research station. Similarly, the Global Exploration Roadmap refers to sustainable exploration missions as “partnerships” with both the public and the private sector.<sup>59</sup>

This aspect of the principle of affordability aligns with Articles III and X of the Outer Space Treaty, which require that exploration activities promote international cooperation and understanding.<sup>60</sup> Kapustin writes that international cooperation is the idea underlying the entire Outer Space Treaty.<sup>61</sup> However, the scope of the required degree of international cooperation under the Outer Space Treaty is debated among scholars.<sup>62</sup> Some argue that it refers only

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<sup>56</sup> *Id.* (stating that exploration missions should be “implementable, evolvable and affordable”); ISECG Strategy, *supra* note 3, at 12 (“Space is an unforgiving environment and no nation has the resources to take on all of its challenges at once.”); GER 2011, *supra* note 36, at 28 (“No one agency can invest robustly in all the needed technology areas that represent key challenges for executing human missions beyond low-Earth orbit.”); COMM. ON THE PEACEFUL USES OF OUTER SPACE, Note by the Secretariat, U.N. Doc. A/AC.105/1168, at 6 ¶ 45 (“No single space agency can invest heavily in all the areas of technology that are needed.”)[hereinafter Note by the Secretariat].

<sup>57</sup> *The Possibilities of Sustainable Space Exploration*, OPEN ACCESS NEWS (Oct. 6, 2021), <https://www.openaccessgovernment.org/sustainable-space-exploration/121866/>.

<sup>58</sup> Artemis Plan, *supra* note 1, at 9.

<sup>59</sup> GER 2018, *supra* note 28, at 10.

<sup>60</sup> Outer Space Treaty, *supra* note 5, arts. III & X.

<sup>61</sup> Anatoly Kapustin, *Article X*, in COLOGNE COMMENTARY, *supra* note 11, 183, at 184 ¶ 1.

<sup>62</sup> Kuan-Wei Chen, *Outer Space is not the “Wild West;” There Are Clear Rules for Peace and War*, MSN, (Sept. 13, 2022), <https://www.msn.com/en-gb/money/technology/outer-space-is-not-the-wild-west-there-are-clear-rules-for-peace-and-war/ar-AA11MCSn>.

to large scale operations in outer space,<sup>63</sup> while others maintain that it applies to all aspects of exploration activities—including the dissemination of information about space activities and due regard for the activities of others in outer space.<sup>64</sup> The Artemis Plan appears to conform with the more extensive interpretation, since the Artemis Accords regulate aspects of international collaboration such as information sharing<sup>65</sup> and interoperability.<sup>66</sup>

It may also be argued that, by entertaining collaboration with the private sector, the Artemis Plan exceeds the scope of application of the principle of international collaboration under the Outer Space Treaty.<sup>67</sup> Several statements in the Artemis Plan describe the contribution of private actors as strictly instrumental to facilitating scientific research.<sup>68</sup> For instance, selected commercial actors will provide logistics supply launches to the Gateway<sup>69</sup> and payloads to the surface of the Moon.<sup>70</sup> NASA has also concluded investments through public-private partnerships to commission the manufacture and operation of equipment for *in situ* resource utilization.<sup>71</sup> The underlying assumption is that utilizing lunar resources will lead to “safer, more efficient operations” by reducing the dependence on supplies from Earth.<sup>72</sup>

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<sup>63</sup> A.S. Piradov, INTERNATIONAL SPACE LAW: CURRENT PROBLEMS AND PROGRESS 106 (Boris Belitsky ed., 2000) (1976) (specifically referring to human space exploration missions).

<sup>64</sup> Valen Vereshchetin, SPACE, COOPERATION, LAW 29 (1974), [https://archive.org/details/nasa\\_techdoc\\_19750005614](https://archive.org/details/nasa_techdoc_19750005614); CHENG, *supra* note 50, at 252.

<sup>65</sup> Artemis Accords, *supra* note 22, § 5.

<sup>66</sup> *Id.* Similarly, the Global Exploration Roadmap acknowledges that pursuing interoperability initiatives, such as agreeing on international standards and common interfaces “will ensure different systems and nations can work together in exploring the solar system.” INT’L SPACE EXPLORATION COORDINATION GROUP, GLOBAL EXPLORATION ROADMAP, (Aug. 2013), [https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/GER\\_2013.pdf](https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/GER_2013.pdf) [hereinafter GER 2013].

<sup>67</sup> Sean Potter & Cheryl Warner, NASA, *International Partners Advance Cooperation with First Signings of Artemis Accords*, NASA (Oct. 13, 2020), <https://www.nasa.gov/press-release/nasa-international-partners-advance-cooperation-with-first-signings-of-artemis-accords>.

<sup>68</sup> Artemis Plan, *supra* note 1.

<sup>69</sup> *Id.* at 10.

<sup>70</sup> *Id.* at 12.

<sup>71</sup> *In-Situ Resource Utilization*, NASA: AMES RESEARCH CENTER, [https://www.nasa.gov/centers/ames/research/technology-onepaggers/in-situ\\_resource\\_Utiliza14.html](https://www.nasa.gov/centers/ames/research/technology-onepaggers/in-situ_resource_Utiliza14.html) (last visited Sept. 15, 2022).

<sup>72</sup> Artemis Plan, *supra* note 1, at 28; *See also* ISECG Strategy, *supra* note 3, at 11-12. The Guide for Partnership of the Sino-Russian lunar research station similarly states

At the same time, the Artemis Accords acknowledge that, in supporting scientific operations, commercial actors will gain economic profits.<sup>73</sup> They will also acquire know-how and develop their own technologies, which they could reuse for further outer space activities beyond the Artemis missions or adapt for use on Earth.<sup>74</sup> The Artemis Accords refer to such a potential development as an added benefit of space exploration requiring protection.<sup>75</sup> This may be seen as the Artemis Accords encouraging the development of space resource utilization by private actors outside the framework of public-private partnerships.<sup>76</sup> The Vancouver Recommendations on Space Mining warn that such activities are not regulated by the Outer Space Treaty and may be unlawful under the current international space law regime.<sup>77</sup> Similarly, Jakhu argues that appropriating space resources is a violation of the Outer Space Treaty.<sup>78</sup>

A counterargument is that, by recognizing the centrality of international collaboration for the execution of sustainable exploration missions, the Artemis Plan does not add to or detract anything from Article I of the Outer Space Treaty.<sup>79</sup> The Artemis missions

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that the exploration and use of the Moon is most effective when performed in partnership with States, international organization and industry. ILRS, *supra* note 42, at 2.

<sup>73</sup> Artemis Accords, *supra* note 22, § 5.

<sup>74</sup> *Id.* § 11(11) (stating that the signatory States will commit to use safety zones in a manner that encourages “the safe and efficient extraction of space resources in support of sustainable space exploration *and other operations*.” See also ISECG Strategy, *supra* note 3, at 11 (business will find ‘unexpected ways of exploring this know-how in the wider economy’).

<sup>75</sup> Artemis Accords, *supra* note 22, at preamble (recognizing the “global benefits of space exploration and commerce”). See also ISECG Strategy, *supra* note 3, at 7; INT’L SPACE EXPLORATION COORDINATION GROUP, Benefits Stemming from Space Exploration (Sept. 2013), <https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2013/10/Benefits-Stemming-from-Space-Exploration-2013.pdf> (referring to enlarging “the sphere of human economic activity”).

<sup>76</sup> Desmonda Lawrence, *The Artemis Accords: A New Race to Dominate Space*, PRINDLE POST, (July 21, 2021), <https://www.prindleinstitute.org/2021/07/the-artemis-accords-a-new-race-to-dominate-space/>.

<sup>77</sup> *Vancouver Recommendations on Space Mining*, OUTER SPACE INSTITUTE (Apr. 20, 2020), [http://www.outerspaceinstitute.ca/docs/Vancouver\\_Recommendations\\_on\\_Space\\_Mining.pdf](http://www.outerspaceinstitute.ca/docs/Vancouver_Recommendations_on_Space_Mining.pdf).

<sup>78</sup> Ram S. Jakhu, *The Legal Regime of the Geostationary Orbit* (1983) (Doctorate of Civil Law thesis, McGill University) ([https://escholarship.mcgill.ca/concern/parent/bg257f82k/file\\_sets/d504rk94w](https://escholarship.mcgill.ca/concern/parent/bg257f82k/file_sets/d504rk94w)).

<sup>79</sup> Note by the Secretariat, *supra* note 56, at 6 (stating that peaceful exploration requires “a holistic approach to collaboration between all stakeholders in outer space activities”).

are scientific missions aimed at increasing knowledge of the solar system through human exploration.<sup>80</sup> While the Outer Space Treaty is silent as to the actors entitled to conduct scientific research, Article VI thereof establishes that both governmental and nongovernmental entities can carry out activities in outer space.<sup>81</sup> It thus recognizes that private actors are entitled to conduct scientific research in outer space.<sup>82</sup> The Artemis Accords reinforce this provision by stating that private actors taking part in the implementation of exploration missions act on behalf of NASA (or any other signatory of the Artemis Accords that has concluded a bilateral agreement with NASA),<sup>83</sup> meaning that States remain responsible for their activities in outer space.<sup>84</sup>

## ii. Feasibility of Mission Implementation

A second aspect of the principle of affordability is that designing affordable exploration missions also entails cost-benefit choices

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<sup>80</sup> *The Artemis Accords*, NASA, <https://www.nasa.gov/specials/artemis-accords/index.html> (last visited Sept. 15, 2022).

<sup>81</sup> Outer Space Treaty, *supra* note 5, art. VI.

<sup>82</sup> Frans G. von der Dunk, *The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law*, ResearchGate, (Jan. 2011), [https://www.researchgate.net/profile/Frans-Von-Derdunk/publication/280071272\\_The\\_Origins\\_of\\_Authorisation\\_Article\\_VI\\_of\\_the\\_Outer\\_Space\\_Treaty\\_and\\_International\\_Space\\_Law/links/55f2130308aedeb69020e8c/The-Origins-of-Authorisation-Article-VI-of-the-Outer-Space-Treaty-and-International-Space-Law.pdf](https://www.researchgate.net/profile/Frans-Von-Derdunk/publication/280071272_The_Origins_of_Authorisation_Article_VI_of_the_Outer_Space_Treaty_and_International_Space_Law/links/55f2130308aedeb69020e8c/The-Origins-of-Authorisation-Article-VI-of-the-Outer-Space-Treaty-and-International-Space-Law.pdf).

<sup>83</sup> Artemis Accords, *supra* note 22, § 2(1)(d) (“Each signatory commits to taking appropriate steps to ensure that *entities acting on its behalf* comply with the principles of these Accords.” (emphasis added).

<sup>84</sup> Fabio Tronchetti, *Legal Aspects of Space Resource Utilization*, in HANDBOOK OF SPACE LAW 781 (Frans von der Dunk ed., 2015) (referring to the extraction of space resources by private actors); Kofi Henaku, *Private Enterprises in Space Related Activities: Questions of Responsibility and Liability* 3 LJIL 45, 53-54 (1990). This is also the conclusion reached by the Hague International Space Resources Working Group. Building Block 5(a) states:

States shall bear international responsibility for national space resources activities, whether such activities are carried out by governmental agencies or non-governmental entities, and for ensuring that such activities are carried out in conformity with the international framework.

BUILDING BLOCKS FOR THE DEVELOPMENT OF AN INTERNATIONAL FRAMEWORK FOR THE GOVERNANCE OF SPACE RESOURCE ACTIVITIES 42, <https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht--en-ruim-terecht/space-resources/bb-thissrwwg--cover.pdf>.

aimed at maximizing the chances of achieving the mission goals within the budgetary constraints of space agencies. For example, the Global Exploration Roadmap states that “[c]ost must be a consideration when formulating exploration programmes as well as throughout programme execution.”<sup>85</sup> In this respect, space resource utilization turns out to be a more affordable choice than providing regular supplies from Earth.<sup>86</sup> For this reason, the Global Exploration Roadmap states that “lunar surface operations include *in situ* resource activities.”<sup>87</sup> Similarly, the plan for establishing a lunar research station by China and Russia describes *in situ* resource utilization as instrumental for conducting sustained scientific research<sup>88</sup> while the European Space Agency (ESA) strongly supports the integration of space resource utilization into mission designs.<sup>89</sup>

This aspect of the principle of affordability is not recognized in the Outer Space Treaty. However, such is not unknown in the realm of scholarly literature. For example, in relation to the duty of States to share information about their activities in outer space set forth in Article XI of the Outer Space Treaty, Gorove writes that “feasibility and practicability [of information sharing] may involve questions of cost.”<sup>90</sup> Mayence and Reuters also argue that States may lawfully refrain from sharing “economically sensitive data,” such as data generated by the remote sensing of the Earth.<sup>91</sup> Since Article XI of the Outer Space Treaty does not require dissemination of information free of charge, considerations aimed at protecting a

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<sup>85</sup> GER 2018, *supra* note 28, at 10. *See also* Note by the Secretariat, *supra* note 56, at 7 ¶ 58.

<sup>86</sup> GER 2013, *supra* note 66, at 23 (“Use of local resources would limit the cost and complexity of bringing all the needed supply from Earth.”); Note by the Secretariat, *supra* note 56, at 5 ¶ 41 (stating that space exploration “in the long-term will also require *in situ* space resource utilization”).

<sup>87</sup> GER 2018, *supra* note 28, at 16. *See also*, *Global Exploration Roadmap – August 2020 Supplement*, ISECG, (Aug. 2020), [https://www.globalspaceexploration.org/wp-content/uploads/2020/08/GER\\_2020\\_supplement.pdf](https://www.globalspaceexploration.org/wp-content/uploads/2020/08/GER_2020_supplement.pdf) (describing *in situ* resource utilization as “valuable for sustained long-term human presence”)[hereinafter GER 2020 Supplement]; ISECG Strategy, *supra* note 3, at 2 (“Sustainable space exploration is a challenge that no nation can do on its own.”).

<sup>88</sup> ILRS, *supra* note 42, at 3, 5 & 10.

<sup>89</sup> ESA Space Resources Strategy, *supra* note 31, at 16.

<sup>90</sup> Stephen Gorove, *Freedom of Exploration and Use in the Outer Space Treaty: A Textual Analysis and Interpretation*, 1 DENV. J. INT’L L. & POL’Y 93, 103 (1971).

<sup>91</sup> Jean-François Mayence & Thomas Reuters, *Article XI*, in COLOGNE COMMENTARY, *supra* note 11, 189, at 202 ¶ 76.

commercial market for information sharing turn out to be lawful exemptions from the general duty of information sharing.<sup>92</sup> It thus appears that cost-benefit considerations in mission design do not seemingly exceed the remit of the Outer Space Treaty.<sup>93</sup>

Cost-benefit considerations permeate the Artemis Plan and they encourage the collaboration with the private sector.<sup>94</sup> Such a collaboration is deemed so essential for the feasibility of the Artemis missions that their implementation requires a conducive environment for commercial activities in outer space.<sup>95</sup> As a result, the Artemis Plan states that one of its goals is to pave the way for a lunar economy through the “exploitation and development” of the Moon by NASA in collaboration with US commercial companies and international partners.<sup>96</sup> Notably, the Outer Space Treaty does not refer to either exploitation or development of outer space. Article I thereof only recognizes the freedom of exploration and use of outer space by all States as well as the freedom of scientific investigation in outer space.<sup>97</sup> At the same time, it does not forbid the use of outer space for non-scientific purposes. This begs the question of the extent to which, if any, the Artemis Plan is consistent with the concept of exploration and use of outer space mentioned in Article I of the Outer Space Treaty.

On the one hand, the Artemis Plan appears to build on a recent trend in State practice. For instance, the Global Exploration Roadmap states that “sustainable exploration must actively enable the creation of new markets and commerce, *once governments have led the way*.”<sup>98</sup> Similarly, the European position, as expressed by ESA acting as the implementing body of the European Union (EU)

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<sup>92</sup> *Id.* at 198, ¶ 51.

<sup>93</sup> *Space Mission Design Tools*, NASA, <https://www.nasa.gov/smallsat-institute/space-mission-design-tools>, (last visited Sept. 18, 2022).

<sup>94</sup> See discussion *supra*, Section III.B.1; See also Mike Wall, *NASA Will Spend \$93 Billion on Artemis Moon Program by 2025, Report Estimates*, SPACE.COM, (Nov. 15, 2021), <https://www.space.com/nasa-artemis-moon-program-93-billion-2025>

<sup>95</sup> Elle Rothermich, *NASA's Artemis Accords Boost Commercial Space Activity*, THE REGULATORY REVIEW (Dec. 23, 2020), <https://www.theregreview.org/2020/12/23/rothermich-nasa-artemis-accords-boost-commercial-space-activity/>.

<sup>96</sup> Artemis Plan, *supra* note 1, at 9.

<sup>97</sup> See generally Outer Space Treaty, *supra* note 5.

<sup>98</sup> GER 2011, *supra* note 36, at 8 (emphasis added).

space policy,<sup>99</sup> conceives of space operations by commercial actors as instrumental to achieve sustainable human exploration.<sup>100</sup> As part of this vision, the ESA Space Resources Strategy states that “[t]he mastering of space resource utilization transcends domains to advance technologies and transfer expertise across sectors,” including the private sector.<sup>101</sup> Such statements provide evidence of a growing consensus among spacefaring States about the importance of commercial actors’ participation in exploration missions.<sup>102</sup>

On the other hand, the Artemis Plan appears to favor the development of the space mining industry without establishing the conditions for the lawful conduct of space resource utilization. On this point, State practice beyond the ISECG is not uniform. At COPUOS, some delegations maintain that the exploitation of space resources, if undertaken for the purpose of exploration, is in the general interest of States because it contributes to technological progress and scientific advancement.<sup>103</sup> They note that the Outer Space Treaty does not prohibit the utilization of space resources.<sup>104</sup> Other delegations argue that mining space resources for commercial purposes seems to differ from both exploration and use of resources for scientific purposes,<sup>105</sup> while another group of delegations rejects the argument that the exploitation of space resources is lawful under the Outer Space Treaty.<sup>106</sup>

The lack of uniformity among States’ positions about the lawfulness of the involvement of private actors in space exploration suggests that the statements in the Artemis Plan describing the

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<sup>99</sup> ESA Agenda 2025, at 4 & 6, March 2021, [https://esamultimedia.esa.int/docs/ESA\\_Agenda\\_2025\\_final.pdf](https://esamultimedia.esa.int/docs/ESA_Agenda_2025_final.pdf).

<sup>100</sup> ESA Space Resources Strategy, *supra* note 31, at 5.

<sup>101</sup> *Id.* at 6.

<sup>102</sup> GER 2018, *supra* note 28, at 22 (“An international consensus exists on the value of government/private sector partnerships. [...] Strengthening the space exploration community and promoting the development of new markets in space are keys to a sustainable human exploration effort”).

<sup>103</sup> Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Sixth Session, U.N. Doc. A/AC.105/1122, at 32, ¶ 242 (2017)[hereinafter LSC 2017 Report].

<sup>104</sup> LSC 2019 Report, *supra* note 9, at 33, ¶ 245.

<sup>105</sup> Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Seventh Session, U.N. Doc. A/AC.105/1177, at 20, ¶ 237 (2018)[hereinafter LAC 2018 Report].

<sup>106</sup> LSC 2017 Report, *supra* note 103, at 32 ¶ 247 (“the exploitation of space resources goes beyond what is generally understood as exploration and utilization”).

Artemis missions as paving the way for a sustainable lunar economy should be read in the light of the scientific goals pursued by the Artemis Plan. The fact that industry has always been part of NASA's space exploration efforts through public-private partnerships provides further support for this reading.<sup>107</sup> The lawfulness of commercial activities, including space resource utilization under the Artemis Plan, stems from the sustainable character of its exploration missions. Once States "have led the way,"<sup>108</sup> private actors will be entitled to conduct the same type of sustainable exploration missions on their own (while remaining under the continuing supervision of the licensing State).<sup>109</sup> A passage from the Global Exploration Roadmap supports this interpretation: "If the use of lunar volatiles and other space resources is proven to be economically advantageous, it is envisioned that commercial companies will collaborate with ISECG agencies in public-private partnerships to develop a space-based industry of in-situ resource utilization."<sup>110</sup>

The application of the Outer Space Treaty under the Artemis Plan is limited to scientific missions implemented through public-private partnerships. Most notably, the Outer Space Treaty does not cover space mining operations by private actors outside the framework of human space explorations. This indicates that the narrow scope of application of the principles governing the Artemis Plan does not support generalizations about the lawfulness of commercial activities conducted in outer space by private actors.

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<sup>107</sup> The documented history of NASA contains abundant evidence. See e.g., JOAN LISA BROMBERG, *NASA AND THE SPACE INDUSTRY* (2000); W. Henry Lambright, *NASA, Industry, and the Commercial Crew Development Program: the Politics of Partnership*, in *NASA SPACEFLIGHT: A HISTORY OF INNOVATION* 349 (Roger D. Launius & Howard E. McCurdy eds, 2018).

<sup>108</sup> See GER 2011, *supra* note 36 and corresponding text.

<sup>109</sup> Annette Froehlich, *Utilization-Consumption-Appropriation: Asteroid Mining Is in the Pipe* 66 ZLW 268, 272-273 (2017) ("it can be deduced from a logical point of view that if it prohibited for states to appropriate, the same is valid for private persons/entities"); Gbenga Oduntan, *Aspects of the International Legal Regime Concerning Privatization and Commercialization of Space Activities* 17 GEO. J. INT'L AFFAIRS 79, 83 (2016) (arguing that "private corporations cannot do more than their states of origin under treaty law"). See also Tronchetti, *supra* note 84 and corresponding text.

<sup>110</sup> GER 2018, *supra* note 28, at 23.

### C. Staggered Mission Design

The third principle of sustainable exploration consists of designing staggered exploration missions. It logically derives from the principle of affordability and requires the inclusion of milestones in the mission designs to test and develop the technology needed for individual stages.<sup>111</sup> Each stage and related milestone is propaedeutic to the execution of the following one, at the same time leaving the mission partners the flexibility to redesign the structure and revise the timeline for individual stages on the basis of the know-how accumulated in the previous stage.<sup>112</sup> The principle of staggered mission design underpins the Global Exploration Roadmap.<sup>113</sup> The division of both the Artemis Plan (Artemis I, II and III)<sup>114</sup> and the plan for the establishment of the Sino-Russian lunar research station into three stages (site selection or “reconnaissance,” construction and utilization)<sup>115</sup> is another example. Seen from this angle, the inclusion of space resource utilization in mission designs requires the mission partners to test technologies that can only function in the outer space environment. For example, the ISECG Reference Architecture states that verifying the reliability of a pilot *in situ* resource utilization plant must precede the construction of any large infrastructure on the Moon.<sup>116</sup>

This aspect of the principle of affordability is not recognized in either the Outer Space Treaty or the scholarly literature. It may be argued that, by endorsing the principle of staggered mission design, the Artemis Plan aims at encouraging the responsible use of outer space by every actor involved in the execution of the Artemis missions. The operational details for collaboration at each stage of the mission are set out in bilateral agreements between NASA and its international partners. Whether the implementation of such agreements violates the Outer Space Treaty remains a matter of factual assessment.

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<sup>111</sup> GER 2013, *supra* note 66, at 14 (“affordability constraints at global level dictate a stepwise approach”).

<sup>112</sup> GER 2020 Supplement, *supra* note 87, at 21 (describing the staggered approach to mission design as “the process of building capabilities on existent capabilities”).

<sup>113</sup> *Id.* (referring to “a phased approach”); GER 2013, *supra* note 66, at 14 (referring to “a stepwise development”).

<sup>114</sup> See discussion *supra*, Section II.

<sup>115</sup> ILRS, *supra* note 42, at 4-5.

<sup>116</sup> ISECG Reference Architecture, *supra* note 32, at 13.

#### D. Benefit Sharing

The fourth principle of sustainable exploration is benefit sharing. It requires that human exploration missions generate benefits for all, not only the participating actors. The Global Exploration Roadmap states that “[s]ustainable human exploration *must* respond to exploration goals and objectives and *provide value* to the public and other stakeholder communities.”<sup>117</sup> Likewise, the Artemis Accords aim to promote the “sustainable and beneficial use of space for all humankind.”<sup>118</sup> They also recognize that “the utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations.”<sup>119</sup> They do not refer to other forms of benefit sharing. The latter may include promoting the value of space and its applications in developing countries, as proposed by ESA,<sup>120</sup> or increasing the ability of States to address global challenges, such as environmental sustainability. For example, several ISECG documents mention the possibility of adapting water purification and waste management systems for use on Earth.<sup>121</sup>

By requiring space actors to include some form of benefit sharing in their mission designs,<sup>122</sup> the principle of benefit sharing favors a case-by-case assessment of the benefits generated by human exploration missions and their modalities of sharing without rejecting any alternative option, including the creation of a bespoke international regime. As Paxson notes, “from a practical point of view, spacefaring countries can themselves determine their obligations under Article I [of the Outer Space Treaty], which implies that a spacefaring nation can share whatever – and as much or little as – it likes so long as it shares something.”<sup>123</sup>

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<sup>117</sup> GER 2018, *supra* note 28, at 10 (emphasis added).

<sup>118</sup> Artemis Accords, *supra* note 22, § 1(1).

<sup>119</sup> *Id.* § 10(1).

<sup>120</sup> ESA Agenda 2025, *supra* note 99, at 14.

<sup>121</sup> GER 2018, *supra* note 28, at 4-5; ISECG, *Advancing the Global Exploration Strategy: Human Exploration of the Moon*, at 1-2, (Dec. 7, 2009).

<sup>122</sup> See Fengna Xu, Junyuan Su & Miqdad Mehdi, *A Re-examination of Fundamental Principles of International Space Law at the Dawn of Space Mining* 44 J. SPACE L. 1, 31 (2020) (arguing that international cooperation in space activities does not entail a specific list of mandatory benefit sharing).

<sup>123</sup> Edwin W. Paxson, *Sharing the Benefits of Outer Space: Space Law and Economic Development* 14 MICH. J. INT'L. L. 487, 493 (1993).

Arguing that the benefit sharing obligation in Article I of the Outer Space Treaty does not impose any qualitative or quantitative obligation on spacefaring States beyond those they wish to assume themselves contrasts with the view that only the principle of common heritage of humankind,<sup>124</sup> or an international institution modelled after the International Seabed Authority,<sup>125</sup> can guarantee an equitable sharing of benefits. Article I of the Outer Space Treaty only states that the exploration and use of outer space “shall be carried out for the benefit and in the interests of all countries.”<sup>126</sup> It does not exclude the case-by-case assessment. Indeed, noting that benefits can be both direct and indirect, Gorove argues that the identification of benefits to be shared “may depend on the facts and circumstances of the particular case.”<sup>127</sup>

A more challenging issue is whether sustainable exploration missions must ensure some form of benefit sharing at each stage of the mission or in relation to the exploration mission as a whole. Gorove writes that “[s]o long as there is some tangible or substantial benefit, it appears that the requirement has been satisfied.”<sup>128</sup> This suggests that, at a minimum, the international community of States must benefit from the completion of a sustainable exploration mission in its entirety. The sharing of benefits at stage level remains open to a case-by-case assessment involving the balancing of two contending views about the recipient of the benefits.

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<sup>124</sup> RICKY LEE, LAW AND REGULATION OF COMMERCIAL MINING OF MINERALS IN OUTER SPACE 320 (2012).

<sup>125</sup> *Id.* at 277 (advocating the creation of an International Space Development Authority); See Zachos A. Paliouras, *The Non-Appropriation Principle: the Grundnorm of International Space Law* 27 LJIL 37, 48 (2014); FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES: A PROPOSAL FOR A LEGAL REGIME 246-285 (2009). Compare Devanshu Ganatra & Neil Modi, *Asteroid Mining and Its Legal Implications* 20 J. SPACE L. 81, 98-99 (2015-2016) (proposing the creation of an International Space Body with the status of specialized agency of the United Nations); with Priyank D. Doshi, *Regulating the Final Frontier: Asteroid Mining and the Need for a New Regulatory Framework* 6 NOTRE DAME J. INT'L & COMP. L. 189, 208 (2016) (advocating the creation of an international institution independent from the United Nations); and Zach Meyer, *Private Commercialization of Space in an International Regime: A Proposal for a Space District* 30 NW. J. INT'L L. & BUS. 241, 258-261 (2010) (advocating the creation of an internationally authorized space district).

<sup>126</sup> Outer Space Treaty, *supra* note 5, art. I(1).

<sup>127</sup> Gorove, *supra* note 90, at 102.

<sup>128</sup> *Id.* at 101.

On the one hand, scholars point out that outer space activities must benefit all States at once, including the spacefaring States.<sup>129</sup> According to this view, what is due to the international community of States is a benefit shared by all. For example, the sharing of scientific data from exploration missions would increase knowledge and understanding of outer space to the benefit of all States. On the other hand, other scholars point out the duty of spacefaring States to “enable the non-space-faring members of the international community to participate more actively in space exploration and use.”<sup>130</sup> According to this view, benefit sharing is a tool for ensuring equal access to outer space for all States. For example, the sharing of technology, space facilities or monetary benefits with developing countries would increase their ability to actively participate in outer space.

Article I(1) of the Outer Space Treaty refers to the “benefit and interests” of all States, irrespective of their level of economic development. This supports the view describing benefits deriving from space activities as benefits for the entire international community of States. This may include broadening access to outer space for developing countries.<sup>131</sup> However, the Outer Space Treaty does not contain a duty of developmental assistance on the part of the spacefaring States, as acknowledged by COPUOS.<sup>132</sup> The UN Declaration on Space Benefits (1996) confirms that States are required to promote international cooperation “on an equitable and mutually acceptable basis.”<sup>133</sup> This leads to the further conclusion that the

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<sup>129</sup> *Id.* at 105; Stephan Hobe, *The Moon Agreement – Let’s Use the Chance!* 59 ZLW 372, 379 (2010) (stating that the interests of spacefaring countries must be taken into consideration).

<sup>130</sup> Ramya Sankaran & Nivedita Raju, *A Framework to Address Burgeoning Commercial Complexities in Space Mining* 66 ZLW 71, 88 (2017) (arguing that States have a duty to provide access to the extracted resources to all States).

<sup>131</sup> Note by the Secretariat, *supra* note 56, at 9, ¶ 70 (recognizing “the need for broadening access to space”); STEPHAN HOBE, *Article I, in 1 COLOGNE COMMENTARY ON SPACE LAW*, *supra* note 11, 25, at 38 ¶ 51.

<sup>132</sup> Note by the Secretariat, *supra* note 56, at 11, ¶ 91 (“it is desirable to fully include in such activities countries with emerging or limited capabilities in space exploration”). *Contra*, Sankaran & Raju, *supra* note 130, at 88.

<sup>133</sup> G.A. Res. 55/122, ¶ 3 (Dec. 13, 1996). *See also* V. S. Mani, *Paragraph 3 (Promoting International Cooperation/Developing Countries)*, in 3 COLOGNE COMMENTARY ON SPACE LAW 337, 338, ¶ 82 (Stephan Hobe et al. eds., 2015) (pointing out that spacefaring States are free to structure their cooperation with other States. Decisions to initiate

minimum requirement for the States involved in the Artemis missions is to share benefits for all States deriving from the completion of missions in their entirety. Benefit sharing at stage level remains optional. Since space resource utilization takes place within the framework of a public-private partnership and is confined to mission support, no duty of benefit sharing automatically arises from extraction activities.

#### IV. IMPACT OF THE ARTEMIS PLAN ON THE DEVELOPMENT OF INTERNATIONAL SPACE LAW

The Artemis Plan makes several creative arguments relating to the role of private actors in space exploration missions and utilization of space resources. This section evaluates whether the provisions of the Artemis Plan withstand scrutiny in the light of well-established theories of international space law. In doing so, it assesses the impact of the Artemis Plan on the development of two areas of international space law – namely, treaty interpretation (Subsection A) and lawmaking (Subsection B).

##### A. *A Subsidiary Means of Interpretation of the Outer Space Treaty*

The Artemis Plan revolves around the concept of sustainable exploration.<sup>134</sup> The latter is a principled form of practice complying with the provisions of the Outer Space Treaty.<sup>135</sup> Yet its governing principles do not replicate the letter of the Outer Space Treaty. For example, the Outer Space Treaty does not refer to staggered mission planning, affordability, or space resource utilization. Therefore, the question arises regarding the extent to which it is possible to generalize the scope of application of the guiding principles of sustainable exploration: does the Outer Space Treaty allow space resource utilization in other contexts? Are the guiding principles of sustainable exploration an authoritative interpretation of the Outer Space Treaty? The emergence of the concept of sustainable exploration through State practice does not amount to a

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cooperation programs with developing countries are based on moral and political considerations).

<sup>134</sup> Artemis Plan, *supra* note 1, at 12.

<sup>135</sup> As discussed in Section III.

modification of the Outer Space Treaty,<sup>136</sup> thus suggesting that the theoretical limits of its guiding principles derive from the normative value they have acquired through practice.

Article 31(3) of the Vienna Convention on the Law of Treaties (VCLT 1969)<sup>137</sup> states that subsequent practice in the application of a treaty which establishes the agreement of the parties constitutes an authentic interpretation of the treaty. Having developed through the practice of the 26 ISECG space agencies over 15 years, sustainable exploration represents the agreement of a minority of States parties to the Outer Space Treaty, which has been ratified by 111 States.<sup>138</sup> Hence, the principles governing sustainable exploration do not constitute an authentic interpretation of the Outer Space Treaty. They may nonetheless provide a supplementary means of interpretation.

The International Law Commission (ILC) defines subsequent practice as a supplementary means of interpretation under Article 32 of the VCLT as “conduct by one or more parties *in the application* of the treaty.”<sup>139</sup> Conduct in the application of a treaty is not the same as conduct regarding the interpretation of a treaty. Rather, it is a form of conduct falling within the accepted interpretation of a treaty. As a form of exploration allowed under the current interpretation of Article I of the Outer Space Treaty, sustainable exploration appears to meet the requirement of conduct in the application of a treaty; it does not purport to offer a new interpretation of the Outer Space Treaty nor is it intended to amend the treaty.

Further evidence of sustainable exploration as a subsidiary, as opposed to authentic, means of interpretation of the Outer Space Treaty is the fact that it encompasses the conduct of both States and private actors acting on behalf of the space agencies participating in the exploration missions.<sup>140</sup> As the ILC points out, relevant conduct for the purposes of Article 32 of the VCLT “is not limited to conduct of the organs of a state, but may also cover conduct of

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<sup>136</sup> G.A. Res. 73/202, at Conclusion 7(3) (Jan. 3, 2019) (“The possibility of amending or modifying a treaty by subsequent practice of the parties has not been generally recognized”).

<sup>137</sup> Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 (*entered into force* Jan. 27, 1980).

<sup>138</sup> Status of UN Agreements, *supra* note 8.

<sup>139</sup> G.A. Res. 73/202, at Conclusion 4(3) (Jan. 3, 2019)(emphasis added).

<sup>140</sup> As discussed in Section III.B.1 above.

private actors acting under delegated public authority.”<sup>141</sup> As a general rule, Article VI of the Outer Space Treaty establishes that space operations conducted by nongovernmental actors require the authorization of and continuing supervision by States.<sup>142</sup> This indicates that private actors partaking in sustainable exploration missions, such as the Artemis missions, must be licensed and remain open to scrutiny by the licensing State.<sup>143</sup> This also satisfies the requirement that practice in the application of a treaty must be sufficiently unequivocal.<sup>144</sup>

The consequence of considering sustainable exploration missions as practice in the application of a treaty is two-fold. Firstly, it contributes to the clarification of the meaning of the Outer Space Treaty,<sup>145</sup> thus making a distinctive contribution to treaty interpretation in international space law. For example, it acknowledges the lawfulness of space resource utilization in the absence of a bespoke regulatory framework.<sup>146</sup> Secondly, it clarifies that sustainable exploration is a specific form of conduct – a practical agreement between a limited number of parties<sup>147</sup> – of which space resource utilization constitutes an attribute. By acknowledging that the lawfulness of space resource utilization stems from its being instrumental to the sustainability of human exploration missions, it makes a second distinctive contribution to the development of international space law. Specifically, it shows that generalizations about the

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<sup>141</sup> Int'l Law Comm'n, Rep. on the Work of its Seventieth Sess., U.N. Doc. A/73/10, at 37, Commentary to Conclusion 5 (2018). This is also a principle recognized by the International Court of Justice (ICJ); *See Case Concerning Rights of Nationals of the United States of America in Morocco (U.S. v. Morocco)*, Judgment, 1952 I.C.J. Rep. 176, at 211 (August 27) (recognizing that interpretations of Article 95 of the General Act of the 1906 Conference of Algceiras must take into consideration the practice of local customs authorities).

<sup>142</sup> Outer Space Treaty, *supra* note 5, art. VI.

<sup>143</sup> *See Tronchetti*, *supra* note 84 and corresponding text.

<sup>144</sup> Int'l Law Comm'n Rep., *supra* note 141, at 38.

<sup>145</sup> G.A. Res. 73/202, at Conclusion 5(2) (Jan. 3, 2019).

<sup>146</sup> *See Artemis Accords*, *supra* note 22, § 10.

<sup>147</sup> Int'l Law Comm'n Rep., *supra* note 141, at 51.

lawfulness<sup>148</sup> or unlawfulness<sup>149</sup> of space resource utilization are difficult to sustain.

The conceptualization of sustainable exploration as conduct in the application of the Outer Space Treaty reframes the scholarly debate on the three main areas of criticism against the Artemis Accords. Firstly, the conformity of the guiding principles of sustainable exploration with the Outer Space Treaty, as embedded in the Artemis Plan, provides a different perspective from the stream of scholarly literature describing the Artemis Accords as an arbitrary interpretation thereof.<sup>150</sup> Secondly, the emergence of the principle of collaborative exploration demonstrates that the Artemis Accords do not represent the end of multilateralism in international space law.<sup>151</sup> Although the concept of sustainable exploration originates in the practice of States whose interests are “specially affected,”<sup>152</sup> the Artemis Plan, including the Artemis Accords, is not a unilateral act by the United States in disregard of the views of the international community.

Thirdly, the signing of the Artemis Accords by States which are also parties to the Moon Agreement is not *per se* a source of international friction. While it is widely acknowledged that “the existence of conflicting rules in different instruments on the same issues could create serious legal and practical problems for the interpretation and implementation of space treaties,”<sup>153</sup> the Artemis Accords do not create a fragmentation of legal regimes on space resource utilization. As a subsidiary means of interpretation, sustainable exploration does not add to or detract any obligation from the provisions of the Outer Space Treaty. To criticize the Artemis Accords for encouraging the exploitation of space resources in support

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<sup>148</sup> See e.g., JENKS, *supra* note 49, at 275 and Thomas Gangale, *The Legality of Mining Celestial Bodies* 40 J. SPACE L. 187, 189 and 205 (2015-2016) (both arguing that the non-appropriation principle does not apply to the resources of celestial bodies).

<sup>149</sup> See Freeland & Jakhu, *supra* note 11, at 53-54, ¶ 39; LEE, *supra* note 124, at 13 (“mineral extraction activities on celestial bodies [are] difficult, if not impossible, to justify in law”); PHILIP DE MAN, EXCLUSIVE USE IN AN INCLUSIVE ENVIRONMENT: THE MEANING OF THE NON-APPROPRIATION PRINCIPLE FOR SPACE RESOURCE UTILIZATION 407 (2016) (arguing that the commercialization of space resources is unlawful).

<sup>150</sup> See Mosteshar, *supra* note 23.

<sup>151</sup> See Wright Nelson, *supra* note 25.

<sup>152</sup> North Sea Continental Shelf Cases (Ger. v. Den., Ger. v. Neth.), Judgment, 1969 I.C.J. Rep. 3 (Feb. 20), at 42-43.

<sup>153</sup> Danilenko, *supra* note 6, at 241.

of exploration missions amounts to recognizing the existence of a moratorium on space resource utilization until the international regime envisioned in Article 11(5) of the Moon Agreement<sup>154</sup> is established. This position does not find support in either the *travaux préparatoires* of the Moon Agreement<sup>155</sup> or the scholarly literature.<sup>156</sup> Quite the contrary, Article 6(2) of the Moon Agreement recognizes the lawfulness of using “mineral and other substances of the Moon in quantities appropriate for the support of [scientific] missions.”<sup>157</sup>

The emergence of the concept of sustainable exploration is a significant innovation in international space law since it clarifies the scope of application of key provisions of the Outer Space Treaty. However, it does not represent a paradigm shift in international space law. By endorsing the concept of sustainable exploration and its guiding principles, the Artemis Plan aims at encouraging the responsible use of outer space by every actor involved in the execution of the Artemis missions. In this context, space resource utilization turns out to be an application of the principle of affordability of human exploration missions,<sup>158</sup> not an end in itself.

### B. *Lawmaking: Property Claims on Space Resources*

The emergence of the concept of sustainable exploration shows that the provisions of the Outer Space Treaty are the necessary and sufficient condition to regulate issues related to space resource extraction and utilization in context of human exploration missions.<sup>159</sup> The stream of scholarly literature arguing that the UN outer space treaties provide a comprehensive regime for activities in outer space supports the finding.<sup>160</sup> This contradicts the view

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<sup>154</sup> Moon Agreement, *supra* note 7, art. 11(5).

<sup>155</sup> The documentary history is analyzed in THOMAS GANGALE, *THE DEVELOPMENT OF OUTER SPACE: SOVEREIGNTY AND PROPERTY RIGHTS IN INTERNATIONAL SPACE LAW* 121-125 (2009). See also Paxson, *supra* note 123, at 499-500.

<sup>156</sup> *Id.*, at 117; DE MAN, *supra* note 149, at 174; Paxson, *supra* note 123, at 499; Karl-Heinz Böckstiegel, *Legal Implications of Commercial Activities*, in *PROCEEDINGS OF THE TWENTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE* 1, 8 (1981).

<sup>157</sup> Moon Agreement, *supra* note 7, art. 6(2).

<sup>158</sup> See discussion *supra* Section III B.

<sup>159</sup> See discussion *supra* Section III.

<sup>160</sup> Gorove, *supra* note 90, at 95-97 (arguing that the principles set forth in the space law conventions cover all activities of exploration and use of outer space); DE MAN, *supra*

that the Outer Space Treaty fails to address space mining effectively.<sup>161</sup> However, it is noteworthy that the Artemis Plan contains a statement on property rights over space resources which appears to violate the principle of non-appropriation of outer space.<sup>162</sup> A departure from the Outer Space Treaty would amount to the possible creation of a new rule. The statement reads:

NASA plans to *purchase* from one or more providers a sample of an extracted lunar resource for a nominal dollar value. The sample will be delivered in place on the lunar surface for retrieval by NASA at a later date. This process 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>163</sup>

The Artemis Accords refer only indirectly to property rights. For example, Section 2(1) states that the bilateral instruments between the signatories should contain provisions on “the transfer of goods,”<sup>164</sup> which may include extracted resources. At the same time, Section 10(2) states that “the extraction and utilization of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty.”<sup>165</sup> This indicates that the Artemis Accords do not recognize property rights over space resources. Nor do their signatories through the conclusion of bilateral agreements with NASA on the implementation of the Artemis missions. Signing the Artemis Accords does not entail an endorsement of the Artemis Plan, including the statement on property rights.

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note 149, at 43 (referring to the “self-referential nature of the international space law regime”).

<sup>161</sup> Ganatra & Modi, *supra* note 125, at 81 (arguing that “the framework of international space law regimes, such as the Moon Agreement and the Outer Space Treaty, [is] archaic”); Fengna Xu and Jinyuan Su, *New Elements in the Hague Space Resources Governance Working Group’s Building Blocks* 53 SPACE POL’Y 1 (2020); Gershon Hasin, *Developing a Global Order for Space Resources: A Regime Evolution Approach*, 52 GEO. J. INT’L L. 77, 99 (2020) (describing the Outer Space Treaty as “a relic of the Cold War”); Nick Smith, *Space Rocks!: A Perspective on Largely Unregulated Asteroid Mining*, 8(3) GEO. MASON J. INT’L COMP. L. 402, 403 (2017) (the Outer Space Treaty is “a relic of the cold war space race that is intentionally ambiguous, and has far outlived its usefulness on the question of privatization in space”).

<sup>162</sup> Outer Space Treaty, *supra* note 5, Article II.

<sup>163</sup> Artemis Plan, *supra* note 1, at 28-29 (emphasis added).

<sup>164</sup> Artemis Accords, *supra* note 22, § 2(1)(b).

<sup>165</sup> Artemis Accords, *supra* note 22, § 10(2).

It may be argued that, by including the statement on property rights over space resources in the Artemis Plan, the United States intend to make a legal claim aimed at initiating a new practice. A precedent in US history is the 1945 Truman Proclamation, which started the process of crystallization of a new rule of customary international law on State jurisdiction over the resources of the continental shelf.<sup>166</sup> If supported by a large number of States, the statement on property rights in the Artemis Plan could similarly lead to the creation of a new customary rule.

At COPUOS, delegations unanimously agree that neither the Outer Space Treaty<sup>167</sup> nor the Moon Agreement<sup>168</sup> prohibit the utilization of space resources. This aligns with the scholarly position maintaining that there exists no treaty or customary rule prohibiting the exploitation of space resources *per se*.<sup>169</sup> Delegations also agree that the freedom of exploration and use of outer space is not absolute, but limited by other principles of the Outer Space Treaty, such as non-appropriation and avoiding harmful interference with the activities of other States.<sup>170</sup> In relation to human exploration missions, the Guidelines for Partnership of the proposed Sino-Russian lunar research station do not mention property rights. They only commit the signatories to utilize *in situ* resources as part of their exploration missions.<sup>171</sup> Likewise, ESA acknowledges the instrumental role of space resource utilization for achieving the

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<sup>166</sup> Proclamation No. 2667, 59 Stat. 884 (Jan 3, 1945). For an analysis of the Proclamation, see James Crawford, *International Law on a Given Day, in* INTERNATIONAL LAW AS AN OPEN SYSTEM: SELECTED ESSAYS 43 (James Crawford ed., 2002).

<sup>167</sup> LSC 2018 Report, *supra* note 105, at 30 ¶ 238; Comm. On the Peaceful Uses of Outer Space, LSC 2019 Report, *supra* note 9, at 33 ¶ 245. See also Vancouver Recommendations on Space Mining, *supra* note 77, at 1.

<sup>168</sup> LSC 2018 Report, *supra* note 105, at 33 ¶ 260 (the fact that the Moon Agreement attempts to regulate the utilization of space resources shows that space resource activities are permitted under the Outer Space Treaty).

<sup>169</sup> Jinyuan Su, *Legality of Unilateral Exploitation of Space Resources under International Law*, 66(4) INT'L & COMPARATIVE L. QUARTERLY 991 (2017).

<sup>170</sup> Tronchetti, *supra* note 90, at 781. See also LSC 2017 Report, *supra* note 103, at 32-33 ¶ 24 (stating that the principle of non-appropriation applies only to resources “in place”).

<sup>171</sup> ILRS, *supra* note 42, at 2 (describing the research station as designed to conduct “scientific research activities, including exploration and use of the Moon”).

exploration missions' goals while excluding that this amounts to a legal claim over space resources.<sup>172</sup>

The lack of references to property rights over space resources in current State practice does not appear to be coincidental. Therefore, it cannot be considered a form of acquiescence to the US claim in the Artemis Plan, at least in context of human exploration missions. This begs the question of what the consequence of NASA's purchase of a sample of extracted resources from a private actor would be. Since outer space is not subject to national appropriation by any means,<sup>173</sup> the transaction would not be able to create or transfer any property rights.<sup>174</sup> Arguably, it would amount to an exchange of money for the service of space resource extraction and delivery – that is to say, it would be a purchase of service, as such lawful under international space law.

The purchase of service interpretation is not without objections. For instance, De Man argues that any exchange of space resources is unlawful. He writes:

the extraction of tangible resources from celestial bodies can only be legitimate if the excavating state subsequently uses the removed substance *itself* instead of transferring it to another state. [...] the act of sale would imply the existence of property rights.<sup>175</sup>

A counterargument is that this position provides an interpretation of the principle of non-appropriation that is not supported by

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<sup>172</sup> ESA *Space Resources Strategy*, *supra* note 31, at 16 (“ESA cannot assume leadership in interpreting and further developing the legal and regulatory framework applicable to space resources, as this is beyond the Agency’s competences”).

<sup>173</sup> Outer Space Treaty, *supra* note 5, Article II (“Outer space... is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by *any other means*.” Emphasis added). See also Paul B. Larsen, *Asteroid Legal Regime: Time for a Change?* 39(2) J. SPACE L. 275, 282 (2014) (arguing that “Art. II is all-inclusive”).

<sup>174</sup> CHENG, *supra* note 50, at 233 (“outer space and celestial bodies are not only not subject to national also appropriation, but also not subject to appropriation under private law”). See also INT’L INST. SPACE L., Statement of the Board of Directors, at 2 (2004), [https://iislweb.space/wp-content/uploads/2020/01/IISL\\_Outer\\_Space\\_Treaty\\_Statement.pdf](https://iislweb.space/wp-content/uploads/2020/01/IISL_Outer_Space_Treaty_Statement.pdf) (maintaining that private ownership by governmental or non-governmental entities is not legally possible).

<sup>175</sup> DE MAN, *supra* note 149, at 407 (emphasis original). See also Philip de Man, *The Exploitation of Asteroids and the Non-Appropriation Principle: Reflections on the Nature of Property Rights in Light of the US Space Resource Act of 2015*, 40 J. SPACE L. 1, 49 (2015-2016).

the textual analysis of Article II of the Outer Space Treaty, which does not refer to any modality of use of outer space, including limits *ratione personae* to the uses of space resources. Quite the contrary, State practice appears to encourage the conclusion of public-private transactions in space as part of sustainable exploration missions.<sup>176</sup> Transactions over space resources do not, and cannot, imply the existence of property rights in outer space.

Another objection is that, if brought back to Earth, space resources would become property of the State carrying them. Some scholars argue that, in the absence of any specific provision in the UN outer space treaties, such action would be lawful.<sup>177</sup> According to this interpretation, the physical act of moving the extracted resource from outer space to Earth would be constitutive of property rights. However, the argument does not find support in any theory of property rights.<sup>178</sup> Conversely, De Man writes that the space law regime “remains applicable to materials brought back to Earth.”<sup>179</sup> Hence no property rights arise over the space resources. This position is equally problematic, since it reduces outer space into a *res* capable of appropriation. As Lachs writes, outer space is an environment, not a *res*.<sup>180</sup> As such, it cannot be brought back to Earth. A middle position is that States could claim property rights over the space resources returned to Earth under national law. The US Commercial Space Launch Competitiveness Act<sup>181</sup> lends support to this interpretation, since it recognizes the right of US citizens to “own, transport, use, and sell” space resources. Yet, as Cheney writes, absent mutual recognition of property rights at the domestic level, such claims cannot be enforced against other States.<sup>182</sup> A

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<sup>176</sup> See discussion *supra* Section III. B above.

<sup>177</sup> Henry R. Hertzfeld & Frans von der Dunk, *Bringing Space Law into the Commercial World: Property Rights without Sovereignty* 6(1) CHICAGO J. INT'L L. 81, 83 (2005). See also Megan A. MacKay, *Property Rights in Celestial Bodies: A Question of Pressing Concern to All Mankind* 104(2) MARQUETTE L. REV. 575, 593 (2020) (arguing that moving an asteroid “transforms the asteroid into possessable property”).

<sup>178</sup> For a comprehensive analysis, see JOHN G. SPRANKLING, *THE INTERNATIONAL LAW OF PROPERTY* (2014).

<sup>179</sup> DE MAN, *supra* note 149, at 407.

<sup>180</sup> LACHS, *supra* note 51, at 46 (describing outer space as “a sphere of states’ activities”).

<sup>181</sup> U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114–90, § 51303, 129 Stat. 704, 721 (2015).

<sup>182</sup> Thomas Cheney, *There’s No Rush: Developing a Legal Framework for Space Resource Activities*, 43(1) J. SPACE L. 106, 139 (2019). Cf. Tronchetti, *supra* note 90, at 781

more radical view maintains that space resources are not subject to national jurisdiction, hence national legislation conferring property rights over space resources “may be enacted but [does] not have a legally binding character.”<sup>183</sup>

None of the objections above makes a cogent argument against the lawfulness of the purchase of service in outer space interpretation. This suggests that the statement on property rights contained in the Artemis Plan should be interpreted in its context – that is to say, as part of the US civilian program for human space exploration. The latter embraces the principle of sustainable exploration, which includes space resource utilization as part of the mission design.<sup>184</sup> The statement is not intended to modify the Outer Space Treaty and applies only to activities taking place in outer space<sup>185</sup> within the framework of public-private partnerships. It has a narrow meaning and generalizations beyond sustainable exploration missions are difficult to sustain. By discriminating between transactions in support of human exploration missions and transactions concluded for other purposes, the statement shows that the lawfulness of the proposed transaction derives from the application of the bundle of guiding principles of sustainable exploration. Conversely, it is not constitutive of any new rule under international space law.

## V. CONCLUSION

The Artemis Plan ushered in a new era of human space exploration. Adopted by the United States in 2020, its content and structure are informed by 15 years of State practice developed within the

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(arguing that legislation granting property rights over space resources violates the principle of non-appropriation “by other means” set forth in Article II of the Outer Space Treaty).

<sup>183</sup> Stephan Hobe & Philip de Man, *National Appropriation of Outer Space and State Jurisdiction to Regulate the Exploitation, Exploration and Utilization of Space Resources*, 66 GER. J. AIR & SPACE L. 460, 475 (2017).

<sup>184</sup> See discussion *supra* Section III.

<sup>185</sup> See also Exec. Order No. 13914, 85 Fed. Reg. 20,381, Sec. 1 (Apr. 6, 2020) (“It shall be the policy of the United States to encourage international support for the public and private recovery and use of resources *in outer space*, consistent with applicable law.” Emphasis added); *But see* Fabio Tronchetti & Hao Liu, *The White House Executive Order on the Recovery and Use of Space Resources: Pushing the Boundaries of International Space Law?* 57 SPACE POL’Y (2021) (describing the Executive Order as instrumental to the implementation of the Artemis Plan, effectively creating a self-contained regime of international space law).

framework of the ISECG – a consortium of 26 space agencies created for the purpose of elaborating a shared vision for human space exploration. Central to both the ISECG work and the Artemis Plan is the concept of sustainable exploration mission, which envisions space resource utilization as part of the mission design.

The Artemis Plan has been severely criticized as circumventing the provisions of the Outer Space Treaty by asserting the lawfulness of space resource utilization in the Artemis Accords, a memorandum of understanding shared with the exploration missions' international partners. This article critically examined the content of the Artemis Plan in the light of both State practice and theories of international space law.

The findings show that, by embedding the concept of sustainable exploration, the Artemis Plan clarifies the meaning of exploration and use of outer space, as set forth in the Outer Space Treaty. At the same time, the Artemis Plan has a narrow scope and generalizations about the lawfulness of space resource utilization beyond its remit should be avoided. While the findings indicate that State practice is gradually consolidating around the lawfulness of space resource utilization in support of human exploration missions, this new trend in practice does not amount to an authentic interpretation of the Outer Space Treaty, especially in relation to property claims on space resources.

The adoption of the Artemis Plan is a significant development in international space law. However, it does not represent a paradigm shift.