Artemis Accords and Transparency and Confidence-Building Measures (TCBMS) for the Involvement of Small and Medium Space Agencies

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Abstract

The Artemis Accords are a series of non-binding bilateral agreements forming part of the Artemis campaign launched by NASA and the US Department of State and aimed at exploring space, establishing a permanent presence on the Moon and facilitating human missions to Mars. The Artemis Accords' aim is to promote outer space exploration for peaceful purposes and can be extremely demanding both in terms of financial and technological capacity, especially for small and medium space agencies and developing countries. Transparency and Confidence-Building Measures (TCBMs), which could help to address these challenges, are lacking in the Accords. This gap is relevant, especially taking into account that various instruments, such as the Guidelines for Long-Term Sustainability of the Outer Space, encourage supporting emerging space countries in pursuing space activities for civil purposes. Nevertheless, as the purpose of these Accords is "to establish a common vision via a practical set of principles, guidelines, and best practices to enhance the governance of the civil exploration", it is argued that TCBMs can be developed and implemented within the framework of the Artemis Accords. TCBMs are indeed consistent with the principles enshrined in the Artemis Accords, which require signatory countries to, *inter alia*, transparently and in good faith disseminate information regarding domestic space policies, plans for space exploration, results of the activities carried out under the Artemis missions, in compliance with Article XI of the Outer Space Treaty. This paper discusses how TCBMs can help developing countries to pursue their policy goals in the context of the Artemis campaign and how these measures can be formalized into the context of the Artemis Accords.

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A. Legal Analysis of the Artemis Accords and Their Interplay with TCBMs[1]

1. Introductory Remarks

Artemis Accords, formally known as "Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes" is one of the non-binding international instruments that have been adopted in the last decades. Signed by more than 40 countries as of June 2024,[2] the Artemis Accords are a peculiar international agreement aimed at fostering outer space activities and cooperation among signatory countries in compliance with binding and non-binding norms that have been adopted at the international level.

The Artemis Accords establish a number of principles and commitments guiding the cooperation among signatories, including transparency, fair dealing and good faith, interoperability, and peaceful use of resources.[3] However, these principles are not accompanied by any so-called Transparency and Confidence Building Measures (hereinafter: "TCBMs"), i.e., binding and non-binding measures and commitments among states that, among other goals, should help to prevent conflicts by exchanging information, building trust and reducing tensions, and preserving space security. In a context where the capacity and ability to contribute to space activities varies significantly among signatories to the Artemis Accords, TCBMs can improve the effectiveness of the cooperation by facilitating collaboration, enabling technology spillovers, and ensuring the implementation of best practices across various countries.

This paper (i) analyzes some of the TCBMs that have been developed by space law experts and policymakers; (ii) considers their relationship with the principles of the Artemis Accords, in particular the transparency and good faith principles; (iii) assesses whether they can be beneficial to small and medium countries and their space agencies; and (iv) suggests possible ways to implement them in practice and formalize them in the context of the Artemis campaigns.

1 Section A of this manuscript has been prepared primarily by Mr. Mammadov, while Section B by Mr. Loschi. The views expressed therein are solely those of the authors.

2 See https://www.state.gov/artemis-accords/. At the time this paper was drafted, in October 2023, the number of signatories was 23.

3 The Artemis Accords are available online, including at: https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf.

2. The "Transparency" and "Good Faith" Principles and the Role of TCBMS

Section 4 of the Artemis Accords is dedicated to "Transparency" and "good faith" and stipulates that participants to the Accords are committed to transparency in the broad dissemination of information about their national space policies and plans for space exploration on a good faith basis and in conformity with their respective national rules and regulations.

While transparency and good faith inform all activities related to the Artemis Accords and, more in general, all activities related to space,[4] Section 4 does not clarify the exact scope of the parties' transparency obligations nor the way in which transparency should be achieved. On the one hand, Section 4 provides only limited guidance by requiring that the parties "share scientific information resulting from their activities pursuant to these Accords with the public and the international scientific community on a good-faith basis, and consistent with Article XI of the Outer Space Treaty." On the other hand, the principle "good faith" is generally regarded as a "conduct obligation, not a result obligation," the violation of which "cannot be based solely on the result expected by one side not being achieved",[5] and that has been interpreted as requiring all parties to handle in a transparent and honest manner possible conflicts.[6]

TCBMs could contribute to define the contours of this commitment. Research concerning TCBMs in the outer space sector has been conducted over the last decade. For instance, Resolution adopted by the General Assembly on 8 December 2010, No. 65/68 (UN Resolution 65/68) on "Transparency and confidence-building measures in outer space activities" promoted a study on TCBMs, emphasizing how transparency and TCBMs can help to prevent, *inter alia*, militarization of space activities. Moreover, a report of the GGE on "Transparency and Confidence-Building Measures in Outer Space Activities" of July 2013 (UN GA A/68/189) provides a helpful overview of the most relevant TCBMs that can and have been implemented by states and international organizations.

Additional guidance may be found in other sectors. The Maritime Confidence-Building Measures (MCBMs), for instance, apply to the international maritime practice and have very similar purposes to the TCBMs

4 As indicated by the International Court of Justice, "trust and confidence are inherent in international cooperation, particularly in an age when this cooperation is becoming increasingly important across several industries". Lavanya Rajamani, Jacqueline Peel, "The Oxford Handbook of International Environmental Law", Oxford University Press 2021.

5 Dispute Concerning Delimitation of the Maritime Boundary Between Ghana and Côte d'Ivoire in the Atlantic Ocean (Case 23) ITLOS Reports 2017, para. 604.

6 See the analysis of the NATO/UE/CMF Shared Awareness and De-confliction (SHADE) in Jörg Schildknecht, Rebecca Dickey, Martin Fink and Lisa Ferris, "Operational Law in International Straits and Current Maritime Security Challenges", Springer 2018.

in outer space activities, namely ensuring "good order" at sea, and helping to "build" habits of cooperation and conversation so to reduce tensions and promote peace and stability'.[7]

National regulations may also contribute to the definition and implementation of TCBMs. For instance, MCBMs in the United States have been used to facilitate the adoption of laws and policies concerning environmental security in maritime company activities and to protect private and public enterprises in the marine realm against attack and hostile or illegal exploitation.[8] This kind of partnership is critical to global economic stability and growth, and it is only through such an integrated strategy among all maritime partners that these national strategies can be effectively pursued.

Similar to maritime activities, the execution of outer space activities requires trust, good faith dealings, and a concerted application of collective capabilities to (i) increase our awareness about space activities and events; (ii) improve space security frameworks; (iii) deploy layered security based on law enforcement authorities, private sector partners' competencies; and (iv) pursue transformational research and development to advance information fusion and analysis of detection technologies.[9]

3. Distinctive Features of TCBMs for Outer Space Activities

TCBMs in space can be distinguished from those of other sectors or areas of law because outer space is an inherently international activity based on the "common heritage" principle of the OST, where international cooperation in all matters is unavoidable. For instance, TCBMs may require and regulate the exchange of information and data (i) on space policies and activities and risk reduction notifications; (ii) for safety purposes (e.g., traffic management) and to preserve peace and security (e.g., by identifying military activities or double-purpose commercial outer space activities).

Indeed, authors have argued that TCBMs are an example of diplomatic techniques in the context of international affairs that can be applied to space activities and for which there is increasing demand.[10] In this context, TCBMs can contribute to strengthening international cooperation and perhaps even

7 Shengnan Jia and Lijun Liz Zhao, "Commercial and Maritime Law in China and Europe", First published 2023 by Informa Law from Routledge, page 186-193

8 Myron H. Nordquist, Rüdiger Wolfrum, John Norton Moore and Ronán Long, "Legal Challenges In Maritime Security", Martinus Nijhoff Publishers, Leiden-Boston 2008, page 404-405.

9 Ibid, and Kai-Uwe Schrogl, Peter L. Hays, Jana Robinson, Denis Moura Christina Giannopapa, "Handbook of Space Security", Springer Science 2015, page 59-125.

10 *Id*., p. 59-125.

provide for dispute settlement mechanisms in case of disputes concerning their implementation.[11]

To the extent that TCBMs are seen (also) as diplomatic means, however, their proper implementation in the outer space context would likely benefit from the supervision of a "central" authority in charge of coordinating space governance. In the current geopolitical context, it is possible that more developed countries will nevertheless pursue their own economic and military interest by seeking to rely only on their national regulations and exerting undue influence at the international level. In this scenario, small and medium space agencies would find themselves in an unfavorable or weaker position.

4. TCBMs and Artemis Accords: Possible Areas of Application

One area in which TCBMs could be used to increase transparency and coordination is that of governmental and commercial activities for the exploration and exploitation of the space resources. While the Artemis Accords do not clarify which information should be shared, and signatory states determine which confidential information they consider classified, the Artemis Accords put "international cooperation" as one of their main goals and require states to release information about purposes of operation, type of spacecraft, especially about their plans and space policies.[12] Carrying out consultations and negotiations in good faith should thus be considered mandatory, in particular where signatory states conduct operations in outer space and on other celestial bodies.[13]

Similar requirements should apply to space activities that may affect the environment or that may facilitate the achievement of environmental targets. Space debris mitigation and remediation, for instance, can be facilitated by TCBMs which facilitate the exchange of "dual-use" technologies for the exclusive purpose of preventing and remedying space debris issues and

11 More in general, dispute settlement mechanisms should exist in respect of commercial agreements between states and commercial, private, or quasi-private ventures, as this would save costs in terms of time and financial resources invested in the process. No such mechanisms are currently provided by the applicable treaties or do not apply to commercial space actors.

12 See Artemis Accords, Section 4 and Section 2(b): "the Signatories' bilateral instruments referred to above are expected to contain other provisions necessary to conduct such cooperation, including those related to liability, intellectual property, and the transfer of goods and technical data".

13 Another area where good-faith consultations and negotiations are critical and TCBMs could help delineate a clearer process are emergency situations, such as those contemplated by Section 6 of the Artemis Accords and in respect of which all signatories commit to make "all reasonable efforts" to assist individuals in space in case of emergency and to acknowledge their duties on the basis of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space 1968, resolution 2345 (XXII).

require abidance by the EU Code of Conduct in Outer Space Activities or the Inter-Agency Debris Mitigation Guidelines by the UN General Assembly.[14] TCBMs can also provide mechanisms for a collaborative assessment of the anticipated damage of debris, thereby facilitating signatory parties' decision to invest in measures that can achieve this purpose.

TCBMs are also relevant to the management of "dual-use" space technologies. There is no uniform definition of space technologies, and further obstacles are posed by the stringent export control regime of the United States. Under the US export control system, the term "dual-use" identifies "EAR [Commerce Department] controlled items that can be used both in military and other strategic uses and in civil applications from those that are weapons and military related use or design and subject to the controls of the Department of State or subject to the nuclear related controls of the Department of Energy or the Nuclear Regulatory Commission." Arguably, dual-use characteristics of space technology would not impair space exploration for peaceful purposes to the extent that there is a supervisory regime that ensures transparency of activities under the Artemis Accords. To this end, TCBMs can help to regulate the use and sharing of "dual-use" technologies in the context of the Artemis Accords and avoid militarization of the Moon and other celestial bodies.

Another significant part of the Accords that requires TCBMs concerns harmful interferences of radio frequencies. According to Section 11(5) of the Accords, signatory countries are required to provide necessary information, such as location and characteristics of activity, to prevent or address harmful interference issues between Signatories while conducting outer space activities. Unfortunately, the Artemis Accords do not establish a regime of navigation and space traffic management – with Section 11(6) indicating that "Signatories intend to contribute to multilateral efforts to further develop international practices, criteria, and rules applicable to the definition and determination of safety zones and harmful interference." Some guidance may be found, once again, in international maritime law. The United Nations Convention on the Law of the Sea (1982), for instance, serves as the framework for a rules-based order of the oceans and establishes a regime for the navigation in the territorial and extra-territorial seas.[15] Moreover, the 1972 Convention on International Regulations for the Prevention of Collisions at Sea (COLREG) and the 2014 Code for Unplanned Encounters at Sea (CUES) provide a normative foundation for safe interactions in the

14 Klinkrad, H., Space Debris: Models and Risk Analysis, Springer, Berlin et al. 2006, p. 268.

15 United Nations Convention on the Law of the Sea (Montego Bay, 10 December 1982, in force 16 November 1994) 1833 UNTS 396 (hereinafter "LOSC"), and "Maritime Confidence-building Measures for Navigation in the South China Sea" The International Journal of Marine and Coastal Law 32 (2017) 1–30.

South China Sea. The COLREG is legally binding and applies to both commercial and military boats. Binding international regulation of space traffic management appear to be the best solution, and building cooperation with signatory and non-signatory countries to establish a unified system of space traffic management is absolutely essential. It should be emphasized that the EU has identified a comprehensive approach of four pillars to Space Traffic Management (STM) in its technical presentation during 62nd Session of the UN COPUOS Legal Sub-committee. One significant pillar was related to increasing "EU Operational Capabilities" and the EU has identified three key operational capabilities: collision avoidance, re-entry analysis, and fragmentation analysis. A similar approach would help to boost operational capabilities for preventing collisions with the participation of space industry. In this context, TCBMs could facilitate risk assessment among countries beyond the EU and contribute to deconfliction, confidence and transparency.

5. TCBMs and Artemis Accords: Enabling Technology Transfers for Small and Medium Space Agencies

One of the main benefits for small and medium space agencies in participating to the space missions is capacity-building and technology transfers.[16] In practice, however, developing countries and their space agencies often struggle to access and maximize these benefits due to the high pricing and appropriateness of the importer technology and lack of a sufficient capacity and skill to utilize it in a scalable manner. Moreover, based on the authors' experience, developing countries frequently complain about their low bargaining power due to the monopolistic position of the technology supplier and the lack of adequate information about the technology.

This disparity is likely to continue in the context of Artemis missions, in particular where commercial companies are involved. Even though the Artemis Accords are dedicated to space exploration for peaceful purposes primarily conducted by signatory states, commercial space activities are likely to play an important role in the context of the Artemis missions.[17] And while the presence of commercial companies can bolster technological developments potentially beneficial to small and medium space agencies, their collaboration with governments, their market share in respect of a certain technology and their access to sensitive information can raise issues

16 See Section B below.

17 Indeed, although the Artemis Accords do not expressly address commercial private companies, its purpose is clearly focused also on future commercial opportunities connected to the exploration of space. Commercial companies can join and/or contribute to a project (indirectly or directly) in many ways, including through procurement contracts.

concerning the countries' due diligence obligations vis-à-vis their private enterprises. For instance, it cannot be excluded that military, defence and national security considerations may come into play as part of space exploration and mining operations. In these situations, governments generally tend to protect and under-disclose critical information to protect national security, with the consequence that technology sharing with small and medium space agencies is significantly reduced – this effect, in turn, may disincentivize countries from participating to Artemis missions.

As it is key for small and medium space agencies to be able to pursue their interests together with that of leading space-faring nations, TCBMs setting forth limited technology transfer processes using fair price-setting mechanisms while at the same time ensuring the proper use and protection of critical information, could facilitate deconfliction of space exploration and balancing these opposed interests.[18] Similarly, TCBMs may provide for mandatory consultations and information requirements, regulate and assign political and financial obligations in respect of a project, as well as require that governments clarify the purpose of agreements with other governments and/or commercial companies concerning a specific mission or activity. States' due diligence obligations and the precautionary principle enshrined in the space treaties and incorporated by reference in the Artemis Accords treaties,[19] together with the duty to act transparently could serve as a basis for these measures.

When it comes to technology transfer from larger to smaller space agencies, and absent a legal regime regulating technology transfer processes among Signatories,[20] TCBMs in this field should aim at preventing that technology transfer accelerate the militarization of outer space activities, while at the same time promoting foreign direct investment in emerging space-faring nations. This would require effectively controlling military-oriented transactions (including of dual-use technology); and creating favourable socio-economic and political environments to encourage foreign direct investment.

Given the presence of different and conflicting interests, the involvement of international organisations may be advisable both for capacity-building and risk prevention purposes. At the UN level, in addition to space-specific committees and agencies, other agencies may play a role, such as the United Nations Development Programme (UNDP) and the United Nations Industrial

18 "Transparency and confidence-building measures for space security", J. Robinson, Schwarzenbergplatz 6, A-1030 Vienna, Austria.

19 See Artemis Accords, Preamble; Art. VI-VIII OST; Art. I(c) Liability Convention; Art. 1-2 of the Registration Convention.

20 The author submits that a progressive liberalization in the transfer of technologies among states could be accompanied and supervised by an authority on which signatories have supervisory authority.

Development Organisation (UNIDO).[21] Capacity-building may also be enhanced through educational programs via the UNCTC, UNIDO, the UN Conference on Trade and Development (UNCTAD).

6. Preliminary Conclusions on the Legal Analysis of TCBMs in Artemis-Related Space Projects

Section A explained that TCBMs can play an important role in the implementation of the principles enshrined in the Artemis Accords. TCBMs can be of both technical and legal nature and may include measures to evaluate both the non-compliance with countries' obligations or commitments (e.g. adopting space debris mitigation guidelines; causing harmful interference) but also to encourage and regulate the cooperation between developed and developing countries.

International cooperation with non-signatory countries and space agencies is also important to establish a broader basis to implement TBCMs and boost adoption of international soft law norms in future.

With respect to commercial outer space activities, the regulation of which largely depends on national laws, TBCMs and transparency obligations in the execution of the Artemis Accords could help to strike a balance between competing interests and reduce the risk of regulatory fragmentation and disputes.

B. Implementing TCBMs in the Context the Artemis Accords to Enable Small and Medium Space Agencies' Development

Section A of this manuscript discussed the legal principles underlying the Artemis Accords and explained that TCBMs are relevant to integrate and implement them. Section B will analyze ways in which signatory countries can pursue their policy goals in space through TCBMs and formalize those TCBMs in the context of the Artemis Accords.

1. The Increasingly Important Role of Developing Countries in Space and Their Persistent Needs to Achieve Space Policy Goals

In the last decades, developing countries have made important policy and technological progresses and are increasingly contributing to space activities. Several governments in Africa, the Middle East and Asia have started to (i) manufacture, install and launch satellites; (ii) conduct scientific experiments in space; and (iii) invest in space-related projects to address environmental,

21 *Ibid*. at 5.

safety and telecommunication issues.[22] These achievements have been possible thanks to both the cooperation and assistance of developed countries and international organizations and to structured national policies promoting access to space.[23]

Today, most developing countries' space policies are primarily focused on developing space technology for civilian, commercial, environmental and earth-based purposes with the goal of improving socio-economic goals. These policy goals include (i) developing monitoring, forecasting and prevention systems to avoid climate change and environmental issues on earth (e.g., weather forecasting; marshlands, seas and waterflows monitoring, disaster management systems) and in space (debris mitigation, circular economy and reusable technologies); (ii) commencing and/or managing space activities (e.g., ground station support, cooperation in aerosol monitoring, space situational awareness); (iii) producing revenues through space activities, including through satellite telecommunication services, to fund other projects; (iv) sharing of information among all space actors to improve space-based solutions and technology with due regard to the legitimate security interests of all countries and their territorial borders; (v) setting up collaborations to acquire knowledge and skills, including through funding of academic, education, and training initiatives as well as partnerships with leading commercial companies.[24]

Despite the progresses and the increasing awareness of the benefits of space technologies, space agencies of developing countries continue to face persistent capacity constraints. According to a 2020 Report by the UN Secretary General, these constraints include (i) limited financial resources and lack of sufficient sources of financing at the international level; (ii) unbalanced negotiating power vis-à-vis developed countries and leading commercial ventures; (iii) technology and skills gaps as well as paucity of adequately prepared personnel to develop and manage space technologies; (iv) challenges in the use and compatibility of available data and solutions; (v) geographical constraints to setting up launch facilities and conducting astronomical research; (vi) lack of consistent and comprehensive regulatory frameworks, technical standards and best practices; (vii) political, reputational and trade-off risks in using space technologies and limitations in accessing those technologies (e.g., export controls).[25]

22 See, e.g., Amna Kalhoro, Space 2.0: Developing nations lead the race for the final frontier (Reuters, 2023), at https://www.trtworld.com/opinion/space-20-developing-nations-lead-the-race-for-the-final-frontier-12796733 ("Kahloro 2023").

23 See, e.g., UN Economic and Social Council, Report by the Secretary General, Refl: E/CN.16/2020/3, 13 January 2020, paras. 48-50.

24 See UN Press Release on the 77th Session of the Fourth Committee of the UN General Assembly, Ref.: GA/SPD/762 of 28 October 2022, available at https://press.un.org/en/2022/gaspd762.doc.htm; Kahloro 2023.

25 *Id*, paras. 25, 35-37.

Removing or mitigating these constraints is key to enable developing countries and their space agencies to pursue space policies. The following sections investigate possible ways in which the Artemis Accords can help developing countries to do so.

2. The Artemis Accords and Their Contribution to Achieving Small and Medium Size Space Agencies' Policy Goals

The Artemis Accords fit squarely into a landscape of evolving policies to expand and improve space-related capabilities. As mentioned, the Artemis Accords are US-led bilateral agreements between over 20 party-nations aimed at "establish[ing] a common vision via a practical set of principles, guidelines, and best practices to enhance the governance of the civil exploration of outer space" within the contours of the Artemis Program, i.e., on or around the Moon, Mars, comets and asteroids. Albeit not binding, the Artemis Accords clarify that in the context of the Artemis Program, countries should operate in accordance with the commitments undertaken in respect to outer space-related conventions, such as the Outer Space Treaty, the Registration Convention and the Rescue and Return Agreement and in accordance with the so-called best practices adopted and followed by each relevant space agency.[26] The accords also require all signatory countries to conduct their space activities for peaceful purposes and abide by principles and commitments of the Artemis Accords, which include transparency, interoperability, sustainability, reciprocity, cooperation, and good faith.

Although the stated goals of these Accords are generally consistent with those of developing countries' policies, uncertainties surrounding how these principles should be implemented and the significant financial and technical contributions that the Artemis campaign may require can pose challenges to small and medium space agencies which they may not be fully equipped to provide.

TCBMs can help developing countries and their space agencies to overcome and mitigate these challenges and, at the same time, pursue their policy goals by establishing specific requirements of cooperation and collaboration with other space agencies or countries involved in one or more Artemis-related projects.

Although there is no universally accepted definition of TCBMs, TCBMs are generally described as non-binding measures through which "governments share information with the aim of creating mutual understanding and trust, reducing misperceptions and miscalculations and thereby helping both to prevent military confrontation and to foster regional and global stability."[27]

26 See Artemis Accords, Preamble and Section 1.

27 Report of the Group of Governmental Experts on "Transparency and Confidence-Building Measures in Outer Space Activities" of July 2013, Ref.: UN GA A/68/189) ("2013 GGE Report"), para. 20.

TCBMs span measures that seek to improve countries' capabilities and measures dealing with countries' behaviours and conflict-mitigation. Both types of measures have been discussed in the previous sections. The following analysis will focus primarily on capacity-building TCBMs, as these are the measures that can provide more immediate support to the countries' space policy objectives. This category of capacity building TCBMs include: (i) measures aimed at sharing information about each country's space policies; (ii) measures aimed at sharing technology, scientific data and standards to enhance the development of space systems to preserve the environment, increase space awareness and create or improve civil-based applications; and (iii) measures aimed at promoting capacity-building for advancement of space-related knowledge for sustainable economic and social development.[28]
The above-mentioned TCBMs are not only in line with developing countries' space policies but, as mentioned, are also fully consistent with the core principles of the Artemis Accords. The next sections will address how these measures can support developing countries contributing to Artemis-related projects in practice, and how they can be incorporated into the Artemis mission.

3. Pursuing Policy Goals through TCBMs in the Context of the Artemis Accords

The Artemis missions involve a wide variety of projects that can help developing countries to develop the required capacity and skills to achieve their goals.[29] To maximize the benefits of Artemis projects, developing countries participating into those projects should identify TCBMs that can produce positive spillover effects and allow them to build on the technological solutions and knowledge acquired in that context.
Once developing countries have determined that an Artemis-related project can help them to pursue these objectives,[30] they should identify their (and their space agencies') strengths and relevant capabilities, the means through

28 2013 GGE Report, para. 27.

29 See, e.g., NASA Office of Inspector General, NASA's Partnerships with International Space Agencies for the Artemis Campaign (2023), available at https://oig.nasa.gov/docs/IG-23-004.pdf, pp. 3-8 and 19; NASA Office of Technology, Policy and Strategy, Economic Growth and National Competitiveness Impacts of the Artemis Program (2022), available at https://www.nasa.gov/sites/default/files/atoms/files/artemis_economic_competitiveness_impacts_5-18-2022_tagged.pdf, p. 5.

30 This may not be automatic. The promotion of national policies on space and geospatial applications is highly dependent on the socioeconomic and political context in a country. Governments in developing countries may have different motivations to engage at different levels in space related activities and face different limitations. See, e.g., UN Economic and Social Council, Report by the Secretary General, Refl: E/CN.16/2020/3, 13 January 2020, para. 70.

which they can contribute to these projects and the benefits that they seek to obtain in return.

The exact way a specific TCBM can allow a country to obtain the desired result varies depending on the parties involved and the characteristics of the projects and goes beyond the scope of this paper. The concrete examples of TBCMs provided below can nevertheless provide guidance and stimulate discussion on the topic.

A first set of TCBMs comprises measures that help developing countries and their space agencies to obtain a full understanding of the technology developed as part of the project. This is particularly important where the contribution of developing countries to a project is limited to one or more specific aspects of that project. In this case, TCBMs may require that all parties cooperate transparently and fully disclose and share information concerning not only the results of their activity, but also of the technology used in a project. Exceptions may be provided for data and dual-use or proprietary technology that can potentially threaten countries' national security or commercial interests of private companies. For the latter, however, arrangements could be made so that the developing countries may access proprietary technology or in accordance with the applicable regulatory framework (e.g., licenses).

Where the developing countries lack capabilities to develop or use the technology developed for a project, it may be helpful to agree on specific mechanisms that enable the developing country to acquire the necessary knowledge throughout the project. Cooperation and knowledge-sharing commitments can be particularly effective in long-term projects to achieve full interoperability of space systems, as small and medium space agencies can progressively test and apply newly acquired technology and information. For instance, where developing countries are involved in the development of upstream capabilities (e.g., launch facilities and satellite design and manufacturing), they may seek to expand their knowledge to build related critical downstream capabilities (e.g., processing and analysing Earth observation data obtained from the satellites that they contributed to design, manufacture, or launch).

Of particular importance are also TCBMs enabling developing countries to access best practices and technical standards adopted by developed countries, such as environmental standards for launching and space activities, and through which developing countries can achieve space sustainability goals.[31]

Given the increasing commercialization of space activities and the commercial goals of the Artemis missions, public-private partnerships are

31 See, e.g., I. Baumann and E. Pellander, Ensuring Space Sustainability through National Space Legislation, in Routledge Handbook of Commercial Space Law (Smith, Baumann, Wintermuth eds.), Routledge (2023).

particularly important in this context. As space science and technology is increasingly transformed by cloud computing and artificial intelligence, private or quasi-private companies will play an increasingly important role in the Artemis missions.[32] Public-private partnerships may involve joint ventures, foreign direct investments in the developing country, and less structured cooperation agreements. The Artemis Accords however do not regulate or discuss the role of private corporations in any meaningful way. And while space treaties establish that governments are liable for private companies' activities in outer space,[33] public–private partnerships in complex projects can potentially blur the direct relationship between a company and its government. It is therefore important that the parties involved in these partnerships clearly determine their respective obligations and the terms of these partnerships. TCBMs may not only provide that these partnerships be established, but also shape the way in which public-private, multi-stakeholder partnership function. TCBMs are important to regulate the exchange of information and technology, the contribution of each party to the partnership or project, as well as the allocation of financial and political risks, liabilities and resources and outputs that they produce.

Lastly, TCBMs in the context of the Artemis Accords can help developing countries to form and train specialized and skilled personnel, such as geospatial technologists, scientists and engineers who can harness space technologies and data and convert it into applications that enable developing countries to pursue their environmental and socio-economic policy goals. Through TCBMs, developing countries may require that partner countries undertake additional commitments to provide specific education, trainings and knowledge-sharing systems that are relevant and functional to a project. For instance, TCBMs may require educational collaboration through networks of universities, "train-the-trainer" programs and intergovernmental platforms, and multi-stakeholder collaboration where both public and private companies invest in the training of developing countries' personnel in exchange for assistance throughout the duration of the project(s). These measures can be particularly beneficial in long-term projects and different projects carried out under the same framework agreement as they enable a more meaningful transfer of knowledge and skills.

32 See, e.g., UN Economic and Social Council, Report by the Secretary General, Refl: E/CN.16/2020/3, 13 January 2020, paras. 61-63; NASA Office of Inspector General, NASA's Partnerships with International Space Agencies for the Artemis Campaign (2023), available at https://oig.nasa.gov/docs/IG-23-004.pdf, p. 6 *et seq*.

33 See, e.g., Article VIII of the Outer Space Treaty and Art. I(c) of the Liability Convention.

4. Introducing and Implementing Transparency and Confidence-Building Measures in the Framework of the Artemis Accords

Once these objectives and TCBMs have been set, negotiated and, to the extent possible, agreed, developing countries should formalize them.

As mentioned, the Artemis Accords do not provide for TCBMs, and a revision of these Accords to introduce specific TCBM commitments appears impractical, time-consuming and, given the different needs of each country and varied nature of Artemis projects, may lead to potentially unsatisfactory results.[34]

A different, more practical solution could be to formalize TBCMs-related commitments into agreements implementing the Artemis Accords. In order to actually participate to Artemis missions and projects, all signatory countries are required to enter into separate, specific agreements (generally, with NASA and other cooperating space agencies) that determine the scope of a specific project and set the terms of their participation.[35] These agreements may take different legal forms, including intergovernmental agreements, memoranda of understanding, statements of intent, framework agreements or implementing agreements (generally used to define the contents of framework agreements in greater detail).[36]

Nothing prevents countries from formalizing TCBMs commitments and implementing procedures in these subsequent agreements. Indeed, while the Artemis Project does not formally require a tiered agreement structure (unlike, for example, the ISS Program), the agreements entered into between early signatories of the Artemis Accords suggest that that this approach has been followed in practice.[37] As of today, NASA alone has entered into more than 50 binding and non-binding Artemis-related instruments with signatory countries,

34 As no one size fits all solution exists, a revision of the Accords could lead to unsatisfactory outcomes where, for example, only generic and programmatic statements are introduced, instead of case-specific obligations or commitments. The efforts to do so would likely be disproportionate compared to the results. Similar considerations were made when considering the applicability of the IGA to the Artemis Project. See NASA Office of Inspector General, NASA's Partnerships with International Space Agencies for the Artemis Campaign (2023), available at https://oig.nasa.gov/docs/IG-23-004.pdf, p. 23.

35 See Konark Bhandari, "Are We There Yet? The Artemis Accords, India, and the Way Forward", Carnegie India, available at https://carnegieindia.org/2023/03/28/are-we-there-yet-artemis-accords-india-and-way-forward-pub-89375; https://oig.nasa.gov/docs/IG-23-004.pdf.

36 NASA Office of Inspector General, NASA's Partnerships with International Space Agencies for the Artemis Campaign (2023), available at https://oig.nasa.gov/docs/IG-23-004.pdf, p. 11 (Table 3).

37 See, e.g., A. Farand, The Space Station Cooperation Framework, ESA Bulletin 94 (May 1998), p. 3; NASA Office of Inspector General, NASA's Partnerships with International Space Agencies for the Artemis Campaign (2023), available at https://oig.nasa.gov/docs/IG-23-004.pdf, p. 23.

each of which sets different types of commitments and obligations in respect of one or more projects.[38] TCBMs could even be included in different but interdependent agreements: framework agreements or MoUs could identify "matters" or "areas" of a mission or a project in respect of which TCBMs will be implemented (e.g., funding requirements, liability allocation, role of commercial actors, sharing information/best practices), while implementation agreements could provide for more particularized obligations in respect of one or more specific issues within those matters or areas.

This approach has several advantages: it creates the conditions for developing countries to contribute to the Artemis Project more effectively, to openly discuss their capacity building needs with other signatory countries, and to maximize the benefits from the participation and contribution to the Artemis missions, thereby favouring more transparent dealings and stronger trust and confidence among all signatory countries. Possible disadvantages of this approach are the risk of a fragmented approach among different missions and parties, the difficulty for some developing countries to adequately negotiate desired TCBMs commitments, and the risk of stalling or delaying the conclusion of the relevant agreements. These risks, however, do not appear insurmountable. TCBMs do not fundamentally alter the contents of the Artemis Accords and in fact only implement the principles set forth in the Accords that all signatory countries are already actively pursuing (e.g., good faith, cooperation, transparency, capacity building); they do not modify the conditions or the scope of a project; and they do not (and need not) affect national security issues. All that TCBMs require is for signatory countries to make additional, concrete and functional steps to strengthen the cooperation among themselves in the context of a project. This type of cooperation is not only already embedded in the Artemis Accords but is extremely beneficial from both a geopolitical and a capacity-building point of view.

One last point for discussion concerns the need for mechanisms to ensure that TBCMs are observed, for instance by introducing dispute settlement mechanisms. These mechanisms may comprise different alternative or cumulative procedures, such as discussions through diplomatic channels, state-to-state amicable discussions, conciliation procedures, dispute boards and even arbitration. Whether dispute resolution mechanisms are helpful or needed remains to be seen. While this mechanism can improve trust and confidence between signatory parties and foster transparency and cooperation with a view to prevent disputes, TCBMs traditionally follow a bottom-up approach and are generally regarded as voluntary and based on good faith efforts of the parties. The inclusion of formal mechanisms to resolve TCBMs-related disputes risks disincentivizing (developed) countries from entering into this type of commitments. The opportunity to include dispute resolution, as opposed to other non-contentious mechanisms (e.g., incentive or rewarding

38 *Id.*, p. 12 (Table 4) and p. 65 *et seq.* (Table 7).

schemes) largely depends on the specifics of each case, to the nature of the commitments undertook by the parties, the public or private nature of the litigants, and the scope of the relevant Artemis-related agreement.

C. Concluding Remarks

This manuscript has discussed the legal principles governing the Artemis Accords and analyzed how TCBMs can complement the Accords and provide technical, strategic and political advantages to small and medium space agencies of developing countries when participating to Artemis-related projects. While the Artemis Accords do not expressly provide for any TCBMs, the principles of the Accords – which are largely consistent with those expressed in binding international agreements – enable TCBMs to be developed and implemented.

As part of their implementation, transparency and confidence-building measures will require mechanisms to protect and define confidential information in the context of international investment agreements dedicated to space resources and mining, such as the Artemis Accords.

As Artemis Accords require to disclose space policies and space operations of Signatories according to Section A.4, conflicts of laws may emerge, when a cybersecurity of operations is at stake. On the other hand, release of scientific data to the public may also cause conflict with IP rights, such as patent rights of authors, and trade secrets of private space actors. While the scope and target of confidential information could have been disclosed in Artemis Accords, it appears that confidentiality will continue to be governed by applicable laws of commercial agreements. To preserve confidence-building measures, it is hoped that signatory parties will standardize the scope and definition of confidentiality obligations that reflects a fair balance between protection of commercial secrets and state security.

We should take into account that contractual definitions of sensitive data are frequently broader than the legal protection afforded by trade secret law, consequently, controlling disclosure is critical to preserving trade secret designations.[39] Trade secrets might also be distinct based on the country and company's capabilities. Techniques or information that are commonly accessible to qualified workers in any technological sector, for example, are not considered trade secrets.[40]

All of this is relevant when implementing TCBMs providing for sharing of information between signatory parties. In this context, it is recommended that in mutual non-disclosure agreements, parties determine what constitute

39 Information Security Reader, 'Securing Intellectual Property: Protecting Trade Secrets and Other Information Assets (Information Security)', 1st Edition, Elsevier 2009, page 11-56.

40 *Id.*, p. 29.

confidential information and trade secret for the purposes of commercial space operations contracts. This, of course, while keeping in mind other competing duties, such as the duty to keep informed international community about environmental safety of space operations.

In terms of introducing and implementing TCBMs into the Artemis Accords, this can be done either through express reference to TCBMs in subsequent Artemis-related agreements or by reference to international soft law instruments that are already available. In light of the nature and goals of the Artemis Accords and the increasing role of private space actors in space exploration projects, careful policy and legal analysis is required to maximize the effectiveness of TCBMs in the context of the Artemis Project. It is important that all parties involved in a project carefully analyze and discuss the specific content and scope of the TCBMs on a case-by-case basis.

In conclusion, while further analysis is required on the mechanisms for implementing TCBMs and their incorporation into Artemis missions, this analysis shows that TCBMs can foster the progress of developing countries and, by so doing, increase the overall space capacity and ability to carry out space activities for the benefit of all signatories to the Artemis Accords.

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