ARTICLE

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Closing the pacing gap: How emerging space nations are influencing sustainability norms

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HIGHLIGHTS

- The "pacing gap" in space sustainability is increasingly an alignment problem: Operational change is outpacing the institutions that allocate access, define responsibilities, and structure risk.
- In the United Nations Committee on the Peaceful Uses of Outer Space, emerging space nations are shifting from awareness-raising to implementation-focused engagement, using Long-term Sustainability reporting, regional benchmarking, and national uptake to shorten the distance from agreed language to practice.
- In the International Telecommunication Union system, late-entry constraints and capacity demands shape emerging space nations' emphasis on equitable access and efficient, sustainability-aware coordination of spectrum and orbital resources.
- Through the Artemis Accords, emerging space nations are co-signers of faster-moving operational commitments for exploration, extending sustainability expectations beyond Earth orbit within a layered governance landscape.

Space debris and congestion are growing across Earth's critical orbits, driving increased collision and interference risks for satellite operators. This paper uses the term "pacing gap" to describe the mismatch between the speed of technological and commercial change and the slower, incremental pace of policy development, coordination, and implementation in the space industry. It argues that the pacing gap is increasingly shaped not only by time, but by alignment between evolving operational realities and the institutions that allocate access, define responsibilities, and structure risk. Focusing on emerging space nations, the paper examines how sustainability norms are being co-produced across three key institutional settings: the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS), including the voluntary Long-term Sustainability (LTS) Guidelines; the International Telecommunication Union (ITU) system for spectrum and orbit coordination; and the Artemis Accords as a faster-moving set of political commitments for future exploration. Across these governance arenas, emerging space nations are moving from general alignment toward implementation-focused engagement. This includes voluntary reporting, engaging in regional benchmarking mechanisms, coordination practices, and operational commitments. Rather than accelerating consensus-based diplomacy, these efforts narrow the translation distance between agreed principles and practice, and shape how sustainability expectations are interpreted, adopted, and operationalized in an increasingly congested orbital environment.

Space debris in Earth's critical orbits is increasing rapidly, compounding risk across the operating environment. As of April 2026, space surveillance networks track over 44,000 objects in space, of which approximately 15,200 are active satellites. Many millions of debris fragments remain too small to be detected, yet still have the potential to cause catastrophic damage on impact [1]. The number of satellites in orbit continues to increase due to a range of factors including a decrease in launch costs, an increase in the number of large satellite constellations, new entrants in the form of government and commercial space actors, and an increasing desire by many States to operate sovereign assets in space for national security. Figure 1 shows the changing composition of payload traffic in the 200 - 1,750 km altitude band, with commercial space objects far exceeding the civil, defence, and amateur categories. The rapid increase in the number of objects over the past decade, driven primarily by commercial payloads, clearly emphasizes the urgent need to manage congestion, interference, and collision risk in critical orbits.

Multilateral mechanisms exist to address the growing challenge of the long-term safe and sustainable use of space. Since its inception in 1958, the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) serves as a key international forum for States to align on guidelines, treaties, and norms of behavior on the long-term sustainability of the space environment. The International Telecommunication Union (ITU) allocates spectrum and coordinates non-interfering use of orbits, and technical bodies such as the Inter-Agency Space Debris Coordination Committee (IADC) and standards organizations

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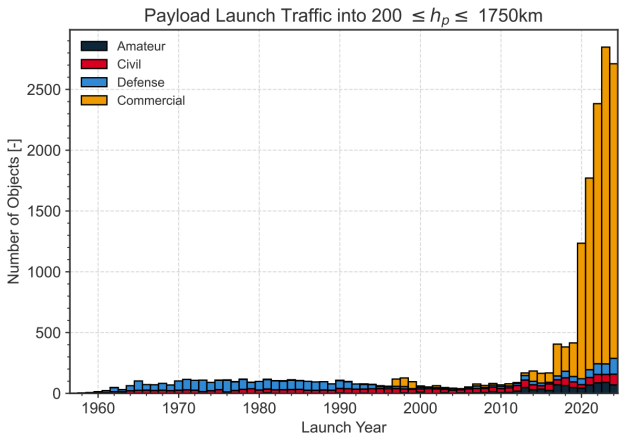

Figure 1: Evolution of payload launch traffic classified by commercial, defense, civil, and amateur (including academic institutions when none of the other entities are the driving contributor) funding sources [1]

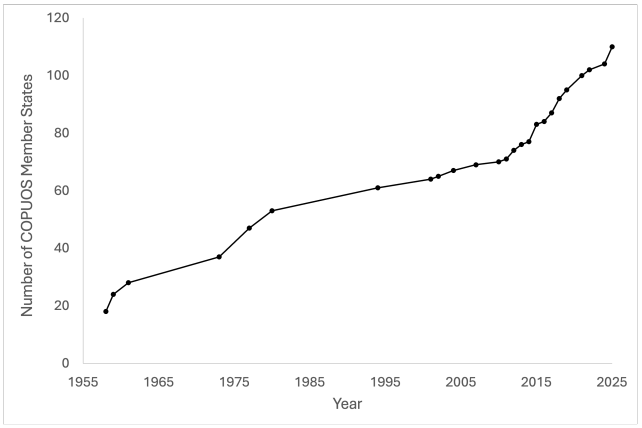

Figure 2: Evolution of COPUOS Member States since its inception in 1958

develop debris-mitigation practices. Over the past two decades (2001 – 2025), membership at COPUOS has grown by nearly 60%, with many new entrants from emerging space nations, as shown in Figure 2. Most recently, Cote d'Ivoire, the Gambia, Honduras, the Maldives, Malta, and Zimbabwe joined COPUOS in 2025, bringing the total membership to 110 States, alongside requests from the Bahamas, Kyrgyzstan, Serbia, and Uganda. Many of these new space actors are launching their first satellites into Low Earth Orbit (LEO) and Geostationary Earth Orbit (GEO). LEO, 160 - 2,000 km above Earth, is increasingly crowded and supports a wide range of missions including satellite broadband constellations, Earth observation science missions, and technology demonstrations. GEO, 35,786 km above Earth, on the other hand is well suited for telecommunications satellites and continuous weather monitoring, but where orbital slots and associated frequency bands are already heavily used. Recent deliberations within the COPUOS Long Term Sustainability (LTS) Working Group (WG) capture this, noting that "opportunities for emerging space nations to participate in space activities come at a higher risk than previous participants as space debris is increasing and space debris should be considered a universal responsibility" [2].

Emerging space nations are defined as States with demonstrated engagement in space beyond the use of downstream satellite services, and who are turning their focus to building national capabilities and an associated space industry ecosystem [3]. This is often primarily through government-driven programs, international partnerships, and policy coalitions. As emerging space nations enter an increasingly congested and geopolitically complex environment, they are immediately operating under higher baseline risks from debris hazards in orbit to spectrum congestion. Under these conditions, emerging space nations have often advocated for equitable access, transparency, and capacity-building in forums like COPUOS. As national space strategies and space sustainability take priority, emerging space nations are increasingly integrating debris mitigation, space object registration, and end-of-life planning into national space laws, establishing funds and investment vehicles that embed sustainability criteria into program design, and forming regional mechanisms to coordinate positions in multilateral forums. Earlier work by Rathnasabapathy et al. [3] on emerging space nations and long-term sustainability has largely centered on national and regional case studies, noting that emerging space nations are becoming increasingly proactive in space sustainability discussions.

This shift from advocating for sustainability norms to operationalizing them can be seen in emerging space nations' growing institutional footprint across governance arenas. One indicator is the increase in State delegations at COPUOS and the ITU over the past decade, suggesting a shift from predominantly awareness-raising engagement toward more active participation in the design and implementation of sustainability norms alongside established (longer-standing) space actors. In recent years, this has extended further to technical coordination at the ITU, and becoming signatories to international cooperation frameworks such as the Artemis Accords. Across these norm-setting and governance arenas, emerging space nations operate both as latecomers and norm entrepreneurs, shaping how sustainability expectations are interpreted and implemented in a more congested orbital environment.

The pacing gap and institutional landscapes

The space industry faces a "pacing gap" [4], defined as the gap between rapidly evolving technology and commercial activity on one hand, and a slower, more incremental development of policy and regulation, on the other. Commercial launch providers and satellite operators can often scale deployments in months, while multilateral rulemaking typically takes years to decades. However, the pacing gap is not only about speed, but also about alignment. Multilateral forums and norms of behavior that were once designed for a small group of early spacefaring States now have to accommodate a much larger and more diverse set of actors, operating in a far more congested environment.

How the pacing gap is managed, who participates in norm-setting, and how quickly those norms are translated into practice has become a central question for long-term space sustainability. In this framing, closing the pacing gap is both about accelerating treaty-making and reducing opportunities for misalignment between i) operational realities; and ii) the institutions that coordinate access, responsibilities, and orbital risk.

For emerging space nations, the pacing gap is experienced in an already congested orbital environment, with rules-of-the-road and coordination systems that were largely designed before they entered as space actors. Understanding their role in closing the pacing gap requires consideration of i) the legal and coordination mechanisms that scaffold equitable access to critical orbits and spectrum allocation; and ii) how operational risk is distributed for emerging space nations.

First come, first served? Earth's orbits are a finite, shared resource. Over the past decade, the number of projects and requests submitted to the ITU for spectrum- and orbit-resource coordination has increased by 5.5 times [5]. This figure refers to filings submitted to the Radiocommunication Bureau, not necessarily systems that have completed coordination or been brought into use. While not all submissions translate into deployed satellites, the increase in the number of filings signals increasing pressure on coordination processes and long-term sustainability. Recent interventions by emerging space nations in multilateral forums often emphasize non-discriminatory access, transparency in operations, and stronger global commitments to debris mitigation and responsible use of spectrum. In 2024, the African Group statement during the 67th session of UN COPUOS noted, "it is imperative to promote equal, non-discriminatory access to outer space, irrespective of levels of socio-economic or scientific development and should be cognizant of developing country needs" [6]. These statements demonstrate the link between space sustainability and access, highlighting that as orbital environments continue to become congested, debates will continue over operational risk and the long-term safety and sustainability of the space environment.

In practice, this shows up in two main implications. First, operators must manage a more complex conjunction environment, especially in LEO. The increase in number of active satellites, in addition to the continued presence of non-maneuverable debris, increases the number of close approaches that require screening, assessments, and where needed, collision avoidance maneuvers. New operators are entering an environment where conjunction assessment and collision-avoidance planning are routine operational requirements. For emerging space nations financing early national missions, these requirements can increase operational complexity, create additional dependence on timely space situational awareness (SSA) data, and reduce mission margins where operational capacity or propellant must be reserved for avoidance maneuvers. Second, many emerging space nations depend on external SSA services, referring to the tracking and assessment of objects and events in orbit (such as satellite positions, conjunctions, and potential collision risks). These nations often rely on notifications from foreign SSA systems (United States, Russia, European Union, China), commercial SSA providers, or partner agencies. This dependency can lead to delays in the timeliness of data and coverage gaps they receive. These operational asymmetries help to explain why many emerging space nations emphasize implementation-relevant sustainability measures, including improved information sharing and coordination practices.

Balancing hard and soft law: Space sustainability is shaped by a combination of hard law and soft law instruments. Hard law instruments create binding obligations, define liability and registration responsibilities, and dictate procedures for accessing orbits and spectrum, such as the UN space treaties, ITU Radio Regulations, and national space legislation. The five UN space treaties, namely, the 1967 Outer Space Treaty (1), the 1968 Rescue Agreement (2), the 1972 Liability Convention (3), the 1975 Registration Convention (4), and the 1979 Moon Agreement (5), constitute hard law in that they are legally binding on States that are parties to them. However, ratification patterns are uneven: many States (including emerging space nations) are not parties to all five treaties, which shapes how uniformly these obligations are internalized through national law and practice. While these legal instruments set baseline obligations, implementation into national regulation and operational "rules of the road" still leaves much to interpretation.

Soft law includes non-binding, voluntary guidelines, standards, and best practices. Soft law instruments, such as the COPUOS 21 LTS Guidelines and IADC debris mitigation guidelines, have increasingly become an alternative way to articulate and refine space sustainability norms, as they are typically faster to negotiate than hard law space treaties and can be updated more easily [7]. However, debates are ongoing over whether the LTS Guidelines are sufficient for today's urgent challenge of space sustainability [8]. This tension is especially evident in debris mitigation, where non-binding expectations can be unevenly adopted, while binding global laws can be difficult to enforce. In terms of the pacing gap, soft law offers a gateway into a more formalized national space regulation (hard law). Examples of national space regulations, stemming from soft law instruments, include:

- Mandating compliance with ITU filing obligations and spectrum-use for licensing;
- Requiring debris-mitigation plans and end-of-life procedures as part of licensing;
- Strengthening national registries of space objects, and greater data sharing policies; and
- Including passivation, post-mission disposal timelines, and where relevant, re-entry risk management.

Role of emerging space nations across governance structures

Over the past decade, more States have joined COPUOS

and taken a more active role at the ITU, reflecting a broader shift in increased participation in the shaping of space governance. Similar to more established spacefaring nations, emerging space nations operate across multiple, often overlapping, governance arenas, including:

- UN multilateral soft-law processes such as COPUOS, where guidelines, principles and working group reports define global norms of behavior;
- ITU technical coordination regimes for submitting filings, advocating for equitable spectrum and orbital access; and
- International cooperation frameworks and non-binding political commitments related to the future of sustainability, debris mitigation, and resource utilization, such as the Artemis Accords.

In this article, "governance arenas" refers to institutional settings where space sustainability expectations are negotiated, coordinated, and translated into practice, through soft-law guidance (e.g., COPUOS Long-term Sustainability Guidelines), treaty-based procedures (e.g., ITU Radio Regulations), or political commitments that shape operational behavior (e.g., the Artemis Accords). These settings engage different parts of the pacing gap problem: COPUOS helps define expectations and common language; the ITU operationalizes equitable access through binding coordination procedures; and international agreements can translate broad principles into faster-moving operational commitments. The cumulative effect is a layered institutional landscape where emerging space nations can influence both what "responsible behavior" means and how it is implemented. Across these arenas, emerging space nations contribute to closing the pacing gap by shortening the translation distance between norms of behavior, coordination procedures, and implementation pathways. Through national reporting, regional coordination, participation in technical processes, and political commitments, they help clarify which sustainability expectations are feasible, where capacity constraints remain, and how agreed language can move into practice.

Emerging space nations in UN COPUOS: Since its establishment, UN COPUOS has been considered a central multilateral forum for the development and adoption of space law and norms of behavior. The Secure World Foundation's COPUOS Briefing Book [9] states that COPUOS remains the "most important international multilateral forum" for fostering cooperation on the peaceful uses of outer space, with growing membership reflecting the globalization of the space industry. For much of its early history, COPUOS was made up of a relatively small group of established space powers. 18 member States constituted the first ad hoc committee in 1958, growing to 28 member States by 1961 when the first international legal document was adopted with respect to Resolution 1721B (XVI) on the UN Registry of Space Objects (6) [10]. Over the past six decades, the number of spacefaring nations, satellites launched, debris population in critical orbits, and COPUOS member States have increased steadily. This growth in COPUOS membership, shown in Figure 2 represents a change in governance mechanisms, spurring the question of who is in the room, or needs to be in the room, when space sustainability guidelines are drafted, negotiated, and adopted? It further changes how the pacing gap is experienced by all COPUOS member States in consensus-based processes that are inevitably slow in decision-making. While a broader and more diverse membership casts a wider net for a consolidated adoption of space sustainability guidelines, it can also mean that alignment to reach consensus can take significantly longer. At the same time, broader participation can make the adoption of guidelines into national regulation, licensing practice, and voluntary reporting easier and faster to implement, because States are more likely to adopt practices they helped to shape.

National initiatives—from awareness raising to norm shaping: For many emerging space nations, engagement at COPUOS often begins with broad alignment with existing treaties and norms largely designed before their time. These interventions often emphasize three themes:

- Reaffirming commitment to the Outer Space Treaty and other UN space treaties;
- Calling for enhanced capacity building and technology transfer in areas such as national space legislation, licensing, and SSA;
- Highlighting the benefits of space applications for sustainable development, including agriculture, climate monitoring, connectivity, and disaster management.

As new COPUOS members join and their participation deepens, a second phase emerges that shows a distinct transition. While emerging space nations continue to reiterate their commitment to long-term sustainability, their interventions are more descriptive about how they are implementing sustainability norms in national legislation and regulatory practice, and they are more open to questioning whether existing practices are adequate in a more congested orbital environment.

An example of this shift is illustrated by Singapore's involvement in COPUOS over the past decade. In 2019, Singapore became a new member of COPUOS, stating to the UN General Assembly that Singapore intended to "participate more actively in international dialogue and cooperation", and "look forward to more collective efforts of the international community to strengthen and maintain the relevance of the global space governance framework, including keeping pace with latest technological advances." [11]. The 2019 intervention additionally reaffirmed Singapore's support for the UN space treaties and endorsed Indonesia's COPUOS statement on behalf of the Association of South East Asian Nations (ASEAN) on the importance of improving access to space technology through capacity building and technology transfer. By 2025, Singapore had become an active COPUOS member, collaborating with the United Nations Office for Outer Space Affairs (UNOOSA) on the "Space Law for New Space Actors" initiative. Under this initiative, UNOOSA and the Singapore Office for Space Technology and Industry

agreed to deliver a Space Law Technical Advisory Mission, with the goal of aligning national legislation with international space law and the long-term sustainability agenda [12]. In the same year, Singapore submitted a detailed report on voluntary implementation of the LTS Guidelines, outlining how national legislation, the national registry of space objects, and SSA coordination efforts were aligned to those in the LTS Guidelines [13]. Singapore's shift from general alignment in 2019 to detailed reporting on national implementation in 2025 captures how emerging space nations are proactively closing the pacing gap. Additional evidence among emerging space nations of broader shifts include:

- Substantive inputs on LTS implementation:
  Emerging space nations are increasingly submitting written contributions to the Working Group on the Long-Term Sustainability of Outer Space Activities that go beyond previous high-level statements. These interventions detail specific LTS Guidelines and how they map international law, licensing criteria, SSA arrangements, and the prioritization of space sustainability in national space strategies.
- Treating LTS guidelines as regulatory scaffolding:
  While the 21 LTS Guidelines remain soft law, in practice many emerging space nations now treat them as a scaffolding structure for national regulation and multilateral negotiations. The 2024 working paper by the Chair of the Working Group on LTS [14] noted that some States were conducting national mapping exercises to translate the LTS Guidelines into national regulation. State delegations routinely describe national adoption of LTS Guidelines, notably A.1 national regulatory frameworks; A.4 equitable and efficient use of spectrum and orbital regions; A.5 on registration; B.1 - B.4 on SSA and conjunction assessment; C.1 - C.4 on cooperation and information sharing; and D.1 and D.2 on research and new measures. By specifying which Guidelines they can implement, where they face constraints, and what kind of assistance would be most useful, emerging space nations are narrowing the divide between soft law and concrete national regulatory implementation. Submissions from emerging space nations demonstrate this in practice, including Algeria's 2023 report linking LTS Guidelines to drafting national registry procedures, as well as noting that some space sustainability measures remain "costly and technologically challenging for emerging space nations" [15]. In the same year, national inputs from Brazil [16] and Australia [17] stated their engagement with specific LTS Guidelines alongside their respective national space strategies.

These trends signal a closing of the pacing gap in two ways. First, it shortens the time between multilateral global consensus and national implementation for sustainability norms. Second, it creates a feedback loop such that emerging space nations report on which Guidelines they can implement, where their capacities are stretched, and which Guidelines might create unintended barriers to entry, so that they can further shape the agenda for future sustainability work streams.

This is also evident in the 2025 report of the LTS Working Group [18], which considers capacity building and inclusive participation by emerging space nations as a core part of the Working Group agenda. The report includes details of a consistent set of implementation challenges that are particularly critical for late entrants, including:

- Gaps in national regulatory and administrative capacity to operationalize the Guidelines, including clearer approaches to registration practices and constellation-related procedures;
- Uneven access to SSA information and difficulties with standardized data exchange, contact points, and coordination for conjunction assessment;
- Recurring concerns about equitable access to orbital and spectrum resources in a congested environment shaped by large constellations;
- Persistent needs for capacity-building tools and infrastructure such as training, templates, glossaries, and repositories to support implementation; and
- The continued challenge of debris mitigation as a mission-design and long-term population-management problem.

Regional Initiatives—providing consolidated input and lessons-learned: Rathnasabapathy et al. [3] noted the establishment of regional initiatives that serve as intermediaries between national practices of countries within a region and COPUOS-level discussions. By working through regional groups and coalitions, regional initiatives help pool expertise, reduce duplicated efforts, and support negotiating positions, particularly for States with small delegations or limited specialist staff.

An example of regional cooperation is the National Space Legislation Initiative (NSLI), launched in 2019. Initiated under the Asia-Pacific Regional Space Agency Forum (APRSAF), NSLI brings together Asia-Pacific countries including Australia, India, Indonesia, Japan, New Zealand, Malaysia, the Philippines, the Republic of Korea, Singapore, Thailand, Türkiye, and Viet Nam to jointly examine national space legislation. NSLI performs several functions that are related to narrowing the pacing gap, including:

- Providing a forum for policy alignment and mutual learning, enabling nations with newer or smaller programmes to draw on peer examples rather than drafting legislation from scratch;
- Promoting LTS Guidelines to inform national legislation, and making it easier to check whether national frameworks are aligned with global norms of behavior;
- Reducing compliance fragmentation by highlighting convergences and divergences in national space law.

Emerging space nations at the ITU: The International Telecommunication Union (ITU) sits alongside COPUOS as a treaty-based coordination regime of radio frequency

spectrum and associated orbital resources. Where COPUOS develops long-term sustainability norms through voluntary guidelines and consensus-based reporting, the ITU governs the practical access conditions for satellite systems through filing, coordination, recording, and interference-management procedures. Article 44 of the ITU Constitution (7) states that radio frequencies and associated orbits are limited natural resources that must be used rationally, efficiently, and economically such that all nations may have equitable access, particularly taking into account the needs of developing countries [19, 20].

For emerging space nations, the ITU is often where being a late entrant is experienced most notably. Entering the ITU system includes navigating filing, coordination, and recording procedures at a time when frequency assignments have already been heavily used. In January 2025, Radiocommunications Bureau Director, Mario Maniewicz noted that requests for spectrum-orbital resources had grown 5.5 times over the past decade [21]. This reflects both the rapid expansion of the space economy and the complexity of managing it. The pacing gap in the context of the ITU now includes how the technical and administrative demands of hard-law systems become more challenging as new space actors enter the Union [21, 22]. "Late entry" therefore translates not only to already crowded orbits, but also to procedural capacity.

For emerging space nations, their role in closing the pacing gap in the context of the ITU is not primarily about making the system move faster. As national administrations, emerging space nations participate in filing, coordination, and recording processes; engage in coordination with other administrations; contribute to the World Radiocommunication Conference processes; and, in some cases, work through regional groupings to consolidate positions. Through these mechanisms, they bring late-entry constraints into practical systems that determine access to spectrum and associated orbital resources. Their contribution therefore includes participation in the procedures through which equitable access to and efficient use of orbits are debated, coordinated, and implemented. Resolution ITU-R 74 (8) [23], adopted in 2023, addresses the sustainable use of radio frequency spectrum and associated orbital resources used by space services, and recognizes that these resources are limited and must be shared amongst all nations. This speaks to the difference between broad sustainability language and the real-world coordination regime that governs access to operational space systems. The ITU Space Sustainability Gateway and the Bureau's 2024 circular letter on implementation of ITU-R 74 indicates a growing institutional effort to connect spectrum-orbit management to long-term sustainability, as well as providing resources for information sharing, and best practices [24]. In terms of the pacing gap, these steps can be seen as attempts to reduce the lag between the scale of new constellation planning and the tools available to track, coordinate, and manage associated interference risks.

Emerging space nations and Artemis Accords: While the Artemis Accords are neither a treaty nor a multilateral forum such as COPUOS, they serve as a non-binding political commitment through which signatories affirm a common approach to the future of civil space exploration and use. The Accords are grounded in existing international law, including the Outer Space Treaty, the Rescue Agreement, and the Registration Convention, adding an operational layer related to transparency, interoperability, and orbital debris mitigation. In the latter, signatories commit to "plan for the mitigation of orbital debris, including the safe, timely, and efficient passivation and disposal of spacecraft at the end of their missions, when appropriate, as part of their mission planning process…" and " …to limit, to the extent practicable, the generation of new, long-lived harmful debris released through normal operations, break-up in operational or post-mission phases, and accidents and conjunctions, by taking appropriate measures…" [25]. The Artemis Accords are not the only cooperation framework through which future exploration norms are being shaped. Other initiatives, including the International Lunar Research Station (ILRS), also use cooperation agreements and partnership structures to organize participation in lunar and cislunar activities. A full comparison of these frameworks is outside the scope of this article. However, their existence reinforces the broader point that emerging space nations are navigating several governance landscapes, where exploration norms are shaped across multiple frameworks rather than through a single process.

Within this broader landscape, the Artemis Accords are relevant to the pacing gap because they give political shape as to what responsible conduct should look like. A growing number of emerging space nations have chosen to become signatories to the Artemis Accords. Examples of emerging space nations include Australia becoming a signatory in 2020 at the inauguration of the Accords, followed by Brazil and Mexico in 2021, Singapore, Nigeria, Colombia, and Rwanda in 2022, and recently Bangladesh and Senegal in 2025 [26]. This growing list of signatories is important as it demonstrates that the Accords are no longer supported by a narrow group of early signatories or established space powers. Instead, the participation of emerging space nations in the Accords allows for greater geographical and political reach, placing these nations inside continually evolving conversations about future exploration norms that are likely to be implemented. For emerging space nations, the Accords are best understood as a form of normative positioning, offering a way to enter discussions on transparency, deconfliction, sustainability, and responsible conduct early, before these practices harden into expectations shaped only by a small number of actors.

The contribution of emerging space nations to closing the pacing gap using the Artemis Accords is not limited to their signatures alone. The National Aeronautics and Space Administration (NASA) October 2024 summary of the Artemis Accords signatories meeting in Milan reported that 42 of 45 signatories participated [27], including established and emerging space nations from every region of the

world. NASA's FY2024 Aeronautics and Space report of the president [28] further noted that signatories agreed on a basic set of mission data that operators should share publicly for purposes of deconfliction. These developments are particularly important as they show the Accords moving from broad principle to more concrete operational practice, with contributions by and with emerging space nations.

Conclusion

Modeling by debris experts indicates that the population of cataloged objects in critical orbits is projected to continue growing over the coming decades even under active mitigation and remediation scenarios, and considerably faster in their absence. This reinforces the central premise of the article that space sustainability is no longer only a technical challenge of debris mitigation, but also an institutional challenge of aligning governance with a rapidly changing operating environment. The need to close the pacing gap is more critical than ever, not because governance can eliminate debris growth entirely, but because timely, well-aligned policy coordination and implementation can reduce the rate at which risk accumulates. As participation expands in COPUOS and related processes, emerging space nations are increasingly present in the venues where sustainability language is negotiated, clarified, and translated into practice. In recent years, emerging space nations have increased their participation in these arenas by proactively demonstrating voluntary implementation of COPUOS LTS Guidelines, and together with other States, contributing to joint papers on the future of sustainability-related mandates. Examples such as Singapore's efforts to implement the LTS Guidelines demonstrate how emerging space nations are adopting sustainability priorities into the design of new space programmes, rather than treating them as afterthoughts. Examples of effective regional policy and coordination mechanisms that provide a consolidated, shared regional approach also support translating LTS-related Guidelines into national practice. These actions do not necessarily accelerate consensus-based diplomacy, but they can shorten the "translation distance" between agreed language and adoption by clarifying what is feasible for late entrants, what support is required, and what implementation pathways are already being used.

A layered institutional and regulatory landscape spanning COPUOS (shared expectations), ITU (coordination), and alongside numerous international cooperation agreements like the Artemis Accords (operational political commitments), can enable alignment on sustainability-related policies. Across all three governance arenas, sustainability norms are increasingly shaped through practice, not only through formal agreements. National implementation reports, regional benchmarking, coordination procedures, and operational commitments all contribute to what "responsible behavior" comes to mean. The contributions of emerging space nations to narrowing the pacing gap lie in helping to shape what responsible behavior means, where it applies, and how quickly it becomes practice across multiple arenas rather than through a single top-down channel.

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