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Space citizen: The gap between you, me and the governance of space

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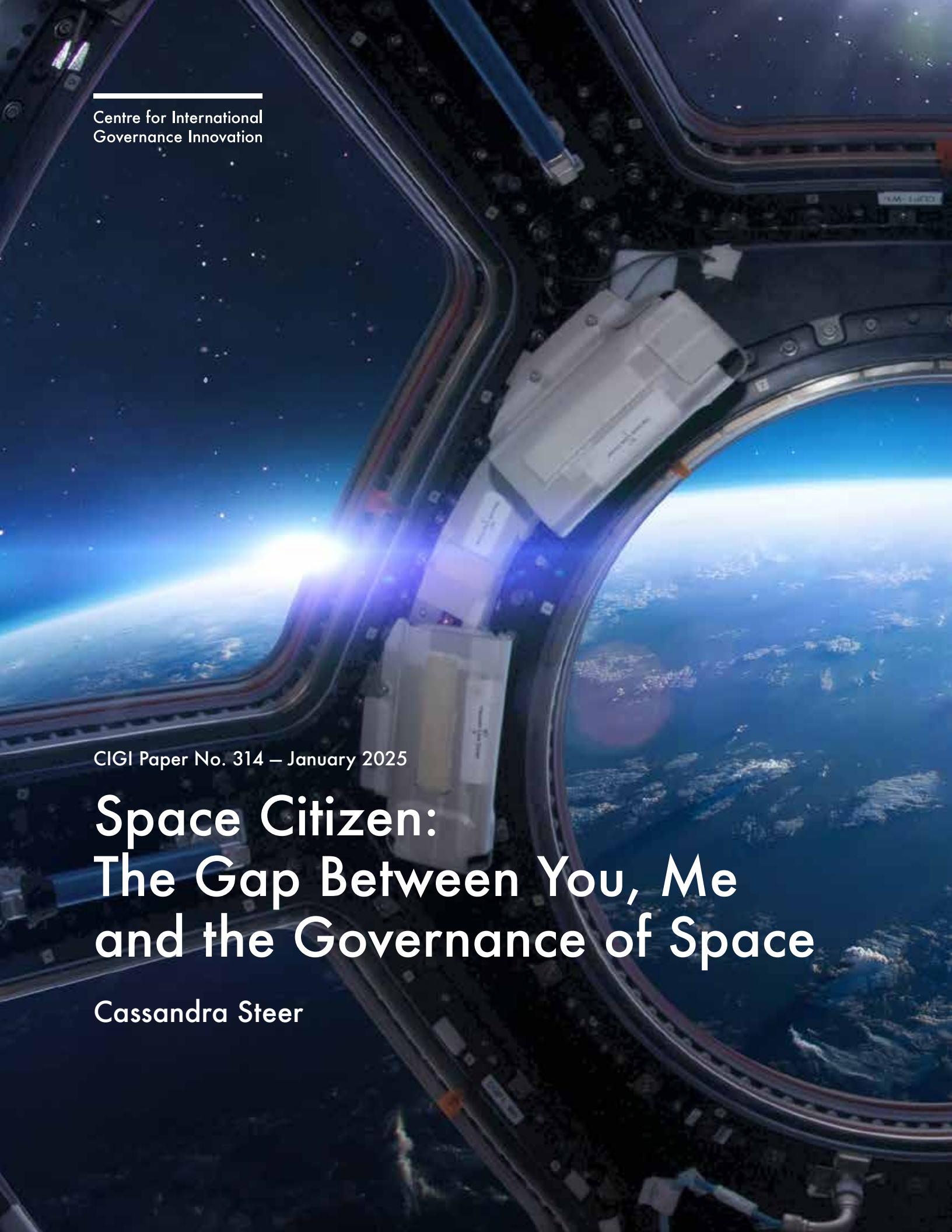

Centre for International
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About the Author

Cassandra Steer is chair and founder of the Australian Centre for Space Governance, and concurrently deputy director of the Australian National University (ANU) Institute for Space. Globally recognized for her expertise in space governance, space law and space security, she has published widely on these topics, including the application of the law of armed conflict and use of force in outer space. She has served as a consultant on these issues for the Australian, Canadian and US departments of defence; the Australian Space Agency; and the Australian Department of Foreign Affairs and Trade. She has taught space law and space security at McGill University, the ANU College of Law, the National Security College and the Australian War College.

Cassandra is multilingual and has lived and worked in five countries across four continents. She has degrees in philosophy, civil law, international law and international criminal law, and training in common law, comparative law and space law. She is a member of the Australian Space Agency's Technical Advisory Group for Space Situational Awareness, an associate expert on the *Woomera Manual on the International Law of Military Space Operations*, a member of the Space Traffic Management Committee of the International Academy of Astronautics and a member of the International Institute of Space Law.

Acronyms and Abbreviations

ASAT	anti-satellite
COPUOS	Committee on Peaceful Uses of Outer Space
EO	Earth observation
ESA	European Space Agency
ISS	International Space Station
IT	internet technology
NATO	North Atlantic Treaty Organization
OEWG	open-ended working group
OST	Outer Space Treaty
PNT	position, timing and navigation
SSA	space situational awareness
UNGA	UN General Assembly
UNOOSA	UN Office for Outer Space Affairs

Executive Summary

Existing space governance institutions and mechanisms are built on a twentieth-century reality, when states were the main actors and the main, if only, subjects of international law. While international space law and multilateral institutions are facing pressures in the twenty-first-century "spacescape," they should not be disregarded or replaced entirely. The framework they provide is an important foundation. Rather, what is needed is an expansive lens to work toward new approaches to the wicked problems of space governance, including safety, security and sustainability. The number and type of space actors, the ever-increasing nature of human activity in space, the dual-use nature of most space services and the vulnerability of civilians in the event of a loss of space-based services: all of these factors create wicked complexities. An expansive cognitive approach is proposed: that of the individual "space citizen." Since we are all dependent on space-based technologies, we all have a vested interest in the good governance of the space environment and our impact upon it. Existing notions of the "global citizen" and "planetary citizen" should be expanded to the "space citizen," so that we can activate our own individual participation in new governance approaches that are multi-stakeholder, muti-domain, inclusive and intergenerational.

Introduction

In 1987, author Frank White (2014) coined the term "the overview effect" to describe the paradigmatic shift in perspective and values that many astronauts reported following their spaceflight experiences. A number of astronauts became committed environmentalists, having seen from above the impact of the Anthropocene on our planet, and reported emotional and spiritual shifts regarding their sense of identity as global or planetary citizens. White asserted that this is a cognitive shift, possibly a next step in collective human development. He has also argued that as more humans have access to this experience through future space tourism, more of us will shift our sense of identity away from national limitations toward being global citizens, with a sense of responsibility for our planet. Similarly, the photo known as "Earthrise," a view of Earth rising over the lunar horizon that was taken in 1968 by one of the Apollo 8 crew members from within their capsule, is often described as one of the most valuable artifacts from this inaugural crewed lunar mission, and is arguably "the most influential environmental photograph ever taken."[1] Crew member Bill Anders (2018) has since stated that the Apollo 8 mission — the first-ever crewed spaceflight to leave Earth orbit — was defined by this moment: "We set out to explore the Moon and instead discovered the Earth."

This paper argues that the next stage of human cognitive development must expand on the notion of "global citizen," or even "planetary citizen," to a wider notion of "space citizen." Just as our international interactions and economies, digital technologies and environmental impacts upon our planet are driving the notion of global citizenship, our technological dependencies in, interactions with and impacts on space similarly require us to shift our cognitive identities to encompass not only our planet, but also our near-Earth space environment. We must expand our sphere of awareness to include the natural space environment within which our Earth system and critical technologies operate: an environment upon which we depend for our individual, national and global needs, and yet one on which we are already making a concerning environmental impact. The "space citizen" concept of identity can lead to closer individual, community and social engagement with these issues, and an understanding that good space governance is intertwined with the issues we face on Earth in the twenty-first century, especially climate change, the digital divide, food security and geopolitical tensions.

This expanded cognitive framework attempts to correct the current general lack of understanding in the wider public and among decision makers globally as to how much we already depend on the space domain. Failing to adopt this expanded framework would contribute to a current downward spiral in terms of the safety, security and sustainability of the space domain — including cis-lunar space. Continuing to ignore our role as space citizens would deny intergenerational access to and benefits from space-based technologies.

1 See www.abc.net.au/science/moon/earthrise.htm.

Current global space governance mechanisms are buckling under the pressures of rapid technological, political, commercial and military developments. Whereas space activities in the twentieth century were predominantly government operated, and involved a small number of states, today space is a multi-stakeholder domain that includes commercial service providers, as well as individuals, communities and societies who depend on space-based services. In addition, the world is in a multi-polar political era, which means that different political, legal and governance solutions are needed from those that were successful in the late twentieth century. Institutions and instruments that focus only on state interactions create an untenable gap between space governance on the one hand, and the world's population on the other hand: both current and future generations, who are dependent on the existence of a stable, safe and sustainable space environment.

The political and governance landscape — or "spacescape" — of the twenty-first century is vastly different from that of the twentieth century, which gave birth to our current global space governance mechanisms. We need to understand what existing international space law and multilateralism can and cannot do, and to decide what to do about new and different actors in the political spacescape. Adopting the expanded cognitive lens of the "space citizen" can contribute to reframing traditional approaches to space law and space governance.

This paper does not propose specific institutional solutions to the problems of global space governance. Rather, it asserts that in order to find such solutions, and tackle the multiple intertwined challenges of governing space, an expanded framework is needed as to who should be making decisions and how they should be made. A "space citizen" framework begins with individual and societal shifts in awareness to include space in our environmental identity — it is a call for each of us to identify as having an individual relationship with space because of our collective dependency on it and, as a result, to care about what happens in our near-Earth environment. This framework leads to an expanded inclusion of actors in decision-making processes, as well as clear normative principles to underpin that decision making. In some ways, it is a call for participatory decision making on a planetary scale.

Actors in the Space Scape

Space technologies are ubiquitous in our daily lives, and critical for national security, economies and well-being. They are also thoroughly implicated in transnational economics, geopolitical interactions and warfare. The increase in global dependencies on services from space systems has led to an untenable increase in space traffic, and with it an increase in space debris, risking irreversible impacts on our near-Earth environment, as well as loss of service at any given moment, due to collisions. There are also increased risks to civilians of loss of critical services due to deliberate targeting during military grey zone operations and armed conflict on Earth.

The mechanisms for governing these increased complexities in space remain very much focused on the role of states, but there are serious limitations to this approach. Multilateral discussions on space arms control and measures for governing the sustainability of space are stymied by geopolitical jostling, and there have been calls for the UN system to undergo major reform for some time. Meanwhile, some states insist that civil society groups and non-government experts should not be part of these important discussions (Hitchens 2022), and yet the private sector, civil society and academia seem to be moving toward solutions to fill the gaps where states cannot seem to agree. Add to all of this the overwhelming commercialization of space, which has disrupted the economic and national security models for interacting with commercial providers, and we have a coalescence of factors making governance of space technologies and of the space environment an overwhelming challenge: Who is governing whom, and are we really tackling the big issues in space rapidly enough? One of the biggest challenges is the change in the nature and number of actors engaged in space activities over recent decades, disrupting traditional approaches to global space governance.

From Space 1.0 to Space 4.0

In the latter half of the twentieth century, this political landscape — or spacescape — was also competitive, but simpler. There were fewer players in the original "Space Age," and they were all geopolitically dominant states. Only wealthy states had the economic and technological

wherewithal to develop space technologies and programs. However, as we approach the second quarter of this century, actors now active in space — providing services critical to our daily lives and to national needs — have both increased in number and changed in nature dramatically.

In the early 2000s, we entered what is often termed "NewSpace" or "Space 2.0," with commercial actors becoming more important in terms of the kinds of technologies they could offer, the scale and pace at which they could work and the lowering of associated costs.[2] Commercial innovation has meant a reduction in the size of satellites and, therefore, in the cost of manufacturing and launching them.

Commercial space actors are the driving force behind technology advancement, including opportunities for new lunar programs and the space economy as a whole: access to launch opportunities is predominantly through a few commercial providers; space-based telecommunications and Earth observation (EO) data are globally accessible due to commercial providers; and many national militaries have moved from acquiring commercial space assets or systems to simply purchasing services or data from a commercial provider. Indeed, the term "NewSpace" must be considered an anachronism, since commercialization is no longer new nor disruptive; it is now the dominant factor in space technologies and economies.

This reduction in the cost of access to space, and the fact that everything from satellite manufacture to launch to operations to space data can be outsourced to commercial providers, rather than requiring the development of an end-to-end space program, has led to more states being able to access space, even when their budgets do not match those of the twentieth-century superpowers. "Space 3.0" can therefore be understood in this context, where rising powers such as Brazil and India have developed successful space programs at a fraction of the cost and in a fraction of the time compared to the traditional superpowers, and there are many more new entrants into the space economy, including smaller nations. Today there are more than 70 countries with space programs, although not all of them have space agencies, as they have been able to lean on researchers and international and commercial partners.

But with this dominance of a competitive private sector comes added governance challenges. Well over two-thirds of all active satellites are commercially owned (Rome 2023), and more than one-half of all active satellites belong to a single company: SpaceX. With the advent of "mega-constellations" of many hundreds or thousands of satellites, a different model of cost versus risk has emerged: in some cases, it is cheaper for a company to assume a certain failure rate and to simply plan for satellite replacements, rather than further innovate the design of satellites to ensure that they have longer lifespans. This new cost/risk model places further pressure on the sustainability and accessibility of space.

The current era of human activity in space has been described as the emergence of "Space 4.0," defined as "a time when space is evolving from being the preserve of the governments of a few spacefaring nations to a situation in which there is the increased number of diverse space actors around the world, including the emergence of private companies, participation with academia, industry and citizens, digitalisation and global interaction."[3] Space 4.0 is one function of Industry 4.0, which is considered as the unfolding fourth industrial revolution of manufacturing and services (Antoni, Adriaensen and Giannopapa 2019; Vena, Baldesi and Bossy 2020).[4] One expression of this is that governments have increasingly become reliant on purchasing "space as a service" from commercial providers; for example, acquiring EO data or telecommunications from commercial entities, without having to procure the infrastructure (Werner 2021; Spark 2022; Undseth, Jolly and Olivari 2021, 24). This trend is visible even in the most powerful militaries, with the United States recently developing three commercial space strategies: one from Air Force Space Command (US Space Command 2022), one from the US Space Force (2024) and one from the US Department of Defense (2024). All three of these strategies focus on the integration of commercial space services and systems into defence systems, which will lead to further commercial space traffic. Similarly,

2 There are some competing definitions of "Space 2.0" as referring to the Apollo era, when human spaceflight pushed new technological boundaries, and "Space 3.0" as the era of the International Space Station (ISS), which demonstrated the necessity and benefits of international cooperation. However, these are not the common usages of these terms, and "Space 2.0" is used here according to the most common definition, denoting the rise of commercial space actors. See www.esa.int/About_Us/Ministerial_Council_2016/What_is_space_4.0.

3 Ibid.

4 Ibid.

the EU Space Strategy for Security and Defence highlights the dual-use nature of most space services, and the need to work closely with and integrate the private sector in defence space services (High Representative of the Union for Foreign Affairs and Security Policy 2023, 13).

But this trend reaches further than governments' dependency on industry. This era is unfolding through interactions between governments, the private sector, different members of society and politics. Access to space-based technologies has become a question of critical infrastructure, such as the need for telecommunications and digital connectivity; the reliance on position, timing and navigation (PNT) for everything from the transport of people and goods to search and rescue to global finance and banking; and the role that EO data plays in underpinning agriculture and food security, supporting primary industries such as mining, protecting fishing rights, managing fresh water, responding to fires and floods, and mitigating the impacts of climate change. The potential loss of these services due to debris collisions in a congested, poorly managed space environment, or due to military interference and attacks, would have dangerous to catastrophic consequences. There would be multiple layers of impacts on individuals, communities, societies and nations; therefore, these multiple actors must have a vested interest in the good governance of space.

Geopolitics Reaching into Space

At the same time, although states are no longer the predominant actors in space, geopolitics continue to significantly influence technological competition in Space 4.0. Because of how critical space-based services are to military operations in times of peace, tension or conflict, military contestation in space has been ramping up in recent decades, with some destabilizing moments, including the testing of direct ascent anti-satellite (ASAT) weapons capabilities by China in 2007, the United States in 2008, India in 2019 and Russia in 2021 (Steer 2023b, 676). The advent of the US Space Force in 2020 was also seen as a threat by China and Russia, and there was a subsequent rise of "space commands" in the armed forces of a number of countries around the world. Because space is a support domain to many aspects of army, navy and air force activities, a highly effective way to compromise an adversary's operational capacity is to interfere with their space systems. This tactic has rendered space a strategic domain unto itself (Steer 2017).

This is where traditional multilateral governance methods have really struggled, resulting in a decades-long deadlock within the United Nations on advancing space security solutions, ongoing politicization and distrust between geopolitically adversarial nations and an emerging security dilemma, as many nations are developing counter-space capabilities in order to be able to interfere with, temporarily disable or permanently damage the space systems of potential adversaries (Samson and Weeden 2024). The early twenty-first century saw a move away from the strategic restraint that kept space stable throughout the Cold War and the end of the twentieth century toward a more aggressive rhetoric and policy on the part of the larger space powers.

In the last few years, the middle powers have been the leading diplomats in space, breaking the deadlock by introducing the UK-led initiative to establish an open-ended working group (OEWG) on reducing space threats through norms, rules and principles. The core partner nations in supporting and advancing this agenda through the UN General Assembly (UNGA) were other middle powers such as Australia, Canada, Japan and New Zealand, for a final total of 22 countries (Ortega and Lagos Koller 2023).[5] Regrettably, at the end of its two-year mandate in 2023, no substantive norms, rules or principles were agreed upon due to the familiar politicization of UN decision making, with Russia and its supporters actively blocking the consensus on a final report (West 2024; Ortega and Erickson 2024). However, there were significant advances made in terms of raising the level of space literacy across many nations and generating a sense of urgency in the international community, given how dependent the entire world is on continued, stable access to space.

Still, the usual global political divides continue to slow next steps. There is a division between those nations that wish to see a binding treaty as the only solution to the space security dilemma, which would ban specific weapons or capabilities, and those who prefer non-binding instruments and agreements. This divide is reflected in the votes of those nations that supported a UNGA resolution calling for a moratorium on testing direct-ascent

5 *Reducing space threats through norms, rules and principles of responsible behaviours*, UNGAOR, 76th Sess, Annex, Agenda Item 98(d), UN Doc A/C.1/76/L.52 (2021), online: <https://digitallibrary.un.org/record/3944822?ln=en&v=pdf>.

ASAT capabilities, and those that refused[6] — namely, Russia and its supporters. And it is reflected in the tensions that arose when the United States accused Russia of developing a nuclear capability in space: Russia vetoed the Security Council resolution, which was the first time space security was discussed by this high-level UN body (*Guardian* staff and agencies 2024). This scenario then fed into existing concerns for the inability of the United Nations to respond to any critical international security situations, since the veto has also been used to block resolutions regarding the conflicts in Ukraine and Gaza, the situations in Mali and Syria, and issues concerning North Korea (UN News 2024). Multilateralism is clearly failing in the face of threats to international peace and security, which is the United Nations' entire raison d'être.

The Limits of State-Based Solutions

Existing governance tools such as UN multilateralism are built on the foundations of the twentieth century, when states were considered to be the sole subjects and objects of international law and influenced international governance. At that time, states were assumed to be the main actors that could access space and the sole actors that could determine space governance. Since this is no longer the case, new approaches to global space governance must take the lead. It must be recognized that twentieth-century governance institutions and instruments have done a great deal to keep space accessible and free from conflict to date; however, the change in who is accessing, depending on and impacting space means that those tools are already buckling under pressure, and some of them may even break.

Twentieth-century space governance instruments and ideals were a result of a "golden age" of international law making, when the United Nations was relatively new and there was a general treaty-making mood to address the governance of trade, oceans, border issues and statehood; exclusive economic zones; movement of passengers and goods at sea and in the air; and technology exchange, arms control and other issues key to geopolitical and economic developments in the latter half of the twentieth century (Boyle and Chinkin 2007, 21). Treaties were clearly the preferred method of governing future access to and use of space. The 1967 Outer Space Treaty (OST)[7] was followed by four other core space treaties within nine years, which is lightning speed for international law making. One reason for this rapid consensus was that the governance of space activities was easier to conceive of and design when states were the only primary actors. The focus could be on multilateral interactions through the UN Committee on Peaceful Uses of Outer Space (COPUOS) and on international treaty making as the main governance mechanism. It was also easier to reach agreement with fewer stakeholders in the room.

Yet large-scale agreement on space governance was already starting to come under pressure by the end of the 1970s. While the OST enjoys the participation of 110 signature states, and the Liability Convention, Registration Convention and Return and Rescue Agreement have more than 90 states parties each,[8] the fifth treaty (the 1979 Moon Agreement)[9] is often pointed to as a "failed" treaty, or an example of why we need to do away with twentieth-century instruments. The Moon Agreement received only 18 signatories, of which none were the major space powers, and no other major global powers have ratified this treaty, although France has signed it. The key reasons for this low participation are due to its statement that the exploitation of the Moon's natural resources is *prima facie* unlawful and its requirement that should such activities take place in the future, a legal regime to govern them shall include a benefit-sharing arrangement "whereby the interests and needs of the developing countries, as well as the efforts of those countries which

6 *Prevention of an arms race in outer space*, UNGAOR, 77th Sess, Annex, Agenda Item 97, UN Doc A/RES/77/41 (2022), online: <https://undocs.org/Home/Mobile?FinalSymbol=A%2FRES%2F77%2F41&Language=E>.

7 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, Res 2222 (XXI) (entered into force 10 October 1967), online: <www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>.

8 *Status and application of the five United Nations treaties on outer space, and way and means,including capacity-building, to promote their implementation*, COPUOSOR, 62nd Sess, Annex, Agenda Item 6, UN Doc A/AC.105/C.2/2024/CRP.3 (2024), online: <www.unoosa.org/res/oosadoc/data/documents/2024/aac_105c_22024crp/aac_105c_22024crp_3_0_html/AC105_C2_2024_CRP03E.pdf>.

9 *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 5 December 1979, Res 34/68 (entered into force 11 July 1984), online: <www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html#:~:text=Agreement%20Governing%20the%20Activities%20of,1979%20in%20resolution%2034%2F68>.

have contributed either directly or indirectly to the exploration of the Moon, shall be given special consideration" (article 11[7]). Indeed, the United States refused to be party to the International Sea Bed Authority for these same reasons.

The imminent competition for access to prime lunar real estate has put a spotlight on the limits of the framework treaties and of multilateralism more generally. Under the Legal Subcommittee of COPUOS, a multilateral Working Group on Legal Aspects of Space Resource Activities has been established,[10] which has held discussions for a couple of years now without any clear road maps to an outcome. As a consensus decision-making body, it is also hampered by the same geopolitical tensions as all UN bodies: certain states will refuse to come to agreement on any substantial issues, out of protest against other unrelated debates or sanctions in different UN bodies.

In a demonstration of the diversity of actors now impacting space governance solutions, the private and academic sectors have come together to try to forge an alternative solution, with the Hague Building Blocks for the Development of an International Framework on Space Resource Activities (The Hague International Space Resources Governance Working Group 2019; Xu and Su 2020; Davis and Sundahl 2017). However, this move has yet to lead to any adoption within domestic, bilateral or multilateral contexts. Meanwhile, since existing initiatives have not filled the gap sufficiently, the countries leading competing lunar programs have developed competing non-binding principles as frameworks for their activities. Both the US-led Artemis Accords and the Chinese-led International Lunar Research Station are highly political projects as much as they are technological endeavours. Since lunar mining is slated to take place before the end of this decade, there is a possibility that parallel normative regimes will develop and create confusion as well as further competition for political, ideological and normative dominance.

This fragmentation of space governance is also evident in response to space safety and sustainability. The Registration Convention[11] was forward-looking in its intent to contribute to space traffic management and space situational awareness (SSA) by requiring both an international registry coordinated by the UN Office for Outer Space Affairs (UNOOSA) and domestic registries maintained by states for all space objects under their jurisdiction. The problem is one of compliance and resourcing: there are no mechanisms for enforcing the obligation to register launches, and states are inconsistent as to whether they register launches at all. When they do register, sometimes information is omitted regarding the payload and objects launched — whether accidentally or deliberately, perhaps out of a desire to keep some information secret, including the military nature of a satellite (Jakhu, Jasani and McDowell 2018, 13). There is a fluctuating compliance rate of between 70 and 90 percent among states that have signed the Registration Convention. However, this range never represents real time, and there is also often a lag time between the launch of new objects into the congested environment of space and the notification to UNOOSA, with only 50 percent of all objects registered within one year of launch and some launches only registered two years later (ibid., 10; Le May et al. 2020, 396). At the same time, UNOOSA is vastly understaffed in managing a registry that needs to be updated every few weeks rather than every year, which was the case when the Registration Convention came into force. In the last 10 years, there has been a five-fold increase in objects launched globally and therefore in space traffic, due mostly to the commercialization of space. The convention therefore remains a useful tool for identifying ownership of a space object if there are questions of liability, but it is a vastly insufficient tool for space traffic management.

Similarly, there is wide variation in standards within domestic legal regimes regarding sustainability requirements for new satellites (Steer and Strong 2022). In response to this, the UN COPUOS Guidelines for the Long-term Sustainability of Outer Space Activities, or LTS Guidelines,[12] were developed over 10 years. They are a positive move forward in identifying

10 See www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html.

11 *Convention on Registration of Objects Launched into Outer Space*, 12 November 1974, Res 3235 (XXIX) (entered into force 15 September 1976), online: <www.unoosa.org/oosa/sk/ourwork/spacelaw/treaties/introregistration-convention.html>.

12 *Guidelines for the Long-term Sustainability of Outer Space Activities*, UNGAOR, 56th Sess, UN Doc A/AC.105/C.1/L.366 (2019), online: <https://undocs.org/A/AC.105/C.1/L.366>.

practices as well as encouraging a culture of sustainability within domestic government and private sector bodies. However, the guidelines are still "top down," relying on the good will of states to implement them into concrete standards and requirements before they can become effective. This approach remains ill-suited to twenty-first-century needs, and exclusive of those most impacted when things go wrong: you and me, as well as citizens in crisis scenarios who have critical need for space-based data and services.

Impatience with slow domestic implementation has led to private sector initiatives; for example, the practices and standards developed by the International Association for the Advancement of Space Safety,[13] or CONFERS, which is self-described as "an industry-led initiative that identifies and leverages best practices from government and industry for rendezvous and proximity operations, on-orbit satellite servicing operations, and in-space assembly, servicing and manufacturing."[14] All of this means that there are a range of standards, guidelines and proposed solutions, but no clear path toward ensuring implementation or coordination.

Do Not Throw the Baby Out with the Bathwater: Retaining Twentieth-Century Foundations

There is no doubt that the core space treaties are a product of their time, and therefore limited in their ability to govern specific space activities or provide rules applicable to new and emerging space technologies. But they were never intended to be detailed technology-governance instruments. As we enter an increasingly complex governance and technological spacescape, new solutions are needed; however, this does not mean that we should do away with the framing instruments that we already have.

Repeated calls to update or do away with the 1967 OST because it is outdated or no longer fit for purpose, misunderstand the function and underestimate the success of this framework treaty. It should be understood as a constitutional document, outlining organizing principles, tenets and limitations — the way a national constitution does. Constitutions and framework agreements do not purport to provide detailed rules of behaviour or regulations. They are meant to be general and overarching, constructed in such a way as to be long-standing and deliberately difficult to change, so as not to be subject to shifts in political will and flavour. In the case of the OST, this includes:

- the non-appropriation principle (article II);
- the applicability of international law to all space activities (article III);
- the prohibition on the placement of nuclear weapons and weapons of mass destruction (article IV);
- the international legal responsibility of states for all governmental, commercial and private activities in space, and the obligation of states to authorize and continually supervise those activities (article VI); and
- a general call for formal equality, due regard for the activities of others in space and peaceful cooperation (in the preamble and articles I and IX).

In some ways, the OST was actually very forward-looking. The burden placed by the OST on states to "authorize and continually supervise" space activities, including commercial activities, is bolstered by states retaining international responsibility for those activities and by the rules in the ensuing Liability Convention[15] and Registration Convention (Convention on Registration of Objects Launched into Outer Space 1976). Indeed, the inclusion of non-governmental, or private sector, space activities in the OST was hotly debated, as the Soviet Union wanted only to include state activities in the treaty text, whereas the United States already saw private sector activities as important in the 1960s (von der Dunk 2011, 1). This is why claims that space is "lawless" could not be further from the truth: not only do all space activities have to comply with other fields of international law by virtue of article III of the OST, but as a result of articles VI and VII of the OST, as well as key articles of the other core space treaties, there is also a plethora of regulation in domestic space laws and licensing requirements.

13 See www.iaass.org/publications/standards/.

14 See https://satelliteconfers.org/.

15 *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, Res 2777 (XXVI) (entered into force 1 September 1972), online: <www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html>.

Granted, there are limits as to how comprehensive this legal regime is (Wright Nelson 2024, 341), and it is up to states to determine how they will authorize and supervise it. In the United States, it is clear that competitiveness is the driving imperative, whereas we see new initiatives in the European Union, and in many European states that are members of the European Space Agency (ESA), to ensure sustainability is at the core of legislation and regulation — for example, the new Zero Debris Charter (ESA 2023). The values that citizens demand of their governments more generally will inevitably drive space licencing regulations and space policies, which is one reason why there needs to be conscious value-driven decisions on future space governance.

Yet despite twenty-first-century pressures, all of the principles in the core space treaties continue to stand the test of time. Any attempt to change, adapt or renegotiate the OST or the other space treaties would lead to an unravelling of the very principles that have kept space free from chaos or conflict thus far. Treaty negotiations require a wide participation of states and consensus on each and every word. At the best of times, treaty provisions represent the lowest common denominator of agreement between states. Current geopolitical tensions, and the politicized debates we see within the United Nations on a range of issues, demonstrate that the world is not in a treaty-signing mood. The number of states willing to enter into new negotiations would be low, while any new text would be hotly debated with low levels of agreement, leading to watered-down provisions and a risk of undoing the very strengths of the existing treaty. There is no doubt that we need more and different forms of space governance, but a rewrite or an update of a multilateral treaty is not the answer.

In national legal jurisdictions, constitutions are designed to be difficult to change because they provide organizing principles that are intended to stand the test of time and not become politicized. Instead, lower-level legislation and regulations are created in response to new technologies or activities as societal norms and needs shift. These types of laws are procedurally much easier to update, change or override with new rules. In global space governance, too, it is not the overarching principles that need updating, but rather the lower-level specific responses to new technologies that need to be more agile.

This is where value- and citizen-driven decision making will make the greatest difference.

Indeed, a citizen-based approach could be seen as the next necessary step toward fulfilling the object and purpose of the OST: that space shall be the province of all and accessible to all. Article I of the OST states that "outer space, including the moon and other celestial bodies, shall be *free for exploration and use by all States without discrimination of any kind, on a basis of equality* and in accordance with international law, and there shall be free access to all areas of celestial bodies" (emphasis added).[16] With today's intensified competition, it is clear that there is no equal access to space, nor to the technological benefits of space services.

Despite the rhetoric of many leading commercial space companies, the reduction in cost and resulting ease of launching into space does not equate to its "democratization." Even though smaller countries can now access space, the wealth derived from space technologies continues to be concentrated in dominant economies such as the United States and Europe, along with a monopoly on access to valuable orbits (Aganaba-Jeanty 2019; van Eijk and Aganaba 2021). The cost of purchasing space services remains out of reach for very small economies such as the island nations in the Pacific. All of this means that international governance of space continues to be dominated by the larger powers (Steer 2019, 2021; van Eijk 2022). As Cristian van Eijk (2022, 30) has put it, the wording of article I of the OST "should be read as a battlefield, a site of hegemonic contestation fought with normative weaponry." Essentially, this provision represents a compromise reached during treaty negotiations between smaller nations asserting their equal right to access space and benefit from it, and the dominant powers being willing to appease concerns about the potential for a monopoly over this new domain, while also believing that the wording did not in any way restrict their activities. But with global dependencies on space-based technologies now ubiquitous, and impacts of poor space governance being felt directly by individuals and communities that are users of those technologies, a shake-up is needed — not a replacement or rewrite

16 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, Res 2222 (XXI) (entered into force 10 October 1967), online: <www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>.

of the OST, but rather new approaches to ensuring these values and promises are enacted and fulfilled for current and future generations. A citizen-based approach, built from the individual up.

Building the Space Citizen Model

The gap between existing institutions and mechanisms that were established for a twentieth-century spacescape and what is needed both now and going forward represents a democratic gap. The implications of who has access to space-based technologies and services — and who has the power to govern those technologies — are felt in the stability of the global economy, the digital gap for minoritized or disadvantaged groups, and the lives of communities and individuals dependent on these technologies. New and comprehensive governance responses are needed that include multidisciplinary and multi-stakeholder engagement, while also building on the foundations of twentieth-century solutions. This is precisely the reasoning behind the case for the "space citizen," which is not only a normative and institutional approach, but rather a cognitive one that starts with the individual.

Arguably, there have been generational shifts over the last several decades from having primarily local or national identities toward holding regional or global identities. While this may not be true in all cultures, there is no doubt that the advent of the internet and the "information age" impacted the way that individuals relate to events happening around the world. Access to information when we want it, in near-real time, has meant that regional shifts in the early twenty-first century have all occured in our own digital backyards instead of in far-flung corners of the globe; these include the breakup of Eastern Europe, the destabilization of the Middle East in the wake of the US response to the September 11 attacks in 2001, the creation and then fragmentation of the European Union, the rise of India and re-emergence of China leading to the beginning of the Asian century and the decline of the American century, the power shifts in Africa, the Ukrainian resistance to Russia's defiance, and the expansion of the North American Treaty Organization (NATO). Similarly, technopolitics has informed us for decades that access to data can change the way that citizens interact with and impact their political and physical environments (Kurban, Peña-López and Haberer 2017; Milan and Gutierrez 2018). And the realities of climate change can be felt locally and also witnessed on our screens as natural disasters unfold across the planet. As a result, the environmental mantra of the late 1990s and early 2000s to "think globally, act locally" later morphed into "think globally, act globally," as citizens have mobilized in the face of global governance failures. "Global citizenship" has become a term that we all recognize, and there are even calls for "planetary citizenship" as an ethical framework for environmental and climate activism (Henderson and Ikeda 2004; Thompson 2001).

More recently, the COVID-19 pandemic created a moment in time when the population of the entire planet was impacted in myriad ways by a single disease. While inequalities became even more apparent in the wake of COVID-19, we will only begin to understand its long-term generational and societal effects over time. But it has been a defining moment of the century, which has further impacted how individuals identify within their communities and beyond national boundaries. Now we need to take a further leap in our cognitive awareness and identities to include our near-Earth environment.

The shift from "global citizen" to "space citizen" is not so abstract as it may seem at first glance. Because of our dependency on space-based technologies in daily life; our economic and political interactions; and our national, regional and international security interests, we are already interacting with the environment just beyond our planetary boundaries. And we are doing so precisely in the course of dealing with our other local, regional and global crises. We are already dependent on the good governance of this environment, as well as on its technologies and activities. We are therefore already vested in the mechanisms, decisions and decision makers being fit for purpose: we are already space citizens. The question is how to move toward truly identifying as space citizens, and how this concept of identity can create a new framework for space governance.

An Individual Awareness

A greater degree of awareness is needed about how vulnerable the stability and sustainability of the near-Earth environment is, as well as the impact this vulnerability has on our terrestrial existence,

given how much space-based technologies and services permeate our lives. This is a big ask when there is already so much information and so many global issues competing for our attention, but these issues are all intertwined. EO data, telecommunications and access to the internet and precision PNT are all critical inputs to our earthly governance challenges. If we wish to respond to climate change, solve housing needs, ensure food security, contribute to flourishing democracies, protect cultural heritage, increase gender equity, monitor borders and fisheries, and stabilize regional and international security, a significant piece of the puzzle for all of these issues comes from satellites. As UNOOSA points out, space technologies contribute to all 17 of the Sustainable Development Goals.[17]

It is also a big ask to turn our individual attention to space issues when understanding the political, economic and technological context is more complex than it was just a few decades ago. However, this is also true of all global issues and is exactly the reason why the notion of "space citizen" needs to be activated.

Even the notion of Space 4.0 may be limiting, since it leaves out the individual — it is a description of interactions between entities (companies, civil society groups, states) and technologies. It could also be seen as a Eurocentric project, as it is a term that was coined by the ESA and assumes a non-existent equality between participants in the discourse on future space governance. Space 4.0 underpins the ESA notion of "Moon Village," which is intended to be "a process rather than a project and…is meant to initiate a global conversation on humanity's future on the Moon" (Köpping Athanasopoulos 2019). This idea gave birth to the Moon Village Association, a non-government organization that aims to "[foster] cooperation between government space agencies, commercial space entities, and academia to advance humanity's presence on the Moon."[18] While laudable in their aspirations and striving to be open and participatory, these projects still assume equal access to the technologies, institutions and discussions taking place, which is not the status quo. There is a risk that these projects will experience a similar unintended Eurocentrism, which was a major part of the downfall of the code of conduct in 2015 (Steer 2019, 757).

Some scholars have advocated for applying governance theories that have emerged from environmental and socio-ecological studies, such as polycentric governance. Polycentric governance explains the multiple layers of governance instruments and mechanisms that have arisen over recent decades and the range of actors involved in their inception and application. Some see a hope in this approach for arriving at useful measures for safety, security and sustainability (Shackelford 2014; Morin and Richard 2021). But the inherent challenge is fragmentation and possible competition between competing governance regimes. As Eytan Tepper (2021) puts it, "the initial monocentric, quasi-hierarchic structure of space governance is experiencing a slow-motion big bang, by which the basic building blocks are still the early ones presented above, but subsequent expansion and evolution of space governance is decentralized. The inevitable future of space governance is by various *fora* or decision-making centers ('governance centers'), with various participants introducing various outputs in distinct sub-issue-areas."

Similarly, adaptive governance is a model that purports to be sufficiently flexible and agile to adapt to changing environmental systems and high levels of uncertainty. Michael R. Migaud, Robert A. Greer and Justin B. Bullock (2021, 6) argue that space governance would benefit from an adaptive governance model that entails: "(1) an inclusive dialog between resource users; (2) complex, redundant, and layered institutions; (3) mixed institutional styles (including market based and state based); and (4) institutional designs that facilitate experimentation, learning, and change." But while these models can be useful tools in rethinking approaches to space governance, the risk of fragmentation is high and it appears there is insufficient coordination and participation of communities for them to provide successful models. One important factor is absent from them both, namely, the individual and their place in communities and societies. While we continue to assume that the only stakeholders in space are the dominant actors in its physical domain (states, international and regional organizations and commercial entities), we will continue to have inadequate responses to the challenges of space governance. Rather, we need a broader, more inclusive and interactive

17 See www.unoosa.org/oosa/en/ourwork/space4sdgs/index.html.

18 See https://moonvillageassociation.org/about.

model that invites real participation by a wide net of stakeholders (Wright Nelson 2024, 415).

This is why the "space citizen" model starts with an individual cognitive shift. It is relational in the first place, which requires beginning with our individual identities. Moving from "global" or "planetary" citizen to space citizen may be easier for younger generations, who have grown up with an unprecedented access to information about the world and the planet, and for whom the climate crisis is their biggest concern. But this cognitive shift also requires those with decades of experience in space governance challenges to look up and out. This is an opportunity for an individual relationship with the space environment, which requires listening to and providing guidance on what has and has not worked in the past. Because we are all consumers of the benefits of space technologies, there is a responsibility to be an engaged citizen in this high-tech age. The space citizen understands that our terrestrial well-being in the twenty-first century cannot be divested from certain technology needs related to communications, closing the digital divide, and accessing education and data to inform climate-response decisions and manage our water, air and other natural resources. The space citizen is therefore concerned with the responsible management of this natural environmental resource.

From this individual cognitive shift, a wider space citizen governance framework must then be:

- → multi-stakeholder and multi-domain;
- → global and inclusive; and
- → intergenerational.

A Multi-stakeholder and Multi-domain Approach

First, this lens is necessarily a multi-stakeholder approach. Creating new governance mechanisms, organizations and instruments that are sufficiently agile and at the same time provide sufficient certainty requires a reframing of who the actors are that have vested interests and responsibilities. The space citizen approach is inherently "bottom up," which makes it possible for us each to participate more actively in the decision making that impacts our space environment and the technologies that operate there.

Traditional space governance institutions are still very much top down, depending on the state to implement rules and legal frameworks to restrain government and non-government activities in space. And overall, they are insufficiently inclusive of the private sector, despite commercial entities dominating the space economy and driving technological innovation. Buy-in from commercial space actors requires their input, and often they can better guide what kinds of rules, principles, best practices and standards are feasible and can assist in how to update them over time.

Twenty-first-century space governance also requires creative solutions beyond traditional state-based multilateral or bilateral interactions and agreements. As the United Nations struggles under its own geopolitical weight and as geostrategic relations shift, a multi-stakeholder approach to space governance is the only way to create sufficient escape velocity from current political deadlocks. This includes giving credible weight to civil society and academic expertise, including from non-space-related fields such as nuclear arms control, peace studies, cybersecurity, environmental studies, Earth-system politics, circular economies, participative democracy and a range of other fields dedicated to tackling the wicked problems of our century.

There is already some recognition of the fact that norms and standards entering into space governance have a multi-stakeholder provenance. This is what the scholarship on polycentric governance demonstrates: that we can observe multiple decision-making fora with different groups of actors interacting. Legal pluralism is a similar descriptive framing; as one scholar puts it: "the space regime is pluralistic not just because the term encompasses local, national, and international laws, and both binding rules and non-binding rules. It is pluralistic because it contains a series of overlapping, functional normative orders and a wide range of state and non-state actors that shape it" (Wright Nelson 2024, 362). The resulting pluralism may be problematic if there are no shared values underpinning each of these governance initiatives, or if there are insufficient avenues for interaction between all stakeholders.

In this sense, the space citizen approach is also, by definition, multi-domain. Space technologies require multiple physical domains for their operations, from land-based (and soon maritime-based) launch, to impacting air traffic, to remote

and cyber operations. Space-based services are also multi-domain, assisting us in managing lands, waters and skies. And military threats to space systems are multi-domain, with the data links, cyber interferences and potential attacks on ground stations being the greatest vulnerabilities. Expertise from all those domains is therefore required. And conceiving of solutions to space governance as part of a system of systems, rather than as something only for specialists, is the only way forward.

A Global and Inclusive Lens

Second, since the space citizen approach is multi-stakeholder and multi-domain, it must also apply a global lens and not one dominated by Western political values or interests. This approach has implications for our precious "international rules-based order," which is an inherently Western-driven agenda. We need to look beyond the "great powers" and see what traditional middle powers and rising powers are doing, as well as their combined impact with smaller nations and non-aligned regional interests, and multilateral diplomacy's desire to find shared interests between Western and non-Western nations. This process builds on decades of advocacy including the UNOOSA Benefits Declaration, which called on states to take into particular account the needs of developing countries as space activities expand,[19] as well as a body of scholarship that identifies the need to reduce the inequality in terms of access to space-based services, which would contribute to greater stability in democratic, economic and eventually well-being metrics (Aganaba-Jeanty 2016a, 2016b; van Eijk 2022; Steer 2019; Trevino 2020).

In doing so, there is the potential to impact domestic and global space law and governance. The role of middle powers and smaller nations has increased in this multipolar era. There is therefore an opportunity for informed citizens to impact wise space investment decisions on the part of their individual governments, and for smaller nations and middle powers to use space technology cooperation as a policy lever to protect regional interests.

The space citizen lens is also inclusive. Decentralized or polycentric approaches can be challenging and can lead to fragmentation. Mechanisms for space governance are already becoming fragmented and diverse in nature, form, source and audience. The task is to ensure that the underlying imperatives and values are similar enough that competition can be reduced. This can only be achieved through sufficient opportunities for co-design, including commercial providers, civil society, academic experts and a range of community stakeholders.

Because the space citizen has a cognitively enlarged identity that expands outwards to include the space environment as our own environment, it must also, by definition, be inclusive of the range of existing identities that interact with and depend upon space at the individual, community, societal, national, regional and global levels. This concept means further expanding who is included in this multi-stakeholder approach and which perspectives and lenses can be applied using it.

For example, Indigenous communities must have co-governance over ground infrastructure development on their lands and data sovereignty when it comes to EO data that observes their cultural heritage and can augment their management and use of lands and waters. Indigenous perspectives must also be taken into account with the impact of the expansion of space activities on Earth and in space, including mega-constellations in the night sky, as well as impending impacts on the lunar environment (Mitchell et al. 2020).

In addition, there is a strong body of scholarship emerging that demonstrates that feminist lenses can benefit technology design and accessibility to the benefit of space technologies, as well as improve domestic and international space policy solutions (Gorman et al. 2024; Litfin 1997; Oman-Reagan 2016; Steer 2021; Whitman Cobb 2023; West and Panchanadam 2024). Ensuring more equal access to space-based services can assist in closing the digital divide and improving accessibility to education for girls, which has been shown to contribute to stable societies. To ensure a more inclusive lens on the design, development and deployment of space technologies, the gender gap in the space workforce needs to be closed, which will also assist in filling the skills shortage in the space sector (Stephenson and Steer 2023; Stephenson 2023; UN Affairs 2021). Similarly,

19 *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries*. GA Res 51/122, UNGAOR, 1997, online: <www.unoosa.org/oosa/en/ourwork/spacelaw/principles/space-benefits-declaration.html>.

the UN Women, Peace and Security agenda requires more women in military space careers; this agenda can help guide the deployment of space services to support the rights of girls and women in conflict scenarios, and requires that the potential impacts on girls and women be taken into account if a dual-use space system is targeted (Dharmapuri and Johnson-Freese 2018; Steer and Stephenson 2022; True 2019). The space citizen lens directs space security debates to learn lessons from feminist foreign policy and integrate expertise from civil society and academia.

Intergenerational Responsibility

Finally, the space citizen must have an intergenerational lens in order to build on inclusivity and multi-stakeholder governance, as a responsibility to future generations is simply the next step of inclusivity. There is an argument to be made that the OST itself contains an intergenerational obligation, since article I requires that space "shall be free for exploration and use by all States without discrimination of any kind, *on a basis of equality* and in accordance with international law, and there *shall be free access* to all areas of celestial bodies."[20] There is no end point at which this is fulfilled — it is an ongoing obligation. Similarly, the notion that space is the province of all (hu)mankind is ongoing and unending, otherwise it is meaningless.

There is a rise of climate litigation around the world that is holding governments responsible for protecting the rights of future generations and finding them in breach of this obligation if their current climate policies are shortsighted (Gonzalez-Ricoy and Rey 2019; Slobodian 2019; Sulyok 2024; UN Development Programme 2023).[21] Wales has even introduced a minister for future generations (Balch 2019), and the United Nations is attempting to open its state-based bureaucracy to a more inclusive, intergenerational approach with the Summit of the Future.[22] Given that the space citizen is aware of our impact on our natural space environment, there is an imperative to protect this environment, and the benefits from technologies that are space-based, for future generations. Our dependencies are only going to grow in the decades to come, and our ability to solve our terrestrial problems will depend more and more upon these space-based technologies and data.

The expansiveness of this framework may seem overwhelming or excessively aspirational. The point, however, is not that adopting this lens will lead to instant or simple solutions. Rather, without such a lens, we are just chipping away at the edges of the wicked problems of space governance, at a pace far too slow for the changes in technology and global politics and in ways that are dwarfed by the problems themselves. Widening our lens and becoming relationally engaged with our space environment, our uses of space technologies and our vested interest in the good governance of space is the only way to move toward collective solutions.

In overcoming the challenges of land warfare — including any future war with Russia, China, or even Iran or North Korea — stand-off warfare, precision strikes and long-range fires would only play small supporting roles. The majority of combat would occur on the ground between land forces, which means that the victor would have to be capable of surmounting the seven challenges of land warfare outlined within this paper. In achieving a clear victory using the methods outlined above, the winning forces would simplify diplomacy for NATO policy makers.

Closing the Gap Between You, Me and the Governance of Space

That there is a gap between existing governance approaches and what is needed, between who is impacted and who (or what) appears to be empowered to act, is undeniable. As debates about how to govern artificial intelligence, social media and other iterations of big tech surround us, it is apparent that this gap is similar for much of tech governance. Technology is moving faster than regulation, governance or policy can, which

20 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, Res 2222 (XXI) (entered into force 10 October 1967), online: <www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>.

21 *Declaration on the Responsibilities of the Present Generations Towards Future Generations*, UNESCOR, 29th Sess, UN Doc 29 C/Resolutions + CORR (1997), online: <https://en.unesco.org/about-us/legal-affairs/declaration-responsibilities-present-generations-towards-future-generations>.

22 See www.un.org/en/summit-of-the-future.

can leave us feeling powerless or overwhelmed. While it may not be easy, this is precisely one of the reasons for the focus on an individual cognitive shift toward identifying as a space citizen.

Just as commercial entities have a vested interest in space remaining stable and accessible, since their business models depend on it, so too do we all have individual, community and societal vested interests. As heavy users of space data and services, we have a societal as well as an individual responsibility to ensure good governance of our near-Earth environment, and to recognize that we are all, already, actors in the economic, political and governance spacescape.

Activating an Integrated Approach from the Bottom Up

The question is how we can activate this status as space citizens to impact global space governance into the twenty-first century. This remains a challenge as long as the focus is on traditional state-based institutions, but we cannot simply blame these institutions or decry the political will of states.

Instead, we can take lessons from the shift that has taken place over the last 10 years with regard to cybersecurity. A decade ago, internet technology (IT) was the bailiwick of a highly specialized workforce and something most people only thought about when there was a technical breakdown of some sort. Governance of new IT developments was assumed to be the sole responsibility of policy and law makers. Today, with the threat of cyberattacks and cyber fraud influencing everything from national security to one's personal banking information, we are all aware of the importance of cyber hygiene and of how integrated our digital, virtual lives are with the economy, health care, politics and even the electoral system. There is therefore an awareness that while top-down measures are necessary — such as regulations and standards for cybersecurity, cyber hardening of critical infrastructure and law enforcement against cyber fraud — we all have an individual responsibility to act responsibly and with caution in our online interactions at the same time. We have to protect our own information and teach the next generation how to be good digital actors and prevent unwanted incursions. And when the top-down measures prove to be insufficient, we must push back and demand better, because our well-being depends on good cyber governance. We do not have to be IT specialists, or to understand the bits and bytes, to activate what some have asserted is a right to cybersecurity (Papakonstantinou 2022; Shackelford 2021). In a similar way, we need to integrate an awareness about our dependencies on space-based services and our impacts on the space environment into everything we do: into our individual daily lives, our activism regarding climate change, our local urban planning and our national critical infrastructure planning.

Because space-based services are already intertwined in our twenty-first-century interactions, this amalgamated approach brings with it better integration of space governance with other governance decisions. We cannot effectively plan for food security without space data, nor can we provide education and connectivity to remote communities or across cities without satellite-based internet and telecommunications. We cannot predict wildfires or floods, nor undertake better urban planning in the face of climate-induced natural disasters without satellite data. Our militaries cannot operate with necessary precision without satellite services, nor can we respond to humanitarian disasters in a timely manner without them. With an integrated awareness comes integrated governance solutions from the bottom up, as well as demands upon senior decision makers for integrated top-down policies.

Understanding Wicked Problems

A space citizen framework also assists in building an integrated understanding of the key issues of space governance. Currently, these issues are described as separate problems, coming under the responsibility of separate international and domestic entities and requiring separate solutions. For example, a common way to conceive of space governance priorities is through the separate lenses of "safety, security and sustainability." However, it is impossible to solve one of these challenges without impacting on one or both of the others, and as each of these challenges worsens, so do the others. A key factor is their interrelated nature: they are problems that exist as symptoms of each other, or quintessential "wicked problems."

The notion of wicked problems was first introduced by political scientists Horst W. J. Rittel and Melvin M. Webber in 1973, when they argued that complex social problems could not be "tamed" by traditional policy approaches, which are often partial, ideologically partisan and temporary rather than

enduring (Rittel and Webber 1973). While there is no consensus on the definition of wicked problems, the term is widely used to describe issues that have no simple end point (in other words, there is no point in time when the process of addressing the problem is complete) and to which there is no limit to possible solutions, with each problem acting as a symptom of another problem (Rittel and Webber 1973; Lönngren and van Poeck 2021). This is exactly the case for space governance issues.

A space citizen framework accepts the wicked, intertwined nature of these issues of space safety, security and sustainability. The safety of space operations can no longer be conceived of as separate from the sustainability of the space environment, nor from sustainability requirements in the design of space systems. The current impact of the Anthropocene upon the space environment — and soon on the lunar environment — has implications for the safety of current space operations and for the sustainability of space activities over time for future generations.

The sustainability of space operations also has to take into account the impact on our terrestrial and atmospheric environment. With more launches globally, the development of more space ports internationally and the establishment of more ground stations to service space technologies, there is a footprint impact on Earth and a poorly understood impact on the upper atmosphere from rocket fuels as well as burn-up of space objects upon re-entry. At the same time, sustainability efforts on Earth depend, in large part, on space data, including responding to climate change and understanding the impacts of different kinds of energy infrastructure. Therefore, as pressures on the safe and sustainable operations of satellites increase, we need to focus on space sustainability in order to protect the very sources of data for terrestrial sustainability.

There is also an integrated feedback loop between commercialization, sustainability and security. As discussed above, the commercialization of space has led to unmanageable levels of space traffic, which is continuing to grow exponentially. The risk of collisions with debris or other space objects is both a safety issue for military space dependencies and a major security issue. What makes this an even more wicked problem is the overwhelmingly dual-use nature of space services offered by commercial providers, which means that these services are increasingly under threat as space systems are targeted in the course of grey zone operations during conflict, leaving the critical infrastructure needs of civilians vulnerable. A key example is the cyberattack by Russia on the commercially owned Viasat communications system in early 2022, which had the desired effect of limiting communications among Ukrainian forces, but at the same time meant that citizens in a conflict zone lost their communications as well — as did many citizens in neighbouring neutral countries (Page 2022; Tepper 2022; Steer 2023a).

Existing state-based governance solutions continue to treat these as separate issues to be dealt with as different institutional responsibilities. At the United Nations, safety and sustainability are considered the purview of COPUOS, while the UNGA has had the "prevention of an arms race in outer space" on its agenda since 1981. As discussed above, the Conference on Disarmament has faced decades-long political stasis due to the division between those states that are committed to a treaty banning weapons in space, and those refusing to enter into any treaty. Meanwhile, the concentration of space traffic management has largely been in the hands of US Air Force Space Command for many years due to their SSA capability. While recently this task has been passed to the US Department of Commerce, the transition has been slow and interoperability with other sources of space-tracking data, such as from the ESA, Russia and commercial entities, has been difficult.. Until these issues are seen as interrelated, the solutions will be piecemeal and insufficient.

Bringing a Space Citizen Framework to the Forefront

The space citizen framework brings an integrated lens to these wicked problems — which is not to say that the solutions will immediately become evident. Indeed, wicked problems may not be solvable as such, but they can be managed in a sustainable, enduring way through inclusive, collaborative processes that involve a wide range of stakeholders (Alford and Head 2017; DeFries and Nagendra 2017; Head 2019).

One example may be in the OEWG on Reducing Space Threats, which was truly open ended. Of the 115 entities taking part, just under 68 percent were states; the remaining 32 percent were international organizations, commercial entities, members of civil society and academics (Ortega and Erickson 2024, 12). The UN Institute for Disarmament

Research held a consultation with commercial and civil society actors, in between official OEWG meetings, to understand the views of these entities and increase the role that they can play in space security (Blancafort, Erickson and Ortega 2023). The chair of the OEWG also invited a range of individual subject matter experts from around the world, and from a range of academic institutions and private entities, to give presentations to the delegates about technical, legal and policy challenges as well as existing possible solutions. The geographical, gender and discipline diversity of these experts was deliberately cultivated, which ensured the absence of political bias in the information presented and provided an opportunity for space citizens to be directly involved in the diplomatic process. As a result, the time available for states to enter into politicized debates was cut in half, and discussions became much more substantive, as there was a shared level of understanding. Some states acknowledged the importance of including a range of stakeholders and began to recognize the interconnected nature of questions of safety, sustainability and security in their written and verbal submissions (West 2024, 15).

Another example is the inclusion of the private sector in developing new norms and governance mechanisms. This is imperative, not only to guarantee buy-in and compliance, but also to ensure that those norms are reflective of current and foreseeable capabilities. The private sector has a vested business interest in the safety, security and sustainability of their operations in space. The International Telecommunications Union, whose traditional regulatory task has to do with spectrum allocation and the management of geostationary orbital slots, has included the private sector among its members for many years, and has recently turned its attention to "sustainability" (Foust 2023). Similarly, domestic law makers in some countries consult the private space sector as they develop space sustainability requirements in their licensing laws, a process that must always seek to strike a balance between ensuring commercial viability and true sustainability measures (Steer and Strong 2022).

And a final example, although perhaps an outlier, is the impressive work of a single individual in contributing to the manageability of these wicked problems. While states may be reticent to share SSA data due to security concerns, making space traffic management even more difficult, Jonathan McDowell's "Space Report" often serves as an open-source cross-reference for SSA data.[23] His online database and tweets on social media have contributed more than once to space safety responses and to clarifying the nature of a space object when there have been aspersions cast as to whether a given object is a potential weapon.

It is true that some individuals will have more opportunities than others to activate their status as space citizens. This has to do with existing privilege, including access to education and institutions of power. We cannot all build open-source tools for tracking space activities or present views to a global delegation of state representatives. The point is to build on an individual relational approach, integrate space into whatever expressions of citizenship may already be active and hand this awareness on to the next generation. Only by approaching these challenges from a space citizen lens can we hope to manage them, and thereby manage humanity's impact on the near-Earth environment we all depend upon.

As we expand our environmental impact into our near-Earth orbits and the lunar environment, global space governance mechanisms must become inclusive and multi-stakeholder by design and take into account a broader multi-generational "space citizen" framework. We have an intergenerational responsibility to ensure that our impacts are minimal and that space remains accessible.

The space citizen has an enlarged cognitive identity and an awareness that we are located in space and both impacting and dependent upon it. But we all do not need to travel to space to access this awareness. The overview effect may be accessible to us already through livestreams from the ISS, the increasing availability of EO images of our planet or even popular culture, such as the recording that astronaut Chris Hadfield made of himself singing David Bowie's "Space Oddity" during his mission on the ISS (Rare Earth 2013).

In many ways, the notion that we will some day become an off-world species is a distraction from the fact that we are already space citizens. We are already in space and dependent on it; both factors impact the space environment, making us vulnerable to the risks we have created for ourselves. Space-based services are intertwined

23 See https://planet4589.org.

with terrestrial wicked problems such as climate change, food and water security and arms control. And just as individuals and civil society have a growing role to play in impacting the global governance of these wicked problems, we need to close the gap between ourselves at an individual and societal level on one hand and global space governance mechanisms on the other. Approaching this shared responsibility as space citizens is the only way forward in the twenty-first century. Our current and future generations depend upon it.

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