

Space Governance to Achieve Sustainable Development in the New Space Age

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Abstract

The global space governance model, in its current form, excludes numerous space activities and allows actors to operate under the wide-ranging and often conflicting interpretations of existing frameworks. Present-day space exploration has extended its notion far beyond government-led and funded missions, and now fully encompasses private sector actors, new technological advances, and services in non-traditional space sectors. So far, numerous efforts and approaches have not shown to be completely effective, and more is needed to provide new order as new space interests, and technologies are pursued and developed. This phenomenon creates a vacuum in the legal order, forcing nations to devise their own rules of the game and compliance mechanisms.

The paper highlights the global space governance landscape and gaps, the factors affecting the current space governance regime and threats to achieving the United Nations Sustainable Development Goals 2030 and propose recommendations for the new space age.

1. Introduction

This paper highlights the global space governance landscape and gaps, how some countries are responding to the changing landscape to meet the United Nations Sustainable Development goals, as well as to identify viable new regulatory mechanisms that could provide near-term answers and identify key actors. The time has come to define a new order in global space governance underpinned by collaboration and cooperation, and not individualism and competition.¹

The international legal framework governing outer space was developed under the conditions of a bipolar, Cold War world, where the United States

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¹ Scott Atkins *et al*: Governance in outer space: The case for a new global order.

and the Soviet Union were the only space-faring nations and were engaged in a feverish race into space.²

Existing space treaties, shaped by the Cold War era, aimed to prevent outer space militarization and colonization. The focus was on keeping the Cold War out of space, leading to a governance structure frozen in Cold War terms.

The world and space have evolved, witnessing a proliferation of entrants. The rapid advancement of technology ahead of governance often results in inadequate regulation and potentially unsafe practices.

New activities require governance approaches that are appropriate and fitting to the activities being governed and must not stifle innovation.³ Current efforts to develop these measures have been fraught with challenges. It is, therefore, imperative to examine the current space regime, challenges and threats to achieving sustainability and how these can be addressed.

2. What Is Space Sustainability?

While there is no universal definition accepted, it is generally used as an umbrella term for measures designed to ensure that space activities do not have adverse effects on either space or the Earth.⁴ However, Dr Peter Martinez et al define it as concerns regarding safely conducting space activities and preserving the benefits derived on Earth. As per The Secure World Foundation, it entails ensuring that all humanity can continue to use outer space for peaceful purposes and socioeconomic benefit now and in the long term.⁵

3. The Current Space Governance Regime

3.1. Hard Law

The key space governance treaties include the 1967 Outer Space Treaty (OST), followed by additional treaties in 1968, 1972, 1976, and 1984, addressing various aspects such as astronaut rescue, liability for space object damage, registration of launched objects, and activities on celestial bodies.

2 The objectives of the Global Space Governance study are to identify today's new challenges to doing business in space, as well as to identify viable new regulatory mechanisms that could provide near term answers and identify key actors. The time has come to define a new order in global space governance underpinned by collaboration and cooperation, not individualism and competition.

3 Daniel L. Oltrogge; Ian A Christensen; Journal of Space safety Engineering: Space Governance in the new space era.

4 The Next Frontier, Sustainability in Space:

5 Secure World Foundation, Space Sustainability 2018,

These existing treaties have become too expansive to be useful in restructuring the current trend that could make outer space inaccessible in the long run.⁶

In the current era, the development of space governance has been influenced by the setting up of non-binding norms in the form of principles, declarations and guidelines that are voluntary and constitute soft law. This has been seen as the less contentious way to achieve consensus in the development of law. A number of the principles developed under the United Nations include the Space Debris Mitigation Guidelines and the Long-Term Sustainability of the Outer Space Guidelines.

3.2. Global Organisations and Institutions

The present framework includes international bodies like the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). Decision-making through consensus in UNCOPUOS often involves compromises, limiting its capacity to achieve comprehensive agreements on space-related matters or establish new binding legal norms. However, it has been effective in developing 'soft law,' comprising principles, resolutions, and guidelines that complement existing space law treaties.

The International Telecommunication Union plays a role in assigning the orbits to satellites launched into space. In areas where an appropriate regulatory framework is already in operation and largely followed by all the space actors, like the satellite telecommunication sector, the challenge becomes to stay abreast with technology progress and market evolution.⁷

Together with the challenge, there is an opportunity to develop new regulations that spur further technological progress. It has very few enforcement mechanisms and no strong ones as Breaches can be noted, but no real penalties for infringement of the rules.

The International Civil Aviation Organization (ICAO), established in 1944, is another significant UN agency associated with space activities. Although primarily centred on international air navigation, ICAO is actively arranging events to explore the connection between air and space navigation, emphasizing the need for future space traffic management. However, questions relating to its jurisdiction and mandate to deal with space governance as far as commercial space transportation and suborbital activities are concerned remain unanswered.⁸

6 Scott Atkins *et al*, Governance in outer space: The case for a new global order,

7 Guglielmo *et al*, Current Challenges and Opportunities for Space Technologies:

8 Ram S. Jakhu & Joseph N Pelton: Global Space Governance: Key Proposed Actions (Key Findings and Recommendations of the Forthcoming Book on Global Space Governance: An International Study, Springer,

Multilateral and bilateral treaties and agreements have also played a significant role in the development of international space regulation and cooperation. The application is also limited to the Parties concerned.

3.3. State Law

With the growing trend of privatisation and commercialisation of space activities, states deemed the adoption of national space legislation the most suitable way to regulate and control private space initiatives to ensure compliance with international space law principles.⁹ The national legislation constitutes enactments, regulations or decrees adopted by national governments to govern space activities.

International space law is mostly public in nature, hence national space legislation might provide the most comprehensive, transparent, and effective instrument to implement on a domestic level vis-a-vis private entities the international legal obligations arising from the space treaties.

States may be inclined or even strongly induced to develop national space legislation for monitoring and controlling space activities as to their national effects.¹⁰ For obvious reasons, the space treaties deal with the legal effects of private space activities only if these have consequences beyond the borders of the State(s) under whose control the activities at issue fall.

Some have already advanced with the commercialisation legislation and utilised national legislation to include soft law provisions emanating from the space debris mitigation & and long-term sustainability (LTS) of the outer space guidelines to ensure that they are enforceable nationally. That can be topped up with a sanction mechanism to deal with violations. The challenge with this approach is that national laws are confined to national space activities and not beyond the boundaries of the States.

4. Factors Affecting the Space Governance Regime?

There are several factors which necessitate the need for space governance in the new space age.

4.1. New Emerging Space Actors

New trends in space-related activities have alerted us to the ability of space actors to ensure its prosperity. This vigilance is mostly due to the growing importance of emerging space actors (EMSAs) which have destabilised the established order. Between Sputnik 1 and Space X Falcon 9, we have seen more nations establish their defensive space commands, diversify their space technologies and even demonstrate potentially destructive capabilities. Space

9 Dimitri Linden, *The Impact of National Legislation on Private Space Undertakings: Regulatory Competition Vs Harmonisation*:

10 Frans von de Dunk, Page 27: *Current and Future Development of National Space Law and Policy*:

exploration is no longer a domain reserved for wealthy nations, but now encompasses a group of players particularly developing such as China, India and Brazil and South Africa. These nations are starting to develop robust, coordinated future space programs. Furthermore, the private sector constitutes a significant force in reshaping space activities.

Space launches are getting significantly cheaper and have become considerably more frequent over the last decade.¹¹ The increasing accessibility of outer space raises questions about how to use space sustainably and safely. Issues such as the accumulation of debris in space – which threatens critical infrastructure such as satellites – and the development of anti-satellite weapons – which increase the likelihood of conflict – are examples of key issues that need to be addressed. Competition over space resources and valuable regions of celestial bodies may also lead to tensions and increased inequalities, and undermine the coordination needed to solve other global problems.¹²

4.2. Increased Commercialisation of Space

Spaceflight is an occupation of many private companies working on space innovations, for instance, space tourism, which denotes any commercial activity that offers customers direct or indirect experience with space travel. However, what are the legal implications of space tourism? Can the current space law regime, more than fifty years old, deal with new activities, using new technology dedicated to new users?

Only a few references in international space law can be applied to private spaceflight. Article V of the Outer Space Treaty and Rescue Agreement concerns itself with the assistance to be provided to an astronaut in danger, principles that could potentially be applied to non-governmental participants in space. Articles VI and VII of the Outer Space Treaty, as well as the Liability Convention, could be interpreted as a country's responsibility and liability for their citizens' travelling in space, and their compliance with international space law.

International space law lacks a regulatory framework for private spaceflights. For instance, should the law operate a distinction between astronauts and spaceflight participants? If the international community considers those two groups to have different rights, then, the OST and the following treaties should be amended, or a special one created, in order to define the law which applies to spaceflight participants. If no distinction is decided between the

11 How will the space economy change the world: Mckinsey Quarterly

12 Space Governance: How can the use of outer space be safe, sustainable and contribute to a flourishing future

two groups, should space tourists go through a form of selection, as astronauts, such as health tests, mental preparation and physical training?¹³

What would happen in the case of a dispute, or a crime committed in outer space? Would law applicable on Earth serve as jurisprudence? A sort of international space navigation administration would be necessary to set up the agenda of spaceflights, and authorise the launches, trajectories, and landings. States also have a lot to consider in terms of private spaceflight regulations. They need to specify how international norms apply to private companies. For example, though the Outer Space Treaties refer to the national responsibility of any space operation, states should legislate the responsibility and liability of companies, in the case of a dispute during a private spaceflight.

To mitigate the impact of commercial space activities, various soft institutions have been added to the mix of space governance structures. These include the Space Debris Mitigation Guidelines from the United Nations Office for Outer Space Affairs (UNOOSA, 2010), the Space Sustainability Rating initiative (World Economic Forum, 2021), and the Net Zero Space initiative launched at the Paris Peace Forum 2021. Although these voluntary institutions share a common goal of promoting space sustainability, their long-term effectiveness remains an open question.

In short, the world needs a “space traffic cop”, that is, a global body to allocate parking spaces and issue mining permits. Fines are required for littering; a binding obligation to take out your own trash, and provide space road sweepers’.¹⁴

4.3. New Technologies

Technology is an exponentially expanding industry that continuously pushes its boundaries. Such rapid growth should be matched by an equal evolution in the legal framework that governs it. Thus, in many ways, the current space laws and treaties are a hindrance to addressing contemporary problems, because of their obtrusive, outdated nature.¹⁵

Technology and innovation in business and entrepreneurial talent have forged ahead of the regulatory guidelines and necessary standards to ensure safe operation and fair competition. These activities requiring administration and control in space include on-orbit refuelling, retrofitting, servicing, space debris removal, solar power satellites, space mining, planetary defence, space tourism, hypersonic transportation and commercial activities in protospace. There is a serious lack of foresight, leaving the way open to potentially unsafe

13 Cornec, Celia: The post-Cold War issues of the space conquest: Thoughts on the future of an increasingly attractive space, p. 29.

14 Nayef Al-Rodhan, February 2023 GCSP Policy Brief No.3: Preventing the Increased/Uncontrolled Militarisation of Outer Space, p. 9.

15 Joshua Tallis: Remediating Space Debris: Legal and Technical Barriers, p. 88.

practices and impediments to the environmentally correct practices we should be adopting for the sustainable use of outer space.¹⁶

The development of technology ahead of governance generally leads to a lack of regulation and potentially unsafe practices.¹⁷ There is no foresight to sustainable use of outer space.

What the regulatory gaps do is create legal uncertainty. This clouds the regulation of other activities. When we have global and judicious rules that are upheld by all humankind, then cooperating, planning and solving problems generally becomes easier.¹⁸

Related to technology are the conventional challenges associated with the use of artificial intelligence in outer space. Artificial intelligence challenges in outer space depend on its unique features, for example, autonomy and opacity, and how they affect the pillars of the law, whether on Earth or on space missions.¹⁹ There are artificial intelligence systems designed to prevent satellite collisions, and others which can help locate and remove space junk. A good example is space mission ClearanceSpace-1, of the European Space Agency.²⁰

4.4. The Issue of Space Debris

Space debris presents the most alarming issue, in terms of sustainable use of outer space. Debris has been accumulating since the launch of Sputnik in 1957. The proliferation of space debris demonstrates that it is an issue beyond the framework imagined by the regulators in 1967.

The probability of collisions will increase without doubt, as the future development of the private spaceflight industry multiplies the number of launches and, eventually, the amount of space debris.

According to Article IX of the Outer Space Treaty, states are required to “avoid harmful contamination of outer space”. Over the years, the contamination of outer space has been progressive and commonly achieved. The proliferation of space debris demonstrates that it is an issue beyond the framework imagined by the regulators in 1967.

16 Scott Madry *et al*: The Global Space Governance Study -A new regulatory framework for New Space

17 Ram S. Jakhu & Joseph N Pelton: Global Space Governance: Key Proposed Actions (Key Findings and Recommendations of the Forthcoming Book on Global Space Governance: An International Study, Springer,

18 Barfield, W., & Pagallo, U. (2020): Advanced Introduction to the law and Artificial Intelligence. Elgar.

19 Scott Madry *et al*: The Global Space Governance Study -A new regulatory framework for New Space

20 Ugo Pagallo, Eleonora Bassi, Massimo Durante: The Normative Challenges of Artificial Intelligence in Outer Space: Law, Ethics and the Realignment of Terrestrial Standards.

The major problem concerns the collisions that can occur between space debris and satellites or any other space objects. It has already happened several times, proving the reality of the situation. In 2009, for example, a satellite from the company Iridium and a deactivated Russian military satellite collided in space. The North American Defence Command, the aerospace warning organization of the United-States, failed to prevent such a collision.²¹

During the past decades, a consequent number of guidelines have been written by international organizations to take steps towards the mitigation of space debris and providing the fundamental safety and protection measures, such as prohibiting the intentional destruction of space objects.

For instance, the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, endorsed by the United Nations General Assembly in 2007, gather these voluntary guidelines for the mitigation of space debris.

Although some states have implemented national mechanisms to prevent the proliferation of space debris and its removal, the international guidelines are voluntary and non-binding. Professor Al-Rhodan believes that “nations should agree on removing set amounts of debris each year”,²² depending on their space budget, space presence and the amount of debris they produce. This approach is essential to free space from the current trash.

International space law should focus on formulating binding international agreements, based on the rules defined in the guidelines, but combined with a sanction mechanism to deal with violations by any party.²³

One promising candidate, Professor Al-Rhodan proposes, is blockchain technology, which could allow spacecraft operators to make and enforce commitments without reliance on national or international law, and thus unlock new solutions to governance challenges inherent in the legal and physical attributes of the space domain.²⁴

4.5. Military Uses of Outer Space

During the 1960s the race to the moon dominated the attention of the two major space powers, the (then) USSR and the USA,²⁵ and the potential use of space for military purposes has continued to be intrinsically linked to the development of space technology and space flight, since the end of the Second World War.

21 Shenyan Chen: The Space Debris Problem - Asian Perspective 35 (2011).

22 Cornec *supra*.

23 Cornec *supra*.

24 Julia Selman Aytey: In Support of Global Accountability for Private Commercial Space Actors; Georgia Journal of International and Comparative Law Volume 48, Issue 3

25 Lyall and Larsen *Space Law* 508. See Mayer ‘Short Chronology of Spaceflight’ 23-24 for a short description of the quest for the moon during the 1960s.

Although the installation and testing of military equipment and space weapons in outer space is clearly unlawful, the problem remains that most space devices have the potential to be used for military purposes.²⁶ Global Navigation Satellite Systems (GNSS) or Global Position Systems (GPS) can be used for civilian purposes, but also to direct bombs or cruise missiles.²⁷ Telecommunication satellites are used to transmit not only civilian communications but also military messages.²⁸ Remote sensing through satellites is also used in the civilian as well as military spheres.

It is clear that the distinction between military and non-military uses of space is becoming increasingly blurred.²⁹ The question, therefore, should be posed, whether the military use of space equipment is contravening the stipulation in the *OST*, that outer space must be used for peaceful purposes exclusively. Outer space has been and will continue to be, of strategic and military importance to states.³⁰ It has even been contended unequivocally by some, that space has always been militarised. Military considerations were at the heart of the original efforts to enter space and have remained so to the present day.³¹

4.6. The Multiplicity of Dispute Settlement Mechanisms

Space law currently functions under a fragmented system for dispute resolution. The development of outer space at an international level has arguably stagnated after the Moon Agreement in 1979. Currently, a robust framework for dispute resolution has become an increasingly vital necessity in the space law regime.³²

The Liability Convention of 1971 constitutes the first framework of dispute settlement by providing the ability to pursue claims against a country for damage caused by a space object. If the claim can also be pursued through national courts, it cannot be pursued through both systems simultaneously.

26 Also see Goodman 2010 *Journal of Space Law* 108, who confirms that ‘it is widely known that any object in space can become a space weapon’.

27 Lyall and Larsen *Space Law* 500, 519. The authors point out that “the present operation systems, US GPS, Russian GLONASS and the Chinese Beidou are systems designed, operated and owned by the military to which civilians have been granted access” (Lyall and Larsen *Space Law* 519). Also see Frischauf “Satellite Navigation” 126-133 on the dual use of satellite navigation systems.

28 Lyall and Larsen *Space Law* 521-522. Also see Soucek “International Law” 317; Ospina 2009 *Proceedings of the International Institute of Space Law* 178.

29 Lyall and Larsen *Space Law* 519; Ospina 2009 *Proceedings of the International Institute of Space Law* 180.

30 Sheenan: *International Politics of Space 2* as quoted in Soucek ‘International Law’ 317

31 Ospina 2009 *Proceedings of the International Institute of Space Law* 180

32 Karl-Heinz Bockstiegel (1993a): *Developing a system of Dispute Settlement Regarding Space Activities*

The International Court of Justice (ICJ) represents another mechanism of conflict resolution. However, only states can pursue claims through this mechanism.

There is also the Permanent Court of Arbitration situated in The Hague. Regrettably, the private arbitration and mediation framework is currently underdeveloped concerning outer space disputes.³³

All the same, arbitration remains the most effective means to sort out a space problem seems to be arbitration as more and more countries are resorting towards this technique to resolve all international disputes. The main advantage of arbitration is that actors can also include private entities and not only governments.

5. Threats to Sustainable Development

Current efforts to develop these measures have been fraught with challenges ranging from reaching an agreement on what the problems are, to conceptualising possible solutions.³⁴ This is a reflection of the shifting balance of power equations, on the one hand, and the proliferation of technology in the hands of a large number of players, on the other. As a result, decision-making processes become problematic. Thus, the crisis in the decision-making mechanism, and the lack of consensus among major space powers, is impeding the process of developing an effective outer space regime.

The absence of a space governance framework suited to commercial activities may lead to ongoing regulatory gaps, hindering investment and potentially escalating geopolitical tensions.

This results in legal uncertainty for regulating space debris removal, satellite servicing, in-space manufacturing, astronaut treatment, activities by non-state participants, space resource use, and admissibility of satellite data in courts.³⁵ Thus, safe and secure access to outer space is being challenged by several old and new threats.

6. Addressing Challenges

The question is how do we go about addressing these governance issues? Looking at the literature, there are many varying views on this matter with options proposed.

33 Scott Atkins: Dispute Resolution and Restructuring in outer space: Using ADR to drive efficiency and better outcomes for creditors

34 Henry Hertfeld: Current and Future issues in International Law

35 Jo Feldman et al: Who is going to clean up all this junk?

6.1. Maintain the Status Quo

We could decide to do nothing and let history take its course, with the expectation that we can successfully cross the bridge when we get to it. After all, it has worked out in the past.³⁶

Human history reflects progress rather than catastrophe. Nevertheless, adopting a passive 'waiting for the bridge' stance is perilous. Although overall history trends positively, it doesn't guarantee uniform improvement. The creation of the UN post-World War II, forming the modern international order from conflict's ashes, exemplifies the need for proactive measures. Waiting for circumstances to unfold risks repeating history and invites potential future disasters. Yes, we have done well so far, but that fact is not a guarantee that things will continue to be well.³⁷

We could estimate the general chronological order of governance challenges and try to find solutions in that order.³⁸ In contrast to the 'waiting for the bridge' strategy, we would be attempting to prevent problems, before we reach the proverbial bridge. This kind of strategy is preferable, not least because it represents a form of planning instead of letting things happen. After all, good governance rules can encourage positive and desired behaviour.³⁹

The approach is not without its own set of questions, though. Firstly, if we hope it to be effective, one might wonder why international space policy, which has generally been pursued in this way since the OST of 1967, has not already made notable progress in the domain of space governance. In other words, if it works, then it should already have produced results. Secondly, even though we can reasonably predict the general space governance challenges, we cannot be confident about the specific timeline.

6.2. Revision of Treaties

New developments have occurred in the world in general, and the space sector in particular with serious implications for current and future space activities and the sustainable use of space for peaceful purposes for the benefit of all humankind. The time has come to assess the efficacy of the current regime of global space governance and to propose an appropriate global space governance system that addresses current and emerging concerns.⁴⁰ It is important to move international cooperation and enhanced space regulatory actions in the area of Global Space Governance forward.

36 Marko Kovic: Rules in space; If we don't invent a legal framework for space colonisation the consequences could be catastrophic: the time to act is now.

37 Also see Goodman 2010 Journal of Space Law 108, who confirms that 'it is widely known that any object in space can become a space weapon.

38 Marko Kovic, *supra*.

39 Marko Kovic, *supra*.

40 The 2nd Manfred Lachs International Conference on Global Space Governance held at McGill University, in Montreal, Canada, on 29-31 May 2014.

This has been especially true for areas related to the UN Sustainable Development Goals (UNSDG) and especially in areas related to space education and health, space application, space commercial and economics, space transportation, space security-related issues, the environment, and planetary defense-related activities.

As indicated earlier it is increasingly clear that the body of international space law, drafted in the 1960s and 70s (and showing the hallmark of that era) has several deficiencies concerning existing emerging and proposed space activities. The deficiencies include both intended deficiencies in the law. This is where drafters refrained from law-making (either out of modesty or political expedience). There are also unintended and emergent deficiencies (where technological progress in spaceflight technologies and capabilities were not addressed in the law because they were simply not imagined at the time.⁴¹

6.3. Global Standards of Accountability

While we may still be far from having detailed solutions to the challenges, we can, and should, start thinking about general strategies on how to arrive at specific solutions.

Imposing global standards of accountability for space actors may be a solution. However, it may be impossible to enforce such standards, or other governance norms, in formal treaty law. Attention may be given to other formats for meaningful governance. Blockchain technology may be another format for meaningful governance. This could compel spacecraft operators to 'make and enforce commitments' without reliance on national or international law.

6.4. Adopt, Revise, and Amend National Regulatory Frameworks

Domestic legislation thus presents a possibility for States to harness private enterprise for the public cause by making it attractive for it to participate in space activities.⁴²

These national laws may be insufficient to respond to the growth of private space activities and to new trends in space activities, such as small satellites, constellations of satellites or reusable launchers.

Activities in space cannot be contained within the boundary of a country's border, and they have the potential to affect assets or areas of the planet well beyond the jurisdiction of a launching country, or the nation where a satellite operator is registered.⁴³ Therefore, the international regulatory framework should prevail on national regulations and limit the capability of countries to use less stringent regulations as a means to attract foreign business. Some

41 Christopher D. Johnson et al: Deficiencies and Pressing Issues in the Existing legal Regime of outer space: the incompleteness of the legal order for space.

42 Frans von der Dunk, *supra*.

43 Guglielmo, *supra*.

consideration needs to also be given to how to enforce the agreed rules and regulations at an international level.

At the same time, the development of rules and regulations must be mitigated to avoid unnecessary red tape, which could stifle new enterprises. Space law should preserve the freedom to generate new ideas and implement new applications. Hence, the challenge lies in balancing these competing requirements: a regulatory framework which protects stakeholders, countries' interests, and current and future human rights on one hand, with the freedom to develop and exploit new technologies, on the other.

7. Conclusion

The space governance model, in its current form, excludes numerous space activities and allows actors to operate under the wide-ranging and often conflicting interpretations of existing frameworks.

The current regime does not sufficiently address the current geopolitical and sustainability challenges. The five foundational United Nations Space Treaties were a product of cold war and were a response to pertinent challenges of its time.

In the absence of an adequate space governance, states and non-state actors are rapidly expanding their scope of influence in space, through their ways of governing.

It is therefore critical to address space governance gaps at national and global levels, considering a range of priority issues, to keep the space domain accessible to everyone, preserve it for future generations and maintain it as a common heritage of humankind.