

Enhancing Space Law for Ensuring Global Space Security in an Era of Growing Space Threats

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This article delves into the imperativeness of addressing space threats and safeguarding global space security, elucidating actionable measures to mitigate risks and safeguard the interests of humanity. The paper explores the evolving landscape of space threats, including the increase in space activities, the accumulation of space debris, challenges in space traffic management, and the preservation of dark skies. It highlights the need for enhanced space law to serve as an effective legal instrument and examines the interpretation of “peaceful” in the context of space activities. The role of space security and its interplay with global security is also discussed, emphasizing the protection of assets, activities, and interests in space.

Keywords: space security, weaponization, space race, militarization and deterrence, space activities, Space Code.

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Introduction

In a world plagued by devastating invasions and nuclear threats, preventing conflicts in space activities is crucial. The current international legal framework and regulatory systems were established in a different geopolitical context, leading to confusion, inconsistencies, and violations. The absence of a unified international organization capable of managing space risks complicates the situation. This article emphasizes the urgency of addressing space threats and proposes measures to mitigate risks and safeguard global space security. The absence of any previous space wars poses a significant challenge, as governments possess limited experience upon which to draw when attempting to anticipate the actions that might incite a potential adversary to engage in hostile acts. Moreover, the velocity and trajectory by which such actions could escalate into a full-fledged conflict further complicate this issue (Maxwell & Wilson, 2021).

In an era marked by grave ramifications of invasions, wars, and nuclear peril, redirecting our focus toward preventing conflicts in the sphere of space activities becomes paramount. The proliferation of space actors and emerging technologies, coupled with the anticipated exponential increase in orbital objects and space security concerns, necessitates a comprehensive reassessment of the existing international legal framework and regulatory systems. The prevailing geopolitical context, significantly different from when these mechanisms were initially established, has led to confusion, inconsistencies, and violations pertaining to natural mechanisms, space security, and human rights. Furthermore, the absence of an international organization vested with full authority to manage risks and threats to space assets further complicates the scenario. Against the backdrop of an increasingly deteriorating geopolitical environment, collaborative control over orbital resources emerges as an urgent necessity, underscoring the cruciality of enhancing space law as an effective tool for ensuring space security in the future.

The evolving landscape of space threats

Historically, economic, and military competitiveness go hand in hand, but humanity cannot afford to follow the same pattern in space (Townsend, 2021). Currently, there is a noticeable rise in the quantity of both public and private entities involved in space activities. This expansion is accompanied by the emergence of novel space technologies and markets. Consequently, one can anticipate a proportional increase in the number of objects present in orbit, as well as a corresponding surge in space security concerns. These concerns include the escalating accumulation of space debris, challenges associated with space traffic management, and the issue of dark sky preservation, among others. It is worth noting that the existing international legal and regulatory framework was formulated within a distinct geopolitical context, wherein only two spacecraft were operational in Earth's orbit. In stark contrast, the present reality entails the presence of over 20,000 space objects currently orbiting our planet. Projections suggest that this figure will escalate to approximately 38,000 spacecraft within the next decade (Pivovarov, 2021). The proliferation of numerous satellites will impose a substantial burden on the already strained technical capacities of terrestrial infrastructures. This surge in space objects and vehicles, coupled with the prevailing international legal and regulatory framework, gives rise to legal ambiguities and inconsistencies, and compromises the integrity of natural mechanisms, space security, and human rights. The understanding of risk has evolved beyond the concept of a physical adversary that can be combated with weaponry, to a persistent sense of vulnerability that permeates the daily lives of individuals. This multifaceted scenario is marked by novel challenges, including an upsurge in crises of various types, their unpredictable nature, and their global extent. Additionally, the escalation of military conflicts has further amplified these threats (Fiumara, 2015).

Simultaneously, the absence of a comprehensive international organization with the authority to effectively manage risks and threats to space assets presents a significant challenge. The establishment of international governance systems for outer space encounters complexities arising from bureaucratic structures and political legacies. While it is crucial to make progress in adopting multilateral approaches to space security, the barriers extend beyond conflicting public interests to encompass competing interests that may prove difficult to overcome. Furthermore, the contemporary landscape is characterized by a growing number of global predicaments, including deglobalization, the conflict in Ukraine, supply chain

disruptions, the global energy crisis, and a prolonged decline in foreign direct investment. These factors further complicate the situation surrounding the management of space risks and threats (Kornprobst & Paul, 2015).

Hence, the repercussions of such circumstances may result in a diminished impact of international programs, specifically those pertaining to space security and safety on a global scale. Presently, these programs encompass the domains of space situational awareness and space weapons concepts. This escalation amplifies the proliferation of space-related threats and holds the potential for catastrophic consequences. This concern was similarly raised and acknowledged during the 76th Session of the United Nations General Assembly in 2021. In his address to the Assembly, the United Nations Secretary-General issued a fervent call to the international community, urging them to awaken to the gravity of the situation. He emphasized that humanity teeters on the precipice, traversing a path that leads in the wrong direction. He further underscored that our world has never faced greater peril, confronting a formidable array of crises unparalleled in our lifetimes (European, 2021).

One year following Russia's invasion of Ukraine, the situation experienced a substantial deterioration, giving rise to new and emerging threats. These threats encompass the unanticipated exploitation of data by external entities, the susceptibility of space infrastructure to malicious activities and orbital hazards, as well as a concentrated and delicate global supply chain reliant on a limited number of major stakeholders and intricately specialized components. The present geopolitical landscape raises apprehensions regarding the feasibility of international space cooperation precisely when collaborative management of orbital resources is crucially needed¹. In order to guarantee space security in the forthcoming era, it is imperative to enhance space law, enabling it to serve as an effective legal instrument.

The role of enhanced space law

In contemporary times, it has become imperative to embrace a methodical and all-encompassing strategy in tackling the predicament of space threats. To illustrate, Astrium UK, a division of the France-headquartered enterprise Astrium, is currently engrossed in the advancement of harpoon technology with the purpose of eradicating defunct satellites from the vast expanse of outer space (Reed & Barraclough, 2013). However, based on its inherent characteristics, such a harpoon possesses the potential to facilitate space traffic, while simultaneously raising concerns regarding its high firing speed, which could classify it as a weapon. It is worth noting that international law explicitly prohibits the utilization of space weapons, although the implementation of effective regulations for space traffic management remains elusive. An additional cause for apprehension revolves around the existence of nuclear power plants aboard certain spacecraft. These power plants are specifically engineered to separate the enriched uranium block and subsequently place it in a distant orbit during re-entry. Unfortunately, instances of failure have been documented, leading to the contamination of debris that subsequently plummets Earth. Even the presence of a solitary fragment with an unpredictable flight trajectory can pose substantial risks within orbital space. Presently, one of the most critical threats we face is the potential transformation of space into a theater for

¹ Space security is a critical issue for the United Nations, with references to it in the General Assembly's First Committee (Disarmament and International Security Committee) and Fourth Committee (Special Political and Decolonization Committee). At the Committee on the Peaceful Uses of Outer Space (COPUOS), especially in the Scientific and Technical Subcommittee and the Legal Subcommittee, today this is the main topic of conversation.

armed conflicts, a development that would render space infrastructure vulnerable and inflict catastrophic effects on the entirety of the planet. Inadvertent threats encompass a range of issues, including space debris, collision risks, and radio frequency interference. Conversely, intentional threats primarily manifest as the weaponization and militarization of space. The proliferation of anti-satellite weapons, conventional kinetic-energy weapons, laser weapons, jamming techniques, and cyber threats serves as evidence of the deliberate utilization of space for weapon development. In 1961, the American lawyer F. Schick made a significant observation, stating that attempts to reach a consensus on the timely implementation of a comprehensive space code incorporating effective international control measures would inevitably fail due to the prevailing realities of the space domain (Schick, 1961). These realities stem from the fact that continued technological advancements will exacerbate the complexities involved in resolving security concerns. Regrettably, there is a measure of truth in this statement. The expansion of the space industry presents formidable challenges to the establishment of a unified "Space Code." The rapid progression of ongoing processes obstructs the formulation of enduring and restrictive regulations (Soroka, 2020). Consequently, there is a pressing need for legal frameworks that are more responsive and adaptable to these evolving circumstances.

In his book, Max M. Mutschler emphasizes that the Outer Space Treaty (OST) serves as the primary legal framework governing the utilization of outer space (Mutschler, 2015). The treaty is founded upon the fundamental principle that the concept of national appropriation by sovereignty claims should not apply to outer space (Article II). Furthermore, it asserts that the exploration and utilization of outer space are a collective responsibility shared by all of humanity (Article I). While the preamble of the OST advocates for the peaceful utilization of space, it does not explicitly define the term "peaceful." However, it is widely understood that the parties to the treaty interpreted "peaceful" in line with the original perspective of the United States, which denotes a state of non-aggression.

Additionally, Article III of the OST imposes an obligation on parties to conduct their space activities in accordance with international law, including the provisions of the United Nations Charter. Consequently, a more comprehensive examination of the United Nations Charter is required to ascertain the precise definition of "peaceful purpose." Article 2(4) of the United Nations Charter establishes a general prohibition on the use of force by states. Nevertheless, Article 51 of the United Nations Charter explicitly recognizes the inherent right of self-defense. This recognition, as highlighted by the author, allows for an interpretation of "peaceful" as "nonaggressive" and implicitly legitimizes military applications of space, such as reconnaissance, under the pretext of self-defense (Mutschler, 2015).

Within the domain of space activities, the terminology employed, namely "peaceful" and "nonaggressive," often conveys a comparable notion, thereby enabling their interchangeable use. These terms signify the absence of hostile or aggressive behaviors in the pursuit of outer space exploration and utilization.

The interpretation of "peaceful" in the context of space activities aligns with the original perspective of the United States, which perceives it as synonymous with "nonaggressive." Thus, it follows that space activities should eschew acts of aggression and the application of force against other nations or their spatial assets. Instead, the focus ought to be on cultivating cooperation, collaboration, and the peaceful attainment of scientific, commercial, and exploratory objectives.

It is worth acknowledging that the precise explication of “peaceful” in the realm of space activities may diverge across nations. However, the connotation of “peaceful” underscores distinct aspirations and remains distinct from the notion of “nonaggressive.” In the context of space activity, “peaceful” denotes that space exploration, research, and utilization should transpire in a manner that precludes the utilization of force, the engagement in military aggression, or any endeavors that may engender the militarization of outer space. This interpretation accentuates the promotion of cooperation, collaboration, and the constructive dividends derived from space exploration, such as advancements in scientific knowledge, technological innovation, and international amity.

Kai-Uwe Schrogl (Schrogl, 2005; Mutschler, 2015) suggests that the agreement governing the use of space does not explicitly prohibit the placement of conventional armaments in space. According to his interpretation, the development of conventional armaments in space may be considered legal as long as it does not involve aggressive actions and is solely intended for self-defense. However, this viewpoint presents an inherent contradiction, as self-defense cannot be regarded as “peaceful” in its nature. Furthermore, the explicit prohibition of weapon use in space renders the necessity of self-defense unnecessary, raising doubts about the validity of this interpretation.

In contrast, Detlev Wolter (Detlev, 2006) argues against the notion that the United States and the Soviet Union intended to legalize the placement of space weapons. Instead, these superpowers aimed to ensure that space activities served the collective interests of humanity, aligning with disarmament efforts and the avoidance of an arms race in space. Soviet scientists maintain that the United States and its military partners continue to pursue the utilization of space technology for military purposes. The US military space program includes the development of early warning and interception systems for satellites and ballistic missiles, the construction of military reconnaissance and radio navigation satellites, a series of communication satellites, the advancement of manned hypersonic spacecraft, orbital space stations, and exploration of the feasibility of creating orbital belts of artificial meteorites (referred to as space “minefields”) and “asteroid bombs” (Zhukov & Kolosov, 2014).

Despite initial concerns about a potential space war, Andrew F. Krepinewich notes that the major powers, the United States, and the Soviet Union, managed to avoid an arms race in orbit. Instead, their competition shifted towards prestige, with manned and scientific achievements in space serving as indicators of national power. Although there was a moment when an arms race seemed possible, the intensity of the competition diminished after the successful US moon landing. However, during President Reagan’s administration, the United States pursued an aggressive missile defense program that included a space component, which directly violated the Anti-Ballistic Missile Defense Treaty. This space component had the potential to ignite a new arms race in space as the Soviet Union sought to match or counter the United States’ new capabilities. Nonetheless, the long-term costs of military competition, economic inefficiency, and a loss of faith in the capabilities of the Soviet forces eventually prompted the Soviet authorities to seek a peaceful solution (Krepinewich, 2015). Hence, it is imperative to promulgate well-defined regulations and precise delineations concerning these matters, particularly in relation to the terms “peaceful” and “nonaggressive” within the context of space activity. The establishment of unambiguous guidelines serves to minimize the likelihood of misunderstandings and mitigate the potential negative ramifications that may arise in this domain. By providing explicit definitions and clarifying the scope of these terms, the international community can foster a shared understanding and facilitate the

implementation of measures that promote the peaceful utilization of outer space, thereby ensuring the preservation of stability and the prevention of adverse outcomes.

Space security and its interplay with global security

The term “space security” refers to the protection and preservation of assets, activities, and interests in the space domain. It encompasses the measures taken to ensure the safety, sustainability, and peaceful use of space for all nations and stakeholders involved. Space security involves safeguarding satellites, spacecraft, space infrastructure, and other assets from potential threats, both natural and man-made. It also includes addressing challenges such as space debris mitigation, orbital congestion, cybersecurity, and the prevention of the weaponization of space. Space security is not limited to the protection of physical assets alone but also encompasses the broader aspects of security in the space domain. This includes ensuring the integrity and availability of space-based services such as communication, navigation, weather monitoring, and remote sensing, which are vital for various sectors of society, including telecommunications, transportation, emergency response, and scientific research.

The concept of space security is closely intertwined with global security, as the increasing reliance on space-based systems and technologies has made space an integral component of many aspects of modern life and national security. Disruptions or threats to space systems can have significant implications for a nation’s security, economic well-being, and overall stability.

Considering the aforementioned context, a profound consideration of potential courses of action becomes imperative at this critical juncture. Central to this endeavor is a comprehensive examination of the concept of “space security,” aiming to broaden its scope and understanding. Over time, the notion of “space security” has undergone a significant evolution, transitioning from a simplistic two-dimensional model to a more intricate three-dimensional framework.

Initially, space security was primarily defined in the context of the military balance between the United States and the Soviet Union during the Cold War. However, with the conclusion of the Cold War, a more comprehensive two-dimensional model emerged, encompassing both military and environmental aspects of space security. Presently, this two-dimensional approach is progressively giving way to a three-sector understanding that discerns various applications of space for security and defense. This paradigm recognizes three distinct sectors: the protection of assets in space against both natural and man-made threats, and the defense against threats originating from space itself (Sheehan, 2015).

Originally conceptualized as a two-dimensional model, the evolving nature of the “space security” concept necessitates a deeper exploration, particularly concerning the intricate interplay between space security and global security. In the contemporary era, the increasingly evident interdependence of global security and space security demands comprehensive exploration and analysis.

By delving into the multifaceted dimensions of space security, it becomes possible to formulate robust strategies that address the complexities of safeguarding assets in space, ensuring resilience against diverse threats, both terrestrial and extraterrestrial. Moreover, acknowledging the interconnection between space security and global security allows for the development of cohesive frameworks that promote international cooperation, transparency, and mutual understanding among nations, while mitigating potential conflicts and negative consequences in the space domain.

In conclusion, the quest for space security must be viewed holistically, integrating the evolving understanding of this concept with the broader context of global security. Emphasizing a multidimensional approach enables policymakers and stakeholders to navigate the intricate challenges and opportunities presented by space activities, promoting a safer and more stable space environment for the benefit of all humanity.

Mitigating risks and protecting human interests

Mitigating risks and protecting human interests in space activity is a paramount undertaking in ensuring the safety, sustainability, and responsible utilization of outer space. The pursuit of space exploration and exploitation brings forth a multitude of advantages and prospects, yet it also presents inherent risks and challenges that necessitate attention. One of the principal concerns in space activity revolves around the mitigation of risks associated with space debris. The accumulation of non-functional satellites, spent rocket stages, and other fragments poses a substantial hazard to operational spacecraft and the long-term viability of space endeavors. Endeavors are being made to track and document space debris, develop technologies for its removal, and establish best practices for satellite design to minimize the generation of such debris. Another critical facet of risk mitigation entails ensuring the safety of astronauts and space travelers. Human spaceflight entails inherent perils, including exposure to microgravity, radiation, and physiological stress. Robust safety protocols, advanced life support systems, and rigorous training programs are implemented to minimize risks and safeguard the well-being of astronauts during space missions.

In addition to technical risks, space activities also give rise to legal and ethical concerns. The protection of intellectual property, prevention of unauthorized access to space systems, and safeguarding of sensitive information are vital to uphold human interests in space. International agreements, such as the Outer Space Treaty and the Moon Agreement, provide a legal framework for governing space activities and ensuring the responsible conduct of states and organizations.

Furthermore, the safeguarding of human interests in space encompasses the assurance of equitable access to space resources and opportunities for all nations and stakeholders. The exploration and utilization of celestial bodies, such as the Moon and asteroids, should be conducted in a manner that fosters cooperation, fairness, and the collective benefit of humanity. International collaboration and the establishment of transparent and inclusive frameworks are essential to prevent the exploitation or monopolization of space resources. Ultimately, the endeavor to mitigate risks and protect human interests in space activity necessitates a multidimensional approach that encompasses technological advancements, international collaboration, robust legal frameworks, and ethical considerations. By addressing these challenges, we can forge a safer and more sustainable space environment that facilitates the exploration, scientific discovery, and commercial utilization of space for the benefit of present and future generations.

Moreover, it is essential to enhance the protection of human rights in space activities while considering the principles of “common genesis.” Space threats in outer space may have an impact on the realization of human rights, including the right to access space and the information obtained there, the right to benefit from scientific progress and its applications (Experts, 2009), the right to privacy (Regulation, 2016), the right relating to life and the environment in the context of ecocide (Boyd, 2012), the rights relating to humanitarian law,

and military conflict. The “development of weapons technologies endangers the enjoyment of human rights worldwide” (Experts, 2009), and the weaponization of space is no different. In particular, the militarization and weaponization of space raise concerns for specific rights, such as the right to life, the right to a safe environment, the right to development, and the right to peace, among others (Freeland & Ireland-Piper, 2022).

Transitioning from militarization to cooperation

Shifting from a militarized space race to cooperation and demilitarization is essential for expanding human utilization of space. Economic opportunities in space should be prioritized over unnecessary arms races. The existence of space weapons and the principles of deterrence may have unacceptable consequences when used by individuals. We should implement the transition from the military space race to cooperation and enhance the process of demilitarization and dewatering in space activities, despite the challenges and drawbacks. Shifting towards an economic race rather than a militarized one is currently the most effective approach to expanding human utilization of space. The resources allocated to safeguarding existing capabilities could be better utilized in expanding economic opportunities in space. Allocating resources to an unnecessary arms race only distracts from realizing the economic benefits of increasingly affordable access to space (Townsend, 2021). The existence of space weapons, along with the principles of deterrence, may have unacceptable consequences when utilized by individuals.

Max M. Mutschler in his work, “Security Cooperation in Space and International Relations Theory” (Mutschler, 2015), examines the applicability of different theoretical perspectives in explaining the dynamics of security cooperation in the realm of space. Neorealism, which focuses on the anarchical nature of the international system and states’ pursuit of power and security, provides an explanation for the absence of formal security cooperation. According to neorealism, the unequal distribution of gains and the fear of relative losses impede states from engaging in cooperative efforts, particularly in the context of arms control agreements. However, neorealism encounters difficulties in elucidating the tacit form of security cooperation observed between the United States and the Soviet Union during the Cold War. This raises inquiries into why the United States, despite possessing a technological advantage, did not fully exploit its power in space. On the other hand, neo-institutionalism underscores the significance of interdependence and the establishment of international regimes to facilitate cooperation. Neoinstitutionalists argue that states share mutual interests and that regimes can mitigate the risks associated with cooperation by defining the scope of collaboration, monitoring compliance, and fostering trust among states. Within the context of space security cooperation, neo-institutionalists highlight the interdependence generated by the reliance on space technology and the imperative for sustainable space utilization. They contend that an arms race in space poses risks to the benefits derived from space activities, thereby rendering cooperation desirable. Nevertheless, the fear of non-compliance and the challenges associated with defining and verifying adherence to a ban on space weapons present obstacles to effective cooperation.

Constructivist/liberal perspectives center analysis on the role of ideas, norms, and learning processes in shaping state behavior. These accounts argue that actors’ perceptions of problems and interests are influenced by their beliefs and knowledge. Epistemic communities play a pivotal role in promoting new interpretations of reality and advocating for policy changes. In

the case of space security cooperation, constructivist/liberal accounts underscore the influence of dominant beliefs that prioritize unilateral behavior over cooperation.

In conclusion, the author mentioned that while each theoretical perspective offers valuable insights, none of them fully captures the intricacies of security cooperation in the domain of space. The analysis underscores the necessity for a multidimensional approach that encompasses systemic, institutional, and ideational factors to achieve a more comprehensive understanding and foster effective cooperation in this field. Further research is warranted to explore these dynamics and develop strategies for enhancing space security cooperation (Mutschler, 2015).

Conclusions

This research emphasizes the need for a systematic and comprehensive approach to tackle escalating space threats and ensure global space security. To achieve this, several key points must be considered.

Firstly, the concept of “space security” should be expanded to encompass its three-dimensional nature and recognize its interconnectedness with global security. This broader understanding will enable a more holistic approach to addressing space threats.

Secondly, increased protection of human rights in space activities is crucial. This involves safeguarding the right to access space, ensuring privacy, benefiting from scientific progress, and addressing concerns related to life, the environment, humanitarian law, and military conflicts. Incorporating the principles of “common genesis” will contribute to a more inclusive and equitable approach.

Thirdly, a shift from a military space race to cooperation, demilitarization, and dewatering is necessary. By focusing on economic opportunities in space, we can utilize resources more effectively and avoid unnecessary arms races that hinder the realization of the economic benefits of space exploration.

Additionally, it is imperative to promulgate well-defined regulations and precise delineations concerning these matters, particularly in relation to the terms “peaceful” and “nonaggressive” within the context of space activity.

To ensure the preservation of space security and the well-being of humanity, it is vital to address space threats urgently. This requires comprehensive analysis, global legal regulations, and cooperation among various stakeholders. Human rights should be incorporated into the principles, recommendations, and normative legal frameworks governing space activities and space security. In the context of current trends such as deglobalization, the space race, militarization, and the escalation of military conflicts, it becomes even more critical to act swiftly and collaboratively.

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