

Space Security, Balance of Power, and Deterrence Theory

Larysa Soroka

Professor, Doctor of Law, Scientific Institute of Public Law (Kyiv, Ukraine)

E-mail: lsoroka_kw@ukr.net

<https://orcid.org/0000-0002-6979-6049>

Anna Hurova

Ph.D. in Law, Fellow Researcher at Koretsky State and Law Institute of NASU

(Kyiv, Ukraine), LIENSs/CNRS, La Rochelle (France)

E-mail: a.m.hurova@gmail.com

<https://orcid.org/0000-0003-4134-761X>

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The article examines the transformation of the deterrence concept amidst the development of outer space as a new strategic environment for confrontation. Based on Thomas Schelling's game theory, the author analyzes the changing nature of global conflicts – from “zero-sum games” to mixed-motive games increasingly emerging in the field of space security. Particular attention is given to the role of private space companies like Maxar, Icyeye, and Capella Space, which significantly influence the distribution of power, information flow, and strategic planning during modern military conflicts, notably in Russia's war against Ukraine. The article raises questions about the legitimacy of using commercial satellite data for military purposes and analyzes Russia's position, which considers such activities military in nature and threatens the destruction of satellites. In this context, the key principles of international humanitarian law – distinction and proportionality – as well as the dangers associated with the forming orbital debris due to anti-satellite attacks are explored. The author concludes that there is a need for a new system of deterrence in space based on international law, accountability, regulatory mechanisms, and technological responsibility by both states and the private sector.

Keywords: space security, deterrence, game theory, balance of power, private space companies, international law, space law, responsibility, international law, regulatory, military.

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Introduction

Safety and security issues have been relevant at all stages of human development. In any society, the ability to live without risks and dangers has always been highly valued. Security is an absolute value; it is universal and recognized as fundamental by all humanity. This is especially keenly felt during periods of social upheavals, epidemics, wars, and terrorist acts. It gains even greater significance with the blossoming of technical capabilities, such as gaining access to outer space, resources, and space technologies.

The perception of security as a socio-legal phenomenon has constantly evolved: from collective security as a “superstructure of the existing international legal and political system” (Orakhelashvili, 2011) to “human security” (Human, 1994) and the development of the “responsibility to protect” (Weiss & Hubert, 2025) concept as a political agenda.

Security is traditionally understood in connection with the State sovereignty and its territorial integrity, as stated in Article 2(4) of the UN Charter (United, 1945). However, modern realities indicate the existence of security problems without ties to state territories and their sovereignty. These issues have extended beyond traditional borders to various maritime zones (Basil, 2015), the Arctic (Geopolitics, 2014), Antarctica (Antarctic, 2012), outer space (Bourbonniere, 2005), and even cyberspace (The Routledge, 2010).

While working on the problems of political and legal provisions for space security, we occasionally encountered polemics in scientific publications regarding the idea that law might hinder technological development (Soroka & Kurkova, 2019). We disagree with this statement; as Michel Bourbonniere correctly pointed out “law never aims to regulate technology; its main purpose has always been and remains to bring order to competing human interests resulting from technology” (Bourbonniere, 2005). We observe the same with space exploration and the creation of space technologies. The impetus for its active development was spurred by competition between the two hegemonic countries of that time – the USSR and the USA, which in turn required the creation of a legal platform – Space Law.

Since the beginning of the 21st century, space activities have interacted with other spheres of activity at various levels – global, international, national, local, and individual. This process is reflected in two opposing directions: on the one hand, it interacts with other spheres of activity in all its aspects, and on the other one, – it competes in the struggle for allocated resources. The international space context is rapidly changing: global competition is increasing, new actors bring new ambitions to space activities; the latter is becoming increasingly commercial, and private sector participation is growing (Soroka, 2020). Key technological innovations, such as digital development, miniaturization, artificial intelligence, or reusable launch vehicles, are disrupting traditional business models in the space sector, reducing the cost of accessing and using space, which in turn creates legal conflicts and gaps.

It is also necessary to note that changes are occurring regarding traditional security risks: from economic and social threats, transnational organized crime, interstate and internal conflicts, terrorism, and weapons of mass destruction, which were identified as threats to global security in the report of the High-level Panel on Threats, Challenges and Change, entitled “A more secure world: our shared responsibility” (A/59/565, 2004), to uncontrolled technologies (artificial intelligence and robots), digital inequality and cyber threats, the spread of pandemics and other incurable diseases, a lack of social cohesion, and consequently, the States’ inability to jointly overcome these threats and act preventively.

Consequently, nowadays outer space isn’t just an arena for technological breakthroughs or commercial expansion; it’s also a new security frontier where the interests of States,

transnational corporations, and private players are encountering. Simultaneously, the strategic value of space infrastructure, which becomes a key element of both civilian and military interaction, is growing. In this new environment, traditional approaches to global security, including deterrence theory and the balance of power, need rethinking and adaptation to 21st-century realities.

Given this, it's logical to analyze how deterrence and balance of power theories have evolved within space security context, starting from classic interstate models to modern multi-level configurations.

Theories of balance of power and deterrence in space security

To start, it's important to note that the very idea of the balance of power first emerged in international politics during the Renaissance. The concept was rooted in ideas borrowed by analogy from other areas – ethics, art, philosophy, law, medicine, economics, etc. – where the idea of balance and its connection to equilibrium and counterweight was already widely recognized (Schweller, 2016). As early as the 16th century, Francesco Guicciardini, who served as an advisor and confidant to three popes, governor of several central Italian states, ambassador, administrator, and military captain, wrote in his work *Storia d'Italia* that the Italian situation should be maintained in a state of equilibrium, without favoring one side over another one. He emphasized that the weakest party should be helped to ensure that equilibrium prevails (Guicciardini, 1984).

The balance of power theory has had both its advocates and critics in the course of history. Today, it's part of international law and a diplomatic principle through which, as Morten Skumsrud Andersen states, intervention can be legitimized to preserve the balance of power (Andersen, 2018).

The core of the balance of power theory is as follows: it's one of the theories explaining how international politics works and how States interact, always prioritizing their own interests, including survival (Andersen, 2018). States can pursue balance of power policies in two ways: by increasing their own power, for instance, by engaging in an arms race or competing for territory; or by joining forces, for example, by forming alliances (Andersen, 2025). Randall L. Schweller even considers the balance of power theory to be about international security and preparation for potential war (Schweller, 2008). Hegemonic countries typically pose a potential security threat to other nations. When one State accumulates significant power, it can dictate the rules of the international system, launch unilateral attacks on other sovereign territories, or use economic coercion or other diplomatic or military tools to achieve its goals. This concentration of power is precisely what prompts other States to cooperate to achieve a balance of power and ensure that a hegemon's unilateral actions don't pose future threats for other countries (Hope, 2025).

The development of space activities, and with it, space security, unfolded during the confrontation between the two hegemonic powers – the United States and the USSR. Therefore, when discussing the concept of the balance of power in the context of space security, it's impossible to overlook deterrence theory, developed by the renowned American scholar and Nobel laureate, Professor Thomas Schelling. His book, *"The Strategy of Conflict"* (Schelling, 2021), explores general logic of behavior among participants in conflict situations – game theory. Later, it became the foundation for the concept of nuclear deterrence, international arms control, and other foreign policy doctrines. Schelling viewed game theory as a promising new area of research, offering hope for creating a theory of deterrence strategy. In this theory,

deterrence is as relevant between friends as it is between potential adversaries, with the only difference being the extent to which their interests differ.

Schelling's thesis that most conflict situations are primarily bargaining situations is, in our opinion, both interesting and relevant. He believed that negotiations are indeed a form of bargaining, where parties in a conflict, to achieve their goals, choose a course of action that can either lead to mutual benefit or mutual harm. When elaborating on deterrence theory, the professor emphasized that "the effectiveness of a threat may depend on the alternatives available to the potential enemy, who must be given some acceptable way out so that he does not react like a trapped lion" (Schelling, 2021). The practical application of this thesis is observed in the war between Russia and Ukraine (Young, 2022). In response to Russia's constant nuclear blackmail, America, along with NATO Member States clearly indicated that in the event that Russia attempts to carry out its threat, it will receive a preventive strike with conventional weapons (Could, 2022), thus leaving room for "taken back."

Modern "games" of major players

As a proponent and author of his own concept of using game theory to resolve conflicts, Schelling insisted that "pure conflict, in which the interests of two antagonistic parties are completely opposite, is a very specific case" (Malyarenko, 2009). In practice, unlike "zero-sum games" (Rapoport, 1974), mixed-motive games are more common, closely resembling the real world of modern armed conflicts, threats and promises, trade and negotiations, agreements and compromises (Malyarenko, 2009). However, although Schelling synthesized classical game theory and psychology, his views were shaped by the bipolar world of the 1960s.

This is particularly evident in outer space, where not only the national interests of major powers confront, but also private companies that possess powerful means of observation, communication, and data collection. Technological breakthroughs in unmanned systems, AI, Earth remote sensing, quantum computing, and satellite internet are radically changing both the nature of potential conflict and the possibilities for strategic deterrence.

These processes are not purely theoretical. A striking example is the provision of remote sensing data by private entities such as Maxar, Capella Space, and Iceye during Russian aggression against Ukraine. Despite Russia's accusations of using this data for military purposes, it has, in fact, become a powerful tool for protecting civilians, detecting damage to critical infrastructure, and documenting war crimes.

Consequently, space is becoming an arena for new "mixed-motive games," where the key participants are not only states but also technologies, corporations, and information, with all implications for security, ethics, and responsibility. In this context, game theory needs to be modernized – taking into account new forms of influence, blurred boundaries between civilian and military, as well as the growing power of non-state actors such as Elon Musk's companies.

Recent global events, particularly the war in Ukraine, have demonstrated the unprecedented effectiveness of decision-making based on commercial geospatial intelligence and the value of programs like EOCL, which allow for information sharing with U.S. allies and NATO partners. Therefore, the question arises: can open information and data from satellites providing by various private space companies used both military and civilian be considered neutral? After all, for example, the aforementioned private company Maxar has been providing commercial satellite imagery to the U.S. government and intelligence community since 2000 (NRO, 2022).

Russia also recognized the value of such information and data, so the activities of private space entities, including those providing information to Ukraine, were recognized as military

activities in favor of its opponent. For example, in August 2022, Moscow accused the United States of direct involvement in the war after Vadym Skibitsky, Deputy Head of Ukraine's military intelligence, told the British newspaper *The Telegraph* that Kyiv was using U.S.-supplied High Mobility Artillery Rocket System (HIMARS) launchers and real-time satellite imagery and information provided by private commercial companies (Russia threatens, 2022). As a result, Konstantin Vorontsov, a senior official of the Russian Foreign Ministry, claimed at the UN First Committee meeting that the use of Western satellites to assist the Ukrainian military was an "extremely dangerous trend," and the satellites themselves "may be a legitimate target for counterattack" (Russia warns, 2022). In other words, Russia insists that the public dissemination of satellite imagery by a private space company, which is then used by Ukraine's intelligence community, falls under the principle of distinction, thereby granting Russia the right to destroy such a satellite as one that weakens its military potential. However, according to this principle, a distinction must be made between combatants and civilians even in an armed conflict (Principle, 2025). And if a private satellite, which, according to its license and statutory activities, has the right to sell products (satellite imagery or provide communication), is destroyed, then civilians would be the ones to suffer.

And even with all the controversy of the situation that we provided as an example, there is another principle – the principle of proportionality, which aims to limit the harm caused by military operations, demanding that the consequences of the means and methods of warfare used should not be disproportionate to the desired military advantage (Proportionality, 2025). And if a satellite is destroyed, the resulted space debris can harm any space object, even destroy it. Therefore, an attack on even a single satellite is not a proportional harm, as the increased number of debris will lead to even more collisions. Ultimately, collision fragments will collide with other fragments until the entire aggregate is reduced to sub-critical sizes (About, 2025). To confirm this, we can cite the following example: thus, in 2021, Russia experienced a direct-ascent anti-satellite missile or DA-ASAT, which struck a Russian satellite and formed a low-earth orbit field of more than 1,500 orbital particles, which will also likely involve hundreds of thousands of debris smaller than its orbital debris (Atwood et al., 2021). Earlier, two other events generated significant amounts of space debris: China's destruction of its satellite in 2007 (Zissis, 2007) and the collision of Russia's Kosmos 2251 satellite with the commercial US Iridium 33 satellite 90 (Jakhu, 2010).

In the context of the new geopolitical reality and the transformation of warfare, including the use of commercial satellite data, we see that classical deterrence models need re-evaluation. Deterrence theory was based on predictability, the state's monopoly on force, and clear identification of actors. However, in practice, these principles are blurring with the emergence of private space players and fuzzy lines between civilian and military satellite use.

The situation where private companies like Maxar or Icyee provide imagery to governments, including for military purposes, creates an area of "hybrid responsibility." Russia's threat to destroy such satellites, even if they are not formally military objects, is an attempt to restore the balance of power through intimidation. But here's the problem: the principles of distinction and proportionality, which operate in international humanitarian law, contradict such intentions.

The destruction of a commercial satellite is not merely an act of military confrontation; it poses a risk to the entire space ecosystem due to the generation of orbital debris. The universality and safety of space as a shared resource are lost. The balance of power in such an environment can no longer rely solely on traditional deterrence tools – military capabilities, alliances, or even nuclear arsenals.

Modern space requires a new, multi-layered deterrence mechanism including not only States but also the private sector, international legal institutions, new treaty formats, and clear sanction mechanisms for violations. Strategic deterrence in the 21st century is not just about punishing an antagonist, but also about preventing a catastrophe for all humanity. Only such an approach will allow for maintaining a true balance of interests in space – not through force, but through responsibility, transparency, and global regulation.

Conclusions

In our opinion, the modern balance of power politics currently widely used by hegemonic countries to justify their behavior in outer space toward other countries should be ceased by using UN mechanisms and platforms, including the application of international sanctions and the abolition of Russia's veto power. Furthermore, «soft» space law needs to be transformed into «hard» law. This means creating not only clear rules of conduct in outer space but also sanctions for their violation, procedures for accountability, and jurisdictional institutions capable of bringing these procedures to a logical conclusion. This would create a real deterrence system, similar to one existing in criminal law (inevitability of punishment, societal condemnation, criminal prosecution, conviction, and sanctions), which has proven effective in combating crime.

By the way, Schelling also emphasized this, stressing that true deterrence is effective only when based on clear rules, mutual responsibility, and trust in the system. However, in the modern international arena, we have witnessed the destruction of these foundations.

A striking example is the negotiation strategy of US President Donald Trump, which actually ruined the established deterrence architecture that had provided relative stability in international relations for decades. Trump operated exclusively in terms of bargaining and profit, systematically replacing multilateral agreements with personal “deals.” This approach substituted the logic of deterrence with the logic of pressure and gain, creating a precedent for unpredictable player behavior and devaluing traditional mechanisms of strategic balance.

In the space domain, such an approach is particularly dangerous. The space above us is transforming into an arena of hidden competition without proper constraints and accountability. That is precisely why the global community must move from declarative “soft” law to a clear system of «hard» space regulation. This entails not only the formalization of rules but also the implementation of sanctions, international prosecution procedures, and the creation of an effective institutional architecture for deterrence. Only in this way can we prevent a space arms race and guarantee the peaceful use of outer space for the benefit of all humanity.

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