Politeja
Nr 5(92), 2024, s. 235-258
https://doi.org/10.12797/Politeja.21.2024.92.11

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RUSSO-UKRAINIAN WAR'S IMPACT ON SPACE SECURITY – THE WESTERN PERSPECTIVE[1]

ABSTRACT: In this paper, the impact of the democratisation of space on space security is investigated using the example of the war in Ukraine, with particular attention to the transatlantic community's security concerns. It is argued that the growing reliance on space systems for security-related purposes by an increasing number of international actors has significant potential to impact the dynamics of international relations, particularly in a regional dimension. This process naturally accelerates the development of counterspace measures designed to negate space-derived, security-related capabilities. Consequently, increasing the resilience of current and future space systems – including commercial ones – is crucial if Western nations are to maintain their edge in space applications.

Keywords: international security, space security, war in Ukraine, European security

INTRODUCTION

Even though commercial space systems were being utilised for military purposes well before the war in Ukraine broke out, the intensity, scope and significance of the use of commercial assets in this conflict are unprecedented. Consequently, the Russo-Ukrainian war has been labelled *the first commercial space war*[2] in which market-available

[1] The publication has been supported by a grant from the Faculty of International and Political Studies under the Strategic Programme Excellence Initiative at Jagiellonian University.

[2] J. Suess, "Ukraine: The First Commercial Space War?," *Royal United Services Institute*, 22 December 2022, at https://rusi.org/podcasts/war-in-space/episode-24-ukraine-first-commercial-space-war, 22 December 2023.

services are widely employed for military communications, intelligence gathering and direct combat. This, however, is the consequence of processes that have been developing for years or even decades, so the course of the conflict in question has only underlined and amplified significant changes within space security which have been in play for a considerable period.

We can observe in Ukraine, when it comes to the use of space systems, one of the facets of a wider phenomenon termed by RAND experts *the democratisation of space*.[3] This process can be described, in essence, as the rapidly growing availability of various space-derived services provided by an increasing number of commercial entities operating satellite systems. In effect, more and more actors – both state-owned and private – are gaining access to benefits which until recently were accessible only to the governments of the most advanced nations and the wealthiest corporations. In the security realm, the democratisation of space has brought military-grade, space-derived services to the commercial market[4] so that non-spacefaring nations – and even non-state actors – can now benefit from previously unavailable capabilities.

This paper will assess the impact of the democratisation of space on space security using the example of the war in Ukraine, with particular attention to the transatlantic community's security concerns. Firstly, it will be argued that the growing reliance on space systems for security-related purposes by an increasing number of international actors has significant potential to impact the dynamics of international relations, particularly in the regional dimension. Secondly, it will also be argued that this process naturally accelerates the pace of the development of counterspace measures (CSMs) designed to negate space-derived, security-related capabilities. Consequently, and this is the third hypothesis, increasing the resilience of current and future space systems, including commercial ones, is crucial if Western nations are to maintain their edge in space applications. For this purpose, the United States, which remains the unquestioned leader in both military and commercial space systems, is already advanced in the process of restructuring its security-related space architecture. In contrast, European NATO and EU members are not only lagging behind the U.S. in space applications, but are also sluggish in adopting prospective measures to enhance the resilience of their space assets. Consequently, Western Europe must redouble its efforts to build and maintain a security-related space architecture that is both capable of providing sophisticated services for the military and resilient to emerging threats.

[3] D. Baiocchi, W. Wessler IV, "The Democratization of Space: New Actors Need New Rules," *Foreign Affairs*, 20 April 2015, pp. 98-104, at https://www.foreignaffairs.com/articles/space/2015-04-20/democratization-space, 22 XII 2023.

[4] See for example: D. Kim, "The «Democratization of Space» and the Increasing Effects of Commercial Satellite Imagery on Foreign Policy," *New Perspectives in Foreign Policy*, no. 18 (2019), pp. 35-37.

RESEARCH SUBJECT, METHODOLOGY AND LITERATURE

The research conducted for the purpose of this article is situated within International Security Studies and International Relations. An attempt has been made to assess the relationship between important current international events that have a significant impact on international security and the development of nation-states' security policies, which – in turn – reflect on the international security environment. Specifically, the intent was to explain the relationship between the lessons stemming from the space dimension of the war in Ukraine and changes in the state of space security.

As the term 'space security' delineates the scope of this research, it must first be explained thoroughly. In general, it entails every aspect of human activity in the Earth's orbit related to security issues. Thus, it consists of two intertwined planes: the first is 'security through space' and the second is 'security in space'. The first dimension refers to the ways in which space systems contribute to nation-state security and, consequently, to the shape and dynamics of international security and international relations. For example, during the Cold War, space systems significantly contributed to the successful implementation of strategic arms limitation/reduction treaties by providing information that helped verify compliance with their provisions. The second dimension, 'security in space', refers to the operation of space systems and the threats they are confronted with, as space systems' capabilities may be compromised or negated by many means and methods due to intentional or unintentional actions of state- and non-state actors or as a consequence of natural causes. 'Security in space' is sometimes divided into two sub-categories: 'security', which refers to intentional threats to space infrastructure, and 'safety', referring to unintentional ones. This division is certainly valid because of the fundamentally different nature of intentional and unintentional threats, but for linguistic reasons, it works well only in English.

The basic research question was how certain characteristic features of the space dimension of the war in Ukraine have contributed to changing the approaches of international actors to space security, particularly regarding security in space. Thus, the research covered developments over a period of roughly a year and a half,[5] with only short references to what happened previously; the latter represent the background against which the main argument is presented.

To answer the research question and verify the hypotheses mentioned above, it was first necessary to depict the characteristics of the space dimension of the war in Ukraine, with special attention paid to the new features that have changed the nature of the way space has been used in conflicts to date. This was not an easy task, however, as it required the investigation of ongoing large-scale military operations in which space applications played very important roles. Military secrecy and the novelty of many applications and tactics obviously preclude giving a detailed technical and operational account of what was occurring in the space dimension of the war in Ukraine, as it was not possible to access primary sources depicting in detail the operational use of space assets

[5] Cut-off date of this article is 31 May 2023.

in the hostilities. Even though some information regarding that was available in open sources, it was scarce and not necessarily reliable. Thus, it was not easy to assess the value of and aggregate the scattered information found.

Despite these difficulties, it is suggested here that the publicly available information was sufficient to build a general understanding of the underlying developments and the qualities of the processes involved – and to explain their nature and consequences if this information was properly processed and critically reviewed. Consequently, even though the author was not aware of many of the technicalities and details of the operational use of space systems in Ukraine, it was possible to draw general conclusions about the nature of the processes in question.

The research was based on the analysis of two kinds of data. First, and particularly important, were reports by think tanks – which aggregated existing open-source information and placed it in an analytical context. Two such reports were issued recently: *Space Threat Assessment* by the Center for Strategic & International Studies and *Global Counterspace Capabilities 2023* by the Secure World Foundation, both published in April 2023. Among other things, they contain a summary of the information openly available on the space dimension of the war in Ukraine. The second source of data was information outlets, particularly those dedicated to space and military issues like *Space News* or *Defense News* and the webpages of commercial entities.

The description of the main characteristics of the space dimension of the war in Ukraine enabled an analysis of its impact on space security to be conducted. Qualitative methods were used, including a review of texts related to the current developments pertaining to space security available within academia and published by leading think tanks. The realist theoretical perspective was employed for the purpose of the analysis, as it referred – for the most part – to nation-states' strategies and policies in military and intelligence contexts.

The subject of this research is new, as ongoing developments have been investigated. It is, therefore, natural that not many related analytical works had been published by the time of completion of the article. However, it is worth listing several important examples of the most current analytical papers, as of May 2023, on the impact of the space dimension of the war in Ukraine on international security. One of the first such analyses, *Early Lessons from the Russia-Ukraine War as a Space Conflict* by David T. Baruch, was published by the Atlantic Council in August 2022 and highlighted the spread of military-relevant space services due to the increased capabilities of commercial entities. Marko Höyhtyä and Sari Uusipaavalniemi of the Finland-based European Centre of Excellence for Countering Hybrid Threats, in their paper *The Space Domain and the Russo-Ukrainian War: Actors, Tools, and Impact*, published in January 2023, observed that the use of commercial space assets blurs the distinction between civilian and military actors in the war. Last but not least, Guilhem Penent and Guillaume Schlumberger from the French Institute for International Relations, in their February 2023 article *How the War in Ukraine is Changing the Space Game*, argue, among other things, that: firstly, the war in Ukraine has confirmed the view that the adaptation process that the United States undertook a decade ago in order to renew its space architecture was the

right thing to do; secondly, that Europe risks lagging behind like the U.S. and China, who are leading in space applications.

THE DEMOCRATISATION OF SPACE AND ITS SECURITY DIMENSION

At the very beginning of the Space Age, human activities in the extra-terrestrial realm were predominantly governed by security concerns. As early as the mid-1940s, several research projects were conducted – for example, by Douglas Aircraft, which established that placing an object in orbit above the Earth's surface would bring great benefits for national security.[6] Simultaneously, the development of long-range missiles led to the designing of vehicles capable not only of carrying a nuclear warhead to another continent, but also of placing objects permanently in space in close proximity to Earth. In this way, the capability to put something into space met the need to do so, stemming from the perceived benefits – particularly within the realm of national security. Certainly, all the new space-borne capabilities could have been implemented for many non-military purposes as well, but the realities of the Cold War brought national security concerns to the forefront. Of particular importance was the fundamental desire of the U.S. government to increase its ability to peer behind the Iron Curtain to assess the mounting Soviet threat in order to neither overestimate nor underestimate a secretive enemy.

From the very beginning of the Space Age, the complexity and extremely high cost of all space-related activities contributed to the establishment of a specific pattern of space exploitation, characterised by the predominant role of nation-states represented by governments in their capacity as organisers and defenders of society, with security concerns at the forefront. The state encouraged the development of crucial technologies through large financial transfers to manufacturers and by structuring the effort under the umbrella of state agencies. If commercial entities were involved (in the case of capitalist states), they were dependent on the state for crucial know-how, subsidies and the procurement of their products. Left to their own devices, private companies were unable and would probably have been unwilling to sustain the development of space launch systems and space applications at that time. Thus, the defining trait of the traditional pattern of space exploration was that it was organised and controlled by governments for the purposes defined by them, with security concerns naturally forming the bulk of these purposes. Certainly, governments were influenced by the private sector to an extent that varied relative to a given country's economic and political system, but still the state remained the main actor. Initially, there were only two space-faring nations, the United States and the USSR, later joined by several other smaller powers, but the pattern was similar everywhere. Additionally, this model involved huge

[6] Douglas Aircraft Company, Inc., *Preliminary Design of an Experimental World-Circling Spaceship*, Report no. SM-11827, 2 May 1946, pp. 9-11.

communications corporations which operated their satellite constellations in close co-operation with governments at national and international levels.

This, let's call it a 'traditional pattern' of space exploitation, is a reference point for understanding the transition to what is termed the Second Space Age,[7] and it is characterised – for the most part – by the democratisation of space. It is, however, worth noting that no date is set to mark a shift from the First Space Age to the Second, as it is suggested that this was a process lasting approximately a decade. Todd Harrison et al. mark the advent of the Second Space Age with the fall of the Soviet Union but admit that, at this moment, *the space domain began to transition*[8] into its new shape. This is correct because the end of the Cold War contributed to accelerating the developments that characterised the coming of the Second Space Age. The transition, however, took a considerable amount of time, and only by the turn of the 20th and 21st centuries were the features of the new era clear enough to be discerned and defined, making the whole new pattern distinctly visible. That is why, while agreeing that the First Space Age might have come to an end in 1991 with the conclusion of the Cold War rivalry, the second one did not emerge in its full form until the beginning of the 21st century.

Contrary to its first iteration, the advent of the Second Space Age has not been spurred by political challenges, although the development of the world landscape in the early nineties did contribute to the economic and technological processes at play. The advance of space technology had its own dynamics, stemming from the maturation and dissemination of the relevant know-how among commercial entities. The most significant change was the reduction in the cost of operating in space due to the development of launch systems and the miniaturisation of satellite components, which translated into better capabilities for less money than before. Furthermore, an increased number of private companies gained access to crucial technologies, making them much less dependent on governments, if at all. All of this led to a quick expansion in the volume of what is called 'the space economy', particularly within the last decade or so.[9] According to the Space Foundation, the global space economy, in which entities from 90 countries participated, amounted to almost USD 450 billion in 2020. Governments spent only 90 billion of the total sum, meaning they funded just one-fifth of the global space business.[10]

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7 T. Cremins, "How to Maximise the Benefits of a New Space Age," *World Economic Forum*, 18 January 2015, at https://www.weforum.org/agenda/2015/01/how-to-maximise-the-benefits-of-a-new-space-age/, 30 IV 2023.

8 T. Harrison et al., *Escalation and Deterrence in the Second Space Age: A Project Report by the CSIS Aerospace Security Project*, Lanham–Boulder–New York–London 2017, p. 5, at https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/171109_Harrison_EscalationDeterrenceSecondSpaceAge.pdf, 21 II 2023.

9 "How the War in Ukraine is Affecting Space Activities: New Challenges and Opportunities," *OECD*, 15 November 2022, p. 2, at https://www.oecd-ilibrary.org/docserver/ab27ba94-en.pdf?expires=1682855245&id=id&accname=guest&checksum=1CEF0ED48C98E76B32EF8678B0FF6DA0, 30 IV 2023.

10 *2021 Annual Report*, Space Foundation 2021, p. 5, at https://www.spacefoundation.org/wp-content/uploads/2022/04/SpaceFoundation_2021-Annual-Report_Final-1.pdf, 1 V 2023.

The Second Space Age, then, features an increasing dissemination of space capabilities on a commercial basis, outside the direct command of governments. Certainly, nation-states retain legal control over the distribution of crucial technologies and services. For security and other political reasons, states restrict commercial companies from selling their products wherever they wish, but they do not control capabilities as such. For example, American companies exporting several kinds of positioning, navigation and timing (PNT) equipment, which might have specific military applications, require licensing by the U.S. Department of Commerce.[11] Similar control is maintained over other sensitive satellite services. The democratisation of space significantly changes the landscape of space security in both of the abovementioned dimensions.

As far as 'security through space' is concerned, we can observe an increasing number of commercial companies that possess communications and imaging capabilities which may be used for national security missions. For example, as of May 2023, California-based Planet Labs operated over 150 observation satellites, 21 of which featured 50-cm resolution,[12] and Finland-based ICEYE operated 21[13] SAR (synthetic aperture radar) satellites capable of providing images with a 25-cm resolution.[14] These capabilities are fully sufficient to support many kinds of security-related missions, including military operations, by providing crucial strategic, operational and tactical information on a persistent basis. Secure satellite communication is also commercially available, particularly with the advent of internet mega-constellations. The paramount example is Elon Musk's Starlink, which consists (as of 17 May 2023) of 4,182 active orbiters.[15] Regarding global navigation space systems (GNSSs), they belong to nation-states that control access to secure channels, although basic PNT services are freely available. Multiple commercial companies offer receivers that work with public channels but are equipped with technologies that enable enhanced security and reliability of services.[16] These receivers are better suited to operating in situations where jamming or spoofing is employed, so they may be used for security purposes, including military ones, even if the user is not eligible to employ secure channels.

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11 J.Y. Kim, *U.S. Export Controls on GPS/GNSS Equipment*, Presentation to National Space-Based PNT Advisory Board Toughen Working Group. 18 March 2022, at https://www.space.commerce.gov/wp-content/uploads/2022-03-US-export-controls-GPS-GNSS-equipment.pdf, 1 V 2023.

12 "Our Constellation: Soaring Through Space and Time," *Planet Labs*, at https://www.planet.com/our-constellations/, 2 V 2023.

13 G.D. Krebs, "ICEYE X4, ..., X38," *Gunther's Space Page*, 2023, at https://space.skyrocket.de/doc_sdat/iceye-x4.htm, 2 V 2023.

14 P. Laurila, *New Benchmark in Imaging from SAR Microsatellites: ICEYE Presents 25 cm Azimuth Resolution*, ICEYE, 2 IV 2020, at https://www.iceye.com/blog/new-benchmark-in-imaging-from-sar-microsatellites-iceye-presents-25-cm-azimuth-resolution, 2 V 2023.

15 J. McDowell, "Starlink Statistics," *Jonathan's Space Pages*, 17 May 2023, at https://planet4589.org/space/con/star/stats.html, 20 V 2023.

16 "Assured PNT for Defense Security and Critical Applications," *Septentrio*, 2023, at https://www.septentrio.com/en/applications/assuredpnt, 2 V 2023.

'Security in space' has also been the subject of important changes due to the democratisation of space. First of all, from a safety point of view, the sheer number of satellites and the amount of space debris have grown significantly, leading to increased chances of collisions. This is a paramount safety concern because every collision produces a portion of debris that remains in orbit, further increasing the risk to other satellites. As envisioned as early as 1978, this process may eventually lead to rapid cascade effects rendering some orbits unusable,[17] called the 'Kessler syndrome'. Furthermore, the congestion of orbits leads to congestion within the electromagnetic spectrum, resulting in possible tensions between the owners of satellite systems and growing interference with them. The latter may also yield increased numbers of satellite mishaps and even collisions, further increasing the risk of a cascade effect. From the 'security' point of view, the maturing and dissemination of related technologies have led to the rapid development of counterspace measures (CSMs). Tools that allow for electronic interference, spoofing, jamming and, particularly, cyber intrusion are available on the market and may be employed even by non-spacefaring nations and non-state actors. These capabilities will certainly evolve even further, as many actors will seek to offset the benefits their adversaries gain from using space applications. Moreover, in the near future, we will probably witness the advent of the common counterspace use of directed energy weapons – particularly lasers. The maturation and increased usage of CSMs will result in a growing likelihood of the destruction of satellites in orbit, which brings us back to the 'safety' issue and the likely Kessler effect. All in all, the growing number of satellites in space results in multiplying threats to 'safety' in space, and, as Kari Bingen et al. observed, *the advantages that space capabilities provide make them a target*[18] – no matter whether they are commercial or dedicated military craft.

Let's reiterate the point that the democratisation of security through space commenced once satellite-derived services relevant to national security, including military-grade capabilities, stopped being the monopoly of governments. In effect, it is not only the main spacefaring countries and large corporations working for governments that now wield crucial space-derived, security-related capabilities – many non-spacefaring nations and even non-state actors can purchase the systems or services they need on the market. Certainly, the wealthiest governments continue to restrict the use of sensitive capabilities, but they remain widely available in a range of qualities and technical characteristics.

Thus, the democratisation of space also brings with it the democratisation of space security, as more services are available to more actors. Of course, the main spacefaring nations retain an advantage in that field, and their dedicated military space systems remain more or less superior to commercial ones. However, the latter are sufficiently

[17] D.J. Kessler, B.G. Cour-Palais, "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt," *Journal of Geophysical Research*, vol. 86, no. A6 (1978), pp. 2637-2646.

[18] K. Bingen, K. Johnson, M. Young, *Space Threat Assessment 2023: A Report of the CSIS Aerospace Security Project*, Washington 2023, p. 37, at https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-04/230414_Bingen_Space_Assessment.pdf?VersionId=oMsUS8MupLbZi3BISPrqPCKd5jDejZnJ, 27 IV 2023.

effective to change security dynamics in interstate relations during periods of international tension or conflict. This is exactly what is happening during the course of the war in Ukraine.

THE SPACE DIMENSION OF THE WAR IN UKRAINE – IMPACT ON SPACE SECURITY

It is often emphasised that the extensive use of space systems by the Ukrainian intelligence and military is a vital part of the war effort, but this aspect alone does not represent the uniqueness of this conflict. Supporting war-fighters with satellite services has been a well-known 'force multiplier' at least since the first Gulf War in 1991, which was even labelled *the first space war*.[19] However, this time, space-derived services are largely acquired from the commercial market with the consent of Western governments. Thus, the space dimension of the Ukrainian war clearly manifests the democratisation of space in its security-related aspects.

It is not the intention here to depict in detail all the capabilities and activities related to the space dimension of this war, as the focus of interest is rather on explaining how new developments impact international security. Furthermore, the course of the war in all its facets is widely commented on and reported,[20] even though these reports are greatly obscured by the fog of war. Therefore, the following provides only a brief and very general assessment of the space capabilities possessed by Ukraine, serving as context for subsequent analysis.

According to Bingen et al., then, even though it is not a developed spacefaring nation, Ukraine enjoyed: *(1) transparency on military aggression by showing the world the buildup and movement of Russian forces; (2) connectivity by enabling Ukrainian forces to transmit information across the battlefield; (3) a lifeline to the outside world by allowing the Ukrainian people to connect with the world and expose the horrors of war*.[21] This is an effect of the extensive help rendered by the Western nations, particularly in the form of allowing Ukraine to use market-available commercial services. Ukraine, therefore, has access to a wide range of intelligence gathered by space assets, of which almost 50 percent is believed to come from the commercial space industry, according to the former chairman of the Space Agency of Ukraine, Volodymyr Usov.[22] Furthermore, secure

[19] D.T. Baruch, "Early Lessons from the Russia-Ukraine War as a Space Conflict," *Atlantic Council*, 30 August 2022, at https://www.atlanticcouncil.org/content-series/airpower-after-ukraine/early-lessons-from-the-russia-ukraine-war-as-a-space-conflict/, 12 IV 2023.

[20] See for example: S. Erwin, "As Russia Prepared to Invade, U.S. Opened Commercial Imagery Pipeline to Ukraine," *Space News*, 6 April 2022, at https://spacenews.com/as-russia-prepared-to-invade-u-s-government-and-satellite-imagery-suppliers-teamed-up-to-help-ukraine/, 7 April 2022, or J. Beale, "Space, the Unseen Frontier in the War in Ukraine," *BBC*, 6 October 2022, at https://www.bbc.com/news/technology-63109532, 8 X 2022.

[21] K. Bingen, K. Johnson, M. Young, *Space Threat...*, p. 37.

[22] Cited in: ibid., p. 35.

communication is ensured through the use of satellite systems, particularly the broadband internet services provided by Elon Musk's Starlink mega-constellation, which has proven to be highly resilient to hacking.[23] Thousands of Starlink terminals were donated to Ukraine by Musk himself,[24] and the United States and other countries purchased thousands more.[25] As of the end of April 2023, 42,000 Starlink devices were in use in Ukraine[26] for civil and military communications, including controlling combat drones engaged in direct hostilities. The latter practice was labelled the *weaponisation of Starlink*,[27] and Elon Musk's company stated in February 2023 that it had had to *undertake measures to preclude its terminals being used in direct combat*.[28] It is, however, unknown to what extent these measures were effective. Finally, the U.S. government and other allies have donated thousands of GPS receivers to Ukraine, many of which are likely commercial types reinforced against hostile interference.

The abovementioned developments are clear manifestations of space democratisation as described above. However, it is worth adding that this entails not only situations in which actors friendly to the most advanced Western nations gain access to commercial military-grade services. Many actors likely obtain these services through illicit methods, as the Western control system is far from foolproof. Furthermore, commercial space service providers and manufacturers of related hardware are based not only in Western countries, as space technologies have been disseminated worldwide. Consequently, commercial capabilities that might be used for security-related purposes, including military operations, are much more widely available than many in the West might expect. In the near future, we will most likely witness the rapid development of such capabilities outside the Western sphere of influence, so the democratisation of space in its security-related dimension will not be confined to those actors who enjoy the support of Western governments.

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23 K. Nizokami, "Russia Tried to Hold Ukraine's Internet Hostage, then SpaceX Stepped in," *Popular Mechanics*, 22 April 2022, at https://www.popularmechanics.com/military/weapons/a39788022/spacex-quickly-countered-a-russian-threat-in-ukraine/, 3 V 2023.

24 K. Collier, "Starlink Internet Becomes a Lifeline for Ukrainians," *NBC News*, 19 April 2022, at https://www.nbcnews.com/tech/security/elon-musks-starlink-internet-becomes-lifeline-ukrainians-rcna25360, 3 V 2023.

25 "Poland Funded More than Half of Starlink Terminals in Ukraine: Report," *Polskie Radio*, 18 October 2022, at https://www.polskieradio.pl/395/7789/artykul/3054835,poland-funded-more-than-half-of-starlink-terminals-in-ukraine-report, 3 V 2023.

26 "Ukraine Already Receives 42,000 Starlink Terminals," *Ukrinform*, 27 April 2023, at https://www.ukrinform.net/rubric-ato/3701465-ukraine-already-receives-42000-starlink-terminals.html, 18 V 2023.

27 C. Albon, "SpaceX's Shotwell Says Ukraine 'Weaponized' Starlink Network," *Defense News*, 8 February 2023, at https://www.defensenews.com/battlefield-tech/space/2023/02/08/spacexs-shotwell-says-ukraine-weaponized-starlink-network/?utm_source=sailthru&utm_medium=email&utm_campaign=dfn-space, 9 II 2023.

28 F. Bajak, "Musk Deputy's Words on Starlink 'Weaponization' Vex Ukraine," *AP News*, 9 February 2023, at https://apnews.com/article/russia-ukraine-elon-musk-spacex-technology-business-c79c81ff4e6a09f4a185e627dad858fa, 10 II 2023.

This situation, as exemplified during the conflict in Ukraine, has numerous consequences that impact space security and international security as a whole. The following is the briefest possible assessment of this process from the perspective of space security as defined above.[29]

There are three distinct, but intertwined, developments which should be taken as reference points for further argument:

1. Space-derived commercial military-grade services have a high potential to influence regional security dynamics by providing numerous actors with 'force multiplier' capabilities, which they had not possessed until the advent of the democratisation of space;

2. As a direct consequence, the development of counterspace measures has become an increasingly important, even crucial, option for every international actor as a means of offsetting the actual and potential capabilities of adversaries;

3. Thus, CSMs can be disseminated quickly, complicating strategic calculi for actors active in space regarding the use of their space-borne assets. This particularly refers to the greatest space powers, which face the question of how to strengthen the resilience of existing and future space systems.

The dissemination of military-grade services, mentioned in Point 1 above, may change strategic equations regionally and worldwide in several ways. Weaker states may be able to offset some of the advantages of more powerful adversaries, limiting their freedom of choice and manoeuvring space in political relations and on the battlefield during hostilities. Furthermore, local adversaries may acquire more opportunities to assess one another's potential, which may bring many consequences, ranging from encouraging hostilities to enhancing mutual deterrence and supporting disarmament processes. Additionally, advanced spacefaring nations may use the commercial entities they control as supplementary instruments for interacting with allies or dependants by offering or withdrawing assistance. Finally, as the number of commercial companies possessing access to high-end military-grade space technologies increases, the likelihood of these technologies leaking to unauthorised actors, such as unfriendly nations or rogue non-state actors, grows.

The Russo-Ukrainian war exemplifies many of the abovementioned observations. Early on, in the run-up to the conflict, information gathered by commercial satellite systems and released to the media in significant quantities helped the Ukrainian forces assess their strengths and shortcomings versus the Russians and prepare strategy and tactics accordingly. On the other hand, the Russians went to war virtually without any element of surprise and with their forces exposed to the enemy's intelligence. When hostilities broke out, it soon became apparent that Ukrainian forces were able to offset much of the Russian forces' advantages in size and equipment. The extensive use of satellite systems, including commercial ones, significantly contributed to that process. In

[29] The assessment presented here is based to a large extent on my previous, non-peer-reviewed blog entry: M. Czajkowski, "Space Security and the War in Ukraine – A Preliminary Assessment," *Analiza KBN*, vol. 1, no. 116 (2023), pp. 1-6, at https://zbn.inp.uj.edu.pl/documents/92718966/141790394/Czajkowski+M.+-+A116+-+A/9614c7cc-7de3-420b-8b5f-303a7db55da3, 4 V 2023.

this way, a theoretically more powerful nation-state has found itself bogged down on the periphery of the smaller and weaker adversary due to, among other things, a lack of up-to-date satellite services.[30] Sparse information from the Russian military space architecture precluded the Russian forces from obtaining sufficient information for the effective planning and execution of the invasion. Even though Russia may utilise some of its civilian space assets for military purposes or acquire certain services from Western companies illicitly, it lacks a constant flow of sensitive information comparable to Ukraine's access to commercial services. Consequently, the weaker side gained a significant advantage on the battlefield, particularly by using commercial satellite systems. In essence, Ukraine has become much more powerful in space than Russia, even though it is not an advanced spacefaring nation; as Baruch puts it, it appeared *that what matters is having access to the 'products' of space systems, not owning the satellites*.[31]

For the United States, as the leading spacefaring power and the one most reliant on space systems, there are three strategic advantages to the situation in which commercial companies provide extensive services for Ukraine. Firstly, the U.S. does not have to expose its secret assets and capabilities to the public or its Ukrainian ally to provide important information. Secondly, the United States can argue – in general or in selected cases[32] – that it was not directly supporting the Ukrainian side, which would be difficult if Washington supplied Ukraine solely with its own intelligence resources that were subsequently used for the execution of military operations. And thirdly, in selected cases, the U.S. may provide Ukraine with sensitive information from its own sources and afterwards insist that it came from commercial services, thus concealing Washington's involvement. Höyhtyä and Uusipaavalniemi correctly conclude that *the use of commercial space assets in military operations is blurring the line between military and civilian actors in the war*,[33] which gives Washington additional political and military opportunities.

The developments listed above represent a radical transformation in strategic relations worldwide, which has been emerging for a decade or so – the war in Ukraine has merely highlighted this process. Let's underline two essential facets of the new situation. Firstly, technological powers that control commercial space applications are now able to allow allied non-spacefaring nations to use certain space capabilities as 'force multipliers' without providing them with the direct support of dedicated intelligence

[30] M. Czajkowski, "The Russian Satellite Reconnaissance Capabilities – Political and Strategic Assessment," *Analiza KBN*, vol. 13, no. 108 (2022), pp. 1-7, at https://zbn.inp.uj.edu.pl/documents/92718966/141790394/Analiza108-Czajkowski/d33a6b64-6cb0-4c75-9408-cf48c79855e1, 4 V 2023.

[31] D.T. Baruch, "Early Lessons..."

[32] M. Seyler, "Officials Push Back on Report US Intel Helping Ukraine Target Russian Generals," *ABC News*, 6 May 2022, at https://abcnews.go.com/Politics/officials-push-back-report-us-intel-helping-ukraine/story?id=84518393, 24 V 2022.

[33] M. Höyhtyä, S. Uusipaavalniemi, *The Space Domain and the Russo-Ukrainian War: Actors, Tools, and Impact*, Hybrid CoE Working Paper, no. 21 (January 2023), p. 5, at https://www.hybridcoe.fi/wp-content/uploads/2023/01/20230109-Hybrid-CoE-Working-Paper-21-Space-and-the-Ukraine-war-WEB.pdf, 5 II 2023.

and military assets. The latter could be politically difficult and operationally inconvenient, so the use of commercial capabilities presents immense new opportunities for influencing local or regional security environments and translates into global changes as well. The second, newly emerging facet of the process in question is that military-grade capabilities are disseminated beyond the control of the leading technological powers, which will further increase the pace of their worldwide diffusion. This will further increase the pace of the democratisation of space in the security domain.

Referring to Point 2 above, we can notice an increase in the capacity and sophistication of counterspace measures in recent years. In particular, electronic warfare and cyber tools used to negate satellite capabilities continue to mature and be disseminated. In the near future, directed energy weapons will also be more widely used to blind and dazzle observation satellites. This process is naturally strictly interconnected with the increasing reliance on space-derived services in military and other security-related activities worldwide. International actors need CSM capabilities to offset the benefits their adversaries obtain from using space-derived services; as an authoritative report observed, *today there are increased incentives for development, and potential use, of offensive counterspace capabilities*.[34]

However, the war in Ukraine has not demonstrated a radical increase in counterspace activities. In the first hours of the conflict, a massive cyberattack was directed against the ViaSat KA-SAT communication network used by the Ukrainian army.[35] In May 2023, information surfaced regarding the enhanced capability of Russian forces to counteract the U.S. military GPS receivers used in missiles launched from the U.S.-made M142/M270 artillery rocket systems.[36] Compared to the scale of the hostilities and electronic warfare potential at Russia's disposal,[37] these activities seem limited. There are several – possibly coexisting – explanations for this phenomenon. Firstly, as already mentioned, it appears that some modern communication space systems, particularly those providing broadband internet, are more difficult to jam or spoof than previously believed. Secondly, Russia did not decide to aggressively counteract commercial optical and SAR satellites, either because it lacked the capabilities to compromise these systems significantly or because some unclear political limitations on using CSMs were in play. Thirdly, Russian jamming and spoofing of the GPS service in Ukraine were not frequent because Russian forces needed Western civilian services for their own

[34] B. Weeden, V. Samson, "Global Counterspace Capabilities 2023: An Open Source Assessment," *Secure World Foundation*, April 2003, p. xvi, at https://swfound.org/media/207567/swf_global_counterspace_capabilities_2023_v2.pdf, 11 V 2023.

[35] C. Poirier, *ESPI Short Report 1: The War in Ukraine from a Space Cybersecurity Perspective*, European Space Policy Institute, October 2022, pp. 5-15, at https://www.espi.or.at/wp-content/uploads/2022/10/ESPI-Short-1-Final-Report.pdf, 10 XII 2022.

[36] A. Marquardt, N. Bertrand, Z. Cohen, "Russia's Jamming of US-Provided Rocket Systems Complicates Ukraine's War Effort," *CNN Politics*, 6 May 2023, at https://edition.cnn.com/2023/05/05/politics/russia-jamming-himars-rockets-ukraine/index.html, 7 V 2023.

[37] K. Bingen, K. Johnson, M. Young, *Space Threat...*, p. 19.

operations.[38] There are also operational constraints on jamming and spoofing, mainly stemming from the inversely proportional relationship between jammer/spoofer effectiveness and the distance to the jammed/spoofed receiver. In essence, the closer a jammer/spoofer is to a receiver, the more effectively it works, but it is also more exposed to an enemy attack. On the other hand, the Russians probably understood that Ukraine employed modern jamming-resistant receivers and weapons that were difficult to jam at great distances. All in all, the Russian counterspace measures are either ineffective or not frequently used due to technical, operational or other constraints.

Despite the fact that the Ukrainian conflict has not brought a substantial increase in the effective use of countermeasures so far, it is apparent – as Weeden and Samson note – that *significant research and development of a broad range of destructive and non-destructive counterspace capabilities in multiple countries*[39] is ongoing. NATO's strategic concept of 2022 acknowledges that *strategic competitors and potential adversaries are investing in technologies that could restrict our access and freedom to operate in space, degrade our space capabilities, target our civilian and military infrastructure, impair our defence and harm our security*.[40] This means that space-derived services are increasingly exposed to a growing range of methods aimed at disrupting them. Particularly vulnerable are commercial systems that are not designed to work in an electronic warfare environment and are not as hardened against cyberattacks[41] as dedicated military ones. Let's reiterate the point that growing reliance on space systems, particularly commercial ones, incentivises international actors to seek means and methods to offset adversaries' capabilities. So, even though technical, operational and political limitations may restrain the use of CSMs, as exemplified during the Ukrainian war to date, they do grow in size and capabilities. Russia and China in particular are frequently singled out as powers seeking to *deny the United States and its partners, including commercial space companies, access to the [space] domain*, as U.S. Space Force General Raymond observed.[42] Thus, even though the *Space Pearl Harbor* envisioned by some analysts and politicians over two decades ago[43] is probably much further away than is usually believed, space assets are certainly increasingly vulnerable – particularly commercial ones. It is, therefore, undoubtedly true, as Bingen et al. observed, that *Russia's attacks against space capabilities used*

[38] See for example: A. Rai, "Wrecked Russian Fighter Planes Found with Rudimentary GPS Receivers 'Taped to Dashboards'," *The Independent*, 11 May 2022, at https://www.independent.co.uk/news/world/europe/russian-fighter-jets-gps-dashboard-uk-b2076376.html, 13 V 2023.

[39] B. Weeden, V. Samson, "Global Counterspace...," p. xvi.

[40] *NATO 2022 Strategic Concept: Adopted by Heads of State and Government at the NATO Summit in Madrid 29 June 2022*, NATO 2022, p. 5, at https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/290622-strategic-concept.pdf, 20 V 2023.

[41] C. Poirier, *ESPI Short Report 1: The War in Ukraine...*, pp. 11-12.

[42] J.W. Raymond, "Foreword," in K. Bingen, K. Johnson, M. Young (eds), *Space Threat...*, p. 1.

[43] *Report to the Commission to Assess United States National Security Space Management and Organization*, United States Congress, 11 January 2001, p. xiii, at https://aerospace.csis.org/wp-content/uploads/2018/09/RumsfeldCommission.pdf, 15 XII 2022.

by Ukraine are an example of how counterspace weapons can and will likely be used prior to and during future conflict.[44]

The third point listed above refers mostly to future developments and will be addressed in subsequent parts of the article. Suffice to say – at this point – it represents, first of all, the acknowledgement that the resilience of the current systems is in jeopardy and that the threats to their unhindered operation will grow in the future. Consequently, a concerted effort is now required to ensure the security and safety of space architecture in the future. The understanding of this is particularly profound in the United States and has resulted in the generous funding of multi-pronged efforts to augment the resilience of space systems. Some of these projects are already entering[45] the demonstration phase.

THE FUTURE OF SPACE SECURITY – THE WESTERN PERSPECTIVE

In this section,[46] recent changes regarding space security as exemplified by the war in Ukraine and their likely impact on future developments are summarised. These matters will be depicted from the perspective of the Western nations, meaning the transatlantic community and their security concerns, as that was the main perspective adopted in the research.

It is certainly very difficult to predict exactly what is going to happen, as the changes identified here are mainly qualitative in nature, making them inherently difficult to fathom. However, considering the developments related to the democratisation of space described above, several important trends will shape the near future of space security.

The first trend is the already described process of the democratisation of space, which gives non-spacefaring nations opportunities to augment their capabilities by buying services and/or hardware on the market. The war in Ukraine has widely advertised these capabilities in political circles, spurring efforts to secure military-grade satellite services – particularly in many European countries. Consequently, in the future, we will most certainly witness a quickened pace of development of the military space architectures of non-spacefaring nations belonging to the transatlantic community. They will seek to purchase satellites for their own militaries[47] and will proceed to secure military-grade commercial satellite services for security purposes, including military use. Furthermore, nations already advanced in military space applications will seek to

[44] K. Bingen, K. Johnson, M. Young, *Space Threat...*, p. 16.

[45] C. Albon, "Space Development Agency Again Delays Inaugural Satellite Launch," *C4ISRNet*, 12 December 2022, at https://www.c4isrnet.com/battlefield-tech/space/2022/12/12/space-development-agency-again-delays-inaugural-satellite-launch/, 14 XII 2022.

[46] The following assessment is to a great extent based on a previous, non-peer-reviewed blog entry, as quoted in Footnote 28.

[47] J. Adamowski, "Poland Buys Two Spy Satellites from Airbus," *Defense News*, 28 December 2022, at https://www.defensenews.com/global/europe/2022/12/28/poland-buys-two-spy-satellites-from-airbus/, 30 XII 2022.

augment their capabilities through the systemic integration of commercial, military-grade space services. Additionally, we will most likely witness an increased pace in the creation of commercial military-grade space capabilities outside the Western sphere of influence. China, in particular, may be interested in wielding commercial space capabilities and using them in the same way the United States does. These developments will be of great concern to Western countries, as they will add another field to strategic competition, particularly between the United States and China.

The second trend is a consequence of the increased role of security-related space applications and their likely dissemination, so we will most certainly witness an increased pace of development of counterspace measures. As has been observed here several times, many countries and possibly non-state actors outside the Western community will seek to negate adversaries' capabilities – particularly through the use of relatively cheap and difficult-to-attribute measures like cyber intrusion or electronic warfare. It is also highly possible that some progress will be made regarding directed energy weapons, particularly non-destructive ones. Additionally, it is likely that work will continue on destructive ASAT weapons. However, it is important to reiterate the assessment made elsewhere by the current author that the deployment of anti-satellite weapons in militarily significant quantities is highly unlikely, though not impossible, in the foreseeable future.[48] It is also very likely that counterspace measures will form yet another part of the commercial space industry, particularly outside the Western sphere of technological control.

The third trend, corresponding with the one mentioned above, is of particular importance. Russia will most likely increase the pace of development of its CSMs to offset its weaknesses in space systems and the strengths of its adversaries. It may quickly enhance its already extensive electronic warfare and cyber anti-satellite capabilities and is also likely to develop and field directed energy devices to dazzle and blind optical imaging satellites. Several types of assets such as these will probably be deployed in the short- and medium-term perspective – from strategic, high-power lasers capable of inflicting damage on satellites, to smaller, tactical systems that would accompany land units or be deployed on ships. Russia already has much experience with regard to related technologies,[49] so it is safe to assume that its counterspace capabilities will grow rapidly in the coming years.

The fourth trend refers to the increasing effort to create a more resilient space architecture that will be less prone to disruption as a consequence of the development of counterspace measures. This effort will be observable everywhere, particularly among first-rate space powers and commercial entities. The new military space architecture will be more widely distributed and easier to reconstitute and upgrade. This process is already underway in the United States, which is slated to increase overall funds for

[48] See: M. Czajkowski, "Anti-Satellite Weapons: A Political Dimension," *Safety & Defense*, vol. 7, no. 1 (2021), pp. 110-114.

[49] K. Bingen, K. Johnson, M. Young, *Space Threat...*, pp. 14-15, 19.

space operations[50] – with particular attention being paid to increasing the resilience of future space systems. Thus, the United States Space Force is in the process of executing the first stages of the creation of a new, highly distributed military space architecture;[51] it also continues work to create flexible launch options, including – among other things – cooperation with multiple small contractors in addition to its mainstay United Launch Alliance and SpaceX space launch companies.[52] The U.S. also intends to institutionalise the system of using commercial satellite systems and other space-related capabilities.[53] All of this will result in a technological and organisational revolution in military space, which the United States will lead. In turn, the technological and operational gap between the United States and its competitors will most likely widen.

And finally, the European segment of the Western community is in an entirely different situation from that of the United States. Apart from France, European nations have not been considering the requirements of space security, as Busch and Slous observe in the case of Germany.[54] The dedicated military capabilities of European countries are limited at best. Commercial military-grade systems are better developed, particularly with regard to communications and radar imaging,[55] but they are not well integrated into national security structures. Furthermore, it is only since November 2022 that the European Union has begun to consider commercial space architecture to be a part of critical infrastructure,[56] which obliges its operators to undertake steps to secure it – particularly against cyber threats; however, the execution of these provisions will take years. Consequently, Europe must be aware that in the future the use of space systems for security purposes may be greatly constrained – especially in times of conflict or tensions with Russia. This is particularly true because Russia will likely remain the main

[50] S. Erwin, "Analyst: U.S. Military Space Budget Likely to Get Another Boost in 2024," *Space News*, 16 February 2023, at https://spacenews.com/the-biden-administration-in-its-budget-proposal-for-fiscal-year-2024-is-likely-to-seek-a-significant-increase-for-the-u-s-space-force/, 18 II 2023.

[51] S. Erwin, "Space Development Agency Issues Draft Solicitation for 100 Satellites," *Space News*, 12 May 2023, at https://spacenews.com/space-development-agency-issues-draft-solicitation-for-100-satellites/, 12 V 2023.

[52] S. Erwin, "Space Force to Change how it Buys National Security Launches," *Space News*, 16 February 2023, at https://spacenews.com/the-u-s-space-force-on-feb-16-released-its-procurement-strategy-for-the-next-national-security-launch-services-contracts-expected-to-be-awarded-in-2024/, 18 II 2023.

[53] S. Erwin, "DoD Weighing Options to Create 'Commercial Space Reserve'," *Space News*, 26 April 2023, at https://spacenews.com/dod-weighing-options-to-create-commercial-space-reserve/, 28 IV 2023.

[54] C. Busch, L. Slous, "Germany's Reluctant Approach to Space Security Policy," *War on the Rocks*, 26 April 2023, at https://warontherocks.com/2023/04/germanys-reluctant-approach-to-space-security-policy/, 27 IV 2023.

[55] M. Czajkowski, "The European Military Space Capabilities – A Strategic Assessment," *Analiza KBN*, vol. 4, no. 120 (2023), pp. 1-9, at https://zbn.inp.uj.edu.pl/pl_PL/analizy/-/journal_content/56_INSTANCE_L0OIGPRBo7bv/92718966/153319366, 14 V 2023.

[56] *Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2022 on the Resilience of Critical Entities and Repealing Council*, Official Journal of the European Union, 27.12.2022, L 333/164, pp. 4, 14, at https://data.consilium.europa.eu/doc/document/PE-51-2022-INIT/en/pdf, 22 V 2023.

security concern or even threat to Europe, and it will rather quickly develop and deploy a range of counterspace assets.

Summarising to this point, it has been noted that security-relevant space architecture will remain an important part of the advantage that Western nations enjoy, but it will be increasingly jeopardised by an increase in potential adversaries' space and counterspace capabilities. Therefore, the United States has undertaken a far-reaching effort to reconstitute its space architecture to make it more resilient to future threats and to remain a reliable tool of security strategy and related actions. On the other hand, the European segment of the transatlantic community is dramatically lagging behind, both in terms of its space capabilities and in the effort to address future developments in the space security environment. As Penent and Schlumberger observe, Europe faces the risk *of being overtaken, with the emergence of new players who are gaining skills and power, leading to heightened competition for the largely export-dependent European industrial sector*[57] and of *being outclassed, by maintaining or even widening a gap with major actors whose accelerated investments could bring an unprecedented risk of being ousted from spectrum-orbit resources*.[58] That is why it seems appropriate to provide some policy recommendations for European nations regarding space security.[59]

First of all, it is necessary to understand that space architecture must undergo significant technical and organisational changes. Instead of traditional constellations consisting of only a few expensive and easy-to-target craft, it is necessary to orbit new generation systems of hundreds of smaller satellites that will be easier to replace. Such constellations will also be able to adapt to changing operational realities by quickly replacing old models with new ones equipped with enhanced capabilities. In this way, military-grade space systems will also be more resilient, as they will present a much more demanding target for the adversary. Secondly, proliferated military constellations should be supplemented by hosting military-grade payloads on civilian or commercial satellites. Finally, civilian and commercial entities operating communications and surveillance satellites should be integrated into defence infrastructures to augment dedicated military systems when necessary.

Certainly, this kind of effort is too heavy a burden for any individual state to shoulder, so European countries should abandon the traditional approach to military space – which entails building national capabilities in the first place. Instead, a new common space architecture designed to provide Europe with effective, CSM-resistant military-grade capabilities should be designed and deployed. Admittedly, the main hurdle ahead will be the political will to establish the necessary institutions and provide them with proper funding. However, there are instances of cooperation in the military-relevant aspect of space exploitation in Europe, particularly the GALILEO GNSS. None

[57] G. Penent, G. Schlumberger, "How the War in Ukraine is Changing the Space Game," *Notes de l'ifri*, Ifri, February 2023, p. 18, at https://www.ifri.org/sites/default/files/atoms/files/penent_schlumberger_ukraine-space-game_2023.pdf, 18 V 2023.

[58] Ibid.

[59] This assessment is to a great extent based on a previous, non-peer-reviewed blog entry, quoted in Footnote 54.

of the European countries were able to create such a system, but the need to establish it for the sake of having independent capabilities in the crucial field of PNT services prevailed over national particularities. There are also other instances of multilateral co-operation regarding security-relevant space capabilities in Europe, such as the Helios 2 optical imaging system.[60] Furthermore, on March 10th, 2023, the *EU Space Strategy for Security and Defence*[61] was adopted by the European Commission. It provides guidelines for improved cooperation, particularly in enhancing the resilience of space systems and services in the EU, responding to space threats and enhancing the use of space for defence and security. As the European Space Policy Institute (2023) notes, there are also ideas to *improve the military use of Copernicus, including through the creation of a dedicated service comparable to Galileo PRS*,[62] although this will be rather difficult due to technical constraints.

All of this, however, is insufficient because the abovementioned measures refer to the coordination of national capabilities and the inclusion of civil/commercial entities in the defence effort. The next necessary and logical step is to design and deploy joint European space surveillance and communication systems in the form of proliferated constellations built on assessments of adversaries' future CSM capabilities. It should have military-grade capabilities regarding imaging resolution, response time, resilience and upgrade capacity. However, these constellations do not necessarily have to be exclusively military; it would be even better if they were under civilian control. The European Space Agency seems particularly suited to operate such a system as it unites the most advanced and wealthiest European nations.

We understand that the political consensus required to establish such constellations is very difficult to reach due to well-known features of the decision-making mechanisms of the European institutions. However, there is room for cautious optimism because the gravity of the looming threats – on one side – and the relative backwardness of European military space – on the other – will likely compel governments to compromise. Furthermore, and this is also very optimistic, the European industry has much to gain from increased funding for research, development and procurement of new systems, so it will most certainly lobby for the rapid development of the new space architecture.

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60 G.D. Krebs, "Helios 2A, 2B," *Gunther's Space Page*, 14 January 2023, at https://space.skyrocket.de/doc_sdat/helios-2a.htm, 18 V 2023.

61 *Joint Communication to the European Parliament and the Council: European Union Space Strategy for Security and Defence*, European Commission, Brussels, 10.3.2023, JOIN(2023) 9 final, at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023JC0009, 12 III 2023.

62 "The War in Ukraine and the European Space Sector," *European Space Policy Institute Executive Brief*, no. 57, 5 May 2023, at https://www.espi.or.at/briefs/the-war-in-ukraine-and-the-european-space-sector/, 18 V 2023.

CONCLUSION

The dissemination of commercial military-grade technology does contribute to the reshaping of regional power equations and impacts the course of interstate relations and conflicts. The war in Ukraine has provided a powerful argument validating this thesis. The natural consequence of the abovementioned process is a quickening of the development and further dissemination of counterspace measures. This is congruent with Weeden and Samson's view that the *key driver in the proliferation of offensive counterspace capabilities is the increased use of space capabilities to support conventional warfare*.[63]

Consequently, it was argued that the development of countermeasures plays a crucial role in the evolving philosophy of security in space. A shift is occurring from the traditional *sanctuary* approach – which did not recognise serious threats to space architecture, to the *contested domain* approach – which acknowledges the increasing significance of threats to the operation of space systems. Therefore, the third hypothesis posited that developed spacefaring nations must take steps to enhance the resilience of their space systems. Current trends in the development of countermeasures, particularly the purported prowess of Russia in this matter, create the circumstances in which Western countries must act if they want to retain crucial advantages. Actions already undertaken, particularly by the United States but also by European countries, validate this thesis.

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[63] B. Weeden, V. Samson, *Global Counterspace...*, p. xxxv.

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