

From science fiction to strategic reality

Outer space has traditionally been seen as a domain of scientific exploration and national prestige milestones, but in recent decades we have witnessed how the dimension of national security and the global economy has gained relevance to the point of consolidating itself as one of the new domains of modern warfare¹.

From the emergence of global positioning systems (GPS) and Earth observation systems to communications and image intelligence, our civilisation has become completely dependent on assets in orbit for the functioning of vital infrastructure such as telecommunications, logistics, transport, etc. However, rather than acting as a catalyst for international cooperation, the emergence of this new domain has proved to be a source of great vulnerability that nations seek to mitigate while trying to exploit that of their rivals. This has meant that the militarisation of space is no longer science fiction but has become a strategic reality of the present^{2,3}.

An important milestone in this process was the creation of the United States Space Force in 2019⁴, although at first it may have seemed more like a propaganda campaign than an effective measure. However, there are continually minor events, the kind that go unnoticed among the big headlines, that have proven the wisdom of this measure, shaping the new operational domain as one of the pillars on which modern warfare is based⁵.

For this reason, the question that needs to be asked is not whether space is becoming militarised, since this has been the case since the beginning of the space age. The question is whether we are witnessing a new arms race in outer space. This article aims

¹ SWOPE, Clayton; BINGEN, Kari A.; YOUNG, Makena; LAFAVE, Kendra. "Space Threat Assessment 2025" [online], Washington, D.C.: Centre for Strategic and International Studies (CSIS), Aerospace Security Project, 2025, available at: <https://www.csis.org>

² AZNAR FERNÁNDEZ-MONTESINOS, Federico. "Outer Space, a New Dimension of Security", Madrid: Spanish Institute for Strategic Studies, Ministry of Defence, 2021, Analysis Document IEEE 10/2021. https://www.ieee.es/Galerias/fichero/docs_analisis/2021/DIEEEA10_2021_FEDAZN_EspacioExterior.pdf (Accessed on 01/09/2025)

³ PÉREZ CABRERA, Miguel Ángel. "The Air and Space Force faces a new challenge: outer space as an operational domain," IEEE Magazine No. 23, 2024, pp. 135–162. Available at: <https://revista.ieee.es/article/view/6655/8099> (Accessed on 28/08/2025).

⁴ DOLAN, Brian; TRIEZENBERG, Bonnie L.; YONEKURA, Emmi; EVANS, Sandra Kay; KIM, Moon; BUTLER, Dwayne M.; DENTON, Sarah W.; BHARADWAJ, Shreyas. "Understanding, Managing, and Reporting U.S. Space Force Readiness" [online], Santa Monica, CA: RAND Corporation, 2023, (Research Report RR-A977-1). Available at: https://www.rand.org/pubs/research_reports/RR977-1.html (Accessed 20/08/2025)

⁵ CORRAL HERNÁNDEZ, David. "Stealth ships and satellite constellations, a space in dispute", IEEE Opinion Paper 62/2024. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2024/DIEEEO62_2024_DAVCOR_Espacio.pdf (Accessed 28/08/2025).

to offer a reasoned answer, for which we have considered the particularities of the phenomenon: the desire for dominance as a secondary characteristic, the dual nature of the technologies used, the heterogeneity and diversity of the actors involved, and the dramatic escalation in the sophistication of defensive and offensive means⁶.

Historical evolution and legal framework

Origins and doctrines

The Cold War marked the beginning of the use of near-Earth and extraterrestrial space for military purposes. The US and the USSR competed, as in so many other areas, to demonstrate who had technological and military supremacy in space, especially since the launch of Sputnik 1 (1957) had awakened the worst strategic fears in both blocs. After all, technologically there is not much difference between a civilian space rocket and an intercontinental ballistic missile (ICBM), except for the payload.

Strategic deterrence through mutual assured destruction (MAD), the great conceptual advance that underpinned the relative world peace of the second half of the 20th century, had one of its main pillars, nuclear weapons, inexorably linked to space technology. For this reason, it can be said that space exploration and the militarisation of space have always been two inseparable sides of the same coin.

During the Cold War, countless military programmes with space infrastructure emerged, designed to attack or defend against the capabilities of the rival. This is the case of the NORAD programme, created in 1958 and theoretically intended for aerospace defence, airspace control and maritime alert in North America, or Ronald Reagan's 1983 Strategic Defence Initiative (SDI), which included satellite surveillance, kinetic interceptors and even directed energy weapons (lasers), although it never materialised. On the Soviet side, there was no shortage of ideas for exploiting this new domain, such as the *Istrebitel Sputnikov* (IS) project, which kept kamikaze-type co-orbital satellites in orbit between the 1960s and 1980s, or the failed *Polyus*, which attempted to put an anti-satellite laser into orbit in 1987. It is also worth noting the prolific efforts of both sides to put satellites into

⁶ ANDRÉS HERRERO, Juan Carlos. "The orbital war: a conceptual approach", IEEE Opinion Paper 51/2024. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2024/DIEEEO51_2024_JUAAND_Orbital.pdf (Accessed on 20/08/2025).

orbit whose main or exclusive function was enemy observation, interference or electronic warfare. Some of the constellations that began at this time are still active, after many updates, such as the Russian Kosmos or the American SBIRS or Keyhole (KH).

Also during this period, both blocs developed kinetic interception systems to destroy enemy orbital assets, either by direct impact or by proximity detonation. These interception systems demonstrated how incredibly vulnerable space systems are, but also that there were risks of nuclear escalation as they could be mistaken for ICBMs, which limited their operational use.

Although many of these projects and initiatives were unsuccessful or were overtaken by technological advances, they laid the doctrinal foundations on which the current competition for dominance of near space would be based⁷.

The 1967 Outer Space Treaty

The 1967 Outer Space Treaty⁸, also known as OST, was an agreement sponsored by the United Nations that has now been ratified by 117 countries. It established a series of fundamental principles for the use of near space, focusing on its use for peaceful purposes, prohibiting the placement of weapons of mass destruction (WMD) in orbit and the establishment of military bases on the Moon and other celestial bodies.

Despite its solid foundations, the treaty suffers from a number of significant ambiguities that there has been no willingness to resolve. On the one hand, it does not expressly prohibit the military use of space for activities such as communications, navigation or intelligence, nor does it establish regulations regarding the deployment of non-WMD weapons, non-kinetic systems, anti-satellite weapon (ASAT) testing or proximity operations for offensive purposes.

In addition to lacking credible verification and sanction mechanisms, technological developments have rendered this legal mechanism obsolete, allowing powers interested

⁷ HERNÁNDEZ FERNÁNDEZ, Francisco. "An arms race in space. A deficit in public international law?", IEEE Opinion Paper 16/2021. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2021/DIEEEE016_2021_FRAHER_CarreraEspacial.pdf (Accessed on 20/08/2025).

⁸ United Nations Office for Outer Space Affairs (UNOOSA). "United Nations Treaties and Principles on Outer Space" [online], New York: United Nations, 2002. Available at: <https://www.unoosa.org/pdf/publications/STSPACE11S.pdf> (Accessed 27 August 2025).

in circumventing its provisions to develop military space capabilities without apparently violating the OST⁹.

The treaty anticipated the problem in question, but could not foresee the technological developments that would render it obsolete. Although other agreements have been proposed to correct its shortcomings, there has been neither consensus nor international will to move them forward, or, if there was, it was to avoid hindering the activities of the major powers^{10,11}.

Space military capabilities: technology and doctrine

Technological duality and covert militarisation

The concept of duality refers to the coexistence of civil and military capabilities in a system apparently designed for peaceful purposes. Technically, the vast majority of space technologies are dual-use, if not all. Earth observation satellites (Paz, Kosmos, Keyhole), global navigation systems (GNSS, GLONASS, BeiDou) and launch vehicles (Falcon 9, Miura 1, Chang Zheng) have both civilian and military applications. One example is satellites dedicated to remote sensing or Earth observation, whose civil or military use depends solely on how the data is processed¹².

The ambiguity of the concept of duality has for decades allowed states interested in developing military space capabilities to do so under the umbrella of civil or commercial space programmes, without violating the OST.

In practice, covert militarisation means that the states that engage in it have unique capabilities: surveillance satellites, secure communications, ICBM detection and even

⁹ AZNAR FERNÁNDEZ-MONTESINOS, Federico. "Outer Space, a New Dimension of Security," Madrid: Spanish Institute for Strategic Studies, Ministry of Defence, 2021, Analysis Document IEEE 10/2021. https://www.ieee.es/Galerias/fichero/docs_analisis/2021/DIEEEA10_2021_FEDAZN_EspacioExterior.pdf (Accessed 01/09/2025).

¹⁰ FERNÁNDEZ DE BOBADILLA FERRER, Alejandro. "The space race of the 21st century. Consequences of China's arrival on the Moon," CESEDEN Monograph 156. CESEDEN/ESFAS, 2022, p. 101-140. Available at: <https://www.defensa.gob.es/documents/2073105/2223504/cap+3+monografia+156.pdf/46ffe160-6b52-4e93-1881-90a4a892d496?t=1729595301592> (Accessed on 10/08/2025).

¹¹ PÉREZ CABRERA, Miguel Ángel. "The Air and Space Force faces a new challenge: outer space as an operational domain," IEEE Magazine No. 23, 2024, pp. 135-162. Available at: <https://revista.ieee.es/article/view/6655/8099> (Accessed 28/08/2025).

¹² HERNÁNDEZ FERNÁNDEZ, Francisco. "An arms race in space. A deficit in public international law?" IEEE Opinion Paper 16/2021. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2021/DIEEEO16_2021_FRAHER_CarreraEspacial.pdf (Accessed on 20/08/2025).

electronic warfare. On the other hand, access to space has become an unprecedented symbol of geopolitical and economic status that is increasingly within the reach of a growing number of nations^{13,14,15}.

From kinetic weapons to space debris

The ambiguous concept of kinetic weapons would define all those systems that can be used to physically damage or destroy space assets. Most are devices designed for this purpose, such as anti-satellite missiles, direct collision interception systems or even 'kamikaze' satellites, but elements of circumstance such as satellites at the end of their useful life can also be used. All of them are based on the concept of interception by collision or proximity detonation, causing the fragmentation of the systems involved and contributing to the problem of space debris.

From a geopolitical perspective, the destruction of space assets would be interpreted as a hostile act with consequences analogous to a conventional attack. A potential "ultraterrestrial" conflict, leading to an escalation of attacks and counterattacks, would exacerbate the problem of uncontrolled debris (space debris) and thereby jeopardise the entire global telecommunications and navigation infrastructure, creating tensions with non-contending states that would hinder multilateral cooperation in the management of the orbital environment. Space debris is therefore not only a technical and orbital sustainability problem, but also a source of international tension.

All this may sound like science fiction, but there is evidence that various anti-satellite (ASAT) systems have been tested by the major powers. Furthermore, there are real cases of ASAT use, such as the shooting down of the Chinese meteorological satellite FY-1C in 2007 or the Russian test against Kosmos 1408 in 2021, which generated thousands of fragments that remained in orbit.

¹³ IEEE. "The space sector in Spain: evolution and prospects," pp. 83-86, Ministry of Defence, Technical General Secretariat, 2014, ISBN 978-84-9091-005-4 (e-book edition). Available at:

https://www.ieee.es/Galerias/fichero/cuadernos/Cuaderno_Estrategia_170.pdf (Accessed on 20/08/2025).

¹⁴ MEDINA CASTRO, Javier. "Outer space in national defence", IEEE Opinion Paper 06/2023. Available at:

<https://www.defensa.gob.es/documents/2073105/2267327/El+espacio+ultraterrestre+en+la+defensa+nacional.pdf/f055ccca-94f4-13fe-e14c-db2c97f78978?t=1732178536321> (Accessed 20/08/2025)

¹⁵ ERWIN, Sandra. "New studies provide fresh insights into the escalating space arms race" [online], Space News, 4 April 2019. Available at: <https://www.space.com/reports-on-escalating-space-arms-race.html> (Accessed 20 August 2025)

This is a problem that was anticipated in 1978 by NASA scientists Donald J. Kessler and Burton G. Cour-Palais, who formulated a theory they called the "Kessler effect," proposing a hypothetical scenario in space where the accumulation of space debris in low Earth orbit would become so dense that it would endanger space infrastructure.

In this scenario, debris would collide uncontrollably with still-useful assets, accidentally destroying them and generating more fragments in a domino effect that would ultimately render some orbital trajectories unusable, severely affecting communications, transport, space exploration and satellite infrastructure¹⁶. Space debris would function as an area denial system, analogous to a space minefield, but for which there are still no demining methods.

Electronic warfare and cyberattacks

The most important tools that can be used as threats in the space domain are electronic warfare and cyberattacks, representing the greatest example of dual use of the technologies involved¹⁷.

They pose a growing challenge, as there is no system in orbit that is not remotely controlled from the ground, and this is a vulnerability that is difficult to avoid. All assets are exposed to electronic warfare, interference, *jamming* and even signal spoofing, which can seriously affect navigation systems such as GPS, satellite communications or spacecraft control links.

Cyberattacks, meanwhile, target vulnerabilities in ground control systems, data networks, software embedded in satellites, or even the supply chain for space components. A successful attack could disable, manipulate, or even take control of a satellite without physically destroying it or alerting its legitimate owner.

These threats also pose an intrinsic problem that can complicate the response: they are difficult to attribute. This makes cyberspace a scenario where state and non-state actors

¹⁶ YAGÜES PALAZÓN, Miguel. "Environmental challenges in outer space in the context of the second space age", IEEE Magazine No. 12, 2018, pp. 177–214. ISSN-e: 2255-3479. Available at: <https://revista.ieee.es/article/view/750/1384> (Accessed 10/08/2025).

¹⁷ ABAD SOTO, José. "Paradigm shift in security and defence: future capabilities, already present," IEEE Opinion Paper 04/2025. Available at: https://www.defensa.gob.es/documents/2073105/2320887/cambio_de_paradigma_de_la_seguridad_y_la_defensa_2025_dieeo04.pdf/906bbc95-0e26-e245-f044-a82186f194e0?t=1736933624214 (Accessed on 25/08/2025)

can operate with an unprecedented degree of anonymity, allowing them to exert pressure or carry out sabotage without resorting to open conflict, favouring scenarios of hybrid warfare and covert deterrence.

As there are no applicable international legal limitations, the only viable option left to a state to protect its space infrastructure against such threats is to stay at the forefront of technology, making constant and iterative investments in research and development of cybersecurity systems.

The players in orbital geopolitics

The United States, top of the class

It is well known that Washington has technological superiority in space, as it has been the largest investor for years and has consolidated it in its military doctrine as an operational domain essential to its national security¹⁸. The creation of the USSF marked a historic milestone that institutionalised its space strategy to ensure free access to operations in orbit. In general, with the exception of the US, most countries have chosen to integrate space defence forces into their air forces or strategic commands, rather than creating a completely independent military service¹⁹.

The US doctrine, backed by its huge military spending, is not limited to passive defence. The functions of this Space Force seek to combine satellite protection with the development of proactive capabilities, such as the Golden Dome project. If it materialises, this system will inevitably have to include a very important space component in its technological structure, as is currently the case with the Delta-4 Mission and SBIRS-Low systems.

The implications of this doctrinal change are profound: it increases the risk of a space arms race, strains the international legal framework and raises the vulnerability of critical

¹⁸ GARCÍA ENCINA, Carlota; SIMÓN, Luis. "The new US National Security Strategy", Elcano Royal Institute, Ref. ARI 69/2022, 08/11/2022. Available at: <https://www.realinstitutoelcano.org/analisis/la-nueva-estrategia-de-seguridad-nacional-de-eeuu/> (Accessed on 30/08/2025).

¹⁹ MARTÍNEZ CORTÉS, José M. "The new operational environment and aerospace operations," IEEE Magazine no. 20, 2022, pp. 185–212. ISSN-e: 2255-3479. Available at: <https://revista.ieee.es/article/view/4636/5990> (Accessed on 10/08/2025).

global infrastructure dependent on satellites. In short, the creation of the USSF confirmed a well-established fact: space has become yet another arena for strategic confrontation.

Its doctrine of "space superiority" has fuelled a dynamic of competition that encourages other powers, primarily China and Russia, to develop similar capabilities. However, the USSF is not the cause of this, but rather the culmination of a process that was already quietly underway²⁰.

China, the new revelation

The Asian giant has established itself as the United States' biggest competitor in most geopolitical aspects. Strategic dominance of space is one of the areas that Beijing considers most important, which is why its space strategy is not limited to scientific exploration, but also seeks to position itself as a relevant player, both from a technological and geopolitical perspective²¹.

The turning point for the demonstration of Chinese capabilities was the ASAT test carried out in 2007. The target chosen was one of its own disused weather satellites, which was destroyed by a missile specially designed for this purpose using the method of direct high-speed collision²².

However, after this show of brute force, Beijing's doctrine evolved towards more sophisticated and discreet approaches, prioritising non-kinetic threats such as cyberattacks, electronic interference and even laser weapons to degrade or disable optronic systems²³. The basis of this strategy is precisely to rely on the development and implementation of dual-use assets that camouflage their potential military use. The BeiDou navigation network is the best example²⁴. Officially, it was designed for civilian

²⁰ ANDRÉS HERRERO, Juan Carlos. "The orbital war: a conceptual approach," IEEE Opinion Paper 51/2024. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2024/DIEEEO51_2024_JUAAND_Orbital.pdf (Accessed on 20/08/2025).

²¹ GAO, Jie. "PRC Unveils New Space Plan" [online], The Jamestown Foundation, Washington D.C., 05/11/2024. Available at: <https://jamestown.org/program/prc-unveils-new-space-plan> (Accessed 27/08/2025).

²² COSTELLO, John. "PLA Military Aerospace Force: On the Frontier of Innovation and Competition" [online], China Brief, Volume, 25, Issue 13, The Jamestown Foundation, Washington D.C., 11/07/2025. Available at: <https://jamestown.org/program/pla-military-aerospace-force-on-the-frontier-of-innovation-and-competition> (Accessed 27/08/2025).

²³ HONRADA, Gabriel. "Crystal Clear: China Sharpening Its Anti-Satellite Laser Edge" [online], Asia Times, Hong Kong, 29/07/2025. Available at: <https://asiatimes.com/2025/07/crystal-clear-china-sharpening-its-anti-satellite-laser-edge> (Accessed 27/08/2025).

²⁴ SEWALL, Sarah; VANDENBERG, Tyler; MALDEN, Kaj. "China's BeiDou: New Dimensions of Great Power Competition" [online], Belfer Centre for Science and International Affairs, Harvard Kennedy School, Cambridge

use, but it also serves to provide the Chinese military with critical capabilities such as positioning, missile guidance and synchronisation of operations. Blurring the line between civilian and military infrastructure gives China a strategic advantage, complicating the justification for any response to its activities²⁵.

The result of China's military space doctrine is analogous to that of the United States: erosion of trust, strain on legal frameworks, and systemic vulnerability of international civilian infrastructure. However, Beijing does not seem to care much about these problems, being more interested in challenging US supremacy and redefining the global strategic balance in its favour²⁶.

Russia, the silent decline

Since the dawn of the Cold War, the Russian Federation, and before that the Soviet Union, has maintained an active stance on the militarisation of space, as evidenced by the early doctrinal formulas of the 1960s and the creation of the Russian Aerospace Forces (VKS) in 2011. The VKS initially represented for the Russians the formal separation of aeronautical and extraterrestrial domains, anticipating the American formula by almost a decade, but in 2015 it merged with the air force and missile defence forces to form the Russian Aerospace Forces (VKS)^{27,28}.

In Moscow, it is traditional to consider space as a critical domain for deterrence and the projection of power and prestige, which is why its doctrine has always been geared towards neutralising Western technological superiority. In fact, the Kremlin organised a widely publicised ASAT test in 2021 to expand its already extensive experience, destroying one of its old Kosmos satellites, although on this occasion its intention was

(Massachusetts), 2023. Available at: <https://www.belfercenter.org/publication/chinas-beidou-new-dimensions-great-power-competition> (Accessed 27/08/2025).

²⁵ MARTÍNEZ CORTÉS, José M. "The new operating environment and aerospace operations", IEEE Magazine no. 20, 2022, pp. 185–212. ISSN-e: 2255-3479. Available at: <https://revista.ieee.es/article/view/4636/5990> (Accessed 10/08/2025).

²⁶ FERNÁNDEZ DE BOBADILLA FERRER, Alejandro. "The space race of the 21st century. Consequences of China's arrival on the Moon," CESEDEN Monograph 156. CESEDEN/ESFAS, 2022, p. 101 140. Available at: <https://www.defensa.gob.es/documents/2073105/2223504/cap+3+monografia+156.pdf/46ffe160-6b52-4e93-1881-90a4a892d496?t=1729595301592> (Accessed on 10/08/2025).

²⁷ MARTÍNEZ CORTÉS, José M. "The new operating environment and aerospace operations," IEEE Magazine no. 20, 2022, pp. 185–212. ISSN-e: 2255-3479. Available at: <https://revista.ieee.es/article/view/4636/5990> (Accessed 10/08/2025).

²⁸ McDERMOTT, Roger. "Russia's Military Exploitation of Outer Space" [online], Eurasia Daily Monitor, Volume 17, Issue 47, The Jamestown Foundation, Washington D.C., 8 April 2020. Available at: <https://jamestown.org/program/russias-military-exploitation-of-outer-space> (Accessed 27/08/2025).

probably not only to conduct a technological test. In reality, it also served to test the international community's reaction, as the target satellite's orbit — and the resulting debris — crossed highly frequented orbital trajectories, even affecting the International Space Station (ISS) and the Chinese Space Station (CSS)²⁹.

However, as in the Chinese case, ASAT tests are only a one-off show of force. That is why Russian doctrine focuses primarily on non-kinetic means, which are potentially more damaging and discreet. Electronic jamming systems, cyberattacks and laser weapons to damage satellite optics are the most common tools. In addition, Russia has implemented a programme of 'inspector' satellites (the Nivelir programme) whose function is to approach other objects in orbit, without their actual purpose being known³⁰.

There is no reliable information available on Moscow's objective with this strategy, but it can be inferred that it is a purely asymmetric doctrinal approach, seeking to compensate for the technological advantage of the United States and NATO through the use of differentiated disruptive capabilities, thus generating strategic instability for its competitors³¹. Likewise, the destruction, interception or degradation of satellites at the right moment would affect the United States' early warning capability in the event of a nuclear missile exchange, increasing miscalculations that could be key in nullifying its interception capability.

However, there are signs that all these programmes, plans and strategies are at risk of becoming obsolete, either due to equipment obsolescence, design flaws or lack of investment in upgrades. The most characteristic example is the deterioration of the GLONASS system (the Russian GPS), which is highly dependent on Western technology that is becoming increasingly inaccessible due to sanctions resulting from the war in Ukraine³².

²⁹ VOLOSUYUK, O. V. et al. "Испания и Россия перед вызовами времени" ("Spain and Russia facing the challenges of time"), Editorial Международные отношения (International Relations), Moscow, 2022. ISBN 978-5-7133-1719-5. Available at: <https://publications.hse.ru/pubs/share/direct/585937860.pdf> (Accessed on 27/08/2025).

³⁰ HENDRICKX, Bart. "Project Nivelir: Russia's inspection satellites part 1 and 2", The Space Review, 28/04/2025 and 05/05/2025. Available at: <https://www.thespacereview.com/article/3962/1> and <https://www.thespacereview.com/article/4982/1> (accessed 20/08/2025).

³¹ KORTUNOV, Andrey. "Space development: Star Wars or Star Trek?" [online], Russian International Affairs Council, Moscow, 28 February 2024. Available at: <https://russiancouncil.ru/en/analytics-and-comments/analytics/space-development-star-wars-or-star-trek> (accessed on 27/08/2025)

³² LUZIN, Pavel. "Russia's Satellite Constellation Deteriorates, Increasing Dependency on China" [online], Eurasia Daily Monitor, Volume 21, Issue 69, The Jamestown Foundation, Washington D.C., 6 May 2024. Available at: <https://jamestown.org/program/russias-satellite-constellation-deteriorates-increasing-dependency-on-china> (Accessed 27/08/2025).

The second division

Although the US, Russia and China are the countries that devote the most resources to space, they are not the only ones interested in these technological developments.

The case of India is paradigmatic. In many respects, its development in recent decades has been analogous to that of China in the past, with which it competes in many areas. New Delhi is aware of the potential of space as a strategic multiplier and has therefore been implementing developments in this area. In fact, in 2019, they conducted their first ASAT test (Shakti Mission)³³, demonstrating their ability to destroy satellites in low orbit. They have also created their own Space Defence Agency, aimed at integrating space capabilities into their military doctrine, as well as developing early warning and orbital surveillance systems^{34,35}.

Another interesting case in this field is that of Saudi Arabia. Its approach is based on investing its vast economic resources in technological cooperation and satellites and projects with a discreet dual civil-military focus. They are aware of the importance of ensuring their satellite autonomy in a tense regional context, while at the same time gaining the technological prestige they lack. However, they suffer from a heavy dependence on Western technology, both from the United States and the old continent, which is hampering any progress³⁶.

The European Union, as in so many other matters, is a special case due to its excessive fragmentation. On the one hand, much progress has been made in terms of space integration for security and defence purposes, with the development of dual-use satellite programmes such as Galileo (navigation), Copernicus (observation) and the IRIS project, which is still under development (secure communications)³⁷. On the other hand, the military space strategy is made up of a network of agencies, institutions and organisations

³³ POKHAREL, Sugam. "Mission Shakti: India says it carried out its first operation to shoot down satellites with missiles." CNN en español, 27/03/2019. Available at: <https://cnnespanol.cnn.com/2019/03/27/mision-shakti-la-india-dice-que-realizo-su-primera-operacion-para-el-derribo-de-satelites-con-misiles> (Accessed 25/08/2025).

³⁴ PTI. "India working on military space doctrine, expected to be out in three months, says CDS" [online], The Hindu, New Delhi, 7 April 2025. Available at: <https://www.thehindu.com/news/national/india-working-on-military-space-doctrine-expected-to-be-out-in-three-months-says-cds/article69424189.ece> (Accessed 25/08/2025).

³⁵ KUMAR, R. Anil. "India's Strategic Expansion in Military Space" [online], India Strategic, New Delhi, 13/04/2025. Available at: <https://www.indiastrategic.in/indias-strategic-expansion-in-military-space> (Accessed 27/08/2025)

³⁶ SpaceTech in Gulf. "Saudi Arabia's Ascent in Space: Trends, Opportunities, and Strategic Engagement" [online], SpaceTech in Gulf, Dubai, 15/06/2025. Available at: <https://spacetech-gulf.com/2025/06/saudi-arabias-ascent-in-space-trends-opportunities-and-strategic-engagement> (Accessed on 27/08/2025)

³⁷ Council of the European Union, "EU Space Policy. Analysis", Brussels, 21/08/2025. Available at: <https://www.consilium.europa.eu/es/policias/eu-space-programme> (accessed on 27/08/2025)

from member countries, with very different functions and approaches, most of which are heavily influenced by NATO doctrines. Added to this situation are the traditional ethical constraints that we Europeans tend to impose on ourselves, and the lack of interest of some members in common defence³⁸. However, the technological and investment capacity of the old continent, as well as the geopolitical incentive of Russia, are leading to a change in approach towards military use and technological autonomy, thanks above all to the new trend of incorporating the space dimension into the armed forces of the countries that make up the European Union, as Spain, France and Italy have done^{39,40}.

These are some examples that serve to illustrate different models for credibly addressing the militarisation of space, the viability of which will be seen over time. However, we must not forget that they are not the only ones. Countries such as the United Kingdom, Japan, Israel, South Korea and Brazil are also making significant efforts to develop doctrines and technologies to position themselves as best as possible in this arms race.

The consequences of the proliferation of international interest in militarising space are clear. In addition to the risks inherent in confrontation between states and the vulnerability of civilian systems, space is being consolidated not as a common good, but as a multipolar arena where the separation between the civilian and military spheres is becoming increasingly blurred⁴¹.

Global risks

The introduction of a new domain in the geopolitical sphere generates a whole range of new strategic risks that threaten international stability. Unlike other areas such as nuclear power, where the theory of deterrence has acted as a balancing factor, in space there are

³⁸ Council of the European Union. "EU Space Strategy for Security and Defence", Brussels, 31/01/2023. Available at: <https://www.consilium.europa.eu/es/policies/space-security-and-defence> (Accessed on 27/08/2025).

³⁹ IEEE. "The space sector in Spain: evolution and prospects," pp. 83–86, Ministry of Defence, Technical General Secretariat, 2014, ISBN 978-84-9091-005-4 (e-book edition). Available at: https://www.ieee.es/Galerias/fichero/cuadernos/Cuaderno_Estrategia_170.pdf (Accessed 28/08/2025).

⁴⁰ RODRÍGUEZ VARELA, Alfonso. "Analysis of the suitability for Spain of space surveillance and tracking systems from the perspective of defensive realism", IEEE Opinion Paper 112/2020. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2020/DIEEEO112_2020ALFROD_espacial.pdf (Accessed 28/08/2025).

⁴¹ United Nations General Assembly. "Resolution 75/35: Prevention of an arms race in outer space" [online], United Nations, New York, 07/12/2020. Available at: <https://digitallibrary.un.org/record/3895439?v=pdf#files> (Accessed on 28/08/2025)

no prevention mechanisms to prevent an escalation of hostilities⁴². Moreover, this absence of strategic balance is the perfect breeding ground for hybrid and asymmetric operations, given the vulnerability of space infrastructure and the difficulties in attributing certain types of attacks⁴³.

If there is no explicit assumption of the aggressor, any cyberattack, interference or use of directed energy weapons may go unnoticed or be misattributed. There is even a risk of confusing test or probing attacks as the prelude to a conventional strategic attack, escalating the intensity of a conflict that, a priori, should remain latent⁴⁴.

But the consequences go beyond the military sphere. Any paralysis in global positioning systems would affect air, sea and land transport, as well as key industrial sectors and even the synchronisation of financial networks. A widespread attack on a country's communications networks could block access to the internet, affecting everything from banking transactions to emergency communications and even the continuity of government itself. Furthermore, specialised attacks could be carried out to disable or destroy the capabilities of weather satellites, increasing vulnerability to natural disasters, air transport and even agricultural processes⁴⁵.

This means that the militarisation of space not only increases global strategic instability, but also makes assets in orbit (the backbone of the global economy) overly vulnerable targets. All this without considering the future possibility that non-state actors, such as terrorist groups, could acquire these capabilities⁴⁶.

⁴² ISAKOVA, Irina. "The U.S. Challenges Multipolarity in a Struggle for Space Dominance: from Deterrence to Competitive Endurance" [online], Russian International Affairs Council, Moscow, 28/03/2024. Available at: <https://russiancouncil.ru/en/analytics-and-comments/analytics/the-u-s-challenges-multipolarity-in-a-struggle-for-a-space-dominance-from-deterrence-to-competitive> (Accessed 28/08/2025)

⁴³ National Security Council. "National Aerospace Security Strategy 2025", Order PJC/845/2025, of 29 July. BOE No. 187, of 05/08/2025, Sec. III, pp. 105613-105652, Spain. Available at: <https://www.boe.es/eli/es/o/2025/07/29/pjc845> (accessed on 28/08/2025).

⁴⁴ AZNAR FERNÁNDEZ-MONTESINOS, Federico. "Outer Space, a New Dimension of Security," Madrid: Spanish Institute for Strategic Studies, Ministry of Defence, 2021, Analysis Document IEEE 10/2021. https://www.ieee.es/Galerias/fichero/docs_analisis/2021/DIEEEA10_2021_FEDAZN_EspacioExterior.pdf (Accessed 01/09/2025).

⁴⁵ CORRAL HERNÁNDEZ, David. "Stealth ships and satellite constellations, a space in dispute," IEEE Opinion Paper 62/2024. Available at: https://www.ieee.es/Galerias/fichero/docs_opinion/2024/DIEEEO62_2024_DAVCOR_Espacio.pdf (Accessed 28/08/2025).

⁴⁶ MARTÍNEZ CORTÉS, José M. "The new operating environment and aerospace operations," IEEE Magazine No. 20, 2022, pp. 185–212. ISSN-e: 2255-3479. Available at: <https://revista.ieee.es/article/view/4636/5990> (Accessed on 10/08/2025).

The future: cooperation or conflict

The militarisation of space has long ceased to be a futuristic hypothesis and has become a tangible reality that redefines the global strategic balance. The world is so interconnected that the possibilities for its use have changed dramatically, relegating the possible deployment of weapons to second place.

This is because new ways of harming the opponent are not based exclusively on having the greatest conventional destructive capacity (missiles, ships, soldiers, etc.), but rather on having tools to blind, disable or destroy the enemy's cognitive capacity, i.e. their satellites. However, this dynamic introduces a new risk factor into the system, since the loss of these capabilities not only affects military operations, but can also cause damage to civilian infrastructure. In some cases, the objective could even be to attack the latter.

Without a functioning deterrent or regulatory concept, space becomes too prone to the accidental escalation of any interstate conflict. An isolated cyberattack or aggressive orbital manoeuvre, although difficult to attribute with certainty, may be judged as hostile acts that trigger an even greater crisis. In fact, an attack on early warning systems, or even an orbital accident, could be interpreted as a prelude to a larger-scale conventional attack, further increasing the risk of triggering open conflict.

The only way to avoid these risks would be to establish an international regulatory framework, geared towards peaceful uses, that implements clear and transparent protocols on orbital manoeuvres, establishes verification mechanisms and limits activities that proliferate space debris, such as ASAT tests. However, as is often the case with this type of international agreement, the major powers show limited or merely propagandistic interest, aware that the international community has little authority over them. Nevertheless, such treaties are not completely useless, as they are often accompanied by discussion forums for the peaceful resolution of conflicts, which would in itself be a major step ^{forward^{47,48}} .

⁴⁷ IEEE. "The space sector in Spain: evolution and prospects," pp. 83-86, Ministry of Defence, Technical General Secretariat, 2014, ISBN 978-84-9091-005-4 (e-book edition). Available at: https://www.ieee.es/Galerias/fichero/cuadernos/Cuaderno_Estrategia_170.pdf (Accessed 28/08/2025).

⁴⁸ PÉREZ CABRERA, Miguel Ángel. "The Air and Space Force faces a new challenge: outer space as an operational domain," IEEE Institute Magazine No. 23, 2024, pp. 135–162. Available at: <https://revista.ieee.es/article/view/6655/8099> (Accessed on 28/08/2025).

For Spain, the challenges to be faced are somewhat more modest, but also of great relevance. On the one hand, it needs to develop defensive capabilities to ensure the consistency of its space and communications infrastructure. On the other hand, it has an obligation to collaborate with its partners in a fruitful exchange of technology, doctrine and capabilities, helping the European Union to climb the ranks in this silent race. This is the great strength of belonging to a supranational society with aligned interests⁴⁹.

Although we may not like to see it, outer space has never been that utopian meeting place destined for eminently peaceful use. However, the positive note of any scientific and technological advance in any military field is that, over time, it can usually be extrapolated to the rest of society.

*Alfredo Gil Laso**

Captain CIP of the ET, INTA

*Alicia López Jiménez**

Doctor of Astrophysics, INTA

⁴⁹ National Security Council. "National Aerospace Security Strategy 2025," Order PJC/845/2025, 29 July. BOE No. 187, 05/08/2025, Sec. III, pp. 105613-105652, Spain. Available at: <https://www.boe.es/eli/es/o/2025/07/29/pjc845> (accessed on 28/08/2025).