

NATO looking up: the relevance of outer space in a changing security environment

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Abstract

The increasingly competitive nature of outer space has brought ground-breaking opportunities as well as novel vulnerabilities for NATO member States' defense capabilities. Remarkably, during the last decade and specifically after the outbreak of the Ukraine conflict, the Alliance has progressively relied on space for multiple national security and military operations conducted on Earth, including communication, space-based observing systems and intelligence, which enabled the gathering of an extensive amount of information to ensure an immediate and effective crisis response. In light of NATO's recognition of space as a new operational domain and the subsequent adoption of a Space Policy in 2019, this article examines the strategic implications of a space-based support to NATO's Earth and battlefield operations. Notably, specific attention is dedicated to satellite communication and the development of counter-space technologies on the part of the Russian Federation and China, which could potentially acquire a deterrence function to the detriment of the Alliance.

Keywords

NATO; security; military defense; space-based assets; Low Earth Orbits.

Introduction

During the last two decades, the space environment has been interested by ground-breaking transformations, which eventually marked the end of the competitive logic of confrontation that characterized the era of bipolarism in international relations. Notably, since the first Soviet artificial satellite Sputnik I was launched into orbit in 1957, a wide range of novel space-faring nations have entered outer space, its orbits and, more recently, its resources, spurred by prospective economic benefits. As a matter of fact,

for the time being over 30 States – including China, Turkey, South Korea and Japan – have developed relevant space capabilities, and approximately 84 countries currently operate satellites above Earth. Within this context, not only have space technologies and space-based data become fundamental for global economics and finance, communication and scientific progress, but also for defense and security management. More broadly, space has simultaneously emerged as a strategic security frontier and as a critical infrastructure in most countries, with the ability to enhance services both for civilian and defense-related facilities. For this reason, space exploration and deep space missions are consequently evolving into strategic priorities for regional space-faring nations, as well as for traditional space powers, with a view to affirm a robust presence over the Earth's atmosphere.

After more than fifty years, however, States are also confronting with the rise of new players in the space industry supply chain. As a matter of fact, despite being outer space traditionally a field of mere governmental action, an increasingly consolidated involvement of private entities – whose revenue from space economy reached the amount of \$424 billion for the year 2019 alone – is presently occurring. This paradigm shift has been encouraged by a wide set of advancements in the technological sphere and by the evolution of artificial intelligence applications, which allowed for the development of new economic activities that are often detached from early investments in infrastructures. Furthermore, private entities have largely engaged in the design of launch aircrafts through a significant reduction of production times and costs. In this regard, the launch of the first partially reusable Space X Falcon Heavy rocket on February 6, 2018 from Cape Canaveral Launch Complex 39 in Florida represents a case in point. Hence, Elon Musk's launch vehicle has been able to integrate multiple reusable components providing a significantly higher lift capacity with respect to the most powerful rockets currently in service, and to simultaneously trigger nearly a ten-fold cost reduction over the short and medium run, making space exploration increasingly affordable. In light of the aforementioned reasons, the entrance of private corporations in the space domain reasonably ushered in an era of renowned aerospace excitement, signaling at the same time what has been repeatedly referred to by the scholarly community

as *'the emergence of capitalism in space'*. According to this view, a new set of private companies led by charismatic and high-minded entrepreneurs is paving the way for a novel political and economic arrangement in outer space and especially on celestial bodies, with the aim of bolstering profit maximization for the company itself through a strong infiltration in the new space economy, coupled with a foreseeable-future commercial exploitation of space resources. In that respect, it is worthy of note that the eventual commercialization of space resources still appears to be highly dependent on the governmental authorities of individual space powers, to which the provisions of international space law are addressed. Indeed, the privatization of space does not immediately translate into the disappearance of State competition, which is yet strictly tied to the geopolitical balances on the Earth.

Likewise, by adopting a mere security perspective, the conflict between Russia and Ukraine represents an evident example of the space tendencies which have been described so far. Remarkably, since the beginning of the Russian Special Military Operation (SMO) on Ukrainian soil early on February 24, 2022, outer space promptly characterized itself as a rather innovative and invisible domain through which the two opposing military deployments conduct hostile operations on terrestrial battlefields. Outer space has already played a major role in previous conflicts both for the retrieval of satellite images, essential to identify the movements of enemy armies on the ground, and for the correct functioning of intelligence services. Yet the current conflict between Russia and Ukraine presents novel elements in the use of space orbits as a realm of war in which the respective armies confront each other and from which specific destabilization operations are launched. In this regard, former NATO Secretary General and member of the European Space Agency Advisory Group on Human and Robotic Space Exploration Anders Fogh Rasmussen recently declared that the war in Ukraine amounts to the first major conflict in which both sides have relied on spatial capabilities, though it will not be the last. Additionally, the involvement of private corporations – specifically space capitalists who have entered the promising new space economy – in war opens new scenarios for national governments and space agencies that traditionally own the monopoly of satellites either for civilian or military purposes.

Against this background, NATO member States recently acknowledged the defense and security implications of the aforementioned rapid space-related technologies advancements, both by embarking in the adaptation of their armed forces through tailored space commands and novel military services, and by enacting a collective space policy to orient the Allies' actions in Low Earth Orbits (LEOs) and in outer space.

Defense and security challenges in outer space: NATO responds

With a view to implement the role of space as an operational domain, NATO embarked on a precise path toward the enhancement of the Allies' awareness and common understanding of the space environment, as well as of its risks and security threats. As a matter of fact, the maintenance of situational awareness alongside a reliable access to space services remain firmly critical to ensure the correct unfolding of NATO's missions, activities and operations. For this reason, on the occasion of the 2018 Brussels Summit, NATO member States agreed to develop an overarching space policy, which was later adopted in 2019. Notably, during the June 2019 Defense Ministers' meeting and later in December at the presence of NATO Leaders in London, space was recognized as a new operational domain parallel to air, land, sea and cyberspace. Markedly, the space policy aims at ensuring a correct support to Allies' operations and missions in areas including communication, navigation and intelligence, which heavily rely on space-based support and therefore require greater consideration than in the past. Hence, outer space characterizes as a rather dynamic and rapidly evolving area, which underpins NATO's ability to maintain robust communications, to detect missile launches and to similarly ensure effective command and control, which therefore is considered essential to the Alliance's deterrence and defense capabilities. More precisely, NATO's 2019 space policy identifies a set of critical areas in which the strengthening of defense facilities results to be heavily required. These include positioning and navigation, which enables the tracking of force as well as rescue missions; early warning for the acquisition of information on missile launches; environmental mon-

itoring for mission planning; satellite communications; intelligence, surveillance and reconnaissance. In light of this, on October 22, 2020 NATO Defense Ministers agreed to establish a Space Centre at Allied Air Command in Ramstein, Germany, with the task of serving as a focal point to support NATO's activities, missions and operations. Moreover, the Space Centre coordinates Allies' efforts in the space domain by ensuring that Commanders preserve their capability to access required space data and services.

Nonetheless, of even greater importance is the June 2021 Brussels Summit Declaration, in which an unprecedented stress on article 5 of the NATO founding Treaty of Washington extended the possibility to invoke the abovementioned article in case of aggressions coming from the space environment. Literally, NATO Leaders stated that:

attacks to, from, or within space present a clear challenge to the security of the Alliance, the impact of which could threaten national and Euro-Atlantic prosperity, security, and stability, and could be as harmful to modern societies as a conventional attack. Such attacks could lead to the invocation of Article 5. A decision as to when such attacks would lead to the invocation of Article 5 would be taken by the North Atlantic Council on a case-by-case basis. (NATO, 2021)

Interestingly, a few months later this declaration was followed by a Russian missile test, which NATO countries unequivocally and undoubtedly interpreted as an act of military deterrence. Specifically, in November 2021 the Russian Ministry of Defense carried out a rocket launch aimed at demolishing a decommissioned Soviet-era satellite, later identified as Kosmos 1408. The action raised vigorous protests at the international level, as a cloud of over 1,000 scattered debris spread around the whole Low Earth Orbit. Remarkably, the destruction of Kosmos 1408 put the entire security system and Starlink's technical department on alert. In fact, continuous maneuvers have been implemented for months in order to avoid a possible collision of Space X satellites with orbiting debris, and a considerable quantity of propellant has consequently been consumed with a view to keep satellites in orbit, thereby inevitably reducing the quality of services offered by the company. The Russian Federation, which already intended to ban Elon

Musk's satellites throughout its territory for national security reasons, had to defend itself against international accusations according to which the destruction of Kosmos 1408 seriously endangered the International Space Station, where astronauts were promptly requested to perform emergency procedures by entrenching in the Soyuz and Crew Dragon capsules leaving for Earth in case of impact. This episode marked a further critical turning point for the Alliance, and it directly contradicted Russian Federation's allegations to oppose the weaponization of space tendency, which largely undermines the stability of the current framework of international space law providing for the preservation of the peaceful access and exploration of space for all humanity. As a consequence, at the June 2022 Madrid Summit the adoption of the Strategic Concept – a guiding document defining the Alliance's future security challenges alongside the political and military undertakings to assess them – NATO Heads of States and Governments reiterated the relevance of threats coming from outer space, committing to «enhance [the] ability to operate effectively in space and cyberspace to prevent, detect, counter and respond to the full spectrum of threats, using all available tools [...] and to boost the resilience of the space and cyber capabilities upon which [NATO] depend[s] for [its] collective defense and security» (NATO, 2022). From that occasion, space thus appears to be fully integrated into the Alliance's posture, in order to allow for a prompt, effective and precise capability to anticipate and respond to threats in a highly competitive domain.

In terms of concrete projects to enhance Allies' space security awareness, at the February 2023 Defense Ministers' meeting a group of NATO countries – together with former Invitee and now member State Finland and Invitee Sweden – agreed to establish the Alliance Persistent Surveillance from Space (APSS) initiative, which will contribute to the development of assets in the field of Earth observation with a view to obtain a clear illustration of eventual military displacements on the ground. More precisely, APSS is intended to intensify cooperation on space-based surveillance as a supporting instrument of NATO's overarching Space Policy. Similarly, the mechanism will establish a constellation of national and commercial surveillance satellites known as *Aquila*, which will provide real-time information on enemy forces movements, state of terrains and weather conditions, thereby contributing to NA-

TO's decision making process in times of war. Furthermore, there exist clear indications of NATO's integration of space in training, operational planning, innovation and capability development. As a matter of fact, NATO's Science and Technology Organization network has increased its action to enhance the scientific and technological capacity among its Allies and partners, with a focus on the operational advantages that could come from emerging space technologies and eventually contribute to the maintenance of its technological advantage over enemies. In this perspective, an investment of over 1 billion euros in satellite communication services for the period 2020-2034 will allow NATO forces to dispose of more resilient, quick and secure communications both in ships in the sea, with troops on battlefields and with air forces.

The militarization of space: strategic implications for Allied security

Alongside scientific opportunities, new vulnerabilities and potential threats can easily emerge from the use of outer space for non-peaceful and military purposes. In this regard, the hacking or jamming of satellites and the deployment of anti-satellite weapons into LEOs represents a case in point, with a high probability to affect the Alliance's ability to conduct operations. As a matter of fact, when strategic implications for NATO's security are concerned, space is usually addressed as an *enabling domain*, as it presents strong interconnections with other relevant security domains for the Alliance – especially cyberspace. The space-cyber liaison and the consequent spillover effects on security appear to be particularly evident with respect to satellites. Hence, images collected by satellite constellations are fundamental to provide accurate information on adversary armies' movements, and satellite data already proved to be essential for the transfer of knowledge to the battlefield – as in the case of the First Gulf War, which is usually referred to as the first space war. On that occasion, the US Army extensively relied on space assets to conduct operations at the tactical level, and to specifically detect strategic missile launches from antagonist forces. Eventually, the employment of satellite-based information contributed to the decisive triumph of the US-led forces. In continuity to that, at pres-

ent several NATO's most advanced systems result to be still dependent on space assets. Examples include the Alliance's Ballistic Missile Defence (BMD) programme, the Ground Surveillance System (AGS) and the Airborne Warning and Control Systems (AWACs). Moreover, in a report dating back to March 2020, NATO defined five core areas in which the inclusion of the domain of space emerges as a primary security frontier to ensure the Alliance's ability to defend its member States: positioning and navigation; integrated tactical warning and threat assessment; environmental monitoring; communications for command and control; surveillance and reconnaissance. In NATO's perspective, the abovementioned abilities are at the basis of deterrence, namely the capacity to respond to adversaries as a result of the Allies' preparedness to act. In order to achieve this, the Alliance must therefore have the possibility to observe, orientate and eventually decide. Indeed, the maintenance of resilient space infrastructures and the rapid management of vulnerabilities appear of greater importance in this sense.

Counter-space deterrence technologies: security threats from Russia and China

For the time being, a considerable restriction of NATO's ability to access and to freely operate in space could come from the Russian Federation and the People's Republic of China, where a vast number of counter-space technologies have been recently developed and tested. Russia remains one of the most crucial players in space owing to its longstanding experience which dates back to the Soviet Union. Indeed, despite USSR collapse in 1991, its inheritor Russia continues to affirm as the third largest spender in space, with an estimated budget of 4.2 billion dollars for the year 2018 alone and over 150 satellites launched in orbit in 2021. Nonetheless, there exists an enduring possibility that Russian space power may gradually wane, overshadowed by the successes of China and the United States. For example, with the involvement of US entrepreneur Elon Musk's company Space X and the success of launches into orbit on its own spacecrafts, in November 2020 Russia lost its long-established monopoly on transport flights to the

International Space Station. Similarly, structural problems at the domestic science and technology sector level and erroneous funds allocation are currently undermining Russian ascendancy in the space domain. In this regard, private space enterprises in Russia continue to maintain a huge gap with their US counterparts due to scarce innovation and rampant corruption. Within this context, the Russian Federation adopted two different stances with respect to the future of its space power. On the one hand, a new Vostochny Cosmodrome in Siberia has been manufactured both with the aim of replacing the Soviet-old Baikonur Cosmodrome in Kazakhstan, and of renewing the national space program. On the other hand, a renowned cooperation with China has been understood as a clear attempt to vary the spectrum of partners, as well as to oppose US and NATO dominance in space. Despite internal difficulties, the country undoubtedly possesses considerable space capabilities from a military standpoint, both in terms of ground infrastructures and of personnel.

In this perspective, NATO recognized a severe increase in the number and the capabilities of its space denial capabilities competitors. Among these, Russia appears among those opponents whose weapon systems could potentially harm the Alliance's space assets. Markedly, these weapons include kinetic physical counterspace weapons; non-kinetic weapons; electronic attacks against satellites and interference with radio-frequencies; cyberattacks. By far, kinetic physical counterspace weapons have received most of the attention, as tests of anti-satellite (ASAT) multiplied and more States acquired capabilities in this domain. For example, explicit allegations from NATO member States blamed Russia for employing its Soviet-era ASAT expertise to invest in various kinetic physical counterspace capabilities, and to consequently possess ASAT missiles which would be easily able to target adversaries' satellites. Similarly, Russia appears to be particularly experienced also in the domain of cyberattacks, which in this context could eventually damage NATO's ability to conduct operations in the field of security and defense.

Notwithstanding, in the Alliance's perspective major challenges would come instead from China, which strongly affirmed as the second world's space power with a constantly growing budget for space activities. Remark-

ably, in 2019 China was able to conduct more than 40 successful launches to put over 60 satellites into orbit, and to reach both one of the strategic Lagrange Points in outer space and the hidden face of the Moon. In a strategic perspective, during the last years the Chinese space program has been centered upon the creation of the BeiDou positioning, navigation and timing network of satellites. According to Chinese authorities, BeiDou constitutes an alternative to the USA GPS system and is part of China's Belt and Road Initiative, thereby directly assisting over 60 countries all over the globe. The consequent Chinese financing and the use of the BeiDou system would thus potentially generate a sort of control and dependency over related countries, thereby undermining NATO's role as a security umbrella for Western countries, also due to consistent investments in ground infrastructure and multifaceted cyber-espionage initiatives to acquire sophisticated Western technologies. Even though private space activities in China remain limited, a growing support by the government toward private commercial actor is currently emerging, mainly within the context of the publication of China's 30-year space objective to establish a permanent presence on the Moon and to mine space resources. Alongside economic purposes, China is however accelerating the modernization of its military space apparatus, with the development of advanced space denial assets. In particular, progress in China's non-kinetic capabilities and the ability to jam satellite communications has become one of Beijing's leading priorities, as confirmed by the official announcement of the creation of an airborne laser, which could be potentially employed against satellites. Notably, the described trends of a potential weaponization of space are occurring in a virtual international law vacuum, as the legal framework applicable to space activities hardly adapts to rapid technological developments, to the advancements in the commercialization of space and to the emergence of a wider set of private actors, which pose novel challenges to the traditional conception of space as an exclusive domain of governmental action. Especially for what concerns the field of security and defense, while the deployment of nuclear weapons in space are expressly prohibited by international space law treaties, no reference is made to other space-based weapons and interference with adversary countries' space assets, nor to the ban of ground-based ASAT missiles.

Conclusion: future scenarios in space security and defense

As the fields of security and defense have become increasingly dependent on space-based technologies, NATO member States should further reflect on the need to maintain space as a peaceful and cooperative environment, while ensuring at the same time the development of vast capabilities to secure the Alliance's ability to conduct military operations to protect its role as a Western security umbrella. Nonetheless, these objectives appear to be particularly complex due to the proliferation of national and private actors operating in space, as well as to the potential deployment of offensive weapons in outer space and LEOs.

For this reason, a joint approach appears to be the most effective solution to elaborate collective initiatives and standard definitions which would allow a common understanding of space-related security challenges.

Within this context, alongside the United Nations and the European Union, NATO could configure as an appropriate institutional forum in which to discuss common approaches and coordinated efforts in the space domain, thereby overcoming the current overlapping mandates of national and international space agencies and governments' initiatives which emphasize the risk of fragmentation of space regulation.

Eventually, an effective regulation of space shall not ignore the increasing competitive nature of space, and especially the consideration of the new defense and security challenges that especially concern NATO, which for this reason needs to keep itself updated and resilient in order to be able to quickly and jointly respond in the event of attacks of different nature coming from opposing armies and nations.

For these reasons, in light of the abovementioned considerations three specific scenarios should be contemplated while reflecting on possible NATO future approaches to an increasingly militarized and crowded outer space.

Above all, the emergence of private capitalists in space will in all likelihood contribute to the expansion of the actors who possess the capabilities to operate outside the terrestrial domain. As anticipated by the role played by private entities both before and during the conflict in Ukraine, these ac-

tor's capabilities inevitably invest also the military sphere, thereby opening to new destabilization perspectives to traditional space actors as States and armies, which ordinarily possess the monopoly of strategic space assets and especially satellites for intelligence and surveillance purposes.

Against this background, the acceleration toward a weaponization of space will further exacerbate the lack of an effective regulatory framework, as a legal vacuum for the supervision of private space activities still persists. Moreover, the existing international treaties and bi- or multilateral agreements applicable to States' activities performed in outer space permanently encounter difficulties in adapting to rapid technological developments, to the advancements in the commercialization of space and to the emergence of novel actors in the space domain. Most notably, within a context of legal uncertainty, controversial scenarios will open also in the field of security and defense. Hence, despite being nuclear weapons expressly prohibited in international space law treaties, no express ban of ASAT missiles or other space-based facilities which could potentially interfere with adversary countries' space assets for deterrence reasons is actually present.

As concerns space-faring nations, the increasingly solid deterrence capabilities of the Russian Federation and the People's Republic of China will undoubtedly influence the collective efforts of NATO member States in terms of policies, priorities and investment in the development of new defense capabilities. Therefore, it is possible to consider the adoption of the space policy and the inclusion of space as a new operational domain as a first relevant point of departure of the Alliance to ensure efficient support to ground operations and missions in the area of communication, navigation and intelligence, among others. Nonetheless, there is a concrete possibility that in the near future NATO member States will further concentrate their common efforts on the development of advanced capabilities in various areas connected with outer space and especially Low Earth Orbits, with a view to maintain its strategic advantages in the field of security and defense, as well as to anticipate deterrent actions from enemy countries.

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