



## THE IMPORTANCE OF EMERGING AND DISRUPTIVE TECHNOLOGIES IN THE MILITARY FIELD

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### ABSTRACT

Nowadays, society is in a continuous transformation under the impact of developments in the international security environment. On a global level, in parallel with the expansion of the phenomena associated with globalization, we are witnessing an attempt to redraw the spheres of influence and to change the world order. Under these conditions, humanity is getting closer and closer to the state of conflict, a fact also proven by the multiplication of local and regional conflicts, with the potential for expansion, and NATO and the EU must find solutions to maintain their superiority in all areas and especially in the military field. A solution to the challenges that characterize the current global situation is the development of emerging and disruptive technologies and their use in the military field, which allows surprising the adversary, ensuring one's own security and maintaining action and decision-making superiority.

**Keywords:** emerging, disruptive, warfare, NATO, technology

### INTRODUCTION

Today's society is passing through an extremely dynamic period, with a high degree of volatility and unpredictable evolution. Global tensions are rising exponentially, and potential conflict zones are multiplying. In most regions of the globe, events are unfolding quite rapidly, and the way they unfold leads us to the idea that a regional conflict with world implications or even a global conflict is almost inevitable. On a global level, we can identify a tendency to deny the rules-based world order and the attempt to create a new world order, in which the place of the great powers will be taken by other entities, either emerging powers with regional aspirations and interests, or organizations and non-state entities. It is certain that the Western bloc is being contested more and more, and some states are preparing to assert themselves on the world level by all the means at their disposal, including violent means. The supremacy of the US and of NATO on the global level is strongly contested by China and Russia, but we also observe the emergence of new sources of tension, fueled either by the great global powers or by other states that want to assert themselves on the international stage. Sources of conflict multiply and potential crises grow in complexity. Thus, in Europe, in addition to the classic sources of conflict, in the states of the former Yugoslavia, we are witnessing the unfolding of a bloody conflict that has already been going on for over two years and that will not end in the near future. This ongoing conflict between Russia and Ukraine will completely change the security architecture in Europe, regardless of how it ends. In Africa, we are witnessing the decline of the influence of the Western European states and the increase of the influence of Russia and China, in parallel with the increase in the importance of terrorist organizations, which endanger the stability and security of the North African states. In the Middle East, in addition to the civil conflict in Syria, the instability in Iraq, the systemic problems in Lebanon, we are witnessing an increase in tensions between Israel and Iran, which together with its proxies ( Hamas, Hezbollah, the Houthi rebels) are trying to destroy the Jewish state and to become a regional power with global ambitions. In South and Southeast Asia, tensions are rising, and the main source of them seems to be China, which wants to challenge the influence of the US and at the same time gain strategic advantages in relation to its neighbors. China

disputes borders and spheres of influence and has unresolved issues with the Philippines, Japan, Taiwan and other states, while tensions on the Korean peninsula are far from abated. Also, there are historical tensions between India and Pakistan, between India and China, etc. which can put pressure on the state of regional balance and give rise to conflicts. Even the Arctic region, a region that until a few decades ago did not represent an area of confrontation, is beginning to be militarized and arouse the interest of the various powers. South America, until now a fairly stable area and free from major confrontations, which was sheltered from the first and second world wars, is beginning to feel the effects of instability, through internal and external tensions that have primarily Venezuela as the main actor. Basically, the entire planet is moving towards a state of conflict as it tends to replace cooperation and dialogue with confrontation and the achievement of objectives through the use of violent means. The evolution of technology opens up new opportunities, but also raises new challenges for the security of states and for global security. The emergence and development of the informational dimension, in addition to the opportunities it offers, highlights the vulnerabilities of states and gives rise to a new space for confrontation. Also, in the current security context, modern technologies are gaining increasing importance and offer increased possibilities to surprise the adversary, to achieve action and decision-making superiority and to fulfill political and military objectives. “Modern warfare has continuously evolved, with technological advancements shaping its conduct. Critical technologies like cyberspace and artificial intelligence are making new warfighting tools available, even as traditional ones like nuclear weapons are witnessing a resurgence. These changes have brought greater lethality and destruction in warfighting and blurred the lines of conflict, with direct warfare being replaced by new forms such as hybrid warfare or grey zone tactics (where the threat has diffused, and proxy actors have taken the lead)” (Rajagopalan – Patil, 2024, p. 7).

## **GENERAL CONSIDERATIONS ON EMERGING AND DISRUPTIVE TECHNOLOGIES**

In order to continue to hold regional and global superiority, some states or international organizations increasingly emphasize the development of emerging and disruptive technologies, seen as a way to defeat any adversary and deter potential aggression. The development of these technologies involves huge expenses, attention to scientific research, vision and creates the conditions for obtaining strategic advantages in the medium and long term, and for shaping the international security environment, seen as an essential component of international relations, deeply influencing global politics, stability and prosperity of nations. This environment is characterized by a multitude of factors that, interconnected, determine the degree of safety and the risks to which states and other international entities are exposed and can be defined as the multidimensional space of historical, military, cultural, economic, institutional, geopolitical developments that have impact on human communities, which conditions the level of protection of the individual, the community, the state, the area, the region while promoting their own interests (Stăncilă, 2011, p. 42).

The international security environment behaves like a living organism, which is constantly searching for a state of equilibrium and which, nowadays, is subject to enormous pressures, which may have the effect of destabilizing it (Cîrdei, 2015, p. 32), economically, socially, politically, but also militarily. The security environment can be destabilized by the actions carried out by legitimate or illegitimate actors, carried out both in the physical and in the cyber environment, by using conventional or hybrid means.

Unprecedented technological development determines the evolution and transformation of society, climate crises intensify, geopolitical tensions increase and multiply, expand to more

and more regions, strategic ambiguity and instability encourage state or non-state actors to challenge the current world order, economic, cultural and military competition between the great powers is ever greater and with a higher stake, threats are multiplying and taking on new forms of manifestation, and all these represent new risks and challenges for global peace and security (Grand-Clément, 2023, p. 11) and have the potential to reshape the international security environment. Current events and how they will be understood and managed have the potential to change the face of the world and transform the international security environment, which will reach a new state of equilibrium, whether through violent confrontations, as was the case the two World Wars, either through cooperation and dialogue.

In today's context, emerging technologies play a vital role in transforming warfare and defense. Their use provides competitive advantages, improves defense capability and facilitates interoperability between the armed forces of NATO member states. For example, artificial intelligence and machine learning enable the rapid analysis of large volumes of data to identify threats, anticipate adversary movements and optimize military responses. Similarly, quantum computing technologies can improve the encryption and security of communications, providing a more robust defense against cyber-attacks. “Emerging technologies are technologies whose development, practical applications or both are still largely unrealized, so that they become figuratively prominent from a background of nonexistence or obscurity. These technologies are generally new, but also include older technologies that are still controversial and potentially underdeveloped. Emerging technologies are often perceived as being capable of changing the status quo” (Udrescu - Siteanu, 2021, p. 300). Emerging technologies have a very high potential to change the way conflicts are carried out, can provide a major advantage to the party using them, and can even have a deterrent effect on aggression or military action. Even though they are not completely new, these technologies produce major effects through the innovative way in which they produce their effects and the superior level of knowledge behind them.

The development of emerging and disruptive technologies in the military domain is a necessity to be able to maintain superiority and to ensure optimal means of deterrence. The possession of disruptive technologies with military use allows obtaining and maintaining supremacy, surprising the adversary and dominating the multidimensional space of confrontation. Disruptive technologies provide an initial advantage to those who implement them but also force continued exploration to maintain the advantage and at the same time represent the engine of innovation because those who are directly affected by the effects of these technologies will seek new ways to counter or overcome them, which means continuous progress. We believe that this race of technological development, of supremacy in all fields, will end only when disruptive technologies get out of control and destroy human society, throwing it hundreds of years into the past. Currently, nuclear weapons have this potential, but artificial intelligence can be just as dangerous (Bojor - Cîrdei, 2024, p. ).

“Emerging technologies are increasingly being presented as having disruptive effects on security and defense, both in the civilian and military environments” (Csernatonni – Oliveira Martins, 2023, p. 1) and “refer to cutting-edge and inventive technologies that are currently developing or have been recently introduced. Some of the new technologies include artificial intelligence, 3D printing, the Internet of Things, blockchain, and others. These technologies have transformed the methods by which military strategies are formulated” (Junaid, 2024). These emerging and disruptive technologies must not scare us, due to the way they can influence the evolution of events and how they can affect the current way of thinking and acting in all fields and especially in the military field, but must cause a paradigm shift and trigger a process of adaptation to the new conditions.

Modern disruptive technologies, used in the military field, offer a decisive advantage in front of the adversary, who will not have effective countermeasures, but, at the same time, they

involve essential changes both in terms of the way of thinking, but also in the military organization in order to obtain the maximum of benefits from these technologies. “The use of disruptive technologies accentuates the asymmetric and hybrid character of military confrontation by creating a fracture, a fault in the way of thinking and acting. The use of disruptive technologies belongs to the category of hybrid methods of waging war and creates the conditions for achieving strategic surprise and reducing the opponent's desire to fight, affecting the morale of fighters, political and military decision-makers and the population” (Cîrdei, 2024, pp. 2 - 3) and creating the conditions for achieving success in the actions carried out through the combined effects it can have and through the difficulty of countering them. “The interaction and synergy effects of concurrent developments within multiple technologies and multiple applications also create convergence effects that are both unpredictable and potentially disruptive in nature” (Mayer, 2023, p. 64). For these reasons, many states have become aware of the importance of emerging technologies for ensuring dominance in the international arena and have begun to invest money, time and effort to understand and develop these technologies. Thus, at the level of NATO and the EU, efforts can be observed to discover new technologies that can be used in the military field, to regulate this niche field and to identify ways to control and counter them.

## **EMERGING AND DISRUPTIVE TECHNOLOGIES AT NATO AND EU LEVEL**

As next-generation technology evolves and becomes more present on the battlefield, connections will be established between emerging technologies, which will begin to interact under human control or independently. Interactions between emerging technologies could also enhance existing military capabilities or lead to the emergence of new capabilities – with unexpected consequences for the conduct of military action and strategic stability (Congressional Research Service, 2024, p. 30). In addition, emerging military technologies, especially those based on artificial intelligence and autonomous weapon systems, can produce unintended and unpredictable consequences if they do not perform according to established parameters, consequences that can range from mission failure to various forms of violations of international humanitarian law and the fundamental rights of citizens and other non-combatants who must be protected.

At the EU level, increased attention is paid to emerging and disruptive technologies and the impact they can have on member states. The European Union plays a key role in the development of emerging and disruptive technologies, recognizing their importance for economic growth, citizen security and Europe's technological superiority. The EU aims to promote innovation, support research and development and ensure the responsible adoption of these technologies to boost Europe's competitiveness on the global stage and improve its strategic security.

The European Defence Agency identifies 6 disruptive technologies that must be treated with due care and which can have both civilian and military uses (Clapp, 2022): quantum technologies, artificial intelligence, autonomous robots and weapon systems, big data, hypersonic weapons systems and space technologies and advanced materials, while the US adds to this list directed energy weapons and biotechnology. In order to support research and innovation in the field of emerging technologies, the EU emphasizes the funding of research in the field of emerging technologies, through the implementation of the Horizon Europe program and the granting of structural and cohesion funds to support the development of emerging technologies, it tries to regulate the main aspects related to the development and the responsible use of emerging technologies, promoting international collaboration and partnerships, with a focus on cooperation with NATO and the US, supporting the maintenance of the EU's

technological superiority and autonomy, etc. Through these actions, the EU aims to secure a leading position in innovation, boost economic competitiveness and guarantee the security and well-being of European citizens.

The European Union's vision on emerging military technologies is to develop and use these technologies in a way that strengthens European security, strengthens Europe's strategic autonomy and respects the EU's fundamental values, such as human rights, democracy and the state of law. The EU aims to promote innovation and defense cooperation between Member States, improve defense capabilities and ensure interoperability between Member States' armed forces. The key elements of the EU vision regarding emerging technologies in the military field are:

- Consolidation of Europe's strategic autonomy by reducing external dependencies, developing own military capabilities;
- Promoting cooperation and integration between member states by favoring cooperation through joint programs and creating a common defense market;
- Promoting responsible and ethical defense innovation;
- Improving cyber defense capabilities;
- Promoting space security;
- Adapting to new threats and hybrid conflicts;
- Supporting cooperation and common defense and security policy.

The EU's vision of emerging military technologies is geared towards developing advanced capabilities that strengthen European security and enhance strategic autonomy, while maintaining a firm commitment to the Union's fundamental values and principles. This involves strategic investment in research and development, regulating the use of emerging technologies, promoting cooperation between member states and protecting critical infrastructures. The EU aims to be a global actor capable of responding effectively to emerging threats and contributing to the maintenance of international peace and security.

Emerging and disruptive technologies have the potential to fundamentally change the world and implicitly the way military actions are conducted. In order to maintain its military superiority and to be able to meet its objectives, NATO must adapt and change the way it approaches military operations as innovative technologies provide new opportunities for NATO armies, helping them to become more efficient, more resilient and sustainable, but at the same time represent new threats from state and non-state actors.

In a similar approach to the EU, NATO focuses on nine areas of interest in terms of disruptive technologies (NATO, 2023):

- Artificial intelligence;
- Autonomous weapons;
- Military quantum technologies;
- Biotechnologies and human power amplifiers;
- Hypersonic systems;
- Space technologies;
- New/revolutionary materials;
- Energy and propulsion;
- New generation communication networks.

Emerging and disruptive technologies such as cyberspace, artificial intelligence and quantum computing are changing the way the world works. From a military point of view, such technologies present both opportunities and challenges. They enable militaries to become more

effective and resilient, but they also change the nature of warfare, opening up new domains of potential conflict (primarily outer space and cyberspace) and allow state and non-state actors to operate at a faster and unprecedented scale, both within the parameters of what is considered conventional conflict, but also below that threshold within the "gray zone" (hybrid or asymmetric warfare) (Mills, 2023, p. 7).

To date for the US and its NATO allies, dominance in the conventional spectrum of warfare has been possible due to technological advantage in precision and speed of engagement, due to stealth capabilities, tactical intelligence, superior research, surveillance and reconnaissance capabilities relative to opponents. To ensure their dominance in the 21st century, NATO states must maintain their technological advantage and continue to develop innovative and revolutionary capabilities, in conditions where adversaries will increasingly challenge the dominance of Western states, promote revisionist actions and seek to gain access to or develop emerging technologies that challenge Western supremacy and even give them a strategic advantage. To meet the challenges, NATO states must maintain a conventional warfighting capability with deterrence potential and continue to develop new technologies that allow them to maintain strategic advantage and develop anticipatory policies and strategies, adapted to the international context. The technological superiority of the Western states is evident at this moment, when we see that the modern weaponry donated to Ukraine poses serious problems for the Russian army on the Ukrainian front, but the adversaries or potential adversaries of the US and NATO are making efforts to reduce this technological gap and even to advance the aforementioned states in terms of the level of technologies used in the military field. This gives rise to a race of research, innovation and even an arms race similar to that of the Cold War.

The future way of waging war will be shaped by geopolitical, societal, technological, economic and military trends. However, many of the future threats the Alliance will face will result from technological developments. Emerging and disruptive technologies can revolutionize future military capabilities and the ability to wage war. Therefore, the promotion of technological innovations and their timely introduction into the military will play a major role in the development of the military capabilities of NATO countries (Fridbertsson, 2022, p. 1).

NATO's adoption of emerging technologies is not without its challenges. Firstly, there is a problem of interoperability between the technological systems of different Member States. Also, the implementation of emerging technologies requires significant investment in research and development, as well as in personnel training. In addition, NATO must take into account the ethical aspects of the use of certain technologies, such as AI, which may raise questions about the accountability of automated decisions during conflicts.

On the other hand, the global competition for technological supremacy is another challenge. Rival states such as Russia and China are investing heavily in developing their own advanced technological capabilities, forcing NATO to accelerate its innovation efforts to maintain its strategic advantage.

To address these challenges, NATO has launched several strategic initiatives. In 2019, the NATO Innovation Hub was established, a center dedicated to the exploration and development of new technologies. In addition, the Alliance has created a formal strategy for emerging and disruptive technologies, which sets priorities for research, development and deployment.

NATO also promotes collaboration between the public and private sectors, including with start-ups and technology companies, to facilitate innovation and rapid adoption of new

technologies. For example, the NATO Innovation Program provides funding and support for innovative defense and security projects.

NATO's use of emerging technologies is a crucial factor in ensuring international security and stability in the context of current and future challenges. Although the adoption of these technologies involves many challenges, the opportunities offered by artificial intelligence, cyber warfare, autonomous drones and quantum technologies can transform NATO's defense capabilities and strengthen the Alliance's position in the face of global threats. Through the initiatives and strategies adopted, NATO demonstrates an openness and continuous adaptability in the face of technological changes, thus ensuring a competitive advantage on the international stage. "The implications of emerging technologies for warfighting and strategic stability are difficult to predict, as they will be a function of many factors, including the rate of technological advancement, the manner in which emerging technologies are integrated into existing military forces and concepts of operation, the interactions between emerging technologies, and the extent to which national policies and international law enable or inhibit their development, integration, and use. Nonetheless, many emerging technologies exhibit characteristics that could potentially affect the future character of war" (Congressional Research Service, 2024, p. 30). The future of emerging and disruptive military technologies revolves around the development and integration of advanced innovations that will transform the way conflicts are conducted, defense strategy and global security. As emerging technologies continue to advance, they will redefine both military capabilities and threats to national and international security. These developments will have a significant impact on the tactics, doctrines and organization of armed forces globally. While these technologies offer significant opportunities for improving military security and efficiency, they also bring ethical, regulatory, and security challenges that must be carefully addressed. The armed forces of the future will need to combine technological innovation with an adaptive defense strategy to maintain strategic advantage and protect national and international security.

## **CONCLUSION**

Emerging and disruptive technologies used in the military field have the potential to be a game changer through the implications they can have on military art, in terms of how we think and act. However, emerging technologies are not a silver bullet, a magic solution for winning any conflict because they are quite expensive and their widespread use is not yet sustainable. Also, potential adversaries will develop their own technologies and try to identify countermeasures so that the impact of the technological advantage is reduced as much as possible. In addition, faced with an adversary with a far too high technological level, the opponents will seek asymmetric means of confrontation, will try to adapt, to use on a large scale the tactics specific to hybrid warfare. NATO and EU states must continue efforts to develop technology and do everything possible to maintain their technological advantage regionally and globally, because in this way they can achieve their goals and maintain peace and stability. In parallel with continuing efforts to develop and improve emerging technologies, NATO and EU states must also focus on identifying the best ways to counter the emerging technologies of possible adversaries, both in the physical and cyber environments.

Countering emerging and disruptive technologies in the military requires a complex and multidimensional approach, given the speed with which these technologies evolve and their ability to fundamentally change the nature of conflicts. Countermeasures may include developing new defensive technologies, adapting military strategies, and creating international policies to regulate the use of these technologies. Efforts must be directed towards developing anti-drone and anti-missile defense technologies, strengthening cyber security and defensive

cyber warfare, developing capabilities to defend against hypersonic weapons, creating countermeasures for artificial intelligence, controlling space technologies and protecting assets orbitals, the use of augmented and virtual reality for counter-technologies, the development of international regulatory policies and military diplomacy, the improvement of military response and resilience capabilities, the development of anti-camouflage and misidentification technologies, etc.

Countering emerging and disruptive technologies in the military requires a combination of technological innovation, strategic adaptation and international collaboration. Developing advanced defensive technologies, strengthening cyber security, adapting military tactics and initiating international treaties are essential to ensure national and global security in the face of these emerging threats.

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