

CHALLENGES AT NATIONAL LEVEL REGARDING ENHANCED MILITARY MOBILITY CAPACITY IN THE FRAMEWORK OF IMPLEMENTING THE MULTI-DOMAIN OPERATIONS CONCEPT

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Abstract: *The way conflicts are handled has changed significantly today compared to the image we have of them from a century ago, for example. We can already state that some concepts, such as “joint”, have been replaced, and multi-domain operations seem to be a more effective alternative and a much better adapted response to current threats. However, the combat force continues to play an essential role in military actions, and their deployment in key locations in the area of operations remains a challenge that requires quick responses from both military and civilian leaders. Considering the current security situation, this paper aims to address the topic of military mobility from the perspective of multi-domain operations’ implementation at the NATO level and to identify support needs at the national level for optimizing the force deployment process.*

Keywords: *military mobility; multi-domain operations; civil-military cooperation; operational domains; intergovernmental approach.*

Introduction

Multi-domain operations (MDO) represent NATO’s current approach to future military action. The Alliance quickly recognized the need to replace joint operations with the modern dynamics of multi-domain actions to maintain security and predictability in the transatlantic region. By adopting this new concept, NATO directs its efforts across all fields, operating domains, and environments.

Given the speed with which new doctrine and regulations regarding multi-domain operations are being applied, we see a need to adapt some processes so they meet current and future dimensions of war-fighting. One such process is the deployment, which takes into account all aspects regarding the efficiency of military mobility.

The operational maneuver, the level at which the MDO is most productive and best organized, refers to the organization, deployment, and the use of forces within the joint area of operations to create complex situations from which the enemy cannot escape, thus affecting the rhythm of its operation and destroying its cohesion (Mayer 2023).

By analyzing this last phrase, we can understand the importance of military mobility in the evolution of multi-domain operations. Although it is a long-term project that requires an initial approach at the NATO level so that it can then be integrated and embraced at the level of each member state, increasing the military mobility capacity in the context of the MDO development is a necessary action.

The deployment of troops in the transatlantic region presents challenges not only at the NATO level but also at the national level, owing to the lack of standardization among member states regarding transport networks, insufficient cross-border connections, bureaucratic obstacles that result in lengthy waiting times for military convoys, and restrictions on certain types of transport on European roads. Nevertheless, given the increasing number of troops stationed in the European area,

especially on the Eastern flank, the urgent need for measures to remedy these problems and allow the rapid involvement of troops in multi-domain operations is evident.

This paper aims to identify the main issues that NATO member states, particularly Romania, face when developing two relatively new concepts: military mobility and multi-domain operations. Considering that time poses another significant challenge in a war being fought on NATO's borders, member states must work individually and collectively to find the most effective solutions to the identified problem.

The research will have the following structure: a first chapter in which the author aims to highlight the main reasons for ensuring mobility in military operations; a second chapter that presents the potential effects that the implementation of MDO can have on military mobility; the third chapter describes how military mobility materializes within each of the five domains of the MDO; and a final chapter intends to identify the national challenges that impact military mobility in the context of developing multi-domain operations. At the end of the paper, there shall be outlined some relevant conclusions regarding the researched topic.

The primary research method is documentary analysis, through which it will be examined numerous scientific sources, including articles, books, regulations, doctrines, online publications, and official documents, to identify relevant solutions for the proposed subject.

Although there is currently a relatively vast bibliography on the two key points of the research, namely military mobility and multi-domain operations, we believe that we might face certain constraints in advancing these subjects from a national perspective, as both issues have been intensely debated and analyzed at the NATO level and less from the viewpoint of individual states.

1. The Critical Importance of Ensuring Mobility in Military Operations

The military mobility is a concept that evolved significantly after Russia's initial aggressive actions on Ukraine, which concluded with the annexation of Crimea. The primary organizations that have recognized the importance of ensuring mobility during military operations were the European Union and the North Atlantic Treaty Organization.

In general, the military mobility refers to the capacity to transport personnel and military equipment over various distances, including across national borders, while considering logistical and infrastructural factors.

In its official documents, the EU defines military mobility as "the movement of military personnel and assets from one location to another, including across national borders, using various modes of transport" (European Defence Agency 2019). On the other hand, NATO refers to this term as "the quality or ability of military forces to move from one place to another while maintaining their ability to carry out their primary mission" (NATO 2013).

After analyzing the two definitions, we can see that both emphasize the movement of forces within or across borders to achieve a predetermined objective. The difference is that while the EU is a non-military organization, NATO focuses on the rapid and safe transport of military forces and equipment for military purposes.

Overall, the EU's efforts and funds to develop an efficient transport infrastructure network are proving effective. NATO can swiftly deploy its troops almost anywhere in the transatlantic region and organize military operations without facing obstacles in the deployment process.

Broadly speaking, military mobility entails a collaborative effort from NATO's own or joint military structures and practical inter-agency and civil-military cooperation to ensure the efficient transport of oversized loads over bridges and across varying road conditions, whether by air or sea.

After the launch of the Russia's aggression against Ukraine in February 2022, NATO forces significantly increased their presence in the states along the eastern border of the organization. To enhance its deterrence and defense posture, the Alliance has expanded its troop presence through multinational battle groups in Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and

Slovakia. In addition to the equipment and military personnel deployed on land, NATO has also sent military ships and aircraft to the region (NATO 2024). According to this idea, it was decided to upgrade its multinational battle groups to brigade-level, which require greater efforts to transport all types of equipment and vehicles to the Eastern states. For example, Germany will send, starting with 2025, a brigade of 4,000 soldiers to Lithuania (Hartmann 2024), and France has already begun advertizing its own brigade stationed in Romania at the National Joint Training Center in Cincu (Chapleau 2025). These deployments imply significant actions from a logistical perspective, immense pressure on transport capacity, and additional measures from cross-border structures, national entities that monitor military transports, or inter-institutional organizations involved in this process.

Military mobility is essential for military operations and requires significant attention from a logistical standpoint. Currently, the timing for military actions is extremely short. Meanwhile, the operational environment extends beyond internal borders. Present confrontations mainly occur in the economic, media, informational, or spatial fields. This is precisely why logistical support must be enhanced and adapted for modern warfare. This ensures that force mobility is effective in this operating space where time stretches, distances expand, and the pace is rapid (Mazilu 2022).

The importance of military mobility in NATO operations and missions also arises from the link between this term and others that are illustrative for the deployment process, such as Reception, Staging and Onward Movement (RSOM), Host Nation Support (HNS) and NATO Force Integration Units (NFIUs). To facilitate access to its own transport capabilities, including specific actions related to transporting personnel, equipment, and military materials during the RSOM process, each NATO member state must provide HNS to the respective military structures executing the deployment based on agreements or memoranda.

RSOM is a complex process aiming for foreign troops transiting or stationing in the national territory. It involves specialized forces and means to facilitate the transport of those troops so that they are integrated in the final phase and can execute joint or multi-domain operations (Angiu 2022). Depending on the situation, RSOM is carried out on the host nation's territory through its own civil or military structures. At the Romanian level, the established movement control structures within the units intended for RSOM, together with those of the National Support Element (NSE), ensure the necessary support and facilitate the fulfillment of customs formalities for the military forces who want to transit or to place in Romania (Guvernul României 2014).

Theoretically, HNS constitutes "the totality of logistical, financial, legislative and procedural support actions, which define the civil or military assistance provided by the host nation to foreign armed forces stationed, entering/exiting, operating or in transit on the national territory of HN" (Ministerul Apărării 2008).

The tasks of the logistic capabilities that ensure the support of the host nation at the time when the foreign forces executed the deployment in their own territory consist of warranting:

- an optimal legislative framework for the conduct of military operations;
- HNS specialty assistance in support domains;
- CIMIC coordination and cooperation;
- access to resources;
- expert assistance in the fields of finance and procurement;
- HNS liaison personnel;
- Collaboration with NATO headquarters and sending nations during HNS planning

process (Ministerul Apărării 2008).

NATO Force Integration Units are structures within NATO designed to coordinate military transports on the territory of the host nations in which they are located to facilitate the movement of allied forces within national borders. The main tasks are to facilitate the RSOM process and provide assistance in the planning of the deployment (NATO 2022). These units are also engaged in other specific activities, such as the identification of infrastructure, logistic support, the road network and other necessary and available means that would improve the NATO deployment process (Botik and

Mazal 2022). There are eight Force Integration Units in NATO, positioned on the Eastern flank, as follows: in Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Romania and Bulgaria. They were created following the decision taken at the Wales Summit in 2014 as part of NATO's Rapid Reaction Plan (NATO 2024)

Other essential elements for facilitating the movement and transport of troops according to a well-organized plan include cooperation among member states to harmonize military mobility at the international level and collaboration among all national institutions at both the political and institutional levels through representatives from transport structures (Van Heoymissen 2023). When collaboration between all involved actors is effective, the transfer of information is achieved more efficiently, significantly reducing waiting times and providing an overview of the position, composition, mission, and role of troops executing the deployment.

The legal framework for military forces crossing European borders includes numerous agreements and memoranda signed between the states in the trans-Atlantic space or at the NATO or EU level, through which their military forces can enter, transit or station anywhere in the territory of the signatory state. At the moment, a standardization of this framework is being attempted, such as the implementation of the 302 Form in digital format, the creation of Military Requirements according to the EU directives provided for in the Action Plan 2.0 or the optimization and collective monitoring of customs activity, by all European states.

Although the current period is challenging on an international level, with security threats constantly evolving and increasing and the funds and resources of each state being limited, investments are necessary for military mobility and the efficiency of logistical support. Even at the political level, decisions regarding establishing new ammunition or fuel depots and transport networks that are particularly important to the military actor are crucial for ensuring the forces' successful fulfillment of military missions. Military mobility is not an issue that can be resolved solely by allocating resources or investing in dual-use infrastructure. The logistical approach, encompassing both military and civilian aspects, is equally essential to protect transport infrastructures, replenish stocks, and establish anti-missile defenses. In turn, civil authorities can improve the efficiency of military transports and facilitate the movement of equipment on the same routes used by commercial transports so that deployments no longer take months. Still, they can be completed in just a few hours (Fiott 2024).

The transport network in the Eastern states is underdeveloped compared to other European states. Road and rail transport create challenges during deployment. While investments in enhancing military mobility are made, they occur over very long timelines in a context where time is virtually an adversary for military forces. The European TEN-T network covers almost all of Europe, facilitating the movement of troops from one location to another despite delays in the inauguration of numerous highways, express roads, railways, and more. In other words, having adequate transport infrastructure is essential for supporting military operations, and failing to adhere to established schedules for troop deployment can even lead to mission failure.

2. The Impact of Implementing the Multi-Domain Operations Concept on Deployment and Military Mobility

The 'multi-domain' concept has recently emerged in literature and military doctrine, beginning with NATO and subsequently at the level of each member state. Through multi-domain operations, NATO can strategically influence the evolution of events and ensure the synchronization of the Allies' collective efforts to surprise the adversary. These operations equip the Alliance to operate across all domains and environments (ACT 2023).

According to the common understanding offered by C. Ioniță, the term MDO refers to "the approach of the future war (2025-2050 period) beyond the joint level, represented by joint operations

(land, air and naval), incorporating two new recognized operational domains (space and cyberspace” (Ioniță 2022).

Multi-domain operations represent a modern alternative to military action. The US took the initiative and developed a doctrine of MDO - Field *Manual 3-0*, which emerged in October 2022. According to it, multi-domain operations are “the combined use of assembled forces to create and exploit relative advantages to achieve objectives, defeat enemy forces and consolidate gains, in favor of the commanders of the joint forces” (Department of the Army 2022).

In NATO, the concept of MDO refers to “the orchestration of military activities, in all environments and domains, synchronized with other non-military activities, to enable the Alliance to create convergent effects so that they are relevant” (NATO ACT 2022). This relatively new initiative will significantly enhance NATO’s ability to deliver defense and deterrence in the medium and long term since the regional plans approved at the Alliance level are grounded in concepts from this area. By integrating air, land, maritime, cyber, and space capabilities, NATO enhances its ability to operate as a multinational coalition. A crucial aspect that the Alliance is considering while evolving the MDO involves the use of artificial intelligence (AI) to ensure logistical efficiency and expedite the development of dual-use transport infrastructure in the event of high-intensity conflicts.

In the upcoming period, NATO’s plans and directives emphasize the need to expand the MDO concept through experiments, training, exercises, war-gaming, and capability development to establish a similar mindset and resources among all military and non-military entities, ensuring synchronization and efficiency across all domains. For all these activities to occur, we must emphasize the importance of military mobility and its role in ensuring the rapid movement of forces. The time available for allied troops is limited, and the deployment process, regardless of how it is carried out, must be adapted to current requirements based on the capabilities of each member state. For example, the French troops planned and executed the ‘Orion’ exercise in May 2023 to adopt and understand this term. It was conducted in several phases and culminated in an operation to synchronize capabilities such as tactical vehicles, unmanned aerial systems (UAS), and space sensors in response to a multi-domain conflict simulation scenario (Machi 2023). Another exercise, organized much earlier by the US in 2021, was conducted by the US troops in Wiesbaden, Germany. This exercise tested the functionality of the ‘United States European Command Multi-Domain Task Force’ and the ‘Theater Fires Command’, evaluating how control and coordination of these structures are conducted during artillery strikes (Minculete 2023).

Multi-domain operations bring numerous changes to deployment and military mobility. Firstly, in the event of a conflict, the defense of all types of infrastructure will be achieved through a partnership between the government and the private sector, where the latter will assume some operational activities. The public-private sector will support NATO's military operations, particularly from a logistical perspective.

Secondly, deployed forces will benefit from dynamic support. Logistics planners are considering deploying a resilient, dispersed logistics infrastructure to avoid targeting by adversary satellites and withstand long-range strikes. There are ongoing discussions about the logistics capacity to compensate for transport efficiency if civil infrastructure such as railways, bridges, pipelines, or roads is damaged. One solution could be to utilize AI capabilities to ensure the reorganization of transport on alternative routes when the main lines of communication are no longer usable.

Thirdly, the MDO planning considers the number of forces deployed on the Eastern flank in the event of a confrontation with Russia and those that should be rapidly deployed within the NATO Force Model. While multinational brigades are in a process to be established on the Eastern flank, NATO may face challenges deploying around 100,000 forces in 10 days within echelon 1, as their mobility could present difficulties. Given this situation, the forces within the MDO are equipped with modern weaponry featuring superior capabilities, which provide anti-aircraft protection against the enemy's missiles and ammunition (Kramer, Dailey and Brodfuehrer 2023).

While technology has advanced significantly and artificial intelligence appears to be transforming the development of military weaponry, vehicles, and devices, multi-domain operations still encounter challenges ensuring swift troop movement, particularly on land. This issue significantly impacts NATO's European forces, which face difficulties related to their deployment capabilities (Ellison and Sweijs 2024).

Multi-domain operations specifically integrate an inter-governmental approach, essential for advancing military mobility. This perspective is crucial because a potential conflict on NATO territory would encompass various aspects of governance and society, not just the military sector. For instance, civil defense, law enforcement, emergency services, critical infrastructure, media, and the commercial industry could all play significant roles in achieving victory. This same approach is applied to the growth of military mobility, suggesting that both concepts may evolve simultaneously (Withington 2024).

Given that multi-domain operations co-occur across the strategic, operational, and tactical frameworks, cover nearly all activities within a state - from bureaucracy to governmental or civil-military measures - and exploit every opportunity at the highest level, their implementation provides NATO with a solution to more effectively address potential conflicts in all operating domains and environments.

Future operational concepts must ensure the Alliance's ability to execute multiple complex tasks, whether in peacetime or conflict, regardless of the circumstances or conditions. Consequently, NATO must understand the ever-changing environment and develop strategies that provide an operational advantage, such as in multi-domain operations.

3. Analysis of Military Mobility Through the Five Operational Domains Lens

The interconnected approach within NATO across the five domains is significant because it enables each structure to prepare, plan, organize, and execute activities in a synchronized manner, whether individually or collaboratively, to achieve the intended effect. Military mobility is crucial in orchestrating military and non-military activities, and coordinating measures across all five operational domains of MDO is vital for the mission success. Next, we will examine how military mobility is realized within each of the five domains of MDO.

3.1. Military Mobility and the Land Domain

This is the most prolific environment for advancing military mobility, where most crises, conflicts, or rivalries emerge. The land transport infrastructure development, mainly through the strengthening and expansion of the trans-European TEN-T network, ensures the efficiency of military transport in Europe and facilitates the rapid deployment of forces (NATO Standardization Office n.d.). However, military mobility by land is not solely the responsibility of military organizations. Instead, it encompasses the involvement of various stakeholders: states in the transatlantic area, national authorities, and institutions playing a role in transport developments at the national level, civil entities, and private companies. Military mobility has long surpassed national borders and necessitates collaborative efforts to enhance transportation and establish a unified network that enables the deployment of military vehicles and equipment by road or rail throughout Europe, from west to east and from north to south.

3.2. Military Mobility and the Maritime Domain

Within the Alliance, the interconnection of maritime waters emerged through economic, social, and political relations among all member states, regardless of their direct access to these waters. Preserving freedom of navigation, sea lines of communication, essential infrastructure, energy flow, and protecting marine resources and environmental safety holds significance on both national and international levels. From a military mobility perspective, several sea routes are established for strategic military transports between states in the transatlantic area. These transports are conducted

using either military ships or vessels operated by civilian companies. Additionally, there is growing interest in engaging with non-military actors who can facilitate a wide range of activities at sea, including security cooperation, maritime security, warfare, and combat. Through Naval Cooperation and Guidance for Shipping (NCAGS) and the Allied Worldwide Navigational Information System (AWNIS), a NATO force will effectively interact with merchant shipping by coordinating the operations plan with non-military activities, ensuring that the commander's mission can be accomplished with minimal disruption to merchant shipping (NATO Standardization Office n.d.). Although it is an area that facilitates the deployment of a large number of materiel and military equipment, it limits transportation due to natural barriers, such as the fact that not all NATO states are landlocked. Although all the states on the Eastern flank of NATO have access to the sea, those in the center of Europe cannot ensure the continuity of this connection, which leads to longer times for military transports.

3.3. Military Mobility and the Air Domain

Currently, military mobility in airspace seems more manageable than on land or at sea, as it possesses three essential power attributes: speed, reach, and altitude. Given the extensive distances between NATO member states that must be covered quickly, this air transport option proves effective, primarily due to each state's capacity to provide the necessary support infrastructure (air bases and their surroundings) (NATO Standardization Office n.d.).

This deployment method is preferred because it is accessible to everyone, given that:

- The entire surface of the Earth is covered by air, allowing aircraft unique reach;
- There is coordination among national and international agencies, as well as non-military actors, to establish and maintain air bases at critical strategic locations in the transatlantic area;
- Several passive air defense measures are already in place to protect personnel, installations, and vital equipment from missile attacks.

Despite the advantages offered, air transport limits the movement of a large amount of equipment from one place to another. Aircraft capacity is limited and most military equipment is oversized. That is precisely why, for heavy equipment, maritime or especially land transport is preferred.

3.4. Military Mobility and the Space Domain

Space support for operations encompasses all activities that deliver capabilities through space to assist NATO-led operations. 'Space-based capabilities' consist of services like positioning, navigation and timing, imagery, communications, environmental monitoring satellites or providing Earth-Low Orbit (ELO) transportation of ammunition and missiles. The military, civil, and commercial sectors increasingly rely on these capabilities. Commanders must recognize that some space-based capabilities supporting NATO-led operations may be under military, governmental, or commercial control. These capabilities are susceptible to both man-made threats and natural hazards. Adversaries may attempt to exploit this reliance on space capabilities. Consequently, attacks on or from space systems are becoming more probable. Commanders must anticipate efforts by adversaries or third parties to interfere with, disrupt, or deny access to space-based capabilities for friendly forces or partners (NATO Standardization Office n.d.). Space systems are widely used to monitor and coordinate military transport, simultaneously enhancing military mobility. Given the continuous advancements in artificial intelligence and the development of autonomous vehicles utilizing space capabilities, we can observe the implications of this field on the evolution of military mobility.

3.5. Military Mobility and the Cyber Domain

Cyberspace includes capabilities and activities primarily related to functioning within the interdependent networks of information, technological infrastructures, and resident data, encompassing the internet, telecommunications, networks, computer systems, and embedded processors. There exists a wide

variety of users and uses of cyberspace: military (friendly and adversary), governmental, and non-governmental (commercial and non-commercial). Certain parts of cyberspace constitute key infrastructure. Therefore, managing and coordinating joint task force activities in cyberspace with various non-military actors is necessary to avoid or minimize unintended consequences (NATO Standardization Office n.d.). Military mobility encompasses not only the transportation infrastructure network but also the coordination and control of military equipment and material convoys moving from one point to another. The future of the military landscape appears to be shaped by the evolution of the cyber and space environment. To adapt to these changes, military mobility must keep pace and enable monitoring, coordination, and synchronization of transports through cyberspace capabilities.

In today's security environment, MDO has become both a reality and a necessity, representing a solution for NATO to plan and organize its future activities. Since it encompasses the entire spectrum of operations, understanding how military mobility manifests in each of these areas serves as a starting point for grasping how the transport and movement of military troops will be affected in the future within NATO.

4. National Challenges on Military Mobility Imposed by the MDO Concept Implementation

Regardless of which NATO member state we consider, each of the 32 Allies faces its own set of challenges in facilitating military mobility, especially within the context of expanding multi-domain operations in this unpredictable and insecure environment. First of all, the issues stem from the current status of the existing transport infrastructure in each country. Then, there are other impediments, as the financial resources each country can allocate for various projects, including human, logistical, and infrastructural support, as well as the lack of civil-military cooperation resources and insufficient involvement from competent structures in developing clear, concise regulations regarding these new types of operations.

In Romania, the primary issues addressed concerning the analyzed concepts pertain to a first attempt of developing and implementing the MDO concept at the national level, evolving public-private collaboration, enhancing and ongoing development of transport infrastructure, and applying artificial intelligence in these areas.

The first challenge, that of implementing the notion of multi-domain operation, refers to the need to establish a legal framework by creating doctrines, strategies, regulations, or orders that conceptualize this type of operation for a common and integrated understanding across all national military structures. Considering that in 2022, Romania's strategic partner, the US, adopted a doctrine specifically for understanding and appropriating the concept, and a year later, in 2023, NATO followed suit, Romania also has the obligation to align with these requirements. Currently, the intentions of Romanian leaders are partially aligned, and the results can be observed in the adopted national documents (National Defense Strategy, own defense policies). From a scientific perspective, several researchers are making efforts to develop valuable ideas in this field that military specialists can apply. One notable contributor is Al. Cucinschi, with his paper "The impact of multi-domain operation on the military strategy" (Cucinschi 2021). However, due to a lack of resources, this process will take longer than in other Western countries.

Now, Romania can synchronize a wide range of actions related to MDO, particularly concerning military mobility, but only from the perspectives of land, air, maritime, and cyber domains. The Romanian state currently lacks space capabilities despite ongoing efforts to develop this area, primarily through the Romanian Space Agency, which oversees the country's space activities. The issue lies in the insufficient funding allocated by the government for space research and the absence of platforms or sensors necessary for free access to space.

Under these circumstances, while the intention to broaden the MDO concept is outlined in the official national documents, Romania lacks the full capabilities to align its activities with those of

other NATO member states, which can expand military operations across all five domains of the MDO. Consequently, the Romanian government will adopt a concept that addresses the needs of the MDO only within its capabilities, that is, without incorporating the space domain. This decision, however, comes with certain limitations since Romania will not be able to ensure military mobility efficiency from a spatial perspective, which hinders the deployment process within a standardized NATO framework. On the other hand, other allied nations also struggle to maintain effectiveness in military operations across all five domains of the MDO either. This situation creates a challenge that must be addressed promptly, nationally, and particularly within the North Atlantic Alliance. As NATO continues to develop and expand its space and cyberspace capabilities, its role and ambitions must be clearly defined. In the short term, collaboration with national and commercial entities operating in these two domains must be regulated to align with engagement in other areas. In the longer term, the Alliance may develop core-funded space systems or offensive cyberspace capabilities that would enable more direct NATO orchestration of MDO (NATO 2022).

The second challenge, the development of civil-military collaboration, involves the need for a unified and synchronized understanding of the specific MDO requirements by both military structures and civilian organizations responsible for supporting the deployment of forces by national governments that authorize the budget for infrastructure development, non-governmental organizations that can impact military activities conducted during the deployment, or private companies that can assist with infrastructure projects or enhance systems and technologies to minimize the travel times of military convoys.

MDO contributes to both the political and military strategy of each NATO member state, influencing state capabilities at all levels of power. MDO is focused on achieving military objectives across all domains and environments while recognizing that there are many actors that can collectively contribute to the military's success (NATO 2022).

An intergovernmental approach, while respecting the *need-to-know* principle, can better coordinate specialists in both fields, fill existing gaps, and facilitate the movement of troops conducting multi-domain operations throughout the territory of the Alliance. The relationship within the Romanian structures is quite cumbersome, as some military information cannot be publicly disclosed, preventing all entities from accessing the complete data necessary for efficient activity planning. An equally important aspect arising from the aforementioned principle relates to another specific NATO principle: *need-to-share*. This principle indicates that information concerning military mobility must be shared not only with civil institutions and structures but also with other NATO member states. This sharing is crucial for creating a clear and comprehensive picture of the transport situation at the Alliance level at any given time.

The third challenge, transport infrastructure development, is a primary need for planning and conducting any NATO operation, not just those related to MDO. Forces deploying in the area of operations must have access to roads, rail, air, sea, space, and cyber capabilities that are safe, meet specific needs, and allow for rapid transport. In particular, states on NATO's Eastern flank are experiencing transport infrastructure difficulties, as this is a region where troop movement and transport are slowed, and mission turnaround times are increasing. In Romania, the year 2025 will be the year in which the number of troops pre-positioned in its own territory will be the highest so far (Ciobanu 2024), which will imply greater attention of the national authorities to speed up the terms of commissioning of the dual-use infrastructure segments under construction. Simultaneously, the integration of forces and the provision of logistical support will put pressure on the HNS in the current situation, especially with regard to MDO, as the resources available to the Romanian state are currently quite limited.

A fourth challenge to the execution of multi-domain operations, from the perspective of military mobility, concerns artificial intelligence. Considering the rapid evolution of emerging and disruptive technologies and the increase in the fields in which AI is used, military structures must constantly adapt to new systems, technologies, and devices that are sometimes dual-use. The use of

artificial intelligence generally enhances military mobility by helping to develop devices for monitoring traffic, streamlining transportation routes, facilitating the construction of unmanned vehicles, and supporting the creation of safer, faster vehicles. Under these circumstances, if military mobility improves, so does multi-domain operations. However, for this to happen, states must be willing to allocate funds to acquire systems that utilize artificial intelligence.

Although there are many unresolved issues concerning the analyzed concepts, they can be mitigated or reduced in intensity through measures such as:

- increasing the funds allocated for projects aimed at transport infrastructure, whether they originate from the national budget, private sources, or non-reimbursable European funding. These projects must facilitate the easy movement of military equipment and materials within Romania while also enabling connection to the existing TEN-T network at the European level;

- increasing the GDP percentage allocated for defense so that Romania, along with other NATO member states in similar positions, can support the presence of foreign forces on their territory or procure the latest generation technology necessary for conducting multi-domain operations;

- developing initiatives for military activities on national territory and the logistical efforts to support them, involving all relevant authorities with roles in these areas and sharing information in a unified manner;

- implementing national doctrines and regulations regarding the development of MDO based on individual states' capabilities while synchronized with those of other NATO members. The goal is to maintain coordination among the Alliance's efforts to allow for the implementation of MDO, considering each state's capabilities to ensure that military mobility is managed efficiently and concurrently within NATO.

The evolution of the security situation in the coming years is crucial for understanding the direction NATO is heading. Multi-domain operations are already replacing the well-known joint operations within the Alliance. Troops are beginning to train in multi-domain combat conditions. In this context, military mobility appears to be a factor that could hinder the smooth execution of exercises and training for the forces under the stipulated terms. Therefore, the identified issues must be addressed as quickly as possible, although the pressure on NATO states with a lower GDP contribution to the defense budget will increase.

Conclusions

Developing multi-domain operations is crucial, considering the likelihood of a conflict between NATO and opposing forces is higher today than ever. While such operations encompass the full range of military actions, they cannot be executed if the deployment of troops is not achieved quickly and safely, whether by land, air, sea, or other means. In these circumstances, ensuring the mobility of the military forces is vital, as a situation where they remain immobile could lead to losing the conflict.

The MDO concept's performance is important within NATO and requires greater attention from each member state at both the military and intergovernmental levels. Romania, as a NATO member and due to its geographical location on the Eastern border of the Alliance, which is close to the conflict zone in Ukraine, has a direct interest in allocating resources to research, adopt, and adapt this innovative concept.

On the other hand, military mobility is a critical factor for the success of multi-domain operations. Everything can be replaced in combat except for the combat force and the vehicles and weaponry employed to execute the operations. If these are not deployed promptly to the area of operations, mission success may be compromised. Both are new concepts that, in addition to a solid understanding and insight from military and civilian leaders, require funding, logistics, and specialists to ensure their development.

In the future, the Romanian Armed Forces must apply a series of measures in order to enhance military mobility. The pressure to ensure the rapid transport of NATO troops is very high, and logical, realistic and

timely decisions taken at the national level can make this process more efficient. For example, the Romanian Armed Forces can intervene by providing liaison officers within the working groups aimed at military mobility, national or at the level of the alliances of which Romania is part, improving cooperation, at the intergovernmental level, but also with civil companies, in order to have the exact situation on all aspects related to military transports or the support of initiatives that allow the development of the dual-use transport infrastructure both on the national territory and in the European space.

Eventually, the national challenges faced by both Romania and other NATO member states regarding military mobility amidst the transition from joint operations to multi-domain operations are neither few nor simple to solve, especially with limited human and financial resources. The threat from the Alliance's eastern border appears to persist in the future. However, through collective effort and synchronization of member states' activities, a consensus can be reached to ensure that NATO territory remains a safe space where citizens are protected and feel secure.

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