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Operation of Polish Armed Forces Artillery on the Multi-Domain Battlefield

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Abstract

The paper examines the role of Polish artillery in a multi-domain battlefield. It uses literature and doctrinal analysis to assess how integration across land, air, sea, space, cyber, and cognitive domains affects artillery effectiveness. Findings show that artillery is increasingly dependent on interoperability, information flow, and systemic resilience. The study highlights new threats and opportunities, including A2/AD development. It concludes that multi-domain integration, rather than firepower alone, determines future combat effectiveness.

KEY WORDS: *multi-domain operations, polish artillery, military transformation, interoperability, fire support*

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1. Introduction

In the context of the issues addressed in this article, which concern multi-domain operations on the contemporary battlefield, it is necessary to define the concept of a domain for the purposes of further analysis. With regard to the operational environment, a domain can be understood as a physically defined part of that environment requiring a unique set of capabilities and combat skills. The operational environment currently includes not only air, land, and sea, but also outer space and cyberspace, as well as the informational and cognitive dimensions.

From a historical perspective, most domains have long been present on the battlefield. Today, however, we are witnessing for the first time a situation in which all domains can simultaneously affect every element of a combat formation. This also applies to artillery, which—despite its organizational placement within the Land Forces—must operate under conditions shaped by threats and phenomena extending beyond the land domain.

For a fuller explanation of the phenomenon under discussion, it is useful to briefly refer to the historical determinants of artillery development, closely linked to the spread of gunpowder weapons. Its main functions included supporting infantry and cavalry, destroying fortifications during sieges, and delivering fire over long distances. Technological development led to its emergence in the early modern period as the "final argument of kings," playing a decisive role in battles and wars, where its mass employment and mobility were key to military success. Artillery undoubtedly became an increasingly significant element of combat operations; however, its use was essentially limited to the land domain. Early gunners did not face threats from the air or sea. Both offensive and defensive actions were defined by what occurred on land.

The aim of this article is to determine the place and role of Polish Armed Forces artillery in a multi-domain battlefield and to identify the principal threats and opportunities associated with the influence of contemporary operational domains. The main research problem is formulated as the question: how does the multi-domain operational environment affect the conditions of employment, effectiveness, and significance of Polish Armed Forces artillery? The article adopts the thesis that artillery, despite its traditional grounding in the land domain, has become an element of the multi-domain environment, and that its effectiveness depends on the ability to integrate effects achieved across different domains, as well as on resilience to threats that are not exclusively kinetic in nature. To achieve this objective, the study employs an analysis of the relevant literature, a review of normative and doctrinal documents, as well as historical-descriptive and analytical-synthetic methods.

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2. Domains

The process of organizational development of the armed forces in Poland has been ongoing since the interwar period. A key moment in this regard was April 9, 1938, when the Act on Universal Military Duty came into force. This act divided the Armed Forces of the Second Polish Republic into the Army and the Navy. The Army included the standing forces, organizational units of national defense, and units of the Border Protection Corps. According to the act, the Navy consisted of organizational units of the Naval Forces and river flotilla units. This was therefore the first document to envisage military operations in two domains—land and maritime. From that point on, in addition to the physical capability to operate in the maritime domain, the legislator also recognized their presence within the legal framework.

An analogous process of organizational separation also affected the Air Force. Although the Polish Air Forces, as an independent branch of the Polish Armed Forces in the West, were established under a military agreement between the Polish government-in-exile and the French government in January 1940, they were formally separated by the Commander-in-Chief's Order on the Independence of Aviation of February 22, 1940. In this document, Władysław Sikorski stated: *My ambition is that within the current year we will create an air force at least equal in number, and technically superior, to that with which the army took the field in the autumn of last year*. Due to the geopolitical conditions of the time and the limited material and human resources of the newly formed Air Forces, some considered this move merely cosmetic. However, separating the Air Force from the land forces had more than symbolic significance, as it marked a decisive change in the approach to military aviation and indicated the future organizational structure of the Armed Forces.

The aforementioned division into Land Forces, Air Forces, and Navy remained in force for a long time after World War II, not only in Poland but also in most countries around the world. This stemmed primarily from technological limitations and the reduction of warfare to three classical domains: land, air, and maritime. Technological development, and consequently the growth of space capabilities and cyberspace, created opportunities for even further expansion of the operational environment. Expanded battlespace is illustrated in Fig. 1.

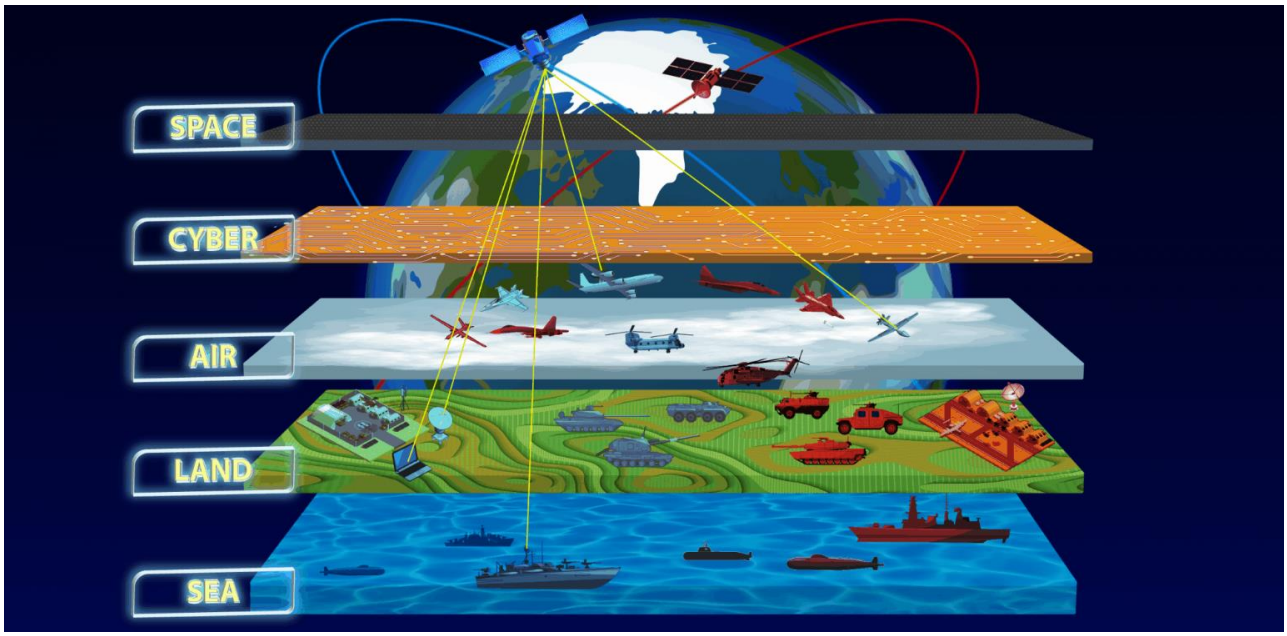

Fig. 1 Expanded battlespace
Source: Metron - https://www.metsci.com/

The United States recognized that the ability to integrate and synchronize space and cyberspace capabilities at the tactical level expands opportunities for creating advantages that can be exploited. Both of these domains have become a kind of testing ground in the ongoing arms race among the world's major powers.

The development of the cyber domain can be linked to Operation Moonlight Maze, a cyber espionage campaign conducted in the late 1990s. U.S. services had to confront a coordinated cyber intelligence attack targeting government and military institutions, likely originating from Russian territory. Moonlight Maze marked a turning point in the development of U.S. cybersecurity policy, leading to the creation of new analytical structures and improved network monitoring. It was a breakthrough moment—cyberspace began to be treated as a real domain of conflict. As a result, in 2002 the United States Cyber Command was established, initially as distributed structures within the Department of Defense. In 2009, United States Cyber Command (USCYBERCOM) was formally established, and in 2011 cyberspace was recognized as an operational domain of warfare on par with land, sea, and air.

Following the United States, NATO adopted a similar position. At the Warsaw Summit in July 2016, NATO members also recognized cyberspace as an operational domain and emphasized that the Alliance should defend itself in this domain as effectively as in others. As a result, in 2020 the doctrine Allied Joint Publication (AJP) 3.20 – Allied Joint Doctrine for Cyberspace Operations was issued, defining the scope of alliance operations in cyberspace and the requirements related to planning and conducting activities in this domain.

Although U.S. military documents had gradually treated space as a potential domain of conflict since the early 2000s, it was not until December 2019 that the United States Space Force (USSF) was established as a separate branch of the armed forces by an act signed by Donald Trump. This was both a symbolic and organizational confirmation of the introduction of another domain. The primary mission of the USSF became competition with China and Russia in the space domain, the development of resilient low-Earth orbit satellite constellations, and defensive capabilities against anti-satellite weapons. NATO also recognized outer space as an operational domain in 2019, effectively designating it as the fifth domain of warfare—alongside land, sea, air, and cyberspace. At the same time, Alliance member states began to create and develop space forces. France expanded the competencies of its air forces, the United Kingdom established a space command, and other countries have been placing their own satellites into orbit while also working on anti-satellite weapons.

These developments should now be related to the Polish context. The Homeland Defence Act of March 11, 2022, in Article 15, identifies five branches of the Armed Forces: the Land Forces, Air Forces, Navy, Special Forces, and Territorial Defence Forces. It also lists the Military Police as a specialized and separate service, and the Cyberspace Defence Forces as a specialized component responsible for conducting the full spectrum of operations in cyberspace, particularly in the areas of proactive protection and active defense of key cyber assets relevant to the Armed Forces. The primary objective is to conduct operations in cyberspace across three dimensions: offensive, defensive, and reconnaissance, in areas related to cryptology, cybersecurity, and the construction and operation of ICT systems. In 2018, the National Cybersecurity System was defined by law for the first time, encompassing government and local administration institutions as well as enterprises from strategic sectors of the economy. Within this system, the Minister of National Defence plays a key role, including ensuring the capability of the Polish Armed Forces to conduct military operations in the event of a cybersecurity threat requiring defensive actions at the national, allied, or coalition level.

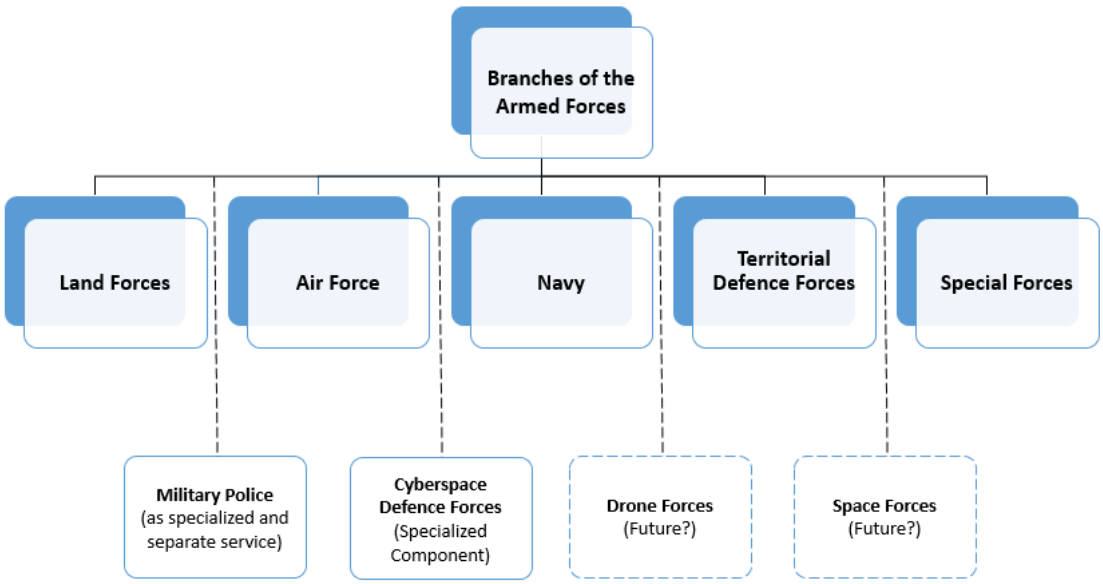

Fig. 2 Homeland Defence Act of March 11, 2022, Article 15
Source: own study

In the space domain, Poland has been consistently developing new capabilities. After joining the COSMO-SkyMed program in 2014, the Imagery Intelligence Center was established, marking the first step toward using satellite reconnaissance data through equipment provided under an agreement with Italy. In subsequent years, the Geospatial Intelligence and Satellite Services Agency was created, responsible for managing satellite systems introduced into the Polish Armed Forces and for tasks related to space situational awareness. These developments initiated the construction of a system of Polish satellites using Synthetic Aperture Radar (SAR), enabling a more comprehensive operational picture. The PIAST (Polish ImAging SaTellites) project is also being developed, aiming to build and deploy a constellation of three nanosatellites for Earth observation. As part of this project, in 2025 the Satellite Mission Control Center of the Military University of Technology was established. Its infrastructure enables full autonomy in satellite operations—from monitoring and control to data analysis—without reliance on foreign solutions or external entities. In 2024, the Minister

of National Defence indicated that the Polish Armed Forces are entering the space domain; however, at the current stage there are no plans to establish space forces as a separate branch. Instead, together with drone forces, they will be developed as additional components of the Armed Forces. Structures responsible for tasks related to the space operational domain will be developed gradually as additional space capabilities are acquired. The legal and factual situation is illustrated in Figure 2.

3. The Concept of Multi-Domain Operations

The concept of multi-domain operations itself was developed by the U.S. Army in response to the 2018 U.S. National Defense Strategy, which shifted the focus of U.S. national security from countering extremists and terrorists worldwide toward confronting revisionist powers, primarily Russia and China. The main reason for this shift was the growing threat posed by peer competitors with significant capabilities to operate across all domains. These threats were evident not only in the military sphere, but also in the economic, political, and diplomatic arenas, as well as in cyberspace and the increasing spread of disinformation. Thus, the risk to U.S. interests exists both before and after the potential outbreak of an armed conflict.

As a consequence of adopting this approach, it was also implemented within NATO. On May 19, 2023, all NATO member states approved the Alliance Concept for Multi-Domain Operations (MDO). In NATO, MDO is defined as "the orchestration of military activities across all domains and environments, synchronized with non-military actions, to enable the Alliance to achieve converging effects at the speed required."

Poland, as one of the NATO member states, has recognized the need for transformation in this direction. Multi-domain operations have been identified by the Polish General Staff as the future of the Armed Forces. In official communications, it has been emphasized that the Armed Forces aim to integrate activities across multiple domains, enabling them to respond effectively to new threats and conduct operations in a coordinated, rapid, and precise manner. This is to be achieved through investments in modern technologies, cyber capabilities, and the development of interoperability with allies. Additional elements will include information activities and cognitive superiority, enabling a better understanding of the battlefield and more effective decision-making.

It should be emphasized that multi-domain operations are not merely a new concept, but also a shift in thinking about the modern battlefield and operational environment. MDO represents a "system of systems" approach, in which each component is capable of independent action while simultaneously cooperating with others to achieve an overarching desired effect. The requirements for such operations include interoperability, efficient and rapid information flow, the use of modern technologies, and effective international cooperation. For future operations to be truly multi-domain, they must be strongly integrated across individual domains, enabling the creation of coherent effects against the entire system of warfare of an aggressor or potential adversary, and they must pursue a clearly defined objective. It is not sufficient for operations to be conducted in several different domains at a similar or even the same time. If conducted separately in distinct environments, they will lack a fully coherent objective and will not be properly correlated in time and space, nor effectively synchronized. Thus, the goal is not merely to use as many domains as possible when planning effects, but to shift from viewing operations through the lens of component command capabilities to focusing on delivering complementary effects across interconnected domains. This approach forces adversaries to defend continuously across all domains and from all directions, presenting them with multiple dilemmas that may expose exploitable vulnerabilities.

Franciszek Skibiński, a major general of the Polish Army and a theorist and scholar of the art of war, wrote as early as 1972 that *we strive to imagine, in the most realistic and probable way possible—and in as much detail as we can—the full picture of a future armed confrontation*. He also drew attention to the concept of respecting the "horizon" in tactical operations, understood as an attitude of intellectual humility—the awareness that what we see is not everything that exists, and that we perceive only a fragment of reality embedded in a specific context.

Every perception has its "horizon," defined by the limits of situation, knowledge, experience, and available information; respecting it means being aware of these limitations and avoiding hasty, absolute judgments. He also emphasized that this is a difficult task, noting that no general staff succeeded in predicting, and therefore adequately preparing their armed forces for, either World War I or World War II. In contemporary terms, respecting the horizon means taking into account all elements that may influence the battlespace—both those that are physical and visible, and those whose impact can only be anticipated. These include the physical domains: land, maritime, air, and space, as well as non-physical domains such as cyberspace, the cognitive sphere, the information environment, and the electromagnetic spectrum. This division is illustrated in Figure 3.

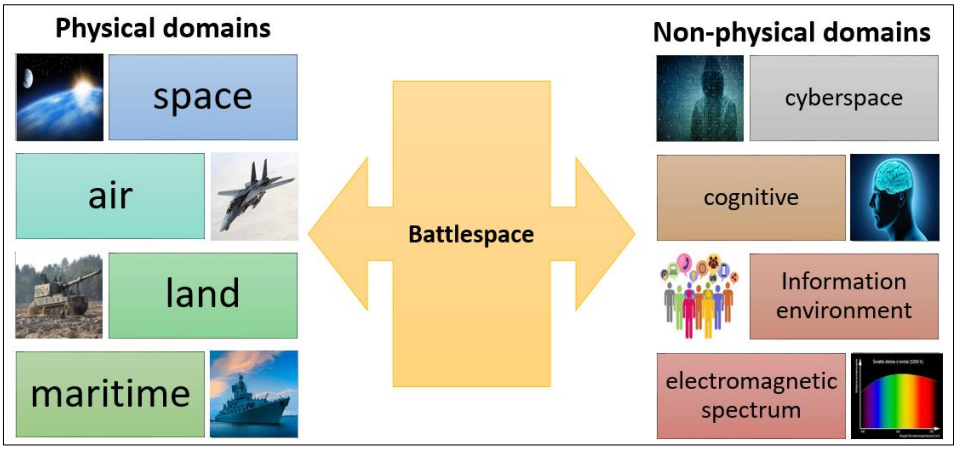

Fig. 3 Physical and non-physical domains on battlespace
Source: own study

The very awareness of the existence of the above-mentioned elements of the battlespace is already the first step toward operating in a multi-domain environment. The next key element is understanding the relationships between individual domains, their impact on us, and our place within the entire complex system of interdependencies. It should also be remembered that the multi-domain approach does not apply solely to military assets. Existing joint command structures have traditionally promoted coordination among different branches of the armed forces, whereas the "multi-domain" approach must go beyond this, encompassing both military and non-military resources. This distinction is a key factor differentiating "joint" operations from "multi-domain" operations.

4. The Role of Artillery on the Multi-Domain Battlefield

In such an operational environment, it becomes necessary to define the place and role of artillery. First of all, it must be recognized that we are no longer dealing with artillery tied solely to the land domain.

Contemporary artillery units face numerous threats from the air, cyberattacks targeting their command and fire control systems, as well as the growing impact of disinformation. It should be emphasized that, despite operating within the same domains, the challenges faced by commanders and units may vary depending on the level of command—tactical, operational, or strategic. An example of such interdependencies is illustrated in Figure 4.

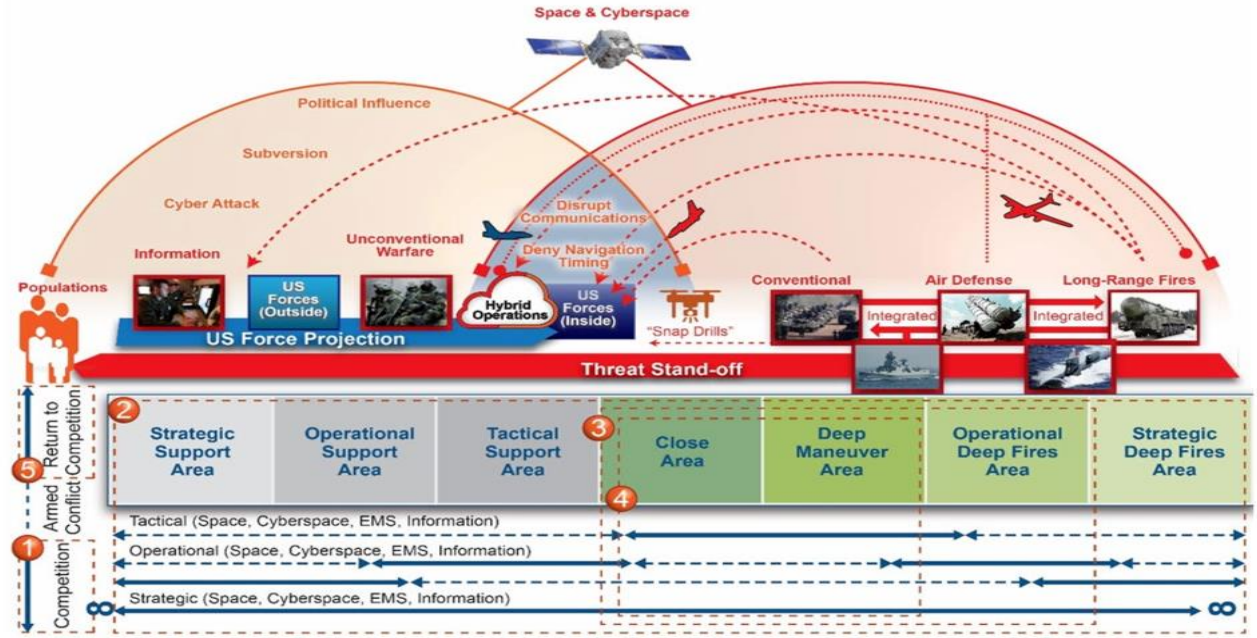

Fig. 4 Artillery on the Multi-Domain Battlefield
Source: Centre for Aerospace Power and Strategic Studies

In the case of the land, maritime, and air domains—within which artillery units have operated for a long time—tactical assumptions provide that threats in these spheres will be mitigated through combat support measures, active and passive air defense, and radar systems. However, these domains should not be regarded as less dangerous, as every technological leap or new tactic can generate new threats or amplify existing ones.

Although distant, the space domain can also affect artillery operations. Satellite reconnaissance may expose concentration areas or firing positions. The loss of GPS signal can also severely impact positioning systems, and consequently the Within the information domain, the overwhelming volume of data creates constant information noise. Moreover, pervasive disinformation and fake news constitute a dangerous weapon in the hands of an adversary. Even in peacetime, it is difficult to quickly and reliably verify information; during wartime, this becomes even more challenging, as does decision-making under such conditions.

The electromagnetic spectrum, though invisible to the naked eye, is another domain of growing importance on the battlefield. These invisible waves are capable not only of jamming and disrupting communications, but also of intercepting drones and taking control of them.

The cognitive domain is the most difficult sphere to systematize. It is impossible to fully predict how actions by an adversary in other domains will affect soldiers. Psychological operations, morale degradation, and influence on the cognitive sphere—although non-kinetic—can significantly reduce the combat effectiveness of a unit and tip the balance of victory in favor of the opponent.

However, the multi-domain battlefield environment presents not only threats, but also opportunities that must be identified and exploited. On land, this includes improved cooperation with supported units and enhanced coordination of activities in time and space during the execution of fire support tasks. Artillery units already have access to drones, radar stations, and modern fire control systems.

In the air domain, there is increasing use of air transport for deploying fire assets. Such synchronization enhances the tactical employment of guns and launchers by combining their firepower with improved maneuverability. These solutions are increasingly reflected in military exercises, where air–land cooperation is practiced.

In the maritime domain, the capability for sea-based deployment is available. Integration also includes the simultaneous conduct of fires from both sea and land, using missiles available in naval missile units. Coastal defense operations likewise fall within the intersection of the maritime and land domains.

The space domain offers artillery the opportunity to develop its own satellites, enabling uninterrupted geolocation systems and satellite communications independent of external providers, as well as reconnaissance systems based on satellite imagery.

Operations in cyberspace for artillery units primarily involve ensuring IT security, as well as the use of advanced command and fire control systems that enable rapid and secure data exchange. This also includes allied connectivity through systems such as ASCA (Artillery Systems Cooperation Activities), which allows for target acquisition and engagement in a multinational environment, thereby fulfilling NATO doctrinal assumptions.

In the information domain, artillery personnel at all levels can benefit from increasingly advanced systems for data acquisition and processing. The role of artificial intelligence (AI) is also growing, effectively supporting commanders in planning and command processes. Through the use of appropriate inputs, AI can accelerate the targeting process.

The electromagnetic spectrum is a domain in which the development of capabilities directly impacts force protection, including that of artillery. Indigenous systems that prevent drone operations in artillery deployment areas make firing positions less vulnerable to enemy attack.

Finally, in the cognitive sphere, psychological operations (PsyOps) can be used to influence the morale of the adversary. One such method is the use of artillery-fired leaflet munitions, enabling influence on the mindset of enemy soldiers.

An example of Polish artillery operating in a multi-domain environment is its growing role within the Anti-Access/Area Denial (A2/AD) system. Anti-Access/Area Denial refers to multi-domain capabilities implemented in two areas. A2 encompasses long-range actions and capabilities aimed at preventing an adversary from entering and deploying forces in a contested area, or, if that is not possible, at limiting movement, slowing force deployment, and inflicting maximum losses. AD, on the other hand, involves shorter-range actions and capabilities designed to restrict the freedom of action of forces within the operational area, particularly those intended to rapidly neutralize an A2/AD system. The common objective of both A2 and AD is to achieve superiority across the entire battlespace. Ranges of equipment conducting A2/AD operations are illustrated in Figure 5.

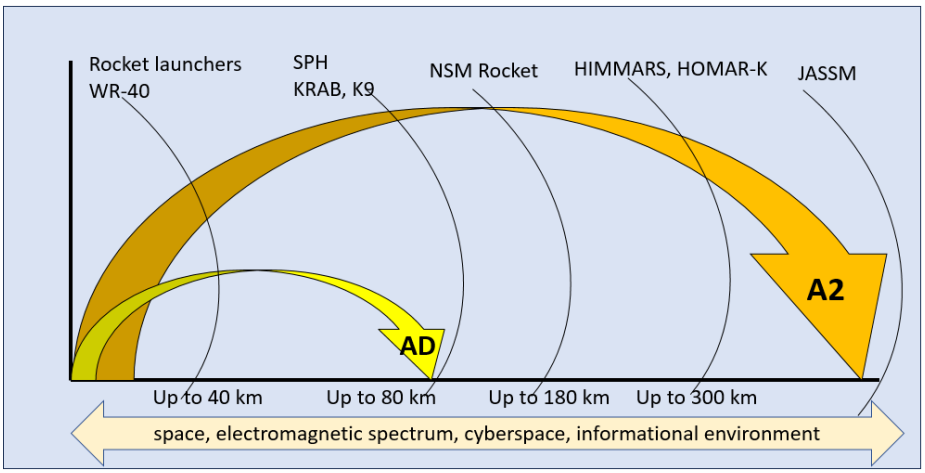

Fig. 5 Ranges of equipment conducting A2/AD operations
Source: own study

The anti-access and area denial concept involves conducting operations and employing available capabilities across all currently recognized domains of warfare, namely air, sea, land, outer space, and cyberspace. It should be emphasized that this typically consists of a set of overlapping capabilities and simultaneously conducted activities in multiple domains. Previous strike capabilities primarily enabled area denial against an adversary. However, with the introduction of systems such as HIMARS and HOMAR-K, engagement ranges have increased to approximately 280–300 km, enabling genuine anti-access operations.

5. Conclusions

To the main research question posed in the article, it should be answered that the contemporary multi-domain operational environment fundamentally changes the place, role, and conditions of employment of Polish artillery. Artillery, although still organizationally embedded primarily within the Land Forces structure, no longer operates exclusively within the land domain. Its effectiveness now depends on the degree of integration with reconnaissance, communications, command and control, electronic warfare, cyber defense, and space support systems, as well as on its ability to operate under conditions of informational, electromagnetic, and psychological disruption. This means that artillery has become part of a complex multi-domain system, in which its combat effectiveness is determined both by its own firepower and by the level of system interoperability, resilience, and the speed of information flow.

On this basis, the following detailed conclusions can be formulated:

1. The expansion of the operational environment to include the space domain, cyberspace, and the informational, electromagnetic, and cognitive dimensions has resulted in artillery no longer being a means of combat operating solely within the land domain.
2. The contemporary effectiveness of artillery depends not only on the technical parameters of its weapon systems, but also on the quality of its integration with reconnaissance, command, and data exchange systems.
3. The most significant threats to artillery in a multi-domain battlefield include satellite reconnaissance, unmanned aerial systems, disruptions in the electromagnetic spectrum, cyberattacks on command and fire control systems, as well as disinformation and psychological operations.
4. At the same time, the multi-domain environment creates new operational opportunities for artillery, particularly in terms of faster targeting, more precise reconnaissance, more effective data exchange, and deeper integration with air, maritime, space, and cyber components.
5. The growing importance of artillery within A2/AD systems indicates that it is not only a fire support asset, but also a key tool for shaping operational advantage and limiting the adversary's freedom of action.
6. The condition for maintaining the combat utility of Polish Armed Forces artillery remains the development of systemic resilience, including the protection of ICT infrastructure, ensuring communication continuity, the ability to operate under degraded navigation signals, and increasing the survivability of firing positions.
7. Consequently, the further transformation of Polish Armed Forces artillery should focus not only on increasing range and firepower, but also on deepening its integration with other operational domains, as it is precisely the level of this integration that will increasingly determine its effectiveness on the future battlefield.

As a result, Polish artillery should be viewed not only as a classic fire support component of the Land Forces, but as an integral element of a multi-domain combat system. This implies the need for further adaptation of command structures, training processes, as well as technical and organizational solutions to the requirements of the contemporary operational environment. The direction of these changes will increasingly determine the ability of artillery to maintain its combat effectiveness and operational relevance in future conflicts.

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