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INNOVATIONS IN THE DEVELOPMENT OF MISSILE FORCES AND ARTILLERY OF THE ARMED FORCES OF THE REPUBLIC OF POLAND

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Abstract: *Influenced by lessons from the war in Ukraine and rapid technological advancements, the Polish Armed Forces are undertaking a comprehensive modernization of their Missile Forces and Artillery. This paper analyzes the transition from legacy Soviet-era systems to modern, NATO-interoperable platforms, focusing on the strategic integration of unmanned aerial systems (UAS). A central focus is the GLADIUS reconnaissance-strike system, an innovative solution combining reconnaissance UAVs with loitering munitions to provide autonomous, deep-strike capabilities. The study also addresses critical challenges, including system complexity and survivability, demonstrating how Poland is developing a flexible and precise force for the contemporary multidomain battlefield.*
Keywords: *Artillery, Modernization, UAS (Unmanned Aerial Systems), Loitering Munitions, Interoperability, Deep Strike.*

1. INTRODUCTION

The development of unmanned aerial vehicle (drone) technology used in recent armed conflicts, particularly during the war of the Russian Federation against Ukraine, significantly influences the shaping of the modern, multidomain battlefield. In this context, there is a necessity to develop a new approach to the use of the forces and resources currently available to the armed forces and to define their future directions of development (Elak, Całkowski, Rewak, 2024, p. 9-13).

Taking the above into account, the specific challenges associated with the implementation of unmanned platforms in conducting military operations are faced by the Rocket and Artillery Forces. In modern armed conflicts, tasks traditionally dedicated to the Rocket and Artillery Forces are increasingly being carried out using drones.

This study aims to characterize the current capabilities and developmental directions of the Polish artillery, with particular emphasis on the synergy between conventional fire support and unmanned technologies. It further intends to identify key challenges facing the modernization process and demonstrate how the implementation of systems like GLADIUS (unmanned reconnaissance and strike system) addresses the demand for autonomy, precision, and deep-strike capabilities.

The rapidly changing technology and conditions on the contemporary battlefield compel the continuous development of new concepts of use and directions for the development of the Armed Forces.

The research was conducted using qualitative methods, with particular emphasis on case study analysis of Poland's modernization of the Rocket and Artillery Forces, specifically focusing on the integration of unmanned aerial systems (UAS) such as the GLADIUS reconnaissance-strike complex. The study was supported by document analysis of strategic reports, technical specifications, and lessons learned from the Ukrainian war, as well as comparative analysis of legacy Soviet-era systems versus modern NATO-standard capabilities. Additionally, a structured comparative method was applied to examine the operational characteristics of conventional high-explosive (HE) artillery shells and unmanned systems (including loitering munitions and

strike drones). This comparison assessed key variables such as precision, response time, survivability, logistical burden, and integration within network-centric command systems, thereby strengthening the analytical framework and contributing directly to the evaluation of innovation-driven development pathways.The primary objective of the study is to assess how the integration of unmanned aerial systems (UAS) enhances the operational effectiveness, responsiveness, and interoperability of Polish artillery forces. The secondary objectives are:

- to evaluate the extent to which modernization reduces structural and technological limitations inherited from Soviet-era systems;
- to identify operational lessons derived from the war in Ukraine and assess their applicability to Polish artillery doctrine and force development.

The central research question of this study is: *What innovation-driven development model should be adopted to enhance the operational effectiveness, interoperability, and adaptability of the Missile Forces and Artillery of the Armed Forces of the Republic of Poland in response to current and anticipated future battlefield requirements?*

The core method focuses on Poland's modernization of the Rocket and Artillery Forces, with particular emphasis on the integration of UAS capabilities such as the GLADIUS reconnaissance-strike complex. The case study enables an in-depth examination of institutional adaptation, technological integration, and doctrinal evolution. The research draws upon strategic defense reports, technical specifications, modernization programs, doctrinal publications, and operational lessons identified from the war in Ukraine. This method provides empirical grounding and contextual validation of modernization trends.

2. CURRENT CAPABILITIES AND MAIN PLANS OF ARTILLERY DEVELOPMENT IN POLAND

Prior to modernization, Polish artillery relied predominantly on legacy Soviet-era systems characterized by limited range, accuracy, and technological sophistication. These systems suffered from a lack of interoperability with NATO standards, particularly in the areas of command, control, communications, and fire control systems. The core artillery assets at that time included (Elak, Całkowski, Rewak, 2024, p. 194-201):

- 122 mm 2S1 *Goździk* self-propelled howitzers, with a maximum firing range of approximately 15.2 km;
- 152 mm *Dana* self-propelled howitzers, capable of engaging targets at ranges of up to 18.7 km;
- BM-21 *Grad* multiple rocket launch systems (MRLS) and RM-70 multiple rocket launch systems, with a maximum effective range of approximately 20.4 km.

Collectively, these systems provided limited deep-fire capability and did not meet contemporary NATO requirements for precision fires, extended range, and network-centric operations (Golonka, Niedźwiecki, Materac, 2025).

Table 1 provides an overview of the current artillery capabilities of the Polish Armed Forces and outlines the principal directions and planned initiatives for the development of Poland's artillery and missile forces.

In response to evolving threats and NATO standards, the Polish Land Forces Missile and Artillery Troops are transitioning from legacy systems to modern artillery characterized by increased range, precision, and mobility.

At the battalion level, support companies equipped with towed mortars are being replaced by company-level fire modules armed with 120 mm Rak self-propelled mortars, offering a maximum range of approximately 12 km.

At the brigade level, post-Soviet howitzers and gun-howitzers are being phased out in favor of Krab and K9 155 mm self-propelled gun-howitzers. Newly introduced fire support systems employ a standardized 155 mm caliber, fully aligned with NATO standards.

At the division level, in addition to the aforementioned155mm artillery platforms, forces are equipped with WR-40 Langusta multiple rocket launch systems, designed for engaging area targets, as well as HOMAR-K rocket launchers. Rocket artillery is capable of conducting fire missions at ranges of up to

approximately 42 km, while missile forces can strike targets at distances of up to 290 km.

Table 1.

Current capabilities and main plans of artillery development in Poland

Level	Current or Replaced Equipment		Main Plans – The Field Artillery of Polish Armed Forces		
	Main artillery assets:	Maximum range:	Main artillery assets:	Maximum range:	Ammunition, Missiles and Rockets:
Corps XXX	-	-	HOMAR-A (HIMARS-based)	GMLRS rockets (approx. 70–84 km) ATACMS missile (up to 300 km)	Missiles and Rockets: **Precision.**
Division XX	152 mm SpGH "DANA"	approx. 18.7 km	155 mm AHS Krab	approx. 40 km	Ammunition: **HE; Precision; Smoke; Illumination.**
			155 mm K9 Thunder	approx. 40 km	
	BM-21 "Grad"	approx. 20.4 km	HOMAR-K (K239 Chunmoo-based)	80–290 km (depending on rocket variant)	Rockets: **HE; Precision.**
			WR-40 Langusta	approx. 32–42 km	
Brigade X	152 mm Sp GH "DANA"	approx. 18.7 km	155 mm AHS Krab	approx. 40 km	Ammunition: **HE; Precision; Smoke; Illumination**.
			155 mm K9 Thunder	approx. 40 km	
	122 mm 2S1	approx. 15.2 km	155 mm AHS Krab	approx. 40 km	
			155 mm K9 Thunder	approx. 40 km	
Battalion III	120 mm mortar	approx. 5,7 km	M120 Rak	10–12 km	Ammunition: **He; Precision; Smoke; Illumination.**

Source: Own study based on: Lt. Col. Adrian GOLONKA, Maj Andrzej NIEDŹWIECKI, Cpt. Janusz MATERAC, *Development of Polish Field Artillery in the light of experiences from the Ukrainian w*ar, Future Artillery Forum, London 2025

At the corps level, commanders have access to the HOMAR-A system, providing deep-strike capabilities at ranges of up to 300 km.

Alongside the introduction of new firing platforms, a broad spectrum of ammunition is being developed and fielded, including high-explosive fragmentation, precision-guided, illumination, smoke, and cluster munitions (Golonka, Niedźwiecki, Materac, 2025).

A key emphasis of the modernization effort is digitalization. This includes the TOPAZ Integrated Battle Management System and its higher-echelon extension, TOPAZ PLUS. In 2024, following successful completion of all interoperability testing, Poland achieved full membership in the international Artillery Systems Cooperation Activities (ASCA) initiative (Wilewski, 2025).

ASCA is a multinational initiative with leading participation from NATO member states. Its objective is to enhance interoperability and enable direct cooperation between automated artillery fire control systems of different nations through the implementation of standardized procedures and unified interfaces embedded within national systems (Nosewicz, 2022, p. 43).

To ensure effective reconnaissance and precision strikes, the Gladius system is being introduced. This system represents a new generation of weaponry—an integrated reconnaissance-strike complex combining unmanned aerial vehicles (UAVs) with loitering munitions capable of operating at ranges of up to 100 km. Loitering munitions are intelligent weapons that, once launched, autonomously patrol the airspace, identify high-priority targets, and execute strikes at the optimal moment (Dalka, 2024).

The system significantly reduces the fire response time - from target detection to destruction - by eliminating delays inherent in traditional artillery command-and-control chains. Gladius effectively complements the HOMAR and Krab systems, filling the operational gap between tube artillery and long-range missiles, particularly in countering mobile targets. Integration with TOPAZ PLUS and ASCA ensures full synchronization with other fire support assets and NATO allied forces (Potrzuski, 2024). Plans for the development of Polish field artillery are presented in Figure 1.

In conclusion, the concept for the development of the Missile and Artillery Forces is primarily focused on replacing legacy Soviet-era equipment currently employed in both tube and rocket artillery units, restoring missile forces capabilities in the areas of operational fire support and deep operations, aligning equipment and procedures with NATO standards, and implementing automated fire control and command-and-control systems. Figure 2 shows the transformation of Polish artillery from legacy systems to modern, NATO-standard capabilities.

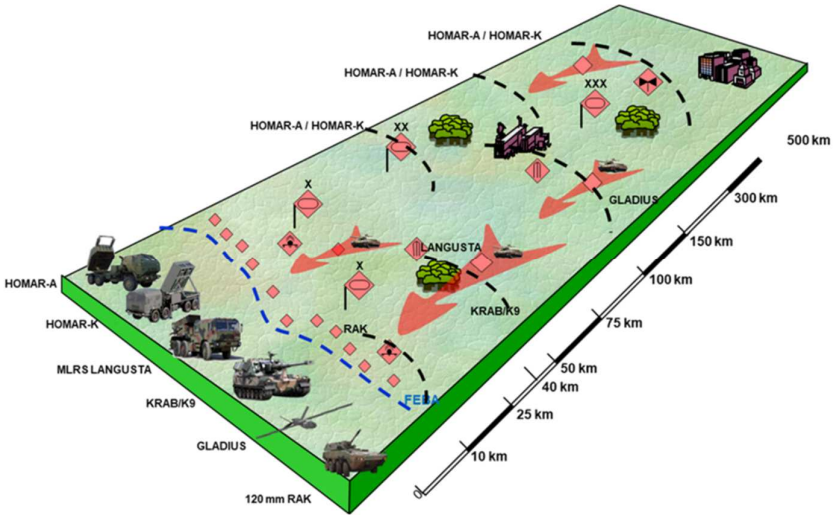


Fig. 1. Plans to Develop The Polish Field Artillery
Source: Gen. Grzegorz Potrzuski, *Plans to Develop The Polish Field Artillery,* International Artillery Conference: "Development of Missile and Artillery Forces in the Context of Lessons Learned from the War in Ukraine," Toruń, 2024

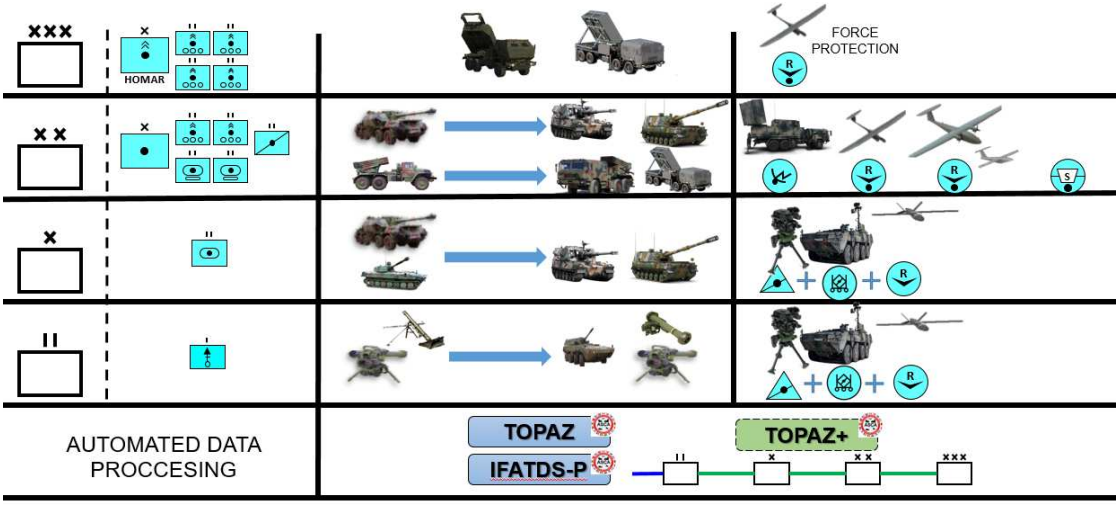


Fig. 2. The transformation process of Polish artillery
Source: Own study based on: Lt. Col. Adrian GOLONKA, Maj Andrzej NIEDŹWIECKI, Cpt. Janusz MATERAC, *Development of Polish Field Artillery in the light of experiences from the Ukrainian w*ar, Future Artillery Forum, London 2025

The restoration of missile forces capabilities is particularly significant, as these capabilities were lost following the disbandment in 2005 of the last tactical missile battalion in the Polish Armed Forces, equipped with the 9K79 Tochka system and assigned to the 1st Masurian Artillery Brigade in Węgorzewo (Elak, Całkowski, Rewak, 2024, p. 130).

It must be emphasized that operations on the contemporary battlefield can no longer be conducted without the employment of unmanned aerial vehicles (UAVs), especially for reconnaissance and strike missions. This operational requirement has been fully recognized and incorporated into the ongoing modernization programs of the Missile and Artillery Force.

3. ARTILLERY VS. DRONES ON THE MODERN BATTLEFIELD

During a review of the literature and open-source materials concerning the use of drones and artillery during Russia's aggression against Ukraine, the most significant statistics regarding changes in the employment of these assets were identified and are presented in Table 2**.**

Table 2.

Artillery vs. Drone

Period	Citation from open sources
2022-2023	**Some analyses prove that artillery in the first year of the war could have caused up to 90% of losses on both sides.** **Source:** Mertens, F., Heer de, B., Sweijs, T., Hooft van, P., Bekkers, F. (2023), *Lessons from land warfare: One year of war in Ukraine*, The Hague Centre for Strategic Studies. https://hcss.nl/report/lessons-from-land-warfare-one-year-of-war-in-ukraine/Google Scholar
2024-2025	**A staggering 75% of Moscow's battlefield casualties have reportedly been caused by Ukrainian attack drones, dwarfing the artillery and a mere 4% from small arms fire.** **Source:** Col. Andranyk Hasparian, Chief of Missile Forces and Artillery Development Department, Armed Forces of Ukraine, *Adaptation Under Fire: Trends And Challenges*, Future Artillery Forum, London 2025
2024-2025	**Widespread drone dominance on front lines, accounting for up to 80% of battlefield casualties; FPV drones overwhelm traditional defenses.** ***Source:*** *Death from above: Drones upend rules of war in Ukraine*, https://theweek.com/politics/death-drones-upend-rules-war-ukrainne, (published July 14, 2025)

Source: Own study based on open-sources

Analytical work has identified several key factors contributing to the dominance of drones on the modern battlefield. First, the shortage of artillery ammunition has forced the parties to the conflict to seek alternatives, accelerating the development and widespread use of drones as a cheaper complement to artillery fire (Hardie and Bowman, 2024). Second, the low production costs of drones - with individual units costing only a few hundred dollars - make them significantly less expensive than traditional artillery shells (The Economist, 2024). Third, the simplicity of production and modification allows drones to be assembled in field workshops from widely available components, with easy adaptation for specific tasks, such as explosive payloads or cameras (Modern War Institute, 2025, p. 49-53). Fourth, operator training is rapid, taking only a few days or weeks compared to the months or years required to train artillery crews, enabling quick replenishment of personnel losses (Molloy, 2024, p. 66). Fifth, the sheer availability of drones through mass production - even in improvised facilities such as garages - permits the expenditure of thousands of units per day, creating a saturation effect on the battlefield (Jensen and Yasir, 2025). The combination of mass availability of inexpensive drones with the ability to conduct continuous reconnaissance and precise strikes has fundamentally altered the dynamics of combat, exposing the vulnerabilities of traditional warfare methods and defensive systems, such as the lack of effective jamming or concealment networks.

A comparison between conventional high-explosive (HE) artillery ammunition and drones, including loitering munitions, FPV systems, and aerial-delivered munitions, highlights fundamental differences in their operational characteristics. Conventional HE artillery ammunition is primarily distinguished by its low susceptibility to countermeasures and its ability to conduct fire missions largely independently of weather conditions, ensuring a high degree of reliability across a wide range of operational environments. In contrast, drones are characterized by a high level of precision and a relatively low unit cost, estimated at approximately USD 300-700 per FPV drone (Hasparian, 2025).

Additionally, drone-based systems possess the capability to simultaneously engage moving targets while conducting real-time reconnaissance, thereby integrating strike and intelligence functions within a single platform. Their modular design allows for a high degree of adaptability and ease of modification in response to evolving tactical requirements. Moreover, the drone sector as a whole is undergoing rapid technological development, which directly translates into high availability of components and spare parts, further enhancing scalability and sustainment in contemporary conflicts (Hasparian, 2025).

The Armed Forces of Ukraine: Artillery Ammunition vs. "Kamikaze Drones" - the comparison is presented in Table 3.

Table 3. presents a comparative assessment of conventional high-explosive (HE) artillery ammunition and unmanned aerial systems, including loitering munitions and strike drones, across selected qualitative criteria. The comparison highlights a shift from massed firepower toward precision-enabled, network-integrated effects. While conventional artillery ensures high-volume fires and operational depth, drone systems provide superior target

discrimination, real-time reconnaissance, and a shortened sensor-to-shooter cycle, though they remain vulnerable to electronic warfare and environmental conditions. The data indicate that these capabilities are complementary rather than substitutive.

Table 3.

The Armed Forces of Ukraine: Artillery ammunition vs. „Kamikaze-drones"

Quality	Conventional High Explosive (HE) artillery ammunition	Drones ("suicide" drones and bombs)
Visibility for detection	LOW	HIGH
Vulnerability to countermeasures	LOW	Volnerable to Electronic Warfare, Kinetic Weapons
Precision	LOW	HIGH
Unit cost	MIDDLE 4 000$ for 155 HE	300-700$ for First-Person View (FPV) "Kamikaze" drone
Weather dependence	LOW	HIGH
Deployment time	LOW	MIDDLE
Ability to strike moving targets	LOW	HIGH
Intelligence gathering	NO	YES
Adaptable for redesigning	LOW	HIGH
Time for development	HIGH	LOW
Access to parts, equipment and technology	LIMITED	FREE AND WIDESPREAD
Flight condition (155 HE shell shot from L39 barrel vs ammo for "Bombers"	Chamber pressure up to 413 MPA spin up to 20.000 REV per minute; Velocity up to 1000 m/s	Free, slow, guided flight with velocity up to 80 m/s

Source: Col. Andranyk Hasparian, Chief of Missile Forces and Artillery Development Department, Armed Forces of Ukraine, *Adaptation Under Fire: Trends And Challenges***,** Future Artillery Forum, London 2025

In response to the research question, the findings suggest that an innovation-driven development model should be based on integrated, network-centric fires architecture combining traditional artillery mass with UAS-enabled precision, digital command systems, and NATO-interoperable solutions to enhance effectiveness, adaptability, and resilience in future multi-domain operations.

4. THE MAIN CHALLENGES FACING THE MISSILE FORCES AND ARTILLERY

Therefore, it is necessary to improve flexibility in the employment of artillery and its adaptability to the current challenges of the contemporary battlefield. The main challenges facing the Missile Forces and Artillery have been defined by the Missile Forces and Artillery Directorate and pertain to the areas listed below (Dalka, 2024):

- implementation of precision and "smart" munitions;
- integrated joint fire support and joint fires;
- autonomy and unmanned nature of strike systems;
- logistics;
- electronic warfare;
- fire-control automation;
- adaptability;
- increased range and precision of fire;
- cybersecurity and electronic warfare;
- manoeuvre capability and survivability;
- artificial intelligence (AI);
- reconnaissance and data fusion.

These requirements compel decision-makers to continue efforts toward comprehensive modernisation, encompassing both the implementation of advanced technologies (including precision-guided munitions, autonomous strike systems, and artificial intelligence) and the integration of capabilities in joint fires support, electronic warfare, and intelligence, surveillance, and reconnaissance (ISR). Key challenges are focused on enhancing the precision, range, mobility, and survivability of fire support systems, while simultaneously ensuring effective logistics, cyber security, and the ability to operate in an environment of satellite navigation interference (Dalka, 2024).

Key threats arising from the increasing complexity of systems in the context of Missile Forces and Artillery development programmes:

- The dynamic growth in the number of systems-technical, digital, organisational, and social-exceeds human cognitive and operational capacities;
- There is a shortage of competent specialists capable of holistically managing complex structures.
- The concentration of knowledge within a narrow group of experts entails risks related to monopolisation, sabotage, and erroneous decision-making.
- The "black box" effect results in limited system transparency and a loss of effective control.

In contemporary security discourse, one of the key threats identified is the rapidly growing number of systems-technical, digital, organisational, social, and others-whose scale and complexity exceed the cognitive and operational capabilities of the personnel responsible for their maintenance and understanding (Cook, 2019). Modern societies,

including armed forces, increasingly rely on complex technical systems to conduct both basic and advanced activities.

The scale, number, and interdependencies of these systems are growing faster than human capacity to fully comprehend, control, and sustain them. Trends originating in the civilian environment have a direct impact on processes within the armed forces. As a result, there is an emerging risk of an insufficient number of competent specialists capable of holistically understanding and managing these complex structures. This, in turn, may lead to an increased risk of system failures or destabilisation (Cook, 2019).

The concentration of knowledge within a narrow technical elite poses additional risks, including monopolisation, sabotage, and flawed decision-making. The "black box" effect, loss of control, and competency gaps constitute real threats to the Missile Forces and Artillery undergoing modernisation processes.

This threat is meta-technical in nature and requires not only technical solutions, but also organisational, educational, and ethical approaches.

5. INNOVATIONS IN THE DEVELOPMENT OF MISSILE FORCES AND ARTILLERY

With regard to the integration of Unmanned Aerial Systems (UAS) with Missile Forces and Artillery, it should be emphasised that the Armed Forces of the Republic of Poland, based on lessons learned from the war in Ukraine, should accelerate the development and fielding of UAS capabilities as a matter of priority.

It is essential to leverage the experience of the Ukrainian armed forces and defence industry in the implementation of cost-effective and operationally proven unmanned systems.

Of particular importance is achieving independence in the execution of missions deep within the adversary's force disposition or on its territory, a capability that Ukrainian forces have developed during the course of the war.

On January 1, 2025, the Inspectorate of Unmanned Weapon Systems was established. Additionally, on July 22, 2025, four contracts and one agreement were signed with military research institutes for the improvement of techniques, tactics, and procedures for the use of unmanned weapon systems. The current priority of the Ministry of National Defence is the training of drone operators (Rewolucja dronowa w Siłach Zbrojnych RP, 2025).

Taking into account the development of unmanned reconnaissance-strike platforms within the Rocket Forces and Artillery, the GLADIUS system currently being introduced into service constitutes an innovative solution. This system is designed to conduct both aerial reconnaissance and strike missions. It can be employed at the level of a battery, platoon, or individual sections. The system's components are integrated via the TOPAZ combat management system.

The GLADIUS system consists of various types of unmanned aerial vehicles launched from a universal launcher mounted on highly mobile wheeled platforms. The unmanned platforms may also be launched from mobile towed platforms. A representative system configuration includes FT-5 reconnaissance platforms combined with WARMATE 5/10 loitering munitions. The system may also incorporate their advanced strike variants developed for the Polish Armed Forces, such as the BSP-U and BSP-UT (*System rozpoznawczo-uderzeniowy GLADIUS*, 2026). The structure of the GLADIUS system is presented in Figure 3.

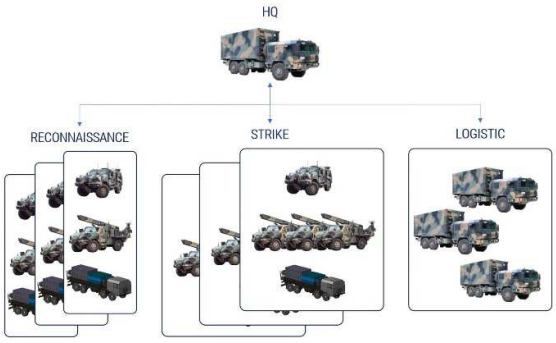


Fig. 3. The transformation process of Polish artillery
Source: Grupa WB, *System rozpoznawczo-uderzeniowy GLADIUS*, https://www.wbgroup.pl/produkt/system-gladius/, (access on 21.01.2026)

In the variant of the GLADIUS system selected by the Polish Armed Forces, FT-5 unmanned aerial vehicles are used for reconnaissance missions. They are equipped

with sensors enabling the detection and tracking of objects in the visible spectrum (FT-5 IMINT), by means of a synthetic aperture radar (FT-5 SAR), and within the radio-electronic emission spectrum (FT-5 ELINT). Unmanned Strike Aerial Vehicles (BSP-U) are intended for strike missions conducted using various types of warheads, including high-explosive fragmentation and shaped-charge warheads (*System rozpoznawczo-uderzeniowy GLADIUS*, 2026). Characteristics of the GLADIUS system are presented in Table 4.

Table 4.

Characteristics of the GLADIUS system

Modularity	Battery configuration tailored to mission requirements.
Battlespace picture	Real-time visualization of the tactical situation.
Integration	Interoperability of strike and reconnaissance assets.
Resistance to electronic warfare (EW) effects	Resistance to the effects of electronic warfare systems, including jamming and spoofing of satellite navigation signals.
Autonomous flight modes	Attack mode, flight via selected waypoints, flight to a designated point, loitering over the target, and return-to-safe-location mode.
Interchangeable warheads	Cumulative (shaped-charge) High-explosive fragmentation Thermobaric

Source: Grupa WB, *System rozpoznawczo-uderzeniowy GLADIUS*, https://www.wbgroup.pl/produkt/system-gladius/, (access on 21.01.2026)

Building upon the operational characteristics and modular structure described above, the GLADIUS system is engineered to deliver high performance in dynamic combat environments. The technical design prioritizes the engagement of high-priority targets through the use of versatile warheads and advanced propulsion systems. A key feature of the platform is its extended range, which allows for deep penetration into enemy territory while maintaining a reliable radio line-of-sight. Furthermore, the architecture ensures robust resistance to electromagnetic interference, guaranteeing system reliability even in contested electronic warfare scenarios. The ease of integration with existing military infrastructure facilitates a seamless enhancement of the artillery's reconnaissance and strike capabilities. Consequently, the detailed technical specifications below outline the critical parameters that define the system's combat effectiveness and strategic value.

Technical specification of the GLADIUS system:

- Engagement of high-priority targets;
- Warheads weighing 5–10 kg (high-explosive fragmentation HE-FRAG, shaped-charge HEAT, thermobaric TB);
- Real-time analysis;
- Resistance to electromagnetic interference (EMC);
- Ease of integration with other systems;
- Radio line-of-sight (RLOS) range > 100 km;
- Electric or hybrid propulsion;
- Service ceiling of 5,000 m AMSL.

The text underscores the critical need for the Polish Armed Forces to urgently develop unmanned aerial capabilities within their Missile Forces and Artillery to address existing technological delays. Drawing valuable lessons from the ongoing conflict in Ukraine, Poland has pursued contracts to accelerate the fielding of indigenous systems like GLADIUS. This innovative solution integrates various reconnaissance and strike platforms, such as the FT-5, with the TOPAZ combat management system to ensure real-time battlefield awareness. Key features of the GLADIUS include its high modularity, significant resistance to electronic warfare, and the ability to autonomously engage targets using interchangeable warheads. Ultimately, these advancements are designed to provide independent strike capabilities deep within adversary lines, significantly modernizing the Polish military's tactical potential.

6. CONCLUSIONS

The concept for the development of the Missile and Artillery Forces in Poland is primarily focused on replacing legacy Soviet-era equipment currently employed in both tube and rocket artillery units, restoring missile forces capabilities in the areas of operational fire support and deep operations, aligning equipment and procedures with NATO standards, and implementing automated fire control and command-and-control systems.

It must be emphasized that operations on the contemporary battlefield can no longer be conducted without the employment of unmanned aerial vehicles (UAVs), especially for reconnaissance and strike missions.

The combination of mass availability of inexpensive drones with the ability to conduct continuous reconnaissance and precise strikes has fundamentally altered the dynamics of combat, exposing the vulnerabilities of traditional warfare methods and defensive systems, such as the lack of effective jamming or concealment networks.

The optimal approach is an integrated fire support system, where drones provide precise target data and situational awareness, while artillery delivers massed, long-range firepower.

The future of fire support lies in synergizing new technologies (such as drones) with traditional systems (like artillery) - leveraging the strengths of both within a cohesive and resilient firepower architecture.

Key challenges facing the Missile Forces and Artillery in Poland are focused on enhancing the precision, range, mobility, and survivability of fire support systems, while simultaneously ensuring effective logistics, cyber security, and the ability to operate in an environment of satellite navigation interference.

The development of unmanned reconnaissance-strike platforms within the Rocket Forces and Artillery, the GLADIUS system currently being introduced into service constitutes an innovative solution. This system is designed to conduct both aerial reconnaissance and strike missions.

Key features of the GLADIUS include its high modularity, significant resistance to electronic warfare, and the ability to autonomously engage targets using interchangeable warheads. Ultimately, these advancements are designed to provide independent strike capabilities deep within adversary lines, significantly modernizing the Polish military's tactical potential.

The development of new technologies will continue to exert a significant influence on the further progress and modernization of the Polish “God of War.” The tactical and combat capabilities of Polish artillery must meet the following criteria: availability, interoperability, effect, precision and range.

Increasing emphasis should also be placed on the development of unmanned, autonomous artillery systems that minimize human involvement by replacing it with artificial intelligence, thereby enhancing the effectiveness of artillery systems operating in hazardous battlefield environments.

In conclusion, in response to the central research question, the modernization of the Missile Forces and Artillery of the Armed Forces of the Republic of Poland should follow an innovation-driven, network-centric development model that integrates advanced unmanned reconnaissance-strike systems with modern conventional artillery capabilities. The synergy between precision-enabled drones, automated fire control, and long-range massed fires—fully aligned with NATO standards—provides a clear pathway to enhancing operational effectiveness. Strengthening interoperability, resilience to electronic and cyber threats, and autonomous capabilities ensures that Polish artillery remains adaptable, survivable, and decisive in current and future multi-domain battlefield environments.

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Inovații în dezvoltarea forțelor de rachete și a artileriei forțelor armate ale Republicii Polone

Rezumat: Influenţaţi de lecţiile războiului din Ucraina şi de progresele tehnologice rapide, Forţele Armate Poloneze întreprind o modernizare cuprinzătoare a Forţelor lor de Rachete şi Artilerie. Această lucrare analizează tranziția de la sistemele vechi din perioada sovietică la platforme moderne, interoperabile cu NATO, concentrându-se pe integrarea strategică a sistemelor aeriene fără pilot (UAS). Un accent central este sistemul GLADIUS de recunoaștere-lovire, o soluție inovatoare care combină UAV-uri de recunoaștere cu muniții de răsucire pentru a oferi capacități autonome, de lovitură profundă. Studiul abordează, de asemenea, provocările critice, inclusiv complexitatea sistemului și supraviețuirea, demonstrând modul în care Polonia dezvoltă o forță flexibilă și precisă pentru câmpul de luptă multidomeniu contemporan.

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