

THE SURVIVAL OF ARTILLERY UNITS IN THE MODERN BATTLEFIELD

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Abstract: *Maintaining artillery units in a state of operational readiness and protecting them from enemy actions in the areas of operations where they are deployed is an essential pillar in the effort to provide continuous, timely, and effective fire support to combat forces and achieve success. In this regard, we believe that military decision-makers must conduct a detailed analysis of all factors affecting the protection of these assets, so that there are no interruptions in the provision of fire support throughout the duration of military operations and across the entire area of operations of friendly forces. It is easy to understand that the loss of artillery support equates to a decrease in the mission success rate of the force group to which it belongs, which can lead to the inability to strike high-value or important enemy targets, with immediate effects on the dynamics of operations in the area of operations. This article analyzes the factors influencing the maintenance of artillery units' operational readiness and the measures that can be taken to increase their survival rate in a modern, high-tech battlefield characterized by unprecedented dynamics.*

Keywords: Artillery, Survival, Fire support, Maneuver, Force protection

1. Introduction

In analyzing the actions of artillery units during various types of operations, the specialized literature highlights several key aspects, among which the capabilities for fire support, the duration of the maneuver in the area of operations, and the provision of continuous logistical support - aspects that have a major influence on ensuring effective fire support by these units.

The analysis of fire support capabilities focuses on the limitations imposed by the technical characteristics and design performance of artillery systems [1], so that they can execute specific missions against a wide range of targets of varying sizes, located at different distances, so that the expected effects can be achieved from the line of contact up to distances corresponding to the maximum range of the artillery systems under analysis. This analysis must be conducted by category of firepower, taking into account the types of

ammunition used and the effects that can be achieved when engaging different targets [2], so as to cover the entire area of operations where military actions will be planned and executed.

Another essential aspect in planning artillery operations is the rapid execution of maneuvers between deployment areas and firing positions, in order to minimize downtime and ensure continuous and effective fire support for combat forces throughout the area of operations.

A short duration allocated to the maneuver results in a brief period of exposure to enemy reconnaissance and a longer period allocated to the execution of specific tasks from firing positions, factors that directly influence the survival rate on the tactical battlefield.

Last but not least, ensuring continuous and timely logistical support necessary for the execution of specific tasks represents

another important pillar in the planning of artillery unit operations.

Effective logistics are essential for artillery operations [3]. Ammunition and spare parts must be delivered on time and in sufficient quantities to maintain operational readiness. In addition to the aspects mentioned above, recent conflicts in Ukraine and the Middle East have highlighted another important area for analysis: the survival of artillery units in the area of operations. While until the beginning of this century the protection of artillery units was limited to camouflaging their firing positions to shield them from enemy ground observation, and movement into the area of operations was planned as covertly as possible - usually at night or in conditions of reduced visibility - we are now witnessing a different approach to this analysis, due to the exponential development of various types of drones and the ability to conduct reconnaissance using them under any conditions of time, season, or weather [4]. Thus, the protection of forces from a ground-based perspective represents only one aspect of the analysis, with the primary focus shifting toward protection against unmanned aerial vehicles.

2. Literature Review

The development of the topic regarding the survivability of artillery units in the area of operations, taking into account ways to enhance the effectiveness of their actions, required a multidisciplinary approach, combining both theoretical aspects, found in various reference publications, and practical aspects, resulting from participation in various tactical exercises at training ranges involving artillery units.

In the research required for the drafting of this article, a detailed analysis of the specialized literature was conducted: reference articles on the operations of artillery units in various armies, scientific publications, books, and case studies from military conflicts specific to the 21st century. We also conducted a study of

military doctrines detailing the actions of artillery in various countries, with an emphasis on those that have successfully implemented solutions for force protection and the optimization of artillery operations in the modern battlefield.

3. Research Methods

This study employs a qualitative research approach based on doctrinal analysis, literature review, case study analysis, and practical observation. The research methodology combines the examination of military doctrines and scientific publications with lessons learned from recent conflicts, particularly the war in Ukraine. In addition, the study integrates practical observations collected during military exercises involving artillery units. The analytical framework focuses on identifying the operational and technological factors influencing artillery survivability in modern high-tech battlefields.

A detailed analysis of recent military operations, particularly the war in Ukraine, comparing the operational methods of towed and self-propelled artillery, contributed to the development of the methodological framework of this study. The research also included the identification of factors influencing artillery survivability, the analysis of planning guidelines for artillery operations, and direct observation during military exercises involving artillery units.

The main questions addressed in this article are as follows:

- What elements are subject to analysis regarding the increase in the survival rate of artillery units in the area of operations?
- What decisions must be made to increase the survival rate of artillery units?
- What constitutes the safety zone specific to artillery units, and how is it determined?

- What are the technological and operational limitations that may make it impossible to ensure an adequate safety zone for artillery units?
- How can enemy reconnaissance activities, which may lead to the discovery of friendly artillery units and subsequently to their engagement, be countered?
- How can the duration of exposure to enemy ground and aerial reconnaissance be reduced?

By identifying the answers to the above questions, viable tools can be provided to military decision-makers, necessary for planning the actions of artillery units, in full accordance with the realities of the modern battlefield, which will ultimately lead to an increase in their survival rate in the area of operations.

Through a multidisciplinary approach and a careful selection of research methods, the aim was to obtain valuable results that would contribute to improving the effectiveness of artillery units by increasing their survival rate, given the existence of a highly technologized battlefield characterized by multiple threats.

4. The safety zone and its importance for artillery units

To maintain operational readiness while remaining out of sight of ground-based observation and beyond the reach of enemy kinetic fire, artillery units are assigned various firing sectors and positions in the field, located at varying distances from enemy deployment areas, behind terrain features or topographic details that ensure an area unobserved by enemy ground reconnaissance [5]. The importance of the safety zone for artillery units is a critical requirement, serving to ensure the safe execution of specific tasks and the protection of personnel, as long as the artillery units remain outside the firing range of the enemy's artillery. This space refers not only to physical distance but also

to the environmental and tactical conditions necessary for operations in various areas and under different time, seasonal, or weather conditions.

At the same time, it must be borne in mind that an increase in the safety margin is directly proportional to a decrease in the firing range of artillery systems, in the sense that they must be deployed on the ground in such a way as to ensure sufficient range to engage enemy targets. As a concrete example, we can cite the safety zone of mortar launchers, which have a relatively short range compared to other artillery systems. Specifically, a mortar subunit with a maximum range of 6,000 m cannot be positioned at a safety zone of 5,000 m from the contact line to ensure enhanced protection against enemy actions. If this tactic were adopted, the maneuvering forces would receive limited fire support which, taking the analysis further, would not be the actual one. Why is the 1,000-meter engagement range for enemy targets not realistic? The answer is very simple: when firing with artillery subunits, the safety margin relative to friendly forces must also be taken into account, so as to eliminate the risk of friendly fire, caused by deviations in the direction and range of shells due to the influence of meteorological and ballistic conditions [6]. Consequently, considering a minimum safety zone of 200 m, the actual range at which targets can be engaged is reduced to just 800 m, which is insufficient to meet the actual fire support needs of maneuvering forces.

Figure 1 illustrates the safety zones for firing different types of ammunition, labeled A, B, and C, which, depending on the explosive power and effect on the target, require different safety zones.

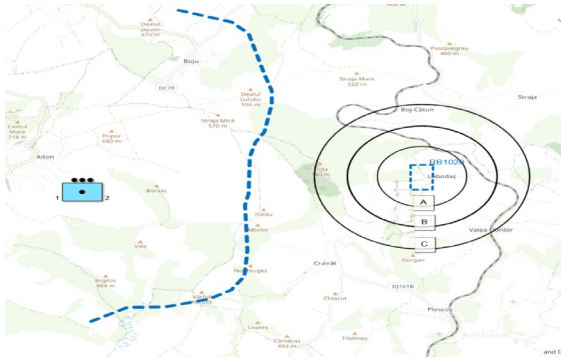


Figure 1 Safety Zones When Engaging Targets
Own study

When we shift our analysis to rifled artillery subunits or those that use reactive ammunition, the situation changes radically. First of all, these systems are capable of engaging targets at long ranges, a factor that can facilitate the establishment of a significant safety zone relative to the line of contact. Thus, an artillery system with design capabilities that allow firing at ranges exceeding 50 km can be assigned a significant safety zone, enabling it to operate as far as possible from the limits of the enemy's detection and engagement capabilities.

From the above, a logical question arises: how is the safety zone determined in which artillery systems can be positioned relative to the contact line, so as to ensure both sufficient space for engaging targets and the highest possible survival rate of those systems in the tactical field? In addressing this issue, I believe the following aspects must be taken into account: the fire support requirements of maneuver forces, so that they can fulfill their assigned mission, the existence of a deployment area that ensures the protection of friendly artillery subunits from direct-fire attacks by enemy ground forces, and, last but not least, an area that allows for the countering of enemy drones. The first aspect under analysis, the fire support requirements of maneuver forces, derives from the mission of these forces, depending on the type of operation and the areas where they require fire support. Thus, following the operation planning process,

the missions that the artillery must execute are determined, and a projection is made of the possible areas where the targets to be engaged may be located [7]. After identifying the fire support requirements, the fire support coordinator assigns specific tasks to the artillery units based on their technical and tactical capabilities, so that the maneuvering forces receive effective support from the artillery. This first aspect does not focus on maintaining a safety margin relative to friendly forces, but rather on positioning relative to potential target areas to ensure their engagement.

Based on analyses by specialists in the field and the provisions of current instructions, the safety zone is established as approximately one-third of the artillery's range, so that two-thirds of the range is allocated to the target engagement zone. It should also be noted that these distances are approximate, as terrain analysis is the determining factor in their final establishment, so as to ensure the specific conditions of the firing positions. These areas are schematically presented in Figure 2.

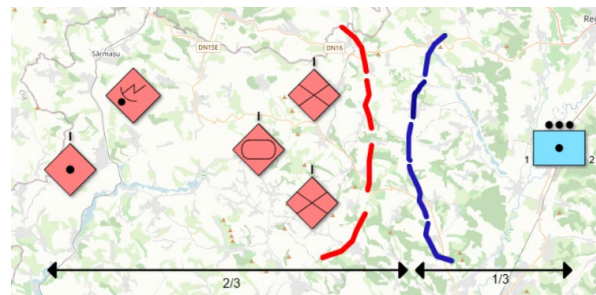


Figure 2: Firing distance and safety margin to the contact line
Own study

The second aspect of this analysis -the safety zone required to protect artillery subunits from direct-fire attacks by enemy ground forces - refers to their protection both in the initial phase, prior to the start of the operation, and subsequently, during the course of hostilities. While a simple solution exists prior to the start of the operation - by positioning artillery subunits behind protected areas such as hills, forests, orchards, buildings, etc. - the problem becomes acute during the operation, in the

sense that a safety zone must be established from which the maneuver must be executed from the respective firing position, so as to ensure real protection against firepower capable of penetrating the firing position area and firing directly at friendly artillery subunits.

The third aspect under analysis -ensuring the capability to counter enemy drones - is a pressing issue, and a simple analysis of the military conflict in Ukraine highlights the fact that most combat operations are conducted with the support of artillery and drones [8]. While at the start of the conflict ground artillery held supremacy in strike operations and force protection focused on shielding against enemy artillery fire, drones now pose the primary threat to artillery subunits, and the safety zone has had to be rethought to ensure conditions for engaging enemy drones [9].

5. The importance of performing the maneuver quickly

The military conflicts characteristic of the early 21st century highlight the increased dynamism of military operations, which are characterized both by rapid adaptation to new situations and challenges in the theater of operations and by frequent changes in the combat formation. This dynamism, viewed from the perspective of artillery subunits, directly relates to the maneuvering of these units in the tactical field, particularly to specific movements for conducting reconnaissance, maneuvering between different deployment areas, or changing firing positions to ensure timely fire support for combat forces.

On the tactical battlefield, a well-trained enemy, equipped with modern observation and firing technology, can locate and strike an artillery subunit using various engagement methods, ranging from direct fire to indirect fire or munitions equipped with proximity fuses. To survive on the battlefield, artillery subunits are forced to frequently change their firing position or deployment area to ensure a high survival

rate for these units. However, frequent changes in firing position or deployment area can result in reduced effectiveness of these units, due to increased time spent on maneuvering and decreased time spent in the firing position -and, consequently, on executing fire support missions.

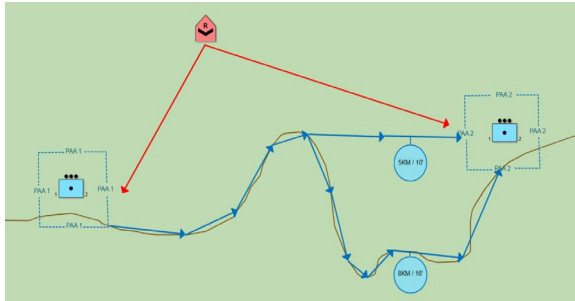
Planning the maneuver of artillery subunits in the tactical field, in turn, requires two separate analyses: planning other artillery units to carry out specific fire support missions for the combat forces, so that there are no periods during which they are deprived of this support, and the analysis of specific measures to protect forces during the execution of relocation maneuvers to other deployment areas/firing positions.

To execute specific tasks involving the engagement of various types of targets, artillery units must reconnoiter, move, and occupy firing positions that must meet certain requirements regarding accessibility, the possibility of concealment, and ensuring the conditions for firing over the topography behind which these positions were selected.

The analysis of these activities, from the perspective of survival in the tactical field, focuses on the travel time/speed required to move from deployment/holding areas to firing positions, the possibilities for crossing various types of terrain/obstacles, and the time required to execute fire missions. In conducting this analysis, consideration was given both to the enemy's capabilities for ground and aerial reconnaissance and to the performance of their artillery capabilities, which can engage friendly targets (with direct fire from artillery) in a short time.

The first aspect under analysis, the time required to move into the area of operations, can increase or decrease the survival rate of artillery units, depending on the capabilities and design characteristics of the equipment with which these units are equipped. The longer the time required for artillery units to deploy, the greater the likelihood of their

detection. Given that modern drones are equipped with advanced surveillance technologies and can conduct reconnaissance both day and night, with the capability to observe from long distances [10].



*Figure 3: Execution of the maneuver by artillery subunits
Own study*

The duration of artillery unit movements must be considered from two perspectives: the maximum speed of artillery vehicles and their ability to traverse various types of rough terrain, which can help shorten the distance between the initial and final deployment areas. In this regard, towed artillery has a major disadvantage because it cannot traverse rough terrain, being forced to follow passable roads or accessible areas. In contrast, self-propelled artillery units have greater capabilities for traversing these areas, particularly tracked vehicles, which can result in a shorter maneuver execution time and, consequently, a reduction in the time the enemy has to detect these subunits [11]. Figure 3 schematically illustrates the maneuver of an artillery platoon between two firing positions, with a long route along communication routes for towed artillery and a short route for self-propelled artillery, highlighting the duration of exposure to enemy aerial reconnaissance.

While measures to conceal artillery subunits can be implemented at the firing position, during movement they are exposed to detection by the enemy and, consequently, to engagement.

Therefore, a short execution time for the maneuver of artillery units in the area of operations results in a high survival rate for

them, and the duration of the movement is directly influenced by the technical and tactical characteristics of the artillery units under analysis.

Regarding the reaction time of artillery units - specifically the time to engage a newly detected target - this is of great importance, particularly when firing at targets characterized by high mobility, such as self-propelled artillery or wheeled vehicles. A delayed reaction time can lead to the targets leaving the positions where they were detected and the expenditure of a number of projectiles without achieving any effect on the target. In analyzing artillery reaction time, we believe that the combination of fire control systems and radars [12], which ensures rapid target identification and effective engagement using firing systems characterized by advanced technology, automation of the process for recording firing parameters, and the loading and execution of shots.

6. Conclusion

Planning military operations while taking into account the importance of protecting forces from enemy actions is a defining requirement of 21st-century operations. Only through a realistic approach to force protection can a high survival rate of military units be ensured in the modern, high-tech battlefield, marked by an unprecedented increase in high-performance systems for the timely and effective detection and engagement of targets located at ever-greater distances.

In addition to the specific aspects relevant to artillery units - such as fire support capabilities, the duration of operations in the area of operations, and the provision of continuous logistical support - the realities emerging from recent military conflicts bring to the forefront a new area of focus in planning the actions of these units: survival in the areas of operations where they are deployed. Thus, there is a significant shift from measures to conceal firing positions and from conducting movements at night or

in low-visibility conditions to proactive measures to protect forces by taking into account all types of threats, the most relevant of which are unmanned aerial vehicles.

In the effort to increase the survival rate of artillery units, the existence and value of a safety zone relative to the line of contact are critical requirements, ensuring that these units are positioned outside the range of enemy artillery fire.

Recent conflicts demonstrate a highly dynamic operational environment requiring rapid artillery maneuver and adaptability.

The importance of reducing the travel time of artillery units is a key factor in shortening the duration of exposure to

enemy reconnaissance and is directly influenced by the maximum speed of artillery vehicles and the ability to traverse hard-to-reach areas, thereby achieving two advantages: the use of these areas as firing positions or temporary staging areas for concealment, and the shortening of the planned movement route, with a direct effect on the time required to execute the maneuver.

Finally, future artillery modernization programs should prioritize force protection requirements and improved survivability in the tactical environment, in order to ensure continuous and effective fire support throughout military operations.

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