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ARTILLERY FROM THE PERSPECTIVE OF FIRING EFFECTS AND ENSURED CAPABILITIES

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ABSTRACT

Artillery is a branch capable of effectively supporting the dynamic operations performed by combat forces, with a decisive role in neutralizing, destroying or annihilating the opponent's capabilities, harassing and banning the actions of troops by executing a precise, effective and timely fire to obtain the expected effects. It uses high-tech subsystems and intelligent ammunition, while the concentration of fire and means is flexible, and the possibility of measuring and evaluating the effects on the target is high, due to the precise means of identification, research, selection and tracking a multitude of fixed or mobile land targets, either planned or unplanned. The ability of the artillery to act in the composition of joint tactical groups gives it an additional utility at tactical level, while the actions of the artillery are complex and ubiquitous in stability and peacekeeping operations, even near the contact alignment, with a strong impact for a wider range of scenarios.

KEYWORDS:
Capabilities, effects, fire support, technology, targets

1. Introduction

Artillery has undergone spectacular transformations over time, particularly generated by the evolution of science and technology, the tactics used, the firepower of armaments, and the destructive capacity of artillery ammunition.

Wars have always represented a remarkable determining factor in revolutionizing the principles, methods and procedures of firing, and the distribution and use of artillery in combat. They have also have led to the emergence of new types of weapons and equipment and encouraged the development of artillery from doctrinal, organizational, actional and technological perspectives.

In combat, field artillery mainly participates in determining (lethal) kinetic effects by annihilating, destroying or neutralizing personnel and firearms, high-precision hit research systems, the opponent's artillery and control system, and its infrastructure or fortifications. Moreover, upon order, it participates in the realization of nonkinetic (non-lethal) effects that reside in fire aimed at the psychologically influencing the opponent,

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crowd control, lighting, fumigation and dissemination of printed materials in areas of interest, jamming of communication systems and radars, etc.

In this context, the US Department of Defense has developed and updated Directive 3003.3 which states that "*conventional lethal weapons achieve the target effect by explosion, penetration, fragmentation, but non-lethal weapons minimize loss of life and collateral damage and have a reversible effect on personnel and means of fire, as well as selective effect on objects / infrastructure in the vicinity of the target*" (Department of Defence, 2004, p 1).

2. Highlights in the evolution of artillery capabilities

In order to correctly understand the evolution of artillery from bombers, cannons, and howitzers to the sophisticated artillery armament and missile systems existing today in the endowment of modern armies, I will make a succinct excursion into the history of artillery to reveal the main moments of transformation and the decisive role of artillery capabilities and the effects of its firing on the battlefield.

Globally, artillery has evolved dramatically over time. In an attempt to summarize the major changes that artillery has undergone over time, I have identified six significant moments in its evolution, which I will detail briefly.

2.1. Artillery during the Middle Ages and in the modern era

In the Middle Ages, the first revolutionary change in artillery was to ensure its mobility, the organization of movements, the shootings and the its use in support of the cavalry and infantry.

The first cannons had a range of about 1-2 km, respectively a limited effect of explosions of stone or bronze cannonballs on personnel, city walls or fortifications, but despite this, ammunition diversified and the caliber of cannons increased considerably, both for naval and siege artillery, and for field artillery. Also, in order to obtain notable results in combat, the armies of the great European powers used a large number of guns, standardized by caliber, built of bronze and later of steel. The artillery was organized into subunits, units and large units, firing rules and new combat tactics were implemented, the promoters of these changes being the French, English and later the Germans.

In the modern era, the second revolutionary artillery change was more consistent and materialized in the application of new tactics and methods of maneuvering and executing firing by direct and indirect sighting, equipping artillery subunits with parts and ammunition made only of steel, strictly organizing the artillery in subunits, increasing the density of artillery fire in front of and on the flanks of the fighting units, as well as executing the fire according to target groups. The effectiveness of artillery fire has increased due to the modernization of cannons and howitzers, the introduction of elastic links between the barrel and the impact, the use of optical sighting devices with independent sight lines, the increase of calibers, and firing range, and increasing the destructive force of cannonballs and projectiles, depending on the characteristics of the targets.

The third important moment was marked by the evolution of artillery after 1900 and during the First World War. Due to the destructive power of ammunition, the mobility and massiveness of the muzzleloaders, artillery became the main means of supporting infantry with fire, and of destruction of the enemy's armored vehicles and campaign and permanent defense works.

2.2. Artillery during the two World Wars

The First World War was nicknamed the "*war of position*", where the role of artillery as a weapon was amplified,

becoming decisive in the battles between the belligerents. Special purpose projectiles were created to destroy the personnel housed in the trenches: fumigants, incendiary, chemicals, shrapnel and bristle. The use of these new types of projectiles required the emergence of new firing methods and procedures.

As the war spread, the technical, tactical and operational stalemate forced the opponents to make extensive use of fortifications and trench lines, large-caliber muzzleloaders – Dick Bertha 420 mm caliber, Paris Canon 210 mm caliber on train platforms, with a remarkable beat of 120 km. For the first time, German gunners used clear rules for fire offensive, but it only lasted for one week, during which the firing was intense, continuous and required the consumption of about 1,000,000 projectiles. Thus, Germany achieved a remarkable success on the front on the river Somme, as the English and French infantry suffered colossal losses due to artillery bombardment, all of which managed to radically change the fate of the war on French territory.

It was the first time when anti-aircraft and anti-tank artillery were successfully used in combat due to the use of research balloons, fighter jets and metal armored tanks during military campaigns.

Furthermore, German artillery colonel Bruchmuler and Captain Pulkovschi managed to implement innovations such as: mathematical methods for calculating weather and ballistic corrections, procedures for coordinating fire with infantry maneuvering and chariots /tanks, firing rules to neutralize personnel and firing means, giving up the effect of destruction only by the exclusive contribution of artillery, due to the enormous consumption of ammunition. Then, precise rules were established for the distribution of artillery and for the execution of the maneuver. The determination of target shooting distances was generalized by using the speed of sound and the use of Shrapnel ammunition, which proved ineffective, was abandoned on troops in trenches/shelters.

The next important moment was marked by the evolution of artillery in the interwar period and during the Second World War. To capture the essential role of artillery in the land forces firing system, I would like to reiterate the words of English Marshal Montgomery: "*The harder the battle and the longer the war, the greater the number of infantry and, in fact, of all weapons, which will always be supported by artillery fire*" (Bucher, 1992).

In fact, the evolution of this branch illustrates the technological innovations and the effects they produce on the battlefield: self-propelled artillery invented by the British, jet projectile launchers invented by the Russians, tactical missiles V1, V2, V4 built and used by the Germans, as well as the appearance of the first command and control system of artillery fire produced by the Americans. The destructive capability of artillery fire in World War II reached mind-boggling levels through the execution of the fire wave and the successive concentration of fire by Russian artillery, the rapid maneuvering of self-propelled parts and fire, and the use of a very large number of artillery pieces in fire preparation and in the support of an attack.

I would like to mention some eloquent examples in this regard. The first refers to the German DORA cannon on KRUPP train chassis, 800 mm caliber, which was transported on 60 trains, and which participated in the massive destruction of the cities of Odessa and Sevastopol. It fired seven-ton shells at a distance of 38 km. 200,000 tons of projectiles and bombs were fired on Sevastopol, and the city was effectively demolished. This revealed the colossal destructive effects of a material and moral nature on the adversary, obtained through the concerted actions of the field artillery, but also of the aviation.

In World War II, artillery was nicknamed the "God of War" by the Soviets.

This euphemism, attributed to Stalin, has a real justification and basis, as artillery fire was the most powerful means of combat available to commanders, especially for the direct and direct support of the actions of infantry and armored vehicles, while the number of guns used in military operations reached aberrant levels. In the operation on the Laşi-Chisinau front (August 20-23, 1944), the Soviets concentrated 200 guns per km of battlefield, in the breaching sector, and the Romanian-German troops used at most 40 guns per km. The balance of forces was therefore crushing in favor of the Russians (5 to 1), and the effects of the fire of the Russian artillery were disastrous for our troops and determined the final rupture of the frontline and the withdrawal of the German army in western Romania.

During the Battle of Berlin, the Soviets concentrated 22,000 guns (cannons, howitzers, launchers) and 3,200 tanks and cannons, obtaining a density of 270 gunshots per km of battlefield in the direction of the main blow of Fr.1 Belarus (commanded by Marshal Zhukov). The artillery preparation lasted 30 minutes, and the fire was executed on a depth of 8 -12 km into the German defense. The city of Berlin was demolished from ground, the army was defeated, and the surrender was imminent.

2.3. The artillery in the modern and contemporary era

Another major moment in the evolution of artillery was the post-war period in which there were profound changes in military theory and practice regarding the use of field artillery in local wars or military operations other than war. I would also like to mention the operational and tactical changes related to artillery methods, combat techniques and procedures / TTPs, as well as the transformations that have occurred at the organizational and action level (the French system of artillery fire bases in Indochina).

With the advent of nuclear weapons, artillery in developed countries have acquired multiple tactical, operational and strategic missile systems, vectors capable of using chemical, bacteriological, incendiary, radiological and nuclear ammunition, as well as conventional ammunition. Their capabilities have increased considerably, as they have been endowed with frequency hopping radio stations, counter-battery radars, weather stations, radiolocation stations, centralized command and control and data assurance systems.

Subsequently, these changes were decisively influenced by the introduction of new types of simulation equipment, ammunition, high-performance armored vehicles, as well as by the implementation of new doctrinal concepts according to which the combat space will no longer accept the established linearity and uniformity of the combat devices materialized in strips, alignments and areas. In conclusion, I can definitely argue that the basic missions of this branch cannot be replaced by other systems such as aviation, attack helicopters, armored vehicles, and naval artillery. In order to accomplish them, the artillery and ground missile system coordinates the achievement of lethal and non-lethal effects of support forces, at the level of joint forces, a reality clearly illustrated during the conflicts in Iraq, the Western Balkans and Afghanistan.

3. Comparative study of current artillery and missile equipment options in terms of capabilities and effects

Obviously, the history of artillery is interesting, but two aspects are currently essential, namely the current technological level of artillery, and then its capabilities in providing timely, accurate and efficient fire support necessary to achieve the effects.

Next, I will perform a comparative analysis of the capabilities and effects obtained by the basic means of artillery fire, namely rifled artillery, smoothbore artillery (launchers) and multiple missile launchers, in terms of their efficient use by groups of

expeditionary forces in joint operations, as well as the execution of the basic activities mentioned above.

3.1. Rifled artillery and launchers

First of all, I consider that the integration in the composition of the expeditionary forces of rifled artillery, in general, and of its self-propelled variant, in particular, has lost ground to smoothbore artillery (missiles and multiple launch rocket systems / MLRS) in theaters of operations / TO.

Launchers are artillery systems considerably lighter than self-propelled artillery, weighing only a few hundred kilograms and facilitating successful use, especially in operations in urban areas, wooded or hilly mountainous terrain, in support of infantry tactical actions, mountain troops, Special Forces, paratroopers or airborne troops. Also, in scenarios involving counter-battery firing, the launchers are mounted on battleships or armored amphibious platforms, in order to ensure high ballistic protection, their tendency being towards self-propulsion, execution of long-range firing and integration into artillery fire control systems.

My argument is also based on the fact that the bomber is much more efficient due to its organic integration at the lowest tactical levels (battalion and company), having a high reaction time and a high firing rate, while its low weight allows fast transport over very long distances (strategic mobility) and areas that are hard to reach.

On the other hand, "*self-propelled artillery systems ensure a high capacity and speed of movement in any type of terrain, the crew ballistic protection by proper armor, a high accuracy of fire, special effectiveness of ammunition that is extremely diverse, multiple target effects*." (Stroea, 2006, p. 26). However, they consume a great deal of resources, especially for LC and ammunition, and require difficult and costly maintenance, especially in theaters of operations. Moreover, they are also considered too massive to deal with contemporary scenarios that require increased operational speed and mobility, low resource consumption, and easy operation and maintenance possibilities.

Secondly, some experts believe that a flexible combination of fire support from different categories of forces, such as naval artillery, field or heliport artillery, ballistic missiles and artillery equipment onboard helicopters and fighter jets will render the use of rifle artillery unnecessary. I partially share this view and would like to mention a few incompatibilities.

Consequently, bomb throwers have sufficient disadvantages. With a caliber not exceeding 120 mm and a limited range, between 5-13 km, the launcher can provide fire cover to a limited area, in contact, and is not effective on armored vehicles, does not fire ammunition with sub munitions, the target effects are limited, due to the caliber and low destructive force of the bombs, most of which are not connected to a centralized artillery fire control system and can only engage certain categories of targets due to the reduced fire possibilities.

Compared to mortars, rifled artillery has large calibers (105-203.6 mm and even larger) and fires the most diverse and destructive range of ammunition that meets all the requirements for achieving target effects, which is a considerable advantage for rifled artillery. Moreover, the howitzers have a very high range (up to 50 km, with increased range projectiles), which favors covering with fire a surface of land where troops 16 times larger than that of the launcher are placed.

It should be noted that most launchers do not have the quality of rifled artillery to execute, under any conditions, direct sighting on moving targets, which is especially important in achieving immediate safety and close defense of the artillery battle formation and in ensuring force protection.

Modern self-propelled artillery management systems integrate and process

data from a wide range of sources: acoustic sensors, observation, surveillance and anti-battery radars, photometric images or images obtained from UAVs, tactical, operational air reconnaissance devices or satellites.

3.2. Comparative analysis of rifled artillery and missile launchers

Supporters of multiple missile launch systems (MLRS, LARS) have not hesitated to recommend their priority use, arguing that modern launcher systems are not much heavier than rifled artillery, which allows them to move by strategic air or maritime transport, while the installation of systems on wheels allows the required operational mobility.

MLRS have a higher range than a standard 155 mm self-propelled system; however the extension of their range up to 150 km has determined the separation of the rocket trajectory into two parts: ballistics and aerodynamics, which indicates that if a counter-battery radar detects the rocket in the second part of the trajectory, it will be impossible to determine the coordinates of the subunit that executed the shooting. During the Cold War, missile launchers could also be used in the fight against armored vehicles attacking a position; today, however, due to construction problems, this is no longer possible.

Nowadays, missile systems have been configured to achieve long-range effects on targets of tactical, and especially operational or strategic importance. This is facilitated by equipping all launchers with GPS and connecting them to a complex database system.

Nevertheless, the use of *rifled artillery* by the expeditionary forces is not impressive in terms of mobility, range and accuracy. The development of new categories of armored or partially armored self-propelled guns / howitzers determines a reconsideration of the tactical advantage of the launchers at distances greater than 45 km, because sometimes the effect obtained cannot be effectively exploited by the combat forces.

I would like to mention a few critical remarks on the tactical shortcomings of the launchers. First of all, the rocket launchers cannot shoot in the whole area between the piece and the target, as there is basically an unbeaten area of about 10-15 km due to the construction problems of the launchers. This limitation is not valid in the case of rifled artillery pieces that can engage, by direct or indirect sight, any target beyond the safety zone, and, in exceptional cases, even inside that area.

Furthermore, the launchers were designed to achieve a high concentration of fire, which in the case of rifled artillery can only be achieved by the simultaneous use of several pieces / subunits. Instead, the reloading of modern artillery pieces is very fast, and a good organization of the firing rhythm ensures the execution of a permanent fire on a target or group of targets, while the reloading of a launcher takes between 20-30 minutes, in optimal conditions.

Rifled artillery can also fire a relatively large number of types of projectiles (explosive, lighting, cargo, fumigation, with printed materials, incendiary, etc.) equipped with different types of warheads, while missile launchers can only fire a low number of missile types, and equipping them with modern warheads, or changing the characteristics of missiles to obtain other target effects can significantly affect their quality, which results in lack of precision, in addition to the rapid wear and tear of launchers.

4. Conclusions

Each of the arguments for or against a particular files artillery system is legitimate, but they should not be viewed separately but as complementary systems, as an integral part of the field artillery and missile system.

Today and in the future, there is a need for a new vision on the training of

artillery specialists, on the organization of the component subsystems and of the standard activities required to be carried out by subunits, units and artillery staffs, on streamlining the planning and execution of fire support in the conditions of national and joint operations.

The dependence on the endowment with new technologies is obvious and allows the achievement of the end state, the improvement of the quality and accuracy of the artillery fire. Therefore, the development of artillery lies mainly in its adaptability to new conflict requirements, the reactivity of the means of impact, the destructive force of ammunition and provision of data security, the possibility of optimizing leadership and creating those logistical and technological capabilities necessary to perform operational functions.

REFERENCES

Bucher, S. A., United States Marine Corps. (1992). *The Third Revolution of Artillery*, available at: http://www.globalsecurity.org/military/library/report/1992/BSA.htm, accessed on 09 November 2020.

Department of Defence USA. (2004). *Force Application Functional Concept*.

Stroea, A. (2006). *Compatibilitatea artileriei cu cerinţele câmpului de luptă modern*. Bucharest: Editura Centrului Tehnic-Editorial al Armatei.