

ARTILLERY AND DRONE ACTION ISSUES IN THE WAR IN UKRAINE

Laurean-Georgel OPREAN
oprean.georgel@armyacademy.ro

“NICOLAE BĂLCESCU” LAND FORCES ACADEMY, SIBIU, ROMANIA

ABSTRACT:

Technological developments in recent decades in multiple fields have revolutionised the actions of armed forces, as recently confirmed in the war in Ukraine where NATO countries' artillery and missiles have undeniably outperformed the outdated spectrum of previous counter-insurgency actions, and the counter-battery fire of self-propelled weapons systems far exceeded the limits of the Iraq and Afghanistan theatres of operations, where such a response was easy to achieve because insurgent forces had no idea that such precise, coordinated and effective action was available at discovered targets. Drones have also become an inseparable part of military operations and have developed in an unprecedented way, being hardly detectable, precise, equipped with weaponry, radars, optoelectronic search means with sensors and modern communication and computer systems. Today, but especially in the future, the actions of drones and artillery means executing counter-battery fire will become indispensable in military operations to achieve desirable effects, and at the same time modern armies must have active and passive means of engagement and countermeasures against them to achieve effective force protection.

KEYWORDS:

Research, drones, target effects, counter-battery fire, artillery fire

1. Introduction

We have been in the third millennium for a few decades now and like a perpetuum mobile new crises, conflicts and wars are emerging, new deployments of forces, new concepts of action, super-technologized weapons systems and military equipment, military forces adapted to the new geopolitical and operational environment, but a timeless truth persists for artillery and missile structures. It is inextricably linked to the robust capabilities of this weapon, the high standards of training and evaluation, the colossal destructive force of the

ammunition used, the multiple effects created on targets, and the realistic and innovative doctrine that gives it maximum effectiveness in achieving fire support and coordination of effects at the level of national or multinational joint force groupings.

One indisputable truth has emerged in theatres of operations and particularly in the conflict in Ukraine, and it concerns the compelling utility of drones (wikipedia.org/wiki/Aeronava_fara_pilot) as a direct combat, strike, but also indirect means of combat, executing reconnaissance-

surveillance and target detection in support of other high-precision strike means, i.e. an unmanned aerial vehicle for reconnaissance, surveillance, espionage or target annihilation. These drones are classified as tactical drones with a range of up to 150 km, theatre of operations drones with a range of up to 100-km and strategic drones exceeding 1000 km flight range (United States Army, Counter-Unmanned Aircraft System (C-UAS), Strategy extract, 2016). They are capable of multiplying the surface area of targets up to thousands of times, accurately determining their coordinates, nature, activity and continuously surveying them for subsequent engagement with aviation, multiple rocket launchers or self- or towed howitzer and launcher sub-units.

In principle, these data and information obtained by drones are complementary to those provided by ground, aerial, naval, satellite, special intelligence, but a drone can easily perform topographic determination, tracking, observation, correction and evaluation of shots on dozens of targets at the same time. This gives them a pivotal role in all types of operations, they become specialised means of scouting, targeting and evaluation, and have proved their effectiveness and usefulness in warfare, while many of their capabilities remain secret and are constantly being developed, even though there are currently a number of anti-aircraft missile systems that are capable of destroying certain types of drones, depending on their technical-tactical characteristics, and Israel's Iron Dome missile defence system ([Wikipedia.org/wiki/Iron-Dome](https://en.wikipedia.org/wiki/Iron-Dome), 2023) is a prime example of this, being inexpensive and effective against unguided or guided missiles.

In the war in Ukraine, Western military specialists found that about 50% of Ukrainian drone missions were circumscribed to the search of the ground space for the use of air assets, and about 50% of missions were used to detect, monitor, correct, execute and assess the

effects of artillery and missile fire. Also, Russian troops did not have a large number of drones, the principles of their organisation, equipping and use in military action were often empirical, and the drones in their equipment proved to have extremely low capabilities. Russian forces have not been provided with sufficient numbers of drones for any type of mission, so 25% of drones have been planned to conduct firing and about 75% of missions have been directed at the actual destruction of ground targets, particularly after the Russian military was equipped with Iranian Shaheh attack drones.

By contrast, in the artillery of Western states, a drone sub-unit is an inseparable and organic part of artillery units and can execute target searches more than 100 km from the line of force contact, and the probability of destroying an enemy artillery and missile sub-unit has increased considerably, because most of the drones are highly technological, medium to large in size, which gives them a remarkable range and flight ceiling, equipped with missiles, high-performance wide-range radars, which gives them a high chance of finding artillery pieces, protection and survival in the airspace.

In this context, Western armies' counter-battery firing frequently uses drone search data in conjunction with counter-battery radar data to avoid artillery sub-units hitting terrain where adversary fire was once aimed. The principle of operation is identical to that of an ordinary radar, it determines the reverse trajectory on eight trajectory points and obtains a firing decision for counterbattery fire, which is usually transmitted within a maximum of two minutes and thirty seconds to a firing subunit ([Rumaniamilitary.ro/focul-la-contrabaterie-in-era-gps-ului-2](https://rumaniamilitary.ro/focul-la-contrabaterie-in-era-gps-ului-2), 2023). Conclusions and lessons learned from Allied artillery participation in recent wars reveal that if a counter-battery radar detects firing from an enemy self-propelled artillery subunit, the response need not be immediate but only if

a drone or other artillery sensor scans the area and confirms with certainty that the artillery structure is still in combat gear or moving/repositioning. This information needs to be fast, reliable and accurate and to support timely decision making for a strong response. This is why the interconnection between drones and artillery units has become indispensable, even mandatory, for accurate and effective firing.

2. Active and passive protection of artillery structures against counter-battery fire

The protection of artillery sub-units is not only about mobility, but also about concealment and camouflage against specialised reconnaissance assets, suggesting that we need to re-evaluate these issues that seemed outdated and obsolete a few decades ago, because most Western countries were overly reliant on the air superiority of NATO armies and sometimes neglected the development and superior potential of drone use. These modern armies have relied on the poorly equipped so-called insurgent forces illegally occupying the territories of states and attempting to retaliate by asymmetric means against a coalition of forces led under a UN mandate by the North Atlantic Alliance, but war brings with it conceptual changes, technological developments, niche developments, new modes of action and lessons learned from the lessons of these conflicts.

In the spirit of modern action, camouflage is about monitoring and reducing the work of electromagnetic and virtual means of communication. I highlight this because firing a single artillery battery requires dozens of video images and direction finding, hundreds of messages, orders and firing commands transmitted between artillery fire support entities via communications and computing assets, which increase the chances of detection of the associated electromagnetic footprint, actions whose vulnerability can be

substantially reduced by telephone links provided by short-distance transmission cables, tuning of frequency-hopping radios to low intensity and transmission of search requests for radar and sound, meteorological search stations for certain predetermined time intervals.

In fact, active and passive protective measures in each unit's standard operating procedures play a key role in responding to all these potential vulnerabilities to counter-fire.

In the war in Ukraine, it was unequivocally demonstrated that the dispersion of artillery subunits front and depth in the combat posture is paramount, and the area of deployment and close action of artillery subunits increased exponentially, depending on the type and calibre of weapon systems in the artillery's equipment.

Then, an artillery piece should not be involved in the execution of firing for more than 2-3 minutes, as it can be discovered after a minimum of 8 seconds. Also, a firing mission with special projectiles (e.g. illumination, smoke) requires a large amount of time and an appreciable amount of ammunition to be discharged at a considerable rate of fire. All these things constitute vulnerabilities that can only be addressed by the use of several firing structures acting in a short time, undoubtedly followed by a rapid manoeuvre in other reserve positions.

In fact, in order to protect our own artillery structures, it is imperative to destroy enemy counter-battery radars, radilocation and sound search stations, drones and search aviation which are extremely active and accurate in detection. However, in Ukraine it has been unequivocally demonstrated that the Russian air force was not able to act to its true potential due to the existence of many Western close, medium and heavy anti-aircraft assets of the Ukrainian allies, did not have sufficient quantities of anti-radar ammunition or offensive radio-electronic

jamming. These means represent a sophisticated, little-known technology developed and used by the Russians, and modern allied drones are difficult to detect due to the absence of angle reflectivity on surfaces coated with special plasma substance.

Another key idea lies in the ballistic dispersion of artillery pieces, firing a small number of projectiles from one position and executing rapid manoeuvres of subunits at appreciable distances from the initial position, as artillery mobility and dispersion are essential for the survival in the tactical field of this weapon frequently subjected to counter-battery fire.

Another measure is to limit the time of high-power, high-intensity transmission of frequency-hopping radios and to use close wire links between the various artillery entities. We also found that mock-ups or fake sound search, communications, radiolocation or counter-battery radars were frequently used in the war in Ukraine in accordance with complex deception plans.

Another technological advance that revolutionised counter-battery firing lies in the digitisation of the battlespace, which allows rapid recognition of the presence and capabilities of all entities present in the operation, the transmission of risk alerts in various operational situations, the updating of the current situation of one's own forces, i.e. the points of impact of the adversary's counter-battery firing are known within a maximum of 6 seconds.

This alert is transmitted and is only valid for structures that are deployed within 500/1000 m of the point of impact of missile or missile strikes. This alert does not allow for a large movement of the missiles as the initial velocity of the missiles is around 1000 m/s, which allows only small dispersions in distance and depth from the risk areas or implies sheltering all personnel in armoured missiles to minimise the effects of the firing.

Other technological limitations are the long periods of time spent on permanent

emission of counter-battery radars for vertical, extended and curved trajectories, and the reduced possibility of detecting the location of the submunitions discharge, which have a different dispersion mode and operation compared to conventional ammunition.

By alerting all artillery units in the area of operations to the intense activity of counter-battery radars, it will temporarily reduce the vulnerability of artillery firepower. Modern technology also allows selective and rapid notification of forces, their protection by limiting emissions in the electromagnetic spectrum, avoidance of radio intercepts, use of function, terrain and target coding, and callsigns for various types of attacks.

3. Determinants of the increase in counter-fire possibilities

In the case of offensive counter-battery actions, the striking, scouting and command assets of the adversary's artillery become the preferred targets. Older counter-battery radars have a detection range of up to 40 km, which tells us that a detection power of 80-100 km is required, including for the upward trajectory of missiles on the active portion, but also for self-propelled howitzers and drones which have a much higher range and flight range compared to the last decade. From the point of view of missile guidance, the arsenal of modern armies includes three types of smart munitions: *“reflected laser wave/semi-active laser (the target is illuminated by laser means by a specialised military person), GPS self-targeting (based on satellites and fire control and correction devices), Brilliant Ammunition (operates autonomously, being able to discover, identify and engage targets independently)”* (Stroea, Oprean & Ciocan, 2007, p. 145).

The complementarity and redundancy of search sensors remains essential, drones are vulnerable like counter-battery radars due to their use of the electromagnetic

spectrum, and wave reflection makes them highly vulnerable.

The considerable development of optical technology, highly sensitive thermal cameras and gyroscopes has facilitated the long-range detection of artillery missiles capable of firing submunitions, using the Hostile Fire Detector System, which does not exceed a detection range of more than 20 km, but which can disperse artillery pieces.

Russian Penicillin anti-drone systems ([Wikipedia.org/wiki/Penicillin](https://en.wikipedia.org/wiki/Penicillin)) built in 2020 combine an acoustic and infrared detection sensor-based system that can detect 90% of mortar, MLRS, anti-aircraft, tactical missile artillery batteries firing within 5 seconds at a range of less than 10 km, and Krasukha-2 ([Wikipedia.org/wiki/Krasukha-2](https://en.wikipedia.org/wiki/Krasukha-2), 2023) is an electronic warfare system capable of detecting and annihilating counter-battery radars using radio waves of various frequencies, but its capabilities do not exceed 20 km and are considered insufficient for large-scale warfare.

Cluster munitions, anti-armour munitions with submunitions, bombardment munitions do not outperform high-precision munitions, and collateral damage and losses must be taken into account, but drones frequently use laser-guided munitions, which are faster than GPS-guided munitions because those coordinates found by drones must be subject to trajectory mapping.

4. Conclusions on the use of drones and counter-firing

Centralised fire control, computer and communications systems support operational analysis to understand, anticipate and make decisions against adversary artillery. Even if artillery actions are predictable, areas of action and maneuver are spatially and temporally developed and require effective protective measures to maintain artillery structures in the effort to conquer zonal fire superiority.

Operational analysis is mainly carried out at the high level, where planning and manoeuvre of forces and assets (pieces, sensors), 3D coordination of firing, action hypotheses and fire support plans are also planned.

The integration, synchronisation and monitoring of fire is a laborious process handled by the centralised fire control system, and understanding the mode of action of the adversary's artillery is essential to predict the deployment areas of the device elements. For example, in 2014 in Ukraine, Russian artillery executed fire missions with an average range of 3-20 km and a maximum range of 30 km, according to the technical specifications of these fire assets and the research conducted by drones and counter-battery radars.

The application of safe, rapid and complete artillery procedures are important in military operations and counter-battery fire must eliminate threats to enemy artillery sub-units at distances of less than 20 km from the contact line. For example, SMERCH missile systems have an accuracy of hundreds of meters within a few kilometers, drones are means that provide sufficient information from the area of contact and the depth of the adversary's device, and the range of more than 16 flight hours and about 200 km of route covered allow for precise coordinate determination and accurate target engagement, and are indispensable in modern counter-battery fire.

Drones attract our attention because of their technical-tactical data, their equipment and functions, their size and the way they are armed for kinetic actions, and according to statistics published by the US military, there are currently around 600 types of drone in 100 countries around the world, and more than 100,000 drones frequently fly over American skies, which is a worldwide phenomenon.

Technological developments in all fields of activity have radically changed the original notions of counter-firing and the use of drones in modern military

operations. In combat with a strong military, the concept of operational employment of artillery structures is becoming a major capability challenge, a major operational challenge in terms of the

tactics, techniques and procedures used, the doctrine of operational employment, and the compliance with administrative, technical and operational standards for the present and the future.

REFERENCES

Centres de doctrine et enseignement du commandement. (2021). *Concept d'emploi des forces terrestres 2020-2035*. Paris.

https://ro.wikiqube.net/wiki/Precision-guided_munition

<https://www.digi24.ro/stiri/externe/ucraina-razboiul-artileriei>

Rumaniamilitary.ro/focul-la-contra-baterie-in-era-gps-ului-2

Stroea, A., Oprean, G., & Ciocan, F. (2007). *Artileria — noi concepte acționale. Tendințe de evoluție și înzestrare*. Bucharest: Editura Centrului Tehnic Editorial al Armatei, p.145.

United States Army, *Counter-Unmanned Aircraft System (C-UAS), Strategy extract*.

wikipedia.org/wiki/Aeronavă_fără_pilot

Wikipedia.org/wiki/Iron-Dome

Wikipedia.org/wiki/Krasukha-2

Wikipedia.org/wiki/Penicillin