American soldiers relax between engagements in a trench near Douaumont, France, circa November 1918. The trenches became trash dumps for the detritus of war—broken ammunition boxes, empty cartridges, torn uniforms, shattered helmets, soiled bandages, shrapnel balls, and bone fragments—in addition to occasionally becoming long graves when the trenches collapsed. (Photo courtesy of the U.S. Army)

First World War Doctrine and the Modern War of Positions

Josiah Mosser

If the Russo-Ukrainian War has proven one thing, it is that a positional war is still possible to initiate and maintain against limited Western equipment and tactics. This makes it imperative to study past and present wars of position due to the realistic possibility that the United States will have to induce, terminate, or prevent a positional war. In this article, I argue that the Russian defense in Ukraine is an iteration of the German First World War elastic defense in depth and explore the effects of technological advances on the offense and defense in positional war.

To begin, it is worth establishing what a positional war is. A positional war is characterized by relatively little movement, where the regular combat revolves around the capture of favorable terrain, the improvement of friendly and the destruction of enemy positions, to create an acceptable ratio of attrition. Positional wars are usually fought as delaying actions that allow one or both sides to create favorable conditions for the return to mobile war, where they seek a decision.[1] In the First World War the positional war in the West gave time for Germany to seek a conclusion in the East, while it gave the entente time for its economic war to take effect.[2] Victory can also be achieved through the bleeding out of armies or destruction of civilian morale without a necessary return to mobile warfare by the capture and retention of favorable terrain, such as the attempt at Verdun.[3]

Though it has been a century since the United States engaged in positional warfare, there are strong reasons to consider it today. In the first case, it may be forced. The Russo-Ukrainian War demonstrates that even aging air defenses with competent crews could deny air space from a numerically superior and more advanced power. U.S. open-warfare doctrine relies heavily on the strategic deep fires and close support of air forces.[4] While the U.S. Air Force is undoubtedly the most powerful, it seems hubristic to assume its advantage in the number and quality of aircraft can be maintained on all possible fronts ad infinitum. Deprived of air dominance, it seems possible that the United States may be forced into a war of positions. A concern unique to America is that despite the great strength of its armies in the event of a peer war, it will be at an initial disadvantage due to their wide deployment. America must be prepared to salvage the situation if it occurs, and positional warfare may be the answer. Additionally, no other power shares the United States' unique position of strength, making understanding the events and innovations in Ukraine worth studying in itself.

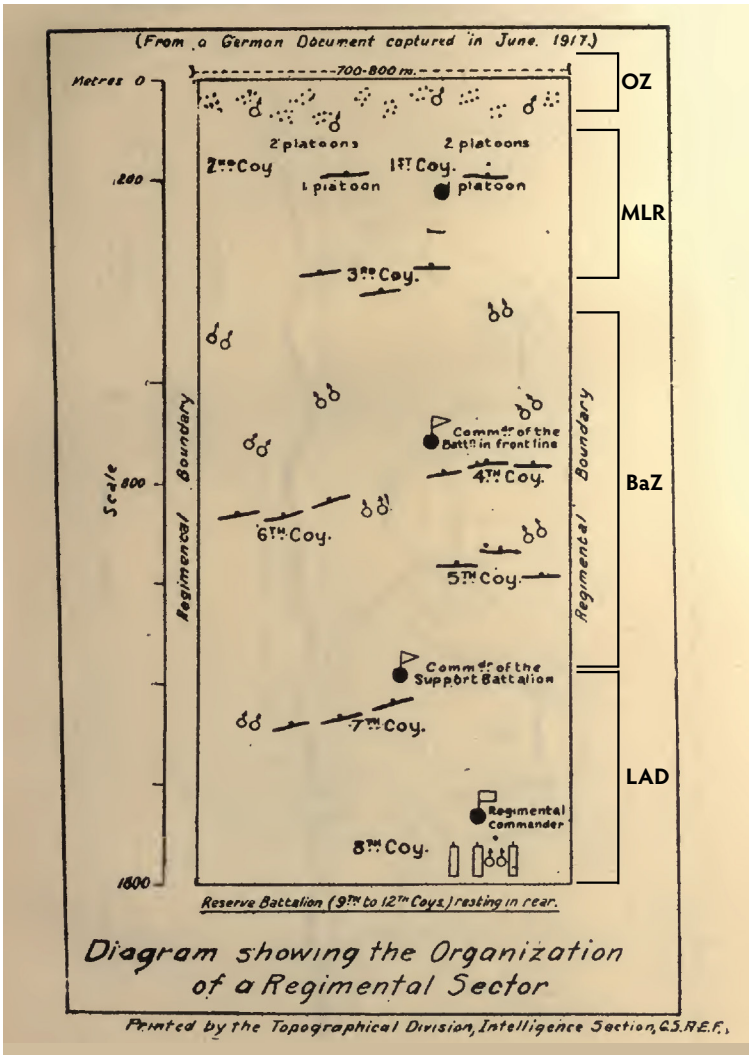
The Elastic Defense in Depth

The Russians in Ukraine seem to be employing a version of the most successful defensive doctrine of the First World War: the elastic defense. The Battle of the Somme is popularly known as a disaster for the entente, but British artillery superiority severely punished the German defenders concentrated on the front lines.[5] It was clear to the Germans that they would have great difficulty withstanding the entente past 1917 without a change in defensive tactics.[6]

The foundational documents of the elastic defense are *The Principles of Command in the Defensive Battle in Position Warfare* (1916) and *The Experience Gained during the English-French Offensive in the Spring of 1917* (1917).[7] The guiding principle was that it was impossible to concentrate enough strength on the front lines to defeat a determined enemy attack, and doing so would lead to horrendous casualties from artillery.[8] Instead, forces would be deployed lightly to the front lines, with authority given to local troops to temporarily withdraw if a position was unfavorable or untenable.[9] It became known as the "elastic defense" because forces would retreat in unfavorable conditions to launch immediate counterattacks. The deeper a position was penetrated, the greater resistance was encountered as it compressed the defenders. When counterattacks and accurate artillery barrages finally succeeded, the position snapped back. While the name evokes an image of passive defense, it is a defense characterized by its offensive nature. In its final iteration, the elastic defense used five zones: the barrage zone (BrZ), the outpost zone (OZ), the main line of resistance (MLR), the battle zone (BaZ), and the line of artillery defense (LAD). This system was so successful that the entente had broadly copied it by 1918.[10]

Barrage zone. The BrZ was the distance from the enemy's fieldworks to the OZ. Here, artillery would fire on predetermined barrage lines while barbed wire stalled and funneled advances. German doctrine considered 200 m to be a medium depth of the

Josiah Mosser is a graduate of the University of California, Santa Barbara with a BA in history and philosophy.



LEGEND

- BaZ (Battle Zone)
- LAD (Line of Artillery Defense)
- MLR (Main Line of Resistance)
- OZ (Outpost Zone)

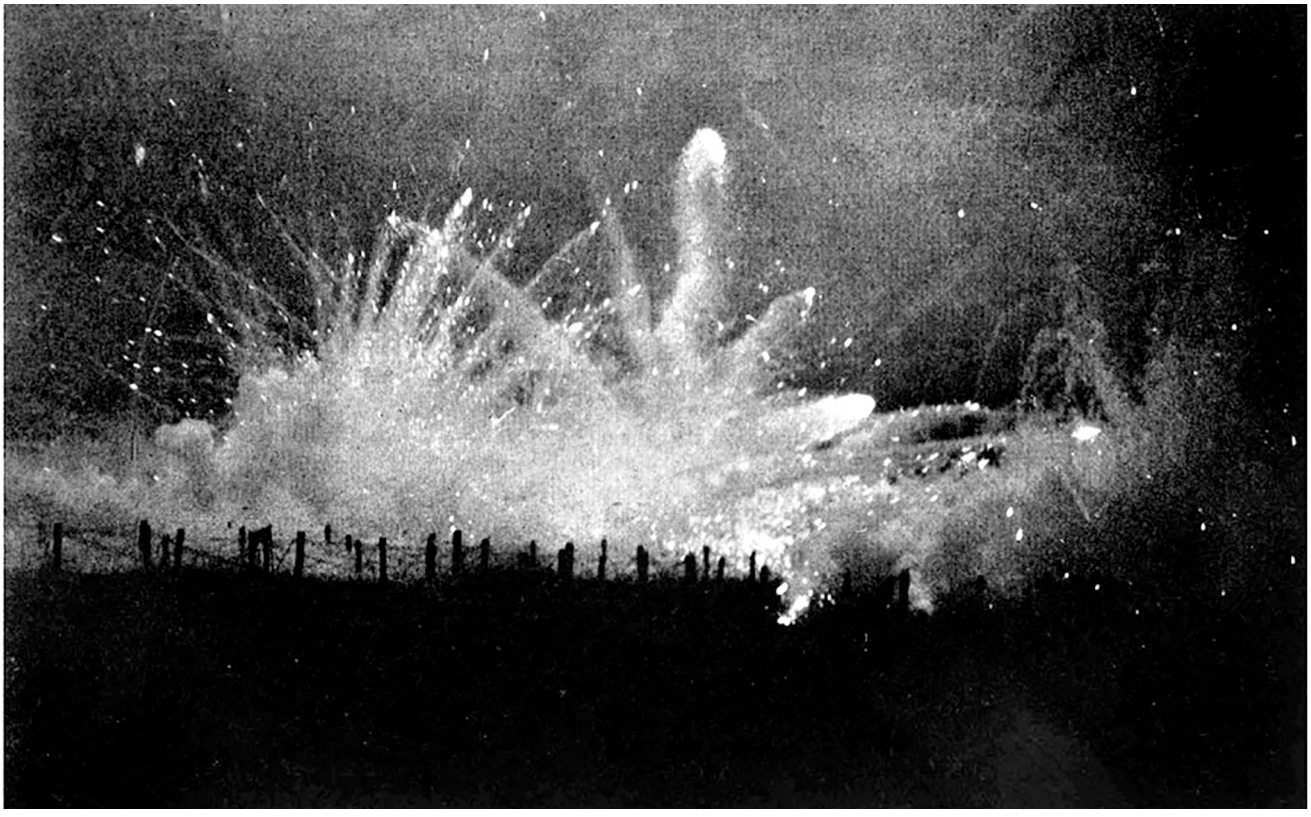
Translated from a captured German document in June 1917, this diagram displays the organization of a regimental sector. (Graphic adapted by the author, courtesy of the Army War College, *German and Austrian Tactical Studies* [1918])

BrZ, though it could be as little as 50 m or as deep as 1,000 m.[11]

Outpost zone. The OZ is a front line formed of small-unit fortifications. There was a continuous trench that provided shelter during daily life. In the event of an assault, defenders moved forward into a line of specially prepared shell holes, and the trench became a communication trench. Rather than defenders positioned evenly throughout the line, groups usually of seven would hold small shell-hole fortifications.[12] This accomplished three things. First, the defenders managed to avoid the majority of the preparatory barrage and suppressive fire so long as they were not observed.[13] Second, it gave an element of surprise because the line of resistance was formed when the attack commenced.[14] Third, it allowed some units to advance further than others as resistance was uneven.[15] The attacker was faced with the choice of arriving at the MLR piecemeal as different units broke through; with an enemy to their rear as points were bypassed; or together but risking artillery fire breaking up the attack.

Main line of resistance. The MLR typically consisted of two or three fire trenches with the appropriate communication trenches, dugouts, and dummy positions. The majority of machine guns were checkerboarded in independent positions behind the MLR. It was sited to be easy for friendly artillery observers to view and difficult for enemy observers. Positions on the reverse slope of hills and behind tree lines and towns were typical, but due to the large front and local considerations, less favorable, and even unfavorable positions had to be held too.[16] Like spaced armor, the OZ was designed to fragment an attack while the MLR stopped it.

Battle zone. The BaZ extended for 1–1.5 km behind the MLR and was filled with false positions and disconnected infantry, mortar, and machine gun positions. It was here that local counterattack troops were found. If the MLR was taken, there was an immediate barrage from directly laid field guns and a counterattack. The idea was that the disorganized enemy who had just occupied the MLR would have suffered heavy casualties and be further disorganized by the well-aimed barrage and easily thrown out of the captured positions.[17] It was for this reason that German troops could give up positions easily if they were temporarily disadvantaged and risked high casualties. Positions would be permanently abandoned if they were costly to retake, did



A German artillery barrage pounds Allied trenches during the night at Ypres, Belgium, in 1915 (likely the Second Battle of Ypres). (Photo courtesy of George C. Nasmith, *On the Fringe of the Great Fight* [1917], via Wikimedia Commons)

not offer a substantial defensive advantage, or could channel the enemy attack into unfavorable ground. This system of withdrawal and counterattack theoretically allowed defenders to funnel advances into disadvantageous terrain even at the lowest level.

By mid-1917, a typical regimental sector placed three-quarters of a brigade in the OZ and MLR, the strength of a full brigade in the BaZ, and a single company garrisoned the critical points in the LAD. On the local level, this made the majority of a brigade available for immediate counterattacks and reinforcement for the MLR and left an unengaged reserve of one brigade per regiment or one regiment per division. The clear offensive spirit of the doctrine can be seen in these in-depth deployments staged primarily for counterattacks.[18]

Line of artillery defense. The LAD was typically one or two fire trenches. The BaZ had the same disruptive effect for the LAD as the OZ had for the MLR. If efforts to recapture the MLR were fruitless, then the LAD bought time for artillery to retreat and new defensive lines to be created.[19]

The Russian Defense as an Elastic Defense in Depth

The Russian defense in Ukraine seems to closely copy the German defense. The largest departure is that the depth of zones has greatly increased. This is because the rate of advance was limited to the pace of an infantryman in World War I. The increased theoretical rate of advance of mechanized columns means that there must be greater depth to allow for adequate reaction time.

In Ukraine, the BrZ, traditionally understood as the distance between fieldworks, is usually between 1 km and 1.5 km deep in open country.[20] The distance from enemy lines that infantry and mechanized forces can operate is different. This has led to a zone behind the front lines that both sides attempt to deny to vehicles: the gray zone (GZ). The primary difference between the two zones is that one is concerned with breaking up attacks after they leave their zone of control, while the other is concerned with denying the use of an area behind the enemy's front line to vehicles, which includes breaking up mechanized assaults.

U.S. troops man a captured German communications outpost 19 September 1918 in France. (Photo courtesy of the U.S. Army)

While there was deep searching fire before this war, it was generally limited to known positions, lines of communication, and situations in which artillery-spotting aircraft could operate. The proliferation of observation and attack drones, guided shells, and ground radar capable of detecting vehicles has greatly increased the range and consistency of accurate engagement.[21] In eight examples of mechanized assaults, both Russian and Ukrainian, the mean distance they came under fire was 1.63 km behind their front lines.[22] Accounting for time between observation and shells on target, the GZ likely extends to a minimum of 3.5–6 km.[23] The zone of "searching fire" beyond this is at least 10 km, where enemy vehicles are commonly engaged.[24] With the increase in number, payload, and range of attack drones like the Lancet, the GZ will continue to expand in depth and increase in efficacy.

So far, the GZ has been the greatest arrow in the defender's quiver and the Achilles' heel to the attacker. The rapid advance in drone technology has forced attackers to gather and launch their strikes from far further than before. This means more time under fire and better prepared defenders. There is no way to bypass or cut through this zone of defense unless artillery and drones can be completely suppressed.

The OZ operates much as it did in World War I, though with an increased depth to deal with faster advances. Unconnected positions work to break up attacks before they reach the MLR. Instead of using dense wire to block and stall advances, deep minefields extend through the entire zone. The additional depth also offers increased opportunities to funnel attacks into naturally and artificially disadvantageous terrain. An excellent example is Russia breaking the pattern of counterattacks southeast of Robotyne, channeling the Ukrainian advance where the hills gave the Russians a significant line-of-sight advantage.[25]

South of Robotyne, two or three MLRs are visible from satellite stills; the first is 10 km from the front line's location at the time of construction. The distance between subsequent lines is from 3 km to 6 km.[26] There are contiguous antitank ditches and a fire trench dotted with fortresses and dugouts. They conform to German positioning doctrine as best as possible, running behind tree lines, hills, and towns. Further comment is not warranted since neither the MLR or the BaZ and LAD have been truly tested.

Objections to the Elastic Interpretation

There are two primary objections to the interpretation offered here. First, one cannot definitively know the Russian doctrine without access to internal publications or discussions. While the epistemological point is true, the latest public publications places preference on maneuver in defense. Where a purely positional defense must be held, doctrine recommends a main defensive position of four layers of strong points separated by 400-1,000 m in depth and brigade defensive zones as wide as 15 km, and emphasizes the importance of directly laid fire from artillery and integrated armored vehicles in repelling assaults.[27] Russia's defenses and actions during the Ukrainian 2023 offensive as described earlier are incongruous with prewar doctrine. There is more to discuss in the shortcomings of prewar Russian defensive doctrine than there is space here, but the unprecedented state of surveillance in Ukraine alone is certainly responsible for many of the changes, as it forces vehicles from near static positions on the forward edge of the defense which in turn requires changes to the whole system.[28] Since the tactics of Russian commanders in the field have been forced to evolve faster than Russian doctrine the argument that the elastic interpretation is not supported by available Russian doctrine falls flat.

The second objection is weaker. One might object that Russia has held the OZ far more strongly than it would if it was employing an elastic defense. This is a simple misinterpretation of an elastic defense. Regarding the pattern of retreat and counterattack, *The Principles of Command in the Defensive Battle in Positional Warfare* says, "These tactics cause the fighting to take place not in, but for, the front line."[29] While an elastic defense acknowledges, plans for, and even generates its greatest strength through retreat and compression, in ideal circumstances (like those in Ukraine) when the enemy attacks with insufficient strength to break through and neither artillery nor local circumstances render the captured positions unfavorable, the front line will be recaptured.[30] Russia's continued counterattacks for favorable OZ positions while relinquishing others is best understood as part of an ideal elastic defense. It is not an argument against the notion that Russia employs an elastic defense. Whether it is favorable to hold the front lines so dear is a different question than whether it conforms with such an interpretation.

A 2015 map of the buffer zone established by the follow-up memorandum of the Minsk Protocol during the war in Donbas, Ukraine. (Map by Goran tek-en via Wikimedia Commons)

Benefits of the Elastic Interpretation

Disruption zones. Even though it is plausible to interpret Russia's defense as an elastic defense, why should we? One reason is that it offers a more discriminating framework than viewing it as an iteration of other types of defenses like the U.S. area defense, which has a single disruption zone. Forcing Russian defense into a framework like that ignores that the GZ, BrZ, and OZ all use distinct methods to achieve their disruptive effects and take place in distinct locations on the battlefield. Accepting the elastic interpretation allows and encourages the focused study of the unique challenges each zone poses to its implementation or destruction.

Air superiority. Understanding Russian defense in Ukraine as an elastic defense helps correctly identify the obstacles to a successful breakthrough battle. While there were many failings of the Summer Offensive, Ukraine's and its Western allies' flawed understanding of the Russian defense is most visible in the importance ascribed to their failure to seize air superiority.[31] Ukraine certainly suffered heavily due to extremely active Russian aviation during those early June nights and would have had more success using Western mechanized tactics if they were able to present at least a contested airspace.[32] Even if they had local air dominance, the likelihood of a successful mechanized breakthrough attempt against a modern elastic defense is slim as no aerial bombardment can totally destroy a defender's ability to resist. A much reduced but steadfast garrison could still plausibly repulse a mechanized advance behind the drones of the GZ and mines of the BrZ and OZ that are left untouched from the air. Simply put, while at least denying airspace to the defender is of critical importance, air superiority is not a sword able to slice the Gordian Knot of a Russian-style defense.

Minefields. We are able to obtain a tentative solution by placing the modern problem of minefields in the context of World War I's elastic defense. These minefields on an unprecedented scale do not represent a fundamentally new challenge but rather a return of an old one. In World War I, a single line of uncut wire and a stouthearted machinegun could stall an advance; now, one undiscovered line of mines can repulse an advance by its own powers.[33] The Mine Clearing Line Charge only clears an 8 x 100 m path, and the largest cleared zone by the mine clearing equipment of a major power is the British Python, with a 200 x 7.3 m cleared zone.[34] When confronted with individual obstacles .5 km in depth that are layered across the entire OZ, they will, of course, be found wanting.[35] The narrow, cleared corridors also make advancing columns more vulnerable to all types of fire. I believe the solution is the same now as it was then: systematic obstacle-clearing artillery fire.

There are three clear objections to this. First, the wear on equipment; second, the consumption of ammunition;

and third, the need to "shoot and scoot." The first two objections are economic and certainly are problems that must already be overcome by any country engaged in a peer war.[36] The third seems more damning until you consider German neutralizing artillery tactics. While it relies on gathering at least a local artillery parity, it also offers the hope of rendering a sustained bombardment plausible. A sustained bombardment is rendered palatable because achieving surprise is always difficult in positional war and has become almost implausible with the advent of drones. An advance is likely to falter even if surprise was obtained without a way to quickly breach minefields. Trading an attempt at surprise for a comprehensive preparatory bombardment, including obstacle clearing, is at least an interim solution.

"In the First World War, the Germans successfully shifted the line of resistance away from fieldworks through a doctrine reliant on counterattacks, and where positions must be occupied, like the OZ, the line of resistance formed only as the attack commenced."

The line of resistance. Understanding the Russian defense as an elastic defense helps to pinpoint the key issue to breaking or maintaining it. The glaring weakness of any defense in a positional war is that with almost constant surveillance, any positions that could be observed can be destroyed by preparatory fire or accounted for in attack plans; the elastic defense is no exception. In the First World War, the Germans successfully shifted the line of resistance away from fieldworks through a doctrine reliant on counterattacks, and where positions must be occupied, like the OZ, the line of resistance formed only as the attack commenced.[37]

Russian doctrine already extensively uses counterattacks, but there are also limited instances where the Russian defense unconsciously mimics German OZ doctrine. There is the famous incident where a single Russian tank repulses a Ukrainian column that had broken past an outpost and other cases where Russian tanks ambush columns well forward in the OZ.[38] Acting alone, these vehicles are far more likely to avoid attack in the GZ and greatly enhance the disruptive effect and defense of the OZ since they are points of resistance that cannot be located or planned for in advance. A more consistent implementation of independent armored vehicles or antitank teams operating deep in the OZ would help shift the line of resistance away from fieldworks.

These mitigate the issue but do not entirely remove it. The infantry is still required to occupy a front line. The German method of moving forward from fieldworks is not employed in Ukraine. I suspect this is primarily due to constant observation. The German manuals are clear that pushing out of cover was effective only when it was not observed as otherwise, they were more vulnerable to the fire now directed on them.[39] In the specific case of Ukraine, where the majority of positions are built in agricultural windbreaks, it may be possible to move forward into the windbreaks on the flanks of the position or possibly break the line of sight of observing drones by moving behind the position.[40] This introduces the risk of the attacker embedding themselves in the defender's position. It may still be favorable in specific circumstances like a typical Russian or Ukrainian mechanized advance where the disembarked infantry will be without support after their vehicles withdraw. The individual tactics to shift the line of resistance must be tailored to the conflict, but an aggressive defense—the German move forward, the Russian disruptive armor, or even the creation of numerous dummy works and saps—all help mitigate a defender's fundamental disadvantage in a positional war.[41]

For any would-be attackers, understanding the Russian defense as an elastic defense reveals that they must find a way to pin the defender to their fieldworks.[42] As discussed later, the use of remote-deployed minefields may help to smother enemy movement, making German breakthrough artillery tactics effective and forcing the defender to fight from his positions.

A soldier from Ukraine's 10th Separate Mountain Assault Brigade "Edelweiss" fires a mortar within the Kupiansk axis on 26 January 2024 after receiving coordinates from drone operators about enemy positions. (Photo by Serhii Nuzhnenko, Radio Free Europe/Radio Liberty via the Collection of war.ukraine.ua)

Breaking an Elastic Defense

The technical method. If the Russian defense is an elastic defense, it is logical to look at the two historical methods of breaking an elastic defense: what I characterize as the entente's technical method and the Quadruple Alliance's shock method.[43] Each method played to the relative advantages and disadvantages of the powers in industry and manpower.

The technical method leveraged the entente's advantages in industry, raw materials, and manpower. I call it the technical method because it believes that technological and industrial solutions such as tanks and an overwhelming advantage in artillery will allow them to grind down and break through the enemy lines.[44] So long as they could keep a nearly even casualty ratio, they would continually degrade the Central Powers' fighting ability relative to their own. They would quickly smash enemy lines and silence defending batteries with their massive advantage in tubes and shells. Tank attacks would move forward without bombardment, bringing an element of surprise and direct fire to the front. In theory, trucks, tanks, and artillery tractors kept the advance faster than the construction of defensive lines. While infantry tactics had improved by the end of the war, the entente's method is best summed up by the dictum, "The artillery conquers, and the infantry occupies."[45]

Modern Western maneuver doctrines share a key feature with the technical method; they rely on technological or industrial advantages to prevent or terminate a positional war.[46] In the case of the United States, there are visions of overwhelming precision air and artillery strikes while mechanized columns slice through defensive lines like a scalpel. The possibility of a positional war is not considered in high-level doctrine.[47] Open warfare is possible in this manner. However, it relies heavily upon industrial and technological advantages or the opponent's willingness to fight an open war. It is unwise to presume these conditions will always be

obtained before the outbreak of hostilities or that they can be sustained throughout a conflict. Weapons and munitions are always finite resources, and their production and distribution can be disrupted in sometimes surprising ways. Furthermore, extended conflicts are one of the primary drivers of technological and tactical advancement on the battlefield. Over time, an undefeated force tends to overcome or at least mitigate the technological superiority of their opponents.[48]

The shock method—artillery. The German High Command realized its industrial weakness and instead focused on improving infantry and artillery tactics and cooperation.[49] German breakthrough artillery tactics departed from contemporary artillery tactics in one important way: they accepted that the ability to resist was impossible to destroy by fire.[50] They instead sought to disorganize their opponent's rear and deny them room to maneuver on the battlefield. The barrage lasted between one-and-one-half and five hours, with overwhelming fire converging on and departing from their determined targets to the minute. The fire from all arms was distributed across a greater width than the intended attack to pin troops on the flanks and deceive the enemy of the center of the effort. The German preparatory barrage consisted of three phases, starting with targets of opportunity, then moving to counterbattery fire, and ending with destruction fire on the front lines.[51]

It began with fire on command posts, rail lines, roads, depots, communication centers, infantry concentrations, and occupied battery positions. The large number of guns made batteries difficult for the entente's forces to locate.[52]

The majority of the artillery shifted to dedicated counterbattery fire after around fifteen minutes. As many battery positions and alternates as possible were located prior to the start of the offensive.[53] Field guns conducted the majority of the counterbattery fire, saturating any potential positions with lingering gas shells.[54] The use of chemicals, which could take days to disperse fully, silenced the batteries for the course of the combat as gas masks made the operation of the guns nearly impossible and had a limited life.[55] With areas as large as a square kilometer contaminated and all observed secondary battery positions hit, it was very difficult for a battery to relocate and reenter the fight quickly.[56] Using gas instead of high-explosive shells eliminated the chance of destroying the battery but was more likely to silence a battery. High-explosive shells would have also introduced the opportunity of a battery not being wholly destroyed and reentering the fight. If there were any unlocated batteries or batteries that managed to reenter the fight, there were field guns dedicated to reactive counterbattery fire.[57]

Finally, fieldworks, secondary lines, flanks, and assembly areas were hit with intense destruction fire and dispersing gas. Trench mortars were largely responsible for destructive fire on obstacles and fieldworks due to their ease of production and high angle of fire. Rather than attempting to destroy every position like the British at the Somme, they focused on battering deep corridors for shock troopers while using gas to smother enemy movements and pin them to their works.[58] The use of dispersing gas prevented the movement of reserves and counterattacks while allowing friendly troops to safely cross those positions later.

Infantry. German stormtrooper tactics are widely recognized for their contribution to modern light infantry tactics, but their ethos is often ignored. They relied on a type of infiltration that now straddles the line between infiltration and penetration.[59] This has led them to be characterized as light infantry tactics; however, I believe it would be more accurate to call them shock tactics due to the frequent emphasis on the enemy's morale.[60]

Stormtroopers were elite units that began forming locally as early as 1915.[61] Their methods had become more uniform by 1918, and the entente had broadly copied the elastic defense.[62] To bypass the OZ as best they could, stormtroopers would deploy in depth with sufficient distance between units so that each could use the terrain to their advantage. They often leaped into the frontline trenches behind grenades even as the last shells of the bombardment burst, catching defenders in their shelters or forcing them to expose themselves to the barrage.[63] As previously discussed, the OZ was formed of many small fortifications rather than evenly spaced infantry in trenches, making it possible to narrowly breech it. The stormtroopers then headed for the MLR as more or less intact groups that would continue attempting to cut through lines without replacement until their strength was exhausted.

Stormtroopers shattered the front lines with the close support of infantry guns, mortars, flamethrowers, and heavy machine guns, but they did not push back

the front line themselves. Regular infantry conducted a frontal assault after numerous local penetrations.[64] In an ideal situation, the enemy offered little resistance after the weight and confusion of the new barrage tactics and the terrible violence of the stormtroopers passing. On the first day of Operation Michael, the first German attempt in 1918 to win a breakthrough battle before U.S. involvement made victory impossible, twenty-one thousand of England's thirty-eight thousand casualties were prisoners.[65] This demonstrates the value of the shock generated by these new German tactics.

A New Method—The Tandem Method

The technical method and its modern descendants are overly reliant on technological and industrial advantages to count on in advance, especially for lesser powers. While successful in returning to open warfare, the shock method never managed to achieve an operational breakthrough. The exact reasons it failed are contested and range from Germany's lack of trucks and tanks to Gen. Erich Ludendorff's decision to switch the main effort to the entente's ample reserves.[66] Whatever the case may be, a tactic that was not wholly successful in its own time cannot be applied to a vastly different technological era unchanged and be expected to succeed.

The modern elastic defense has proved its resistance to the forceful blows of mechanized advances.[67] Armor's breakthrough potential appears to have decreased with the advent of massive minefields, first-person view attack drones, and an increase in infantry antitank weapons.[68] This is demonstrated by the failure of Russia's Thunder Run-like tactics in the opening months of the conflict, in the steady repulse of Ukrainian columns during their Summer Offensive, and the stall of the Russian mechanized advance toward Avdiivka in November 2023.[69]

This is not to suggest the impotence of armor but to highlight the need for improvement in its use. Ukrainian infantry was the first to breach the Russian MLR in the Robotyne direction, and Russian infantry made faster progress fighting through Avdiivka than mechanized forces in the advance to it.[70] These examples should prove that faster-tempo infantry operations could play a critical role in breaking a modern elastic defense.

I propose a tandem method in which infantry pushes through the lightly held OZ and the MLR and mechanized units are committed to defeating counterattacks and preventing the compression of defenders in the BaZ and the LAD. Without the disruptive actions of the OZ and the antitank obstacles of the MLR, the success of armor acting by Western doctrine seems more likely. Their success should also prevent the compression of defenders within the later lines of defense.

Modern breakthrough artillery tactics. Simply clearing the way for armor with infantry will not break a modern elastic defense. A solution to the disruptive actions of the BrZ and OZ needs to be found. Modernized German breakthrough artillery tactics seem to be a potential solution, though a degree of artillery command centralization is required.[71]

While drones are, in large part, responsible for the current positional war in Ukraine, they may be the solution to it as well. Drones allow for the comprehensive tracking of batteries, alternate positions, fieldworks, depots, command posts, assembly areas, and all other targets of breakthrough artillery. While attacking them as they are located is tempting, maintaining surveillance and striking them all with an overwhelming preparatory bombardment is more likely to lead to a successful breakthrough attempt.

A bombardment could open after waves of attack drones strike known battery positions and search for targets of opportunity around alternates and ammunition dumps. Drones have also proven effective in a reactive counterbattery role.[72] The widespread use of first-person view attack drones could reduce the number of guns devoted to counterbattery fire while providing an edge in artillery action.

While the problems associated with obstacle-clearing fire in the modern battlefield require more research and experimentation than I have to offer, it seems to be a possible solution to the densest minefields on the front lines. Mortars, like in the First World War, are the best-suited arm to obstacle-clearing fire due to their low cost, high rate of fire, and ease of production and fielding. They should be tasked with battering deep corridors rather than engaging in every fieldwork and destroying every mine obstacle. Conventional mine-clearing methods can be employed for the safety of vehicles after the infantry assault has passed a position.

An objection is that while the depth of individual mine obstacles is narrow enough to conceivably be cleared by fire (500 m), their total depth in the Russian defense is closer to 10 km.[73] This resurrects a problem encountered in the First World War of maintaining

artillery support during an advance. Fortunately, the mine obstacles are less complete the further a position is penetrated since there must be lines of communication to the front. If an attack manages to maintain close contact with the defenders, they may be able to pass through them before they are able to seal them or use current line charges to breach weak points observed during the enemy's retreat.

The largest objection to the adoption of German breakthrough artillery tactics is that there is nothing to replace the neutralizing roles of lingering and dispersing gas. I believe that using remote-deployed mines with highly variable and perfectly consistent self-destruction may fill this gap. Mines may be especially effective in a counterbattery role to disrupt current shoot-and-scoot tactics, either exposing enemy artillery to fire or outright destroying it.[74] Multiple Launch Rocket Systems, which provide some of the most effective defensive artillery fire due to their volume and maneuverability, would be especially vulnerable to this technique. Their typical approach to the front to fire and retreat to reload could be interrupted by minefields along all roads and likely secondary routes with concentrations around depots. Attack drones could further enhance this effect by loitering around blocked roads to prevent clearing and around gaps in the minefields where the defender attempts to slip through.

Remote-deployed minefields would also be effective in pinning the defender to his works. As discussed earlier in a positional war, one of the defender's greatest weaknesses is that all observable positions can be destroyed or accounted for in attack plans. As such, they seek to shift the line of resistance away from fieldworks. Using an inordinately active defense that relies on counterattacks like the elastic defense or tactics like the First World War German move into no-man's-land, and the modern Russian use of armor in the OZ all accomplish this feat. Saturating fieldworks, support works, likely assembly areas and routes of counterattacks with short-duration minefields, like a German chemical barrage, could smother the ability of the defender to shift the line of resistance. This would weaken an elastic defense, making it more vulnerable to preparatory fire and decreasing the threat of it "snapping back." The mines would be set to destruct before the advance is expected to pass, allowing them to fill the roles of both lingering and dispersing gas.

The two prime objections I can see to this proposal are the increase in munitions and equipment necessary to place dense enough minefields in the required time frame. These are real issues that I suspect any power will already encounter in a peer war. In the specific case of the United States, the German AT-2 rocket is compatible with current equipment and closely fits many of the requirements of offensive mining.[75] An issue that would require development is creating an antipersonnel mine with similar qualities.

Conclusion

The elastic interpretation and the modern technical and tactical challenges that accompany it concern all nations that face the realistic possibility of being forced to induce or terminate a positional war in the near future. The framework of First World War doctrine helps guide one to the fundamental challenges of the offensive and defensive in positional war and historically proven remedies. ■

I'd like to thank Dr. Carl Mosser for his criticisms that allowed me to strengthen and better connect my arguments.

Notes

1. William Balck, *Development of Tactics, World War*, trans. Harry Bell (Fort Leavenworth, KS: General Service Schools Press, 1922), 47–51.

2. Erich von Falkenhayn, *General Headquarters, 1914–1916 and Its Critical Decisions* (London: Hutchinson, 1919), 54–64; Erich Ludendorff, *My War Memories, 1914–1918*, vol. 1 (London: Hutchinson, 1923), 305–8.

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