



Engineer Lessons Learned From the War in Ukraine

By Lieutenant Colonel Matthew S. Holbrook

The unprovoked Russian attack on Ukraine has recently highlighted the need for engineers to shift focus. Such a shift in focus—from the Global War on Terrorism to large-scale combat operations (LSCO)—is mentioned in the *National Security Strategy of the United States of America*¹ and demonstrated by the 2021 withdrawal of troops from Afghanistan. Before the outbreak of war in Ukraine, the idea of LSCO as a brand of warfare had generally faded into the shadowy area between obsolete and inconceivable. It had been relegated to “hip pocket” training in the already jam-packed schedules of an Army struggling with retention and burnout—if it were even considered at all. Acknowledging this training gap isn’t an indictment on leaders; it’s simply a recognition of the factor of time and our mandate to prepare our Soldiers for the missions that they were most likely to face over the last 2 decades. Now, as the largest land combat operation in nearly a century rages in Europe and an emerging power menacingly sits in Asia, it is incumbent on today’s leaders to glean lessons from a real-time conflict in order to prepare for the unwanted possibility of a large-scale outbreak of hostilities.

Institutionally and organizationally, we must train and equip our formations and individual Soldiers for the potential eventuality of facing a peer or near-peer adversary that can challenge us in ways for which we are currently underprepared. Failure to learn from the real-time example in Eastern Ukraine with regard to emerging threats to engineer formations, demonstrated Russian obstacle efforts, and bridging challenges at this scale could result in needless loss of blood and treasure in the event that the United States is pulled into a future LSCO environment. We can glean three important engineer-related points from a study of the Russo-Ukrainian War:

- The importance of dispersal and overhead cover.
- A possible need to improve the required Army force to contend with obstacles.
- A possible massive shortfall of bridging resources in the inventory.

The conflict in Ukraine is far from a revolutionary military affair. Russian Federation forces are utilizing a strategy that has seemingly remained unchanged for more than 100 years. The Russians have developed a complicated and intricately designed defense in depth, using a variety of artillery-covered traditional obstacles that are best defeated by carefully choreographed combined arms actions and traditional suppress, obscure, secure, reduce, and assault techniques. These operational skill sets have severely atrophied

in the 2 decades that we have spent focused on defeating improvised explosive devices. The need to decentralize mission command in the face of evolving threats to the electromagnetic footprint of our large command posts and the unmanned aerial systems (UAS) that are ever-present over the modern battlefield further complicate this revisited way of war. The new aerial threat forces engineers and breaching elements to focus on the sky and ground in ways that the U.S. Army has never before needed to.

Perhaps the U.S. Army must realize just how saturated with UAS the air over Ukraine is. A recent Royal United Services Institute (RUSI) report partially conveys the scale of the saturation, stating that there is “a Ukrainian loss rate in unmanned aerial vehicles of approximately 10,000 per month.”² That statement refers only to *losses* (not total utilization)—and to only one side of the conflict. According to the upcoming book *Lessons From Ukraine for the Future Force*, “The UAS threat could be described as the improvised explosive device of the current conflict, and perhaps the next as well. The proliferation of technology has enabled both state and nonstate actors to develop small, inexpensive, and increasingly lethal UAS.”³ This means that engineers preparing to breach complicated obstacles or conduct river-crossing operations must assume that they are under constant surveillance. As in previous wars, engineer assets are likely to be considered high-value targets in the next conflict. For example, a Mine-Clearing Line Charge (MICLIC) would be a juicy target for what amounts to a cheap and steerable artillery round; the devastation that UAS could reap on a towed or hauled MICLIC charge would far outweigh the cost of the system. This may be a particularly devastating situation where a MICLIC is concerned, but the concept also holds true for logistical convoys that are well in the rear.

The bottom line is that Lesson 1 consists of an equation:

$$\text{dispersal} + \text{overhead cover} = \text{increased survivability}$$

In other words, cover should not be broken until necessary and the maintenance of proper standoff between equipment and ammunition dumps is critical.

As engineers and combined arms elements shift focus to LSCO, we must study the subject matter in real time. The counteroffensive in Ukraine has met stiff resistance along a carefully prepared defensive belt that engineers—one of the stronger-performing elements of the Russian military—have had months to construct. Returning to the RUSI report, “Russian force protection engineering has largely followed

its doctrine, with little methodological change since the Cold War. Russian defensive positions generally comprise two to three lines.”⁴ The initial point of contact usually consists of hasty infantry fighting positions. As the position progresses in depth, the second line is more deliberately prepared—and dangerous. The obstacle belts in that line consist of 6-meter-wide tank ditches, followed by other vehicular obstacles such as wire and concrete dragon’s teeth in front of well-prepared trench systems reinforced by concrete fighting positions if time allows. The obstacle belts are often reinforced with unmarked minefields comprised of both antipersonnel and antitank mines with seemingly no pattern. They are often covered by a company of Russian infantry.⁵ Despite numerous logistical challenges, mines seem to be plentiful in the Russian stockpile and Russian engineers quickly react to Ukrainian tactics. Ukrainian front-line commanders report that their forces had initially placed rollers on the fronts of tanks that were rated for four direct mine strikes but that Russian engineers then began double-stacking antitank mines to more quickly degrade the equipment; Ukrainians also often encountered obstacle belts with four-plus rows of mines, which required significant engineering efforts to overcome.⁶ Some Russian trenches have also been demonstrated to have been constructed solely to trap and destroy approaching infantry. “Mine trenches” (as they are referred to by the Ukrainian forces attempting to clear them) are deliberately empty of troops; still, they are filled with remotely detonated mines that are destroyed by the Russians when Ukrainian forces charge into them.⁷ These stout defenses are organized in four zones that are generally aligned with the annexed oblasts of Ukraine. They cover most of the eastern portion of the country with obstacle belts.⁸ Although the most common obstacle belts range up to 1,000 meters in depth, some outlying belts are much deeper and are interlaced with mines rigged with antitampering devices, trip wires, and seismic sensors.⁹ These obstacles are generally tied into terrain and are almost always covered with artillery fire. In line with the Russian way of war, artillery rounds are another of the supply items that seem to be inexhaustible in the war with Ukraine.

While these obstacles are formidable and capable of causing severe challenges for Ukrainian forces, they could potentially be exploited. The RUSI report and a report by an American think tank, the Center for Strategic and International Studies (CSIS), postulate that the front is simply too long for Russian forces to defend. It is estimated that there are approximately 70 Russian brigades in Ukraine to cover 1,000 kilometers of frontage, likely requiring some form of mobile defense.¹⁰ Surprisingly, some obstacles are not tied into terrain but “appear more like ‘elaborate roadblocks’ that don’t stray too far from the roads or into the fields.”¹¹ Another shortfall in Russian defenses results from the contractors used to build them. In contrast to the effective minefields that are laid by competent Russian engineers, tank ditches and trenches have been constructed by poorly trained and often mistreated workers.¹²

Lesson 2 is twofold:

- Mass could be critical, and it may not currently exist in the engineer personnel or equipment inventory.
- It is paramount that engineer reconnaissance elements find gaps and bypasses to avoid direct assault on heavy defensive works.

A final engineering-related aspect of the Russo-Ukrainian war with which the United States could struggle in a similar scenario is the sheer scale of devastation to road and bridge networks. Within the first 6 weeks of the war in Ukraine, 23,000 kilometers of roadway and 273 bridges and overpasses were destroyed—amounting to 13 percent of Ukraine’s total road and bridge network.¹³ By September 2022, the number of bridges destroyed had risen to 320.¹⁴ While not all of these bridges are critical to mobility, the scale of destruction could be a significant detriment to allied maneuver and resupply in a similar situation or in an Indo-Pacific situation in which tactical bridges may be in short supply. The limited existing Army inventory of tactical bridging and bridging engineers could be an overlooked shortfall when the focus of the military-industrial base is trending toward ammunition and artillery rounds. However, attention must also be paid to protecting these assets from the previously mentioned UAS threat overhead. Bridging operations necessarily occur in an exposed space; there is no overhead cover on a river. The Army should take the time now to determine if there are enough bridging assets in the inventory, if those assets are rapidly deployable, and how permissive a potential wartime environment must be in order to get those assets where they need to go.

Lesson 3 is: Rapid deployability and the availability of a severely limited asset could be critical to supporting a war effort.

The war in Ukraine should serve as a prime opportunity for the United States and its allies to realign focus from the Global War on Terrorism to LSCO. Any war with a great power such as Russia or China would likely play out differently than the war in Ukraine. For example, total national mobilization would make a huge difference. Nevertheless, the Russo-Ukrainian war does present us with a prime opportunity to study and address any shortfalls and regain any skills that may have atrophied since the end of the Cold War. Now is the time to check inventories and develop training scenarios to enable our warfighters to fight and win the next great power conflict. 

Endnotes:

¹*National Security Strategy of the United States of America*, White House, Washington, D.C., 12 October 2022, <<https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf>>, accessed on 25 November 2023, pp. 2–3.

²Jack Watling and Nick Reynolds, “Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine,” RUSI, May 2023, <<https://static.rusi.org/403-SR-Russian-Tactics-web-final.pdf>>, accessed on 25 November 2023.

³Matthew S. Holbrook, Chapter 13: “Protection: Electronic, Air, Civilian, and Infrastructure,” *Lessons From Ukraine for the Future Force*, U.S. Army War College Press (publication pending).

⁴Watling and Reynolds.

⁵Ibid.

⁶Jonathan Bale, “Western Tanks Get [Pummeled] on Ukraine Front Line,” British Broadcasting Corporation, July 2023, <<https://www.msn.com/en-us/news/world/western-tanks-get-pummelled-on-ukraine-front-line>>, accessed on 25 November 2023.

⁷Ryan Pickrell, “Russia Built Fake Trenches Along the Front Lines To Lure Ukrainian Soldiers Into Deadly Explosive Traps, Researchers Found,” *Business Insider*, July 2023, <<https://www.msn.com/en-us/news/world/russia-built-fake-trenches-along-the-front-lines-to-lure-ukrainian-soldiers-into-deadly-explosive-traps-researchers-found>>, accessed on 25 November 2023.

⁸Seth Jones et al., “Ukraine’s Offensive Operations: Shifting the Offense-Defense Balance,” Center for Strategic and International Studies, June 2023, <<https://www.csis.org/analysis/ukraines-offensive-operations-shifting-offense-defense-balance>>, accessed on 25 November 2023.

⁹Michael Peck, “Russian Troops Still Build Battlefield Defenses Like They Did in World War II, and It’s One of Their Rare Successes in Ukraine, Experts Say,” *Business Insider*, June 2023, <<https://www.msn.com/en-us/news/world/russian-troops-still-build-battlefield-defenses-like-they-did-in-world-war-ii-and-its-one-of-their-rare-successes-in-ukraine-experts-say>>, accessed on 25 November 2023.

¹⁰Jones et al.

¹¹Jake Epstein, “Satellite Images Show Russia is Making a Big Gamble on How It Plans To Defend Territory Near Crimea From Ukraine,” *Business Insider*, 1 December 2022, <<https://www.businessinsider.com/satellite-images-show-russia-gambling-defense-territory-near-crimea-ukraine-2022-12>>, accessed on 25 November 2023.

¹²Jones et al.

¹³Anhelina Sheremet, “Ukravtodor: 23,000 Kilometers of Roads in Ukraine Have Already Been Destroyed Due to the War,” April 2022, <<https://babel.ua/en/news/77516-ukravtodor-23-000-kilometers-of-roads-in-ukraine-have-already-been-destroyed-due-to-the-war>>, accessed on 25 November 2023.

¹⁴Myroslava Gongadze, “Ukraine Replacing Destroyed Bridges,” *Voice of America*, 19 September 2022, <<https://www.voanews.com/a/ukraine-replacing-destroyed-bridges/6753387.html>>, accessed on 25 November 2023.

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(“Should Company Commanders . . .,” continued from page 20)

Advanced Leader Course, Engineer Captain’s Career Course, and Engineer Basic Officer Leadership Course could be exposed to the free GIS resources that are readily available to them through the Department of Defense. They could create accounts to gain access to agencies and websites, gain knowledge and practical experience through the courses, and take that knowledge and experience to their units. Another potential solution would be to incorporate registration for GIS website accounts for certain ranks into company and battalion in-processing procedures so that those personnel would have access to GIS capabilities already at the disposal of the Army.

A more robust potential solution could include forming GIS planning cells and assigning Military Occupational Specialty (MOS) 12Ys—Geospatial Engineers to the battalion S-2 to assist in the production of GIS products. Taking this a step further, MOS 12Ys could be assigned to the operations section at the company level; they could specialize in coordinating GIS analysis efforts between the company and higher-level GIS cells. Having GIS specialists at the disposal of the company commander would greatly enhance tactical planning and would allow commanders to distribute tailored products to their platoons to carry out the mission. If, for whatever reason, this arrangement were not feasible, then the battalion could designate one of its personnel to hold an online GIS organizational account and one or two company personnel could be granted access to the organizational account to use the GIS platform. The issue of which organizational funds would be used to pay for the organizational account might arise; but compared to the wages of personnel, this expense would be relatively minor.

GISs contain fantastic sets of tools that can be used by any Army leader. It is an engineer officer’s duty to provide the best engineer capabilities possible to the maneuver units that he or she supports. That requires an understanding of GISs and knowledge about how to employ them to help accomplish the mission and reduce the loss of life in the process. Making GIS assets more accessible to company commanders would streamline the flow of intelligence up and down the chain of command while giving the commanders the perspective of the battlespace their operations demand. The presence of dedicated GIS assets at the company level—either in the form of free software or MOS 12Ys—can only lead to a better outcome for the U.S. Army. A more informed commander makes better decisions.



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