

FUTURE MORTAR SYSTEMS

LESSONS OF MORTAR USE DURING THE UKRAINIAN FIGHT AGAINST RUSSIAN AGGRESSION

written by Pavlo Khoma

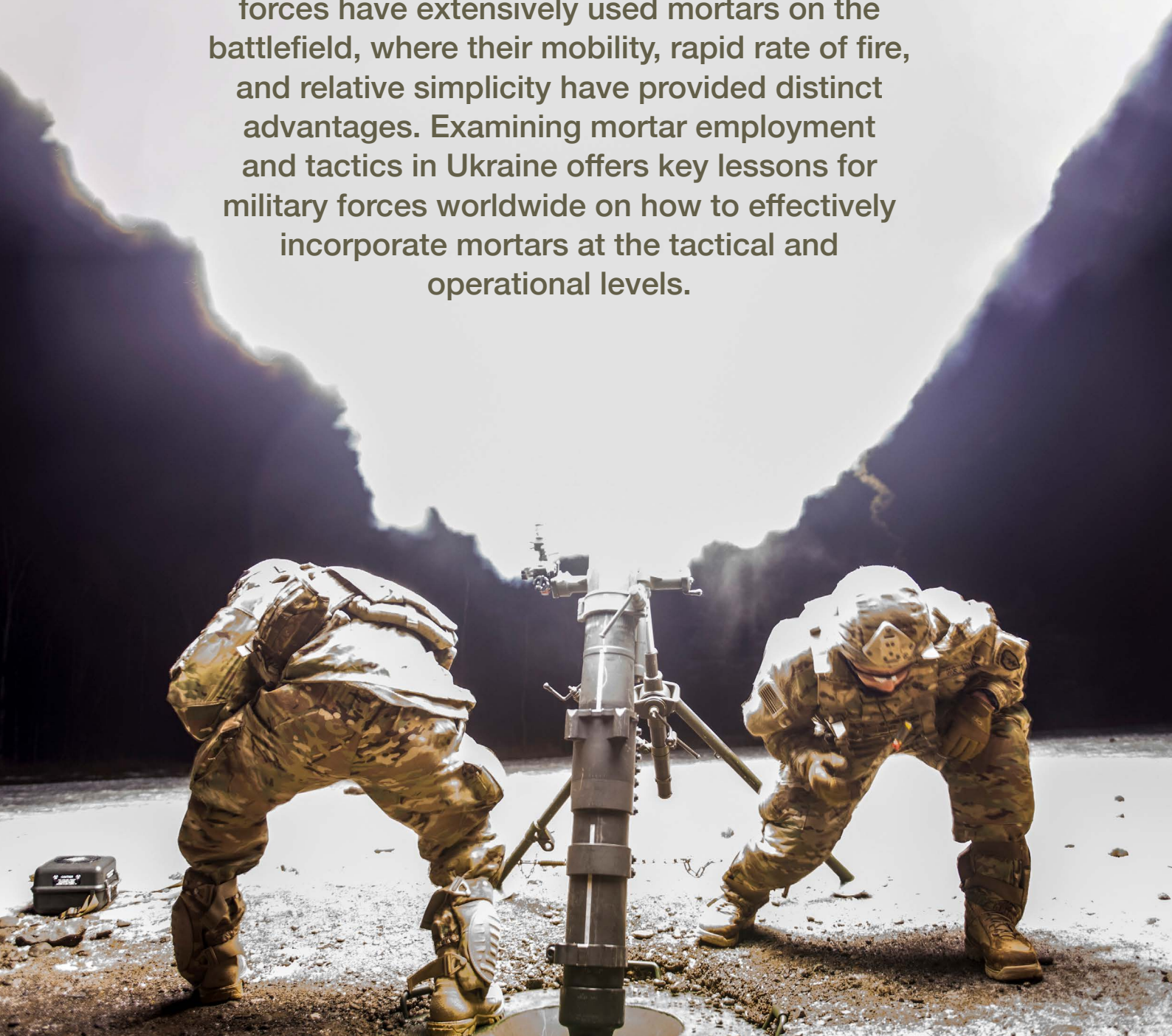




Pavlo Khoma

Expert in international relations, security, and law at the Ukrainian think tank ADAstra delivers his observations on what the Ukrainian war has to teach us on modern warfare and mortars.

The mortar, a steadfast weapon of infantry forces for over a century, continues to demonstrate its significance and usefulness on the modern battlefield during the ongoing war in Ukraine. Both Ukrainian and Russian forces have extensively used mortars on the battlefield, where their mobility, rapid rate of fire, and relative simplicity have provided distinct advantages. Examining mortar employment and tactics in Ukraine offers key lessons for military forces worldwide on how to effectively incorporate mortars at the tactical and operational levels.





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Mortars Remain Prevalent

The classic 81mm and 120mm infantry mortars are the prevailing types used by both Ukraine and Russia, providing an optimal portable firepower balance for frontline combat. Some Ukrainian special forces units currently utilise domestically produced 60mm mortars, but their usage is limited.

Both militaries employ a variety of larger mortar systems. Russia has made extensive use of self-propelled 120mm mortars mounted on armoured carriers, such as 2S23 Nona-SVK, which can provide direct fire support to tank and mechanised units. Towed 120mm mortars can be mounted on trucks, enhancing mobility and enabling quicker repositioning compared to heavy artillery. The Russian army also actively employs heavy Soviet 240mm mortars for prolonged fire missions from fixed positions as well as the heavy self-propelled 240mm 2S4 Tyulpan. However, these larger mortars lack the tactical agility of lighter infantry and vehicle-mounted systems.

Ukraine has efficiently repurposed large-caliber mortars by mounting them onto trucks and armoured vehicles for mobile use. The Ukrainian armed forces use 120mm mortars mounted on MT-LB APCs, BMP-1 AFVs, and trucks for shoot-and-scoot tactics. Furthermore, Ukraine has integrated 120mm mortars into its riverine operations by mounting them onto patrol boats. Before 2022, Ukraine produced some 120mm self-propelled mortars like the Bars-8MMK, but now **the army has a variety of Western systems as well.** Vehicle mounting maximizes mobility while adding protection and enabling mortars to keep pace with advancing forces. 120mm remains the standard for self-propelled mortars. These self-propelled and truck-mounted mortars combine heavy firepower with crucial mobility, showcasing mortars integrated into combined arms maneuvers.

While mortars lack the extended range and precision of modern artillery, they provide responsive area fire with useful versatility at shorter distances. High explosive rounds can decimate fortified positions, destroy enemy infantry in the open, and interdict rear support areas. Smoke and white phosphorous rounds are useful for screening friendly troop movements or obscuring enemy observation. Illumination rounds are invaluable for night attacks. This range of ammunition effects makes mortars a flexible asset at the company and battalion levels.

Lightweight infantry mortars ranging from 60mm to 82mm maximise portability and mobility. **Their small size allows for quick repositioning and concealment, while their simplicity enables rapid emplacement and fire.** But light mortars sacrifice range - generally 1 to 5 km, depending on caliber and shell. They also rely on manual aiming, which reduces accuracy. Heavier 120mm+ mortars, on the other hand, trade some mobility for greater range, payload, and protection.

Wheeled self-propelled mortars like the 2S23 Nona-SVK can achieve ranges of up to 10km.

Tracked carriers extend the range further but at the expense of speed. **Vehicle mounting also enables mechanical aiming and absorption of weapon recoil.** But larger mortar systems require maintenance, lack subtle concealment, and remain vulnerable to counter-fire.

Lighter infantry mortars like the 81mm are also relatively inexpensive to produce and operate. Their simplicity keeps costs low. **Heavier self-propelled mortar systems require more complex vehicles as platforms, substantially raising procurement and lifecycle costs.** A basic towed 120mm mortar may cost tens of thousands of dollars, while a tracked self-propelled 120mm mortar system can cost millions. Logistics, maintenance, and training costs are also higher for mobile heavier mortar platforms. **However, both lighter and heavier mortars provide a high return on investment through their durable simplicity, lethal firepower, and tactical mobility.** This war actually shows that all types of mortars can find their use in different battle scenarios.

Generally, Russia's larger self-propelled 120mm systems provide more range, over 12km, but less agility than Ukraine's infantry and self-propelled mortars with 4-7km reach. Ukraine's tactical mobility and coordinated precision fires have helped its lighter mortars inflict significant damage. **Ukrainian mortar crews routinely fire from short-term concealed positions, relying on shoot-and-scoot tactics to avoid effective counter-battery fire.** Mortarmen pre-register targets with known grid coordinates from scouted locations, enabling rapid fire missions upon call for fire. Skilled forward observers embedded at the company and battalion level actively locate targets of opportunity and communicate them to mortar units for quick engagement. This system of coordinated observation and displacement makes mortars extraordinarily responsive. **By contrast, Russian mortars have largely adhered to firing from fixed, pre-planned positions at targets whose coordinates were scoped out earlier.**



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This modus operandi is slower and gives their mortars poor survivability; Ukrainian drones actively hunt stationary Russian mortars and quickly direct counter-battery fire against them.

To modernise combat management, Ukraine has adopted automated systems like Delta and Kropyva (Nettle). **Delta integrates intelligence data like satellite imagery and sensor feeds into a digital map for real-time situational awareness and target identification.** It enables planning, coordination, and information sharing between units on mobile devices. **Similarly, Kropyva (Nettle) automates tasks like fire coordination, which allows for quick target engagement. Together, these systems create a common operational picture to streamline targeting and mission command.** They reduce deployment time, accelerate counter-battery fire, and synthesize data from drones and other ISR assets. Though targeted by Russia, Delta's cyber protections ensure continuity. The effectiveness of these automated systems demonstrates Ukraine's digitisation of tactics to leverage technological advancements against Russia's numerical superiority.

Kropyva (Nettle) has been integrated with almost every mortar crew on the battlefield. **This relatively simple program runs on tablets and cellphones, providing frontline mortar crews with an electronic map displaying their GPS position, friendly positions, and enemy targets.** Kropyva (Nettle) enables real-time data exchange between allied units, allowing mortars to rapidly receive target coordinates and fire requests through the network. The system also assists vital firing calculations like ranging and artillery corrections. By synthesizing information from ISR sources like UAVs, radars, and sounding systems, in an easy-to-use interface, Kropyva (Nettle) allows mortar crews to respond swiftly and accurately to calls for fire. Once again, the proliferation of this C2 enabler down to the crew level exemplifies Ukraine's agile adoption of technology to gain an edge.

Universal Lessons for Other Militaries

The Russia-Ukraine war provides several broadly applicable lessons for militaries worldwide seeking to leverage mortars as an effective tactical asset. **While every operational environment poses unique challenges, many principles displayed in Ukraine represent mortar integration best practices relevant across contexts.**

First and foremost is the need for thorough and realistic crew training. Proficient mortar crews who can quickly and accurately emplace, fire, and displace their weapon systems are essential for responsive fire support.

Extensive live-fire rehearsals prepare crews for the pressures and intricacies of delivering mortar fire on fluid battlefields. Well-drilled mortar teams can provide devastating suppressive barrages when competently handled.

Relatedly, the nimble "shoot-and-scoot" and displacement tactics used extensively in Ukraine maximise mortars' inherent mobility and minimise their vulnerability. Short, intense bombardments from concealed and frequently alternating firing positions better preserve the element of surprise and survival. Mortars displaced under cover are difficult for enemy drones and radar to track and target.

Forward observation represents another vital integration component. Skilled forward observers at the company and battalion level embedded within maneuver elements are critical for directing timely and accurate mortar fire against emerging targets. Seamless coordination between observers and firing units enables prompt redirection of mortar fire across the brigade's area of operations.

Equally important is coherent command and control (C2) architecture tying together targeting data, fire direction centers, and firing units. Digital links that integrate observer data with firing solutions prevent fratricide and harmonise effects. **Effective C2 enables a brigade's mortars to quickly converge and shift fires against key targets without losing coordination.**

Finally, passive and active defensive measures are essential for mortar survivability. Camouflage, decoys, hardened shelters, and frequent displacement all increase the viability of mortar systems against enemy reconnaissance, precision fires, and artillery suppression. Defending mortars against UAVs is a particular challenge that demands innovation.

While every force tailors mortar integration to its needs, these principles related to proficient crews, displacement doctrine, coordinated observation, digitised C2, and defensive countermeasures offer broadly relevant lessons to optimise mortars' tactical employment. They provide a doctrinal baseline that any military can build upon.



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Emerging Trends and Developments

The mortar integration principles and lessons observed in Ukraine align with several notable trends in mortar technology and employment. These trends reflect militaries' efforts to further leverage mortars' strengths while mitigating their limitations across more contested and lethal battlespaces.

For instance, the continued proliferation of precision-guided munitions (PGMs) for mortars directly improves upon unguided shells' inherent lack of accuracy. PGMs transform area fire mortars into precise point target engagement weapons. They reduce ammunition consumption, limit collateral damage, and extend mortars' reach. Development of multiple PGM varieties by different nations reflects this broader trend.

Relatedly, advanced counter-drone defenses are an emerging priority to defeat the locating and targeting threats that small UAVs pose to mortars and other artillery. From electronic warfare to directed energy weapons, cathode ray tubes to shotgun shells, militaries are experimenting with varied solutions. Defeating the enemy's eye in the sky is vital.

Moreover, networked digital command architectures and user-friendly firing solutions enable the coordinated yet decentralised employment that fluid mortar operations demand. **Shared targeting data, fire planning apps, and responses to calls for fire can be accelerated through user-friendly digital interfaces like those employed by Ukraine.**

Logistical modularisation and hardening of mortar carriers also facilitate adaptable deployment. Modular components enhance strategic transportability while armored carriers and improved engineering increase survivability and mobility. These trends align with the shoot-and-scoot tactics mortars require.

Because mortars remain a constrained resource, these trends aim to maximise the versatility, precision, and responsiveness of mortar systems and munitions across operational contexts. They address core capability gaps while retaining mortars' essential simplicity. **Continued innovation will ensure mortars' enduring relevance on tomorrow's complex battlefields.**

The Future of Mortar Usage

Mortars will continue serving as an essential infantry fire support weapon. **While precision, range, mobility, survivability, and responsiveness will improve through technological enhancements, the core attributes that make mortars uniquely valuable on the battlefield will remain.**

Looking ahead, we can expect wider adoption of guided mortar munitions, counter-drone defenses, and digitised C2 systems at the battalion level and below. These technologies will enable more dispersed, semi-autonomous, and survivable mortar operations. Swarming small drones may eventually replace traditional forward observation roles.

At the same time, larger but modular vehicle-mounted mortar systems will provide heavy firepower to mechanised forces. **Armored, amphibious, and even unmanned mortar carriers are likely to emerge.** Extended range, automated loading, and integrated resupply may be additional features.

However, these technologies will supplement rather than replace the basic tactical role of the mortar. New munitions and delivery methods will make mortar fire more precise and responsive. **But well-trained crews manually employing mobile light mortar systems will remain the backbone of infantry fire support. The essential formula of using simple systems in creative ways will continue defining mortar employment.**

Mortars fill unique niches of portable, sustained firepower across short and medium ranges. Their role as a rapid, devastating, and flexible asset that can quickly reorient across the entire brigade battlespace will keep mortars relevant. **New technologies will make mortar crews more lethal and survivable. But it will be competent mortarmen employing imaginative tactics, capitalising on mortars' innate strengths, that ensure mortars remain an invaluable weapon.**

Conclusion

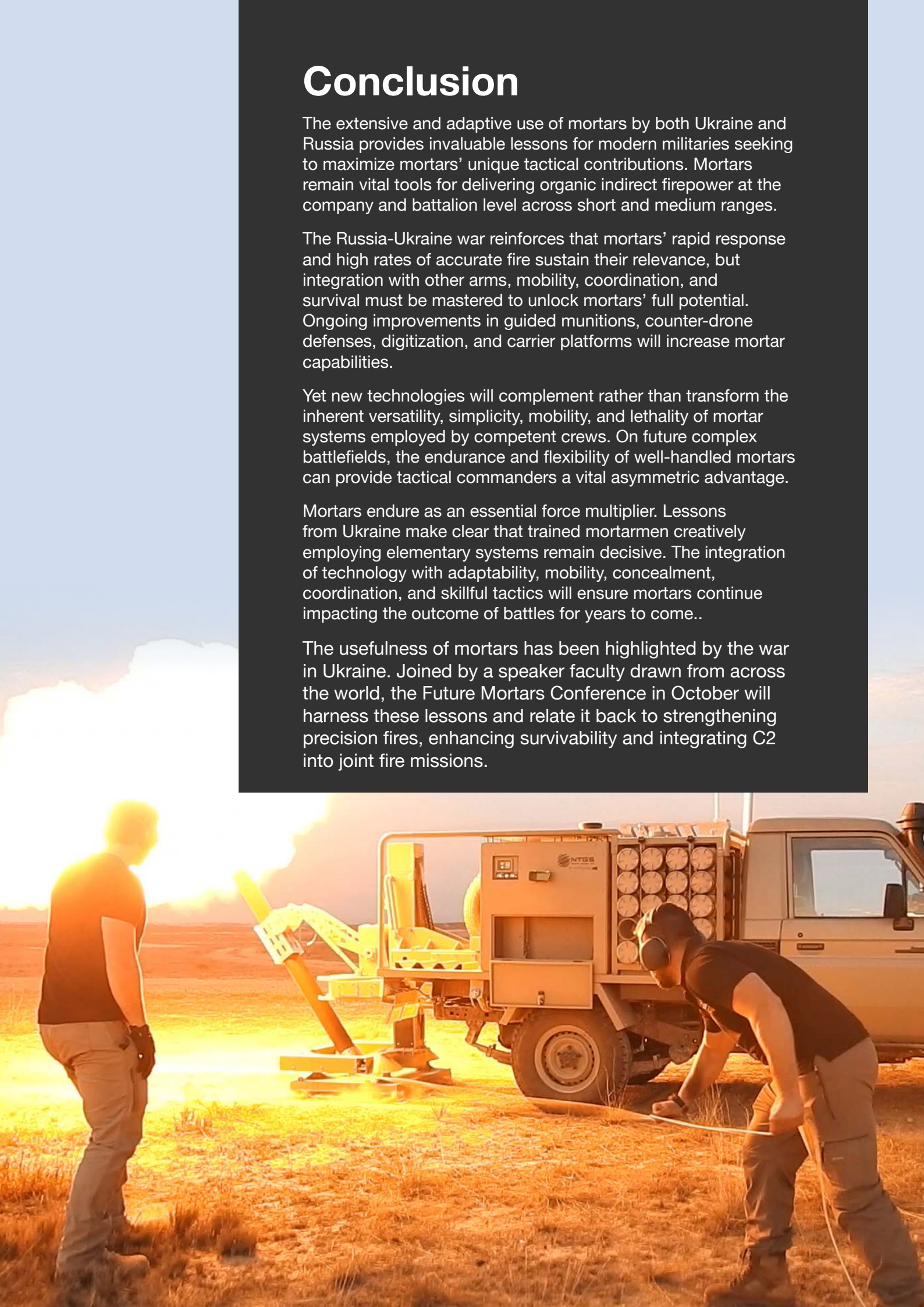
The extensive and adaptive use of mortars by both Ukraine and Russia provides invaluable lessons for modern militaries seeking to maximize mortars' unique tactical contributions. Mortars remain vital tools for delivering organic indirect firepower at the company and battalion level across short and medium ranges.

The Russia-Ukraine war reinforces that mortars' rapid response and high rates of accurate fire sustain their relevance, but integration with other arms, mobility, coordination, and survival must be mastered to unlock mortars' full potential. Ongoing improvements in guided munitions, counter-drone defenses, digitization, and carrier platforms will increase mortar capabilities.

Yet new technologies will complement rather than transform the inherent versatility, simplicity, mobility, and lethality of mortar systems employed by competent crews. On future complex battlefields, the endurance and flexibility of well-handled mortars can provide tactical commanders a vital asymmetric advantage.

Mortars endure as an essential force multiplier. Lessons from Ukraine make clear that trained mortarmen creatively employing elementary systems remain decisive. The integration of technology with adaptability, mobility, concealment, coordination, and skillful tactics will ensure mortars continue impacting the outcome of battles for years to come..

The usefulness of mortars has been highlighted by the war in Ukraine. Joined by a speaker faculty drawn from across the world, the Future Mortars Conference in October will harness these lessons and relate it back to strengthening precision fires, enhancing survivability and integrating C2 into joint fire missions.



2023 Speaker Faculty



General Gabor Borondi,
Chief of Defence,
Hungarian Defence Force



Brigadier General Eugenio Dessi,
Infantry School Commander,
Italian Army



Colonel Marcel Krenek,
Chief of Artillery,
Czech Army



Colonel Juhana Skyttä,
Inspector of Infantry,
Finnish Army



Lieutenant Colonel Tom Foss-Smith,
SO1 Boxer Futures,
British Army



Lieutenant Colonel Audun Jorsead,
Head of Tactics Section,
Norwegian Land Warfare
Centre



John Yancey,
Director, Soldier
Requirements Division,
US Army



Matthew Terreault,
Chief, Branch Mortars
Division,
US Army



Gary Fox,
Director, Office Chief of
Infantry,
US Army



Major Damian Gant,
Chief Instructor 120MM,
Combined Arms
Manoeuvre School,
British Army



Major Christopher Weis,
Teamleader Light Infantry,
Bundeswehr



Major Samuel Josefsson,
Future Organisation Mortar
Development Officer,
Swedish Army



Captain Panu Kaski,
Research Officer,
Finnish Army



Lieutenant Johan Lovrod,
Master Instructor Mortars,
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Colour Sergeant Rodger Munro,
Mortars Chief Instructor,
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