The 2022 Russo-Ukrainian War:
Current and Future Employment of Unmanned Platforms Supporting Infantry Operations

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The Russo-Ukrainian War of 2022 (the third war between the two nations in 10 years) may be the final conflict of Vladimir Putin's wars.[1] Initially planned as a 10-day operation, the Russian invasion has bogged down into a months-long slog, reminiscent of the worst battles of World War I. Part of the reason for the unsettling of Russian plans has been the use and misuse of unmanned vehicles, largely air vehicles and boats. Unmanned ground vehicles do not appear to play a significant role in the fighting to date.

Russia has demonstrated varied and sophisticated drone and drone-related technologies in previous wars. In the Donbas War, the RB-341V Leer-3 electronic warfare system integrated a cell site simulator with a drone, capable of hijacking 6,000 phone conversations over an area with 6-kilometer diameter.[2] The Syrian War saw the deployment of the Orlan-10, a drone producing real-time video. Granat-1 and -2, the Forpost, the Eleron 3SV, the Zastava and the hand-launched Zala-421-08 constitute a family of drones available for targeting and reconnaissance. One variant, the Zala KUB, exhibits poor accuracy and is incapable of carrying significant ordnance. The Geran-2, the Iranian-built Shahed-136, is credited with destroying four self-propelled howitzers and two armored infantry vehicles.[3]

To supplement Uran-6 demining vehicles, Russia uses the remote-controlled 45-ton Prokhod-1 unmanned ground vehicle (UGV), a disarmed T-90A tank equipped with KTM-7 or -8 mine-rollers. The 3-ton Marker 2 UGV may be deployed in Ukraine, although with what capabilities, weapons, and sensors is not known. Uran-9, an unmanned tank, performed so poorly in Syria that it may not be deployed to the war.[4]

While Western economic sanctions impact Russia's ability to manufacture drones, some shortages may have been filled by Iran, although the reported costs are exorbitant. The Iranian UAVs appear to be largely used to attack civilian targets, although a large number, according to Ukrainian sources, are shot down before reaching the objectives.

Counter-drone activities include electronic warfare (EW) as well as more kinetic methods. The R-30Zh Zhitel blanks GPS signals needed for drone navigation, and a handheld jammer, the Pishchal "rifle," is available. Tactical jammers on the Repellent-1 truck are estimated to have a range of 1.6 miles. Another truck-mounted Shipovnik-Aero tactical jammer can reportedly attack two drones simultaneously. The system is fast. In approximately 25 seconds, it

Zala-421-08

Forpost UAV


Leer-3 electronic warfare system **Uran-6 demining vehicle** **Repellent-1 anti-drone warfare complex**

(Photos from OE Data Integration Network, https://odin.tradoc.army.mil/)

identifies the UAV, interrupts the drone's command link, and if the parameters align, assumes control of the UAV's flight path.

The Ukrainians use a mix of commercially available, acquisitions from foreign sources, and local manufactured drones. Turkish Bayraktar TB2 combat drones were employed to scout the battlefield until electronic warfare and kinetic countermeasures negated their utility. Videos of inexpensive commercial quadcopters providing targeting information or dropping grenades on targets are numerous on the internet. Unmanned naval boats, probably home brewed, reportedly struck ships in Sevastopol, causing the Russian military vessels to abandon the port. Other strikes on airbases in Russia may have been conducted using long-range aerial drones.

Ukraine has the Temerland GNOM (pronounced as gnome) kamikaze UGV. Directed via a quadcopter, the machine carries a TM-62 anti-tank mine. Equipped with a quiet 5-horsepower electric motor and a reel of fiber-optic cable for control and video, the UGV has a range of 2,000 meters (1.25 miles) and is immune to jamming. If the cable is severed, the vehicle has enough intelligence to return to base if the cable is severed. A GNOM carrying a machine-gun is pending.[5]

Both sides use unmanned combat aerial vehicles (UCAVs), large aircraft capable of greater ranges, longer loiter times, and carrying heavier payloads. Ukraine reportedly had more tactical success using UCAVs in the liberation of Snake Island and in attacks into Crimea. The attacks have been destructive of material and Putin's political support. Strong air defenses limit the roles UCAVs can play for either side.

Operations in the Russo-Ukrainian War have made it clear, even in these early stages, that infantry will need unmanned aerial and ground vehicles as well as methods to counter the machines to survive and fight on future battlefields. Several issues must be addressed before unmanned vehicles can be successfully integrated with an infantry unit.

Doctrine on manned-unmanned coordination and operation is critical. The U.S. Army must decide how unmanned vehicles, airborne and ground, will be deployed in offensive and defensive operations. Rules of engagement must be elaborated. Doctrine will also establish the mix of soldier-portable and vehicle-carried drones and UGVs, along with weapons and sensors. Establishing the requirements will allow the infantry users to work with the engineers to design appropriate vehicles at reasonable cost, rather than expensive machines capable of many tasks but poor at all of them.

Ethics concerns must be addressed. Improved situational awareness of the operational environment will allow better decision making, reducing risks to friendlies and reducing collateral damage. However, no good is ever unalloyed. Wide bandwidth data links allow staff and higher command echelons to look over the shoulder of the combatant commander.

Personnel remote from the immediacy of the battlefield will opt for a slower pace of operations than will the soldiers in contact with a hostile force. In one discussion, one of the participants asked if killing an opponent at a distance was moral — as if indirect fires and aerial bombardment were not already employed in combat.[6-7]

Unmanned vehicle survivability appears to be a significant problem in the Ukraine conflict. One analysis puts a drone's average lifetime at seven days.[8] Only 10 percent of those are believed to complete assigned missions. Some operators reportedly opt to hover the UAV over friendly territory in hopes of recovering the drone if the command link is lost. GPS jamming causes the majority of losses. A reliable, effective inertial navigation systems (INS) is needed to guide the attacks.

Inexpensive drones are one answer to EW attacks. Overcoming defenses with numbers is a time-honored but costly tactic. However, attributable platforms cannot incorporate expensive sensors capable of finding hidden foes or high bandwidth links needed for video transmissions in contested environments.

The ability to avoid kinetic air defenses helps survivability. A simple sound sensor would change the aerial vehicle's flight path, making it more difficult to hit the drone. Quieter drones would reduce the ability to detect and locate the vehicle, lessening the chances it will be shot down. Enemy troops will also not know when they are under observation or how imminent an attack is. This can have significant psychological effects on soldiers.

Wide bandwidth, encrypted, frequency-hopping data links will lessen the opportunity to seize control and capture drones. High-resolution, multiple-frequency sensors will avoid the embarrassment of striking wooden decoys as the Russians reportedly have.

Real-time transmission of intelligence will reduce kill-cycle times. Accuracy of targeting systems must increase, allowing smaller munitions to destroy high-value targets, such as artillery, or drop ordnance into openings. The need to increase accuracy is exacerbated by the nature of the current battlefield. Open trenches are replaced by earthen structures where the overhead cover is difficult for small explosives. The ability to accurately place munitions into the structures' openings will reduce the defensive positions without placing soldiers in danger.

Counter and counter-countermeasures will continue their dance as the importance of unmanned vehicles on the battlefield grows and technology improves. Detection of quiet machines will require sensors operating in the infrared and radar frequencies, which in turn accelerate the development of camouflage techniques in those wavelengths.

Increasing operational space is vital. Both sides employ drones to locate and attack troops and vehicles, but operations can be limited by trees screening targets. The capability to fly at speed through densely forested areas has already been demonstrated.[9-10]

Artificial intelligence (AI) can play numerous roles. Offloading route identification and target detection/recognition to the drone significantly lowers bandwidth requirements and enhances the survivability of the platform. Operator workload lowers as an analyst does not have to look through large video files largely depicting countryside to locate targets. Attack cycles are reduced as target detection and recognition move to the edge of the network. Sensor fusion, the blending of images at multiple frequencies, lessens the possibility of striking a dummy target.

Logistics pipelines and training must be revised to incorporate the drones and counter-drone equipment into the tail of the combat units. Soldiers should be trained in operating unmanned vehicles, taking into account vehicle operations in a range of tactical situations. Maintenance personnel must be trained in keeping the vehicles operational in a variety of environments.

Soldiers need the proper equipment to safely and effectively complete missions. This equipment will, in future conflicts, include short-range UAVs, medium-range UAVs, and UGVs. Long-range, heavy-payload UAVs are expected to be retained as strategic assets and not available below the brigade level.

Automated systems will provide a picture of what is around the next corner or over the hill. Machines will lessen risk by tripping ambushes before units enter kill zones, assaulting well-defended locations and misdirecting the enemy. Logistics for small units can be simplified and wounded evacuated by unmanned vehicles, shortening the length of the tail and reducing the number of personnel dedicated to the operation of logistics chains.

The Future — A Possible Scenario

An infantry fighting vehicle (IFV) approaches a potential enemy strongpoint. Its upper deck is empty as its mid-range UAV is the lead, probing the area to the IFV's front. Two unmanned IFVs ride on its flanks, watching for any enemy turning maneuvers. Artificial intelligences guide the robots' trek, only bothering humans if something of interest pops into view.

A village appears. The IFV stops. Minefields are detected by infrared sensors and projected onto screens carried by the infantry. As the soldiers dismount, a swarm of small UAVs also leave the vehicle. The UAVs rapidly enter the

village and open doors and windows. Images show civilians hiding and other figures holding objects suspiciously resembling weapons. Loudspeakers, using the local language, demand those holding the objects place them on the ground.

The defenders radio other units, detailing their situation. The small UAVs triangulate on the responses. Other friendly forces will search those locations for hostile units.

Some comply with the verbal warnings; others do not. A few of the small UAVs sprinkle tracking devices that cling to clothes of the retreating forces. As the forces scatter, they will inadvertently betray the location of other forces.

After the infantry secures the village, resupply and support aerial drones, large cargo-carrying vehicles, arrive. The IFVs are refueled, and a malfunctioning computer is replaced. A remotely operated medical system checks the villagers. Amoebic dysentery is uncovered. Painkillers and antibiotics are given to the ill, and a lecture on techniques to avoid the disease is given to all. A boy with a broken arm turning gangrenous is evacuated for treatment at a hospital.

After the infantry moves on to the next phase of the mission, a high-altitude, long-endurance unmanned drone places the village under its protective watch. Its cameras will monitor the inhabitants while its systems will send images of newcomers, particularly ones bearing weapons, for analysis and, if required, another visit to the village.

Conclusion

Despite wishful thinking of many strategists, the demise of infantry is highly improbable. Infantry will be needed to pry stubborn enemies from strongholds. The fog of war will remain; the advent of robots, even those equipped with advanced AI, will never totally dissipate the uncertainties and confusion of battle. The mechanical aides will, however, help lift this fog.

The lessons of the recent Russo-Ukrainian War, aptly and imaginatively applied, will usher in a new method of warfare which uses the strengths of both machines and soldiers to accomplish the mission. Combinations of robots and humans will more effectively complete missions with lower risk to both combatants and civilians.

Notes

[1] Mark Galeotti, *Putin's Wars: From Chechnya to Ukraine* (Oxford, UK: Osprey Publishing, 2022).
[2] Ibid.
[3] David Hambling, "How Can Ukraine Counter Russia's 'Swarm' Drone Offensive, *Forbes* (28 September 2022), accessed from https://www.forbes.com/sites/davidhambling/2022/09/28/how-can-ukraine-counter-russias-swarm-drone-offensive.
[4] Daniel Brown, "Russia's Uran-9 Robot Tank Reportedly Performed Horribly in Syria," *Business Insider* (9 July 2019), accessed on 13 December 2022 from https://www.businessinsider.com/russias-uran-9-robot-tank-performed-horribly-in-syria-2018-7?r=US&IR=T.
[5] David Hambling, "Ukrainian Combat Robots Join Fight Against Russian Invasion," *Forbes* (16 June 2022), accessed from https://www.forbes.com/sites/davidhambling/2022/06/16/ukrainian-combat-robots-join-fight-against-russian-invasion/?sh=5f7a0e703678.
[6] Paul Scharre, *Army of None: Autonomous Weapons and the Future of War* (NY: W.W. Norton Company, 2018).
[7] Joseph Chapa, *Is Remote Warfare Moral? Weighing Issues of Life and Death from 7,000 Miles* (NY: PublicAffairs Hatchette Book Group, 2022).
[8] Dr. Jack Watling and Nick Reynolds, "Ukraine at War Paving the Road from Survival to Victory," special report from Royal United Services Institute for Defence and Security Studies, 4 July 2022, accessed from https://rusi.org/explore-our-research/publications/special-resources/ukraine-war-paving-road-survival-victory.
[9] *South China Morning Post*, "Autonomous Drones Fly through Chinese Bamboo Forest," video accessed from https://www.youtube.com/watch?v=rPul9WKQ6oQ.
[10] Edd Gent, "Watch a Swarm of Drones Fly through Heavy Forest — While Staying in Formation," *Science* (16 December 2020), accessed from https://www.science.org/content/article/watch-swarm-drones-fly-through-heavy-forest-while-staying-formation.

Donald Wilkins is a retired aerospace systems engineer. He holds 12 patents and was responsible for designing, developing, qualifying, and manufacturing advanced aerospace avionics. He has worked on the F-15, the F/A-18, and Apache platforms. His works included system design, requirements development and implementation, and artificial intelligence systems. Mr. Wilkins served in the Army Signal Corps as a lieutenant from 1974-1978. His tours included conducting strategic communications in South Korea and tactical communications in support of the 1st Battalion, 13th Field Artillery, 24th Infantry Division.