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DEBATE

"No end of a lesson:" observations from the first high-intensity drone war

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The Russo-Ukrainian War can rightfully lay claim to being the world's first "drone war" in the same way that the First World War proved the first air war. If this analogy holds, then we ought to scrutinise the present war for lessons as to the future impact of unmanned systems. After all, the First World War provided the creative spark for: terror bombing enemy cities; dedicated fighter aircraft; independent air forces; aircraft carriers; all-metal monoplanes; and armoured ground-attack aircraft. In a similar fashion, the Russo-Ukrainian War proffers the first real lessons as to the character of unmanned warfare.

This call to study the Russo-Ukrainian War for its insights on drone warfare might sound strange. Drones have been used extensively for the past half century. Prior usage, however, featured drones' extensive employment by only one party and usually in auxiliary roles. In a sense, drones' use in these wars is analogous to the use of aerial platforms prior to the First World War – ranging from balloons in the US Civil War (1860–65) to Italian pilots dropping improvised bombs in the Italo-Turkish War (1911–12) – where aerial platforms' employment by one side and in auxiliary roles revealed little about their ultimate potential.

Despite the limited data available about the present war, two clear insights about drones can be induced: 1) the centrality of attrition rates and cost factors; and 2) the importance of rapid adaptation cycles over exquisitely engineered weapons.

Attrition rates and system costs

The years preceding the Russo-Ukrainian War witnessed the development of drones that appeared ever more capable and sophisticated. What the Russo-Ukrainian War is demonstrating, however, are the virtues of low-costs and disposability.

Drones since this war's beginning have experienced high-levels of attrition. According to open source reporting, Russia lost at least 148 reusable (non-kamikaze) drones and Ukraine 40 during the war's first nine months.[1] Likely actual losses are higher. The reasons for high drone losses are manifold. From a technical perspective, drone's data-links are susceptible to jamming and drones tend to fly at

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lower- and medium-altitudes where they are vulnerable to short-ranged air defences. Operationally, both the Russians and Ukrainians are also sending drones to conduct missions in zones where enemy air defences are too dense to risk manned pilots, meaning that drones are being employed for missions that would not be otherwise undertaken.

The result has been a gradual attitudinal shift towards lower cost and more disposable platforms. Nowhere has this been more evident than in the eclipse of the most sophisticated drones fielded by either side, the Ukrainian Bayraktar TB-2, and the Russian Forpost and Orion. Early in the war, observers hailed the Turkish-built TB-2 as a "game changer".[2] Flying comparatively low and communicating via C-band datalinks, TB-2s initially proved resilient in the face of Russian air defences and played a critical role helping the Ukrainians repel Russian tank columns. Russia, however, responded by concentrating electronic-warfare and lower-altitude air defence assets, enabling them to inflict a fearful toll on Ukraine's TB-2s, banishing them from current battlefields and dissuading Ukraine from acquiring more.[3]

Russia's experience with its more sophisticated drones has been similar. The Russian Forpost-R drones originated as license-produced versions of Israel's Searcher UAV; however, the Russians modified the design to carry two air-to-ground missiles. Russia first unveiled the capabilities of the armed Forpost on 13 March, when they released a video of one destroying a Ukrainian rocket launcher.[4] Thereafter, however, Ukraine downed at least three Forposts, after which Russia withdrew the drone. Russia's other high-end drone, the Kronshtadt Orion, experienced a similar trajectory, with Russia's Defence Ministry releasing footage of Orions attacking Ukrainian vehicles on 16 March.[5] In April, however, Ukrainian air defences shot an Orion down. Since then, the Orion too has been notable for its absence.

The larger drones – Bayraktars, Forposts and Orions – all experienced a similar life-cycle, going from being heralded as "game-changing" weapons to finding themselves withdrawn from frontline service. Although these drones all cost considerably less than manned combat aircraft, with estimated costs between $5-10 million apiece for the Bayraktar and Forpost, they nonetheless proved too resource-intensive considering their acute vulnerability. As a result, both Ukrainians and Russians turned increasingly to very-low-cost or disposable drones. The cost of shooting down these one-way attack drones oftentimes exceeds the drone's value.

The importance of rapid adaptation cycles

A key lesson about drones that stands out from the Russo-Ukrainian War is the importance of rapid technological adaptation. Adaptation is, in turn, driven by two realities. Firstly, drones are extremely vulnerable to counter-measures that target their particular digital, and mechanical characteristics. Related to this, however, is the second driver of rapid adaptation, namely that the widespread availability of mechanical and electronic components for building drones renders it easier for designers to modify swiftly drone designs.

Because of their small size and varied flight trajectories, air defences often struggle to destroy drones. Any particular model of drone, however, can become acutely vulnerable once defenders recalibrate their defences to counter its specific characteristics. Radars can be reprogrammed to track drones and electronic-warfare jammers can be set to their frequencies. In certain cases, drone manufactures even market equipment that simplifies the task of tracking their products.[6]

Defenders' ability to modify their defences has repeatedly thwarted efforts to employ drones in ways that previously proved effective. DJI Mavic drones thus went from being a "must have" Ukraine asset during the war's first three months, to being a hazardous encumbrance once Russian forces began employing AeroScopes.[7] Other Ukrainian unmanned systems – such as the Bayraktar and unnamed explosive unmanned surface vessels – likewise fell from grace once Russian adapted their defences to counter them. Ukraine's adaptations similarly reduce the utility or specific Russian assets, as testified to by the increasing loss rate of Russia's Iranian-made one-way attack drones.[8]

Adaptation has therefore emerged as a key competence for drone warfare. Ukraine has proven particularly ingenious at this adaptive battle. Ukrainian designers have developed, for example, a host of devices manufactured by 3D printers to enhance drones' effectiveness, including hardpoints for attaching grenades and fins for aiming drone-delivered munitions.[9] Ukrainian workshops also modified longer-range drones ranging from Cold War-era Tu-141 reconnaissance drones to Chinese commercial drones to hit oil pumping facilities and airfields deep in Russia.[10] Ukraine's philosophy for nurturing such adaptiveness appears to be one of empowering individual units and workshops to innovate as they see fit. Russia's technologists, on the other hand, have thus far appeared less adaptive, which likely flows from their highly centralised and hierarchical organisational culture.

Conclusion

This first experience with a symmetric drone war, with two states employing drones in large numbers, reveals new truths about this mode of warfare. Invariably highly useful, drones are also vulnerable to air defences and defenders that are capable of adapting to them. Cheaper, simpler, and single purpose drones consequently prove more useful than more sophisticated and costly ones. Thus, the world of drone warfare is arguably one governed by Joseph Stalin's perhaps apocryphal maxim that "quantity has a quality all its own".

While this war showcases the value of inexpensive drones, it also demonstrates the centrality of fast adaptation cycles. Particular drone models and patterns of employment rarely yield results after several months. As a consequence, there is no such thing as a "game changing" or "war winning" drone in this war. Rather, whichever side proves the most adept at modifying equipment and sourcing new materiel dominates such drone wars.

Notes

1. https://www.oryxspioenkop.com/2022/02/attack-on-europe-documenting-equipment.html.
2. On the development and export of the TB-2, see Ash Rossiter and Brendon J. Cannon, 'Turkey's Rise as a Drone Power: Trial by Fire', *Defense and Security Analysis* 38, no. 2 (2022): 210–9.

3. ‘Bayraktar TB2 Drones ‘Out of Action’ From Ukraine War?’ *The EurAsian Times,* 4 December 2022.
4. ‘Russia Uses ‘Israeli-Origin’ Attack Drones to Strike Ukraine, Counter Bayraktar TB-2 UAVs Employed by Kiev’, *The EurAsian Times,* 16 March 2022.
5. Frank Johnson, ‘Specifications of Kronshtadt Orion (Inokhodets)’, *International Military*, 20 July 2022, https://www.international-military.com/2022/07/specifications-of-kronshtadt-orion.html.
6. China’s drone maker DJI sells its so-called AeroScope anti-drone detection device that pinpoints any DJI drone’s flight path and the location of personnel flying them. Amos Chapple, ‘The Drones of the Ukraine War’, *Radio Free Europe,* 17 November 2022.
7. ‘DJI drones, Ukraine, and Russia — what we know about AeroScope’, *The Verge*, 23 March 2022.
8. ‘Ukrainian Army Shoots Down 14 Iranian Shahed-136 Drones in Past Day, General Staff Says’, *New Voice of Ukraine,* 7 December 2022.
9. ‘3D printers + Drones, A Lethal Combination in the War in Ukraine’, *RoyalsBlue,* 19 May 2022, https://www.royalsblue.com/3d-printers-drones-a-lethal-combination-in-the-war-in-ukraine/.
10. ‘Drone Attack Hits Oil Storage Tank at Airfield in Russia’s Kursk Region’, *Guardian,* 6 December 2022; and ‘Ukrainian Kamikaze Drone Strike Sets Russian Oil Facility Ablaze’, *Forbes,* 22 June 2022.

Disclosure statement

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