CNA

Drones Over Ukraine: Commercial Technologies in Combat

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On September 23, 2022, CNA's National Security Seminar Series hosted a virtual panel discussion on the use of drones in Ukraine and the implications for commercial technologies in combat (see recording here). The seminar featured Samuel Bendett, an Adviser with CNA's Russia Studies Program and an Adjunct Senior Fellow at the Center for a New American Security; Dr. Heather M. Roff, a Senior Research Scientist with CNA's Special Activities and Intelligence Program and an expert in emerging military technologies; and Faine Greenwood, a senior spatial data scientist at the Massachusetts Department of Transportation and owner of Tarentum Consulting, LLC, which specializes in civilian unmanned aerial vehicles (UAVs). The discussion was moderated by Jeffrey Edmonds, a Senior Research Scientist with CNA's Russia Studies Program and a former Director for Russia on the National Security Council.

Messrs. Bendett and Edmonds reported on the potential use of drones in a Ukraine conflict in early February 2022, and then they recently issued an update as of July 2022.[1] The war in Ukraine has been a real-world laboratory for the use of commercial UAVs in warfighting, with both the Russian military and Ukrainian defenders using commercial UAVs to an unprecedented degree. In addition to military-grade UAVs, both sides have deployed commercially available drones for intelligence, surveillance, reconnaissance, and support of combat and information operations. The war has become a proving ground for the development of tactics, techniques, and procedures related to commercial UAVs in combat. Panelists not only explored the entities that have helped both sides field these technologies, but also the innovations these partnerships have yielded and the vulnerabilities they have exposed. They concluded with implications for future US military operations.

Consumer Drones versus Military Drone Technologies

Ms. Greenwood elaborated on the history and evolution of commercial and military drones and their distinctions. Commercial drones were originally designed for non-lethal consumer purposes and have since been adapted for military applications.[2] Today's battlefield commercial drones have their roots in hobbyist experimentation and academic research in the 1950s, '60s, and '70s. Ukraine was one of the first countries to extensively use small commercial drones in conflict, starting in 2014 after the Russian seizure of Crimea and incursion in the Donbas. Russia also began using commercial drones in 2014. Thus, both sides' use of commercial drones in the 2022 Ukraine War builds on nearly a decade of experimentation and innovation on the battlefield, though their use is much more novel and widespread than in prior conflicts. Ms. Greenwood has thus far documented 767 incidents of commercial drone use in the war in a publicly available database for future research and inquiry.[3]

Drawing on research on the international humanitarian legal framework for commercial drone applications, Ms. Greenwood pointed out one of the central problems with deploying commercial drones on the battlefield: identification.[4] Unlike crewed military aircraft, it is difficult to tell apart Russian and Ukrainian commercial UAVs; they are too small to reliably identify visually, and there are also no electronic means to do so. This has implications for misidentifying and failing to target enemy UAVs, as well as increasing the

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potential for fratricide and friendly fire. This is further complicated by the operation of non-combatant drones by journalists in the same airspace.[5]

> *"**How much control does a private company have over conflict?**"—Faine Greenwood*

Another novel aspect of battlefield commercial drone applications in Ukraine has been the role of the private sector. The private industry's role in producing and controlling drone software has several implications. There are inherent security risks in operating drones (both the software and the hardware) produced by a foreign country. Private companies can directly curtail market access to their products, as Chinese producer DJI has done with Russia and Ukraine, or they could even intervene directly in operations by activating geo-fencing, a capability DJI has not exercised thus far in the current conflict.

Battlefield Applications in Ukraine

> *"**What's interesting is that Ukraine has been the pioneer in using this technology.**"—Samuel Bendett*

Mr. Bendett concurred with Ms. Greenwood that the 2022 invasion was an inflection point in terms of the widespread application of these technologies in combat by all sides. He noted that Ukraine has been the pioneer for combat applications of commercial drones since the outset of the conflict, highlighting their planned use in defense against the anticipated Russian urban assault on Kyiv. The Ukrainian government early on issued a call to recruit drone civilian drone operators and elicit donations of commercial drones, which eventually transformed into the Ukrainian "Drone Army," which today collects civilian and commercial drones for the Ukrainian regular and volunteer forces.[6]

The prevalence and utility of commercial drones on the battlefield, Mr. Bendett said, has led Russian military experts to now recognize them as one of the key elements of modern warfare. One former Russian general officer commented on social media that quadcopters are essential to today's artillery missions, elevating the role of artillery to a level not seen since World War I.[7] Mr. Bendett believes that the utilization of commercial quadcopters in combat is only likely to increase. Their simplicity and affordability has made them easy to field in great numbers, making them relatively expendable. Commercial UAVs have indeed experienced significant losses such that demand for replacements is likely to be strong, and they remain readily available from vendors in Eastern Europe and Southeast Asia.

> *"**We are like blind kittens on the front.**"—Samuel Bendett quoting a Russian soldier's outburst about the lack of drones*

One lingering question Mr. Bendett posed is how official military forces will continue to incorporate these capabilities, which have developed largely organically. The integration and elevation of commercial drone operators in modern combat—many of whom had no formal military affiliation or training prior to the conflict—places them at considerable risk as high-value targets. Drone operators on both sides have suffered significant combat losses since the outset of the invasion. Mr. Bendett noted that both sides have had to rapidly roll out new doctrine and training materials to integrate and protect this valuable new capability. New Russian and Ukrainian training manuals spell out force protection and operation security best practices, such as working in pairs, selecting different launch and recovery sites, mission flying altitudes, etc. Both sides have also instigated informal public-private "hackathon" events to train new drone operators and experiment with new tactics.[8]

Lessons for the US Defense Enterprise

Dr. Roff focused her comments on how the US could and should think about applying commercial drones in its Joint Force concept of operations (CONOPS). She pointed toward the banality of stand-off weapon systems in history, noting that the proliferation of drones in the present conflict is the logical iteration of a cat-and-mouse game of offense and defense technologies. What she finds striking about commercial drones in the Ukraine War is the way their application is forcing militaries to adapt their concept of operations more rapidly. She posited that the US is poorly positioned to conduct agile CONOPS development because the defense enterprise is captive to an offense-dominant model and posture that dates to 1945. The US correctly recognized that drones would be a critical element in modern warfare even before the Ukraine invasion, but, instead of emphasizing offensive applications, it has primarily focused on developing defensive countermeasures. While the private and public defense sector have often worked together on offensive drone applications, developing countermeasures will continue to be much more difficult given a lack of peaceful applications that might incentivize commercial investment.

For Dr. Roff, whose work has focused on human-machine teaming and autonomous weapon systems, a central question is how to scale these technological applications in the existing joint force structure. Until the DOD adopts coherent concepts for their integration into operations, the US would not be well served by acquiring such systems *en masse*. At present, consumer drones are not trusted for critical missions because of their inherent vulnerabilities. Ukraine and Russia are relying on these technologies out of necessity, whereas the US might benefit from a more deliberate approach to testing, verifying, and acquiring such platforms. Commercial drones face barriers to adoption across the Joint Force that date back to the introduction of Predator Drones in the late 1990s. Most of the autonomous command and control architecture is very rudimentary or controlled by human operators. Increased sensor data from ubiquitous drones has not necessarily translated into increased exploitation without increased analytic resources.

Additional Remarks | Q&A

When asked whether the Ukrainian side had developed a commercial drone advantage in the war, Mr. Bendett responded that Ukraine had indeed been very effective in integrating drones into reconnaissance and strike operations. Ukraine's volunteer drone army movement has persisted, and the technology remains absolutely essential in giving a tactical edge to soldiers at the front. Mr. Bendett noted that at the outset of the conflict, he would have expected to see more Russian drones operating, particularly given the lessons the Russian military had learned from the 2020 Nagorno-Karabakh War between Armenia and Azerbaijan. These lessons remain unincorporated for structural, organizational, and technical reasons, and Russia's small (but growing) number of domestic drones and loitering munitions are not expected to arrive in significant quantities any time soon. Panelists also discussed how commercial drones would fare in a less permissive electronic warfare environment. They noted that electronic countermeasures have indeed been one of the leading causes of drone casualties in Ukraine, but that both sides have developed effective countermeasures to protect their drones, meaning that they have been more resilient than expected. Asked whether existing arms control measures adequately addressed the proliferation of these technologies, Dr. Roff highlighted the limitations of the existing Multilateral Export Control Regimes, which address military-use technologies like sensors and communications frequencies but do not adequately account for the advent of commercial drones in combat and require modernization.[9] Low visibility coupled with the pace of innovation occurring today in private and academic research means they are often overlooked.

Notes

[1] Jeffrey Edmonds and Samuel Bendett, *Russian Military Autonomy in a Ukraine Conflict*, CNA, DOP-2022-U-031764-Final, Feb. 2, 2022, https://www.cna.org/reports/2022/02/russian-military-autonomy-in-a-ukraine-conflict; Jeffrey Edmonds and Samuel Bendett, *Russian Military Autonomy in Ukraine: Four Months In*, CNA, DOP-2022-U-032953-Final, July 6, 2022, https://www.cna.org/reports/2022/07/russian-military-autonomy-in-ukraine-four-months-in.
[2] See also Faine Greenwood, "Ukraine is Being Watched from the Sky," *Foreign Policy*, Apr. 2, 2022, https://foreignpolicy.com/2022/04/02/russia-ukraine-war-drones-risks/.
[3] Faine Greenwood, "Ukraine War Drone Incidents 2022," Google Sheet database, https://docs.google.com/spreadsheets/d/1NtgseODXGSAomx6G5Efwz4XY6AuYF9ZjGSGiCxvNHXE/edit#gid=0.
[4] Faine Greenwood, "Consumer Drones in Conflict: Where Do They Fit into IHL?" Humanitarian Law & Policy (blog), Mar. 15, 2022, https://blogs.icrc.org/law-and-policy/2022/03/15/consumer-drones-conflict-ihl/.
[5] See also Faine Greenwood, "Ukraine is Being Watched from the Sky."
[6] Office of the President of Ukraine, "These Are the Drones You're Looking for: Join Mark Hamill and the Army of Drones," *United24*, https://u24.gov.ua/dronation.
[7] Tweet by @SamBendett, Aug. 11, 2022, https://twitter.com/sambendett/status/1557697452039364610.
[8] Tweet by @SamBendett, Sep. 1, 2022, https://twitter.com/sambendett/status/1565413854674296840.
[9] Bureau of Industry and Security, "Multilateral Export Control Regimes," US Department of Commerce, https://www.bis.doc.gov/index.php/policy-guidance/multilateral-export-control-regimes.

For video of this and other CNA events, please see: https://www.youtube.com/user/VisionCNA.

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