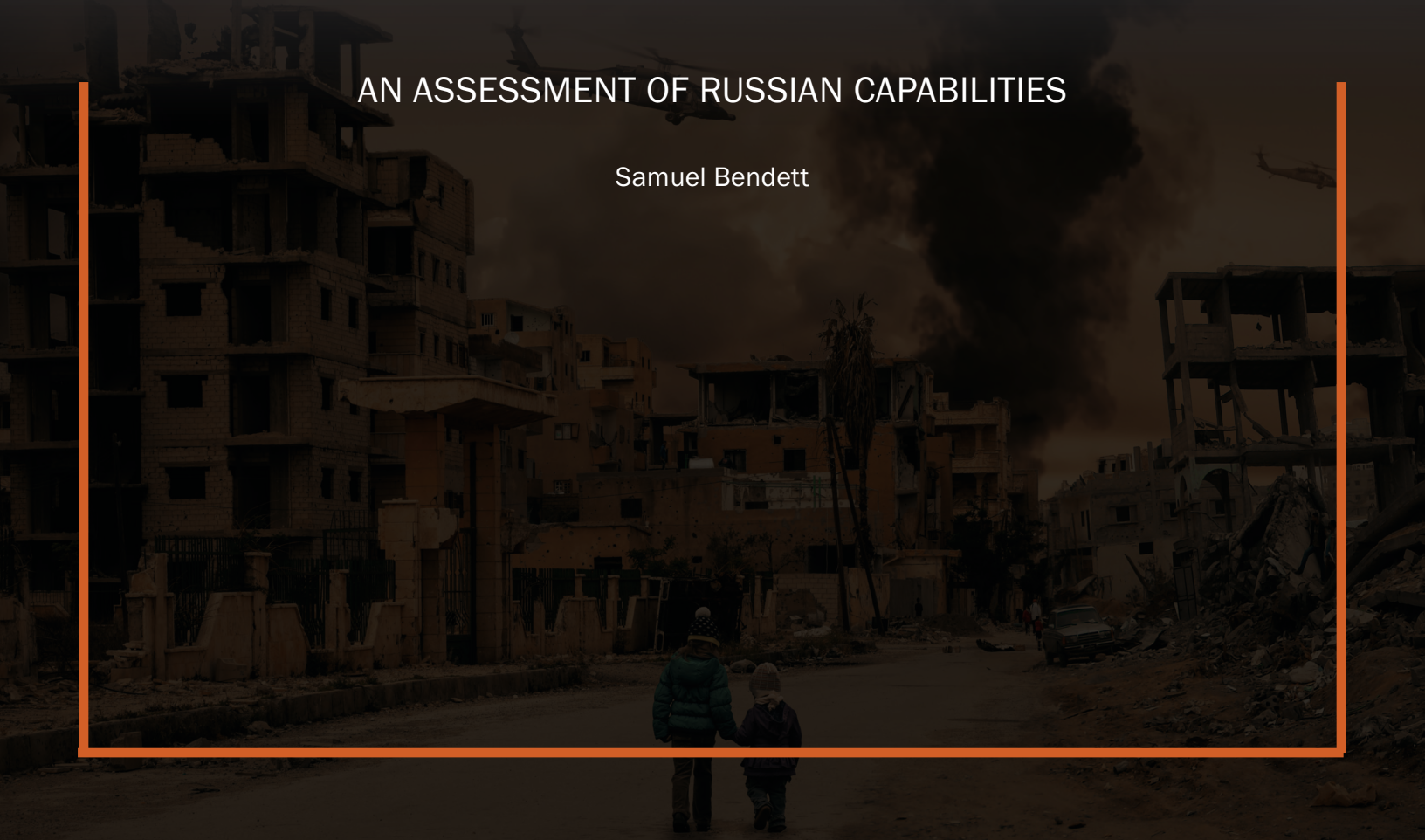




AERIAL DRONES IN THE UKRAINE WAR:

AN ASSESSMENT OF RUSSIAN CAPABILITIES

Samuel Bendett





War in Ukraine, Borodyanka, almost destroyed apartment building, destroyed and burned apartments, drone view, aerial photography. | Anton | Adobe Stock

MORE THAN A YEAR INTO THE Ukraine war, aerial drones—or uncrewed aerial vehicles (UAVs)—have become critical to the operations of both the invading Russian military and the defending Ukrainians forces. For the Russian military, UAVs are a key part of the reconnaissance fire and strike complexes, with short-to-mid-range drones providing real-time guidance and situational awareness for long-range artillery, multiple-launched rockets systems, mortar crews and other weapons systems.¹ Additionally, UAVs have taken on explicit combat functions, with the delivery of rockets, grenades, and other munitions to hostile targets the key mission undertaken by a wide range of UAVs in the war. These missions and functions today represent a significant part of ground-based combat in Ukraine as the Russian infantry, Rosgvardiya (National Guard), Donbas volunteers and Wagner Group forces experiment with such battlefield innovations to make gains against an experienced Ukrainian defensive line.

COMMERCIAL DRONE TECHNOLOGY AS A KEY ELEMENT

Drone development, testing, evaluation and use by the Russian military was well documented prior to the February 2022 invasion², and has received significant media coverage

over the past year.³ Likewise, many aspects of drone warfare in Ukraine have received widespread publicity from a growing body of publicly available data.⁴ However, a real surprise in the war has been the rapid emergence and adoption of commercial and recreational drones—such as Chinese-made DJI quadcopters—as an essential tactical combat element. While it was the Ukrainian military that first seized on this key and widely available technology to monitor and strike invading Russian forces, the significance of the “DJI effect”⁵ was quickly understood by the rank-and-file Russian forces as the war accelerated.

Moreover, although the DJI quadcopter has been deemed the “new symbol of war,”⁶ another commercial UAV, the first-person view (FPV) racing drone, has become equally as essential. These small and fast UAVs are usually assembled by users themselves and are significantly cheaper than a DJI or a similar commercial quadcopter.⁷ Usually costing less than a thousand dollars to build, FPV drones fly faster than DJIs and often operate as “kamikazes”—one-way expendable UAVs that carry a small warhead comparable to an RPG and are used to strike tanks and armored vehicles.⁸ The FPV advantage belongs to the Ukrainians, who had a much earlier start at assembling these drones and training their FPV pilots.⁹ Nonetheless,



Russian forces at the front are catching up and using FPV drones as a faster, cheaper, and deadlier, complement to a typical DJI-made Mavic 3, M30T or Enterprise quadcopter.¹⁰

A real surprise in the war has been the rapid adoption of commercial and recreational drones as an essential tactical combat element.

For over a year after the invasion began, the Russian Ministry of Defense (MOD) lagged behind tactical commanders in understanding the key importance of this commercial technology.¹¹ The majority of small drones operating across Russian forces at the tactical edge—up to 10km (6–7 miles) out—were provided by volunteer efforts, with funds raised across Russia by regular citizens and organizations that send supplies directly to the soldiers.¹² The MOD was not involved in delivery of this technology to the front at scale, and in fact sometimes appeared to prevent the delivery of this technology to its own forces.¹³ It was only in April 2023 that news spread across Russian Telegram channels that the MOD can in fact deliver a quadcopter to a given unit, albeit only after a not insignificant amount of paperwork.¹⁴ Whether many Russian soldiers will take the MOD up on this offer remains to be seen, as it likely remains easier to just acquire a quadcopter from the volunteers without the onerous MOD red tape. This initial lack of coordination between tactical

units and high command, the continued reliance on volunteers, and the sprawling Russian defense-industrial sector's inability to deliver home-grown quadcopter solutions in large numbers is a significant point of contention within the Russian military-media space, with Telegram-based commentators criticizing a bureaucracy that is slow to meet the drone challenge. Indeed, as of Spring 2023, the MOD still appears to endorse a “bring-your-own-quadcopter” policy, with numerous Russian units flying their own tactical drones without significant coordination with other formations at the front or support from above.¹⁵

Along with purchasing finished drones like DJI or Autel quadcopters from China, there is a growing volunteer effort across the Russian Federation to assemble small quadcopters and other small drones from publicly available commercial parts, like the ones that can be acquired on online marketplaces such as AliExpress.¹⁶ This effort, ostensibly to answer soldiers' calls for more tactical aerial technology absent at the front, also includes 3D printing key components for bombs and munitions, and pilot training. Although these initiatives are recognized by state media as essential to the fight, such news coverage avoids discussing why the country's defense-industrial complex has failed to adjust.¹⁷

Additionally, some of Russia's regional governments are supporting and funding both drone training for the mobilized troops, and large-scale drone building efforts with their own funds.¹⁸ Although such indigenous production efforts are celebrated as successes of “technical sovereignty”, many of these drones are assembled with Chinese components and microelectronics, thus exacerbating a significant dependence on that country for key technologies.¹⁹ There is still no clear substitute for Chinese-made quadcopter components in the Russian Federation, even if some Russian manufacturers are starting to claim some domestic substitution. Additionally, many disparate efforts to assemble quadcopters and FPV drones are not technically synched and coordinated, resulting in uneven distribution of such drones across the front.

GROUP, SWARM, OR BOTH?

Both Russian and Ukrainian forces are now working with groups of drones launched against adversary positions. This often involves different drone types working in pairs—such as an intelligence, surveillance and reconnaissance (ISR) drone directing and guiding



A group of Ukrainian military using tablet to operate the drone | dshermeta | Adobe Stock

a loitering munition to a target.²⁰ There is growing evidence that Ukrainian forces are using these tactics to identify and target Russian positions. A typical group raid on the Russian trenches involves one drone to draw the attention of a counter-UAV unit, exposing their position, while other drones subsequently attack exposed soldiers.²¹

Russian forces are launching groups of larger, long-range, Iranian-made Shahed-136/131 loitering drones against Ukrainian civilian infrastructure.

Such group attacks often take place during the night, with one Ukrainian quadcopter flashing its lights to draw attention to itself, attracting Russian anti-aircraft fires, while others flying in “silent mode” immediately strike revealed Russian positions. Russian commentators also note that quadcopters are being used more and more for dropping munitions in groups. In such cases, drone quantity plays a big role—the massed accuracy it provides trumps disadvantages such as individual drone cost, small munitions size and the chances of losing UAVs to countermeasures.²²



Russian drone shot over Donetsk Oblast on 5 April 2022 by the Kramatorsk Border Detachment of State Border Guard Service of Ukraine. The drone was conducting air reconnaissance. | State Border Guard Service of Ukraine | CC BY 4.0 DEED

Recently, Russian forces have started using small and cheap commercial drones to identify Ukrainian electronic warfare systems at the front, prior to launching their own larger and heavier combat quadcopters on a mission.²³ Additionally, Russian forces are launching groups of larger, long-range, Iranian-made Shahed-136/131 loitering drones against Ukrainian civilian infrastructure. This has been reasonably successful as it only takes one drone to break through the multi-layered Ukrainian air defenses to cause significant damage.²⁴ Russian forces are likely to continue to rely on this tactic in the face of stiff resistance across the front and an impending Ukrainian counteroffensive.

However, it should be noted that such mass-scale, simultaneous drone attacks do not qualify as true “swarms”. Rather, a swarm implies that each drone is flying autonomously, recording and exchanging data with other drones, analyzing and identifying targets, and correcting the attack pattern, all while communicating with the operators who launched the swarm. Neither Ukraine nor Russia has fielded this technology, but it is likely that drone swarms may be in operation soon enough, with Ukraine claiming that artificial intelligence (AI) is already used for ISR and target identification on their drones.²⁵ Furthermore, the Russian military is currently fielding Lancet and Klub loitering munitions that supposedly possess AI capabilities for route and target selection, identification and independent targeting, although at this point a human operator maintains a central role in aerial drone warfare.²⁶ The drone swarm breakthrough may also come from volunteers on either side, who use publicly available ICT technologies to modify, test and then field their UAVs.

MISSING IN ACTION?

One of the most intriguing features of this war is the notable absence of Russian mid-and-long-range combat drones. The Russian military had a small number of medium-altitude, long endurance (MALE) combat drones prior to the February 2022 invasion. Some of these combat UAVs performed well in Syria against forces lacking robust air defense and electronic warfare capabilities. Ukraine countered these drones with a sophisticated layered air defense, relegating these UAVs mostly to supporting ISR roles and limited strikes.²⁷



Ukrainian president Volodymyr Zelenskyy stands near a Russian kamikaze drone in Kyiv, Ukraine, on 27 October. Anadolu Agency | Getty Images

The Russian government has faced significant critiques from domestic military commentators and volunteers about the absence of domestic long-range combat drones at the front, a line of criticism that only grew once Russia started using Shahed-type UAVs it purchased from Iran.²⁸ The repeated critique forced the Russian government to eventually respond at the highest levels, with Dmitry Medvedev, former President and current deputy chairman of Russia’s Security Council, admitting the country’s delay in developing and fielding certain UAV types. Although he claimed that multiple domestically-designed drones were concluding their

testing and nearing production,²⁹ no clear timeline exists today for these combat drones’ eventual entry into war, with some developers announcing prior to the invasion that such UAVs may go into mass production between 2023–2025.

IMPLICATIONS FOR THE FUTURE

More than a year into this new form of combat, some Russian military commentators have concluded that the FPV and DJI quadcopter type drones will become the standard means of operation for assault units in the future, noting that these technologies are a revolution in tactics comparable to the Maxim machine gun of the early 20th century.³⁰ Furthermore, they consider application of these drones as a solution to the Russian military’s current “positional impasse”, with the only limiting factors being the speed of drone development and mass deployment across the front lines.³¹ For instance, one Russian Telegram channel argued that mass drone adoption would help alleviate munitions bottlenecks, as a single drone can suppress one firing point more efficiently than an artillery barrage.³²

Pro-Kremlin commentators and journalists also note that while the drone gap between Russian and Ukrainian forces has narrowed at the tactical level, Ukraine still enjoys an advantage in quadcopter integration into its command-and-



Soldiers of Dnipro Brigade of National Guard of Ukraine showing a downed Russian Grifon 12 UAV in Donetsk Oblast. Kvertus drone jammer is shown. National Guard of Ukraine | CC BY 4.0 DEED

AERIAL DRONES IN THE UKRAINE WAR: AN ASSESSMENT OF RUSSIAN CAPABILITIES

control system. While Russian drones are used at a battalion level or below, Ukrainian forces broadcast in real-time drone data to higher levels of command-and-control. As a result, their artillery strikes against identified targets are much faster and can be coordinated with drone strikes from neighboring units.³³ The integration of these tactics above the battalion level is one of the biggest challenges facing Russian forces today, as the growing use of DJI and FPV-type drones by the soldiers is upending some of the pre-war UAV concepts on a daily basis.³⁴

Beyond Ukraine, foreign militaries are considering aerial drone saturation of the combat environment as a key takeaway of the war, with many concluding that not only do soldiers need their own tactical drones for close-range support and operations, but that they may also need their own combat drones and loitering munitions for prompt reaction to a rapidly evolving combat environment. Additionally, they recognize that a persistent hostile UAV presence provides adversaries with near-constant surveillance of ground forces' movements and maneuvers, potentially altering these formations' deployment and combat tactics. This development can potentially be countered by robust counter-UAV defenses including electronic warfare and

different kinetic weapons, but so far the experience of Ukrainian and Russian forces shows the difficulty of identifying and interdicting small drones in combat scenarios. Finally, drone combat in Ukraine demonstrates how quickly technology can impact operations, with the FPV drone emerging as a significant threat in a matter of months, following the widespread adoption of DJI-type quadcopters by all belligerents. As the next drone evolution in Ukraine may include swarms and other breakthroughs, this is an area in which the belligerents and foreign observers are closely monitoring technical progress in order to both emulate successful applications, and develop capabilities to counter the new threat once it emerges.

ABOUT THE AUTHOR

Samuel Bendett is an analyst with CNA's Russia Studies Program and an adjunct senior fellow with the Center for New American Security's Technology and National Security Program. Previously he worked at the National Defense University. The views expressed here are his own.

Southwestern part of Bakhmut (Donetsk region of Ukraine) during the battle of the city. | State Border Guard Service of Ukraine | CC BY 4.0 DEED



AERIAL DRONES IN THE UKRAINE WAR: AN ASSESSMENT OF RUSSIAN CAPABILITIES

ENDNOTES

- 1 Samuel Bendett and Jeffrey Edmonds, “Russian military autonomy in Ukraine: four months in,” CNA, July 2022, <https://www.cna.org/reports/2022/07/russian-military-autonomy-in-ukraine-four-months-in>.
- 2 Samuel Bendett, “The Rise of Russia’s Hi-Tech Military,” *Fletcher Security Review*, June 26, 2019, <https://sites.tufts.edu/flecherrussia/fletcher-alumnus-samuel-bendett-on-the-rise-of-russias-hi-tech-military/>.
- 3 Paul Mozur, Aaron Krolik and Keith Bradsher, “As War in Ukraine Grinds On, China Helps Refill Russian Drone Supplies,” *New York Times*, March 21, 2023, <https://www.nytimes.com/2023/03/21/business/russia-china-drones-ukraine-war.html>.
- 4 Max Hunder, “Inside Ukraine’s scramble for ‘game-changer’ drone fleet,” *Reuters*, March 24, 2023, [https://www.reuters.com/world/europe/inside-ukraines-scramble-game-changer-drone-fleet-2023-03-24/?utm_medium=Social&utm_source=twitter](https://www.reuters.com/world/europe/inside-ukraines-scramble-game-changer-drone-fleet-2023-03-24/?utm_medium=Social&utm_source=twitter;);
Jason Sherman, “Drone-on-Drone Combat in Ukraine Marks a New Era of Aerial Warfare,” *Scientific American*, April 3, 2023, <https://www.scientificamerican.com/article/drone-on-drone-combat-in-ukraine-marks-a-new-era-of-aerial-warfare/>;
Faine Greenwood, “The Drone War in Ukraine Is Cheap, Deadly, and Made in China,” *Foreign Policy*, February 16, 2023, <https://foreignpolicy.com/2023/02/16/ukraine-russia-war-drone-warfare-china/>.
- 5 “General Baluevsky discussed revolution in artillery (Генерал Балуевский рассказал о революции в артиллерии),” RIA Novosti, April 11, 2022, <https://ria.ru/20220811/kvadrokoptery-1808761668.html>.
- 6 Ibid.
- 7 Two Majors (Два майора), Telegram, March 26, 2023, https://t.me/dva_majors/11760;
Two Majors (Два майора), Telegram, March 25, 2023, https://t.me/dva_majors/11687.
- 8 RTsBS (РЦБС), Telegram, March 27, 2023, <https://t.me/DroneCenterDNR/640>.
- 9 Game of Drones, Telegram, January 3, 2023, <https://t.me/droneswar/5357>.
- 10 Dambiev, Telegram, February 8, 2023, <https://t.me/ChDambiev/22171>.
- 11 Game of Drones, Telegram, March 24, 2023, <https://t.me/droneswar/6261>.
- 12 RTsBS (РЦБС), Telegram, March 24, 2023, <https://t.me/DroneCenterDNR/622>;
Dmitry Astrakhan, “Drone amidst the clear sky: how drones change the course of the special military operation (Дрон среди ясного неба: как беспилотники меняют ход СВО),” *Izvestia*, October 24, 2022, <https://iz.ru/1414691/dmitrii-astrakhan/dron-sredi-iasnogo-neba-kak-bespilotniki-meniaiut-khod-svo>;
Moo Veche (МОО Вече), Telegram, December 30, 2022, <https://t.me/MOOVeche/1527>.
- 13 Roman Saponkov (Роман Сапунков), Telegram, November 26, 2022, <https://t.me/RSaponkov/4054>;
Drones (drones, UAVs, UAVs) (Беспилотники (дроны, БПЛА, UAV), Telegram, April 2, 2023, https://t.me/uav_tech/13781.
- 14 Drones (drones, UAVs, UAVs) (Беспилотники (дроны, БПЛА, UAV), Telegram, April 7, 2023, https://t.me/uav_tech/13945.
- 15 Mobilized forces can bring their own quadcopter (Мобилизованные могут взять с собой квадрокоптер), RIA Novosti, September 28, 2022, <https://ria.ru/20220927/kvadrokopter-1819744051.html>;
“The Cabinet of Ministers allowed the regions to purchase equipment and equipment for the military at the request of the Ministry of Defense (Кабмин разрешил регионам закупать по заявкам МО снаряжение и оборудование для военных),” TASS, October 3, 2022, <https://tass.ru/ekonomika/15944241>.
- 16 Drones (drones, UAVs, UAVs) (Беспилотники (дроны, БПЛА, UAV), Telegram, April 1, 2023, https://t.me/uav_tech/13764.
- 17 Drones (drones, UAVs, UAVs) (Беспилотники (дроны, БПЛА, UAV), Telegram, March 25, 2023, https://t.me/uav_tech/13556.
- 18 “The first graduation of military personnel—drone operators took place in Yakutia (В Якутии состоялся первый выпуск военнослужащих—операторов дронов),” *Digital Russia*, March 28, 2023, <https://d-russia.ru/v-jakutii-sostojalsja-pervyj-vypusk-voennosluzhashhih-operatorov-dronov.html>.
- 19 “Kamikaze drones for destroying tanks were tested in Novosibirsk (Дроны-камикадзе для уничтожения танков на СВО испытали в Новосибирске),” *Moskovskij Komsomolets*, March 24, 2023, <https://novos.mk.ru/social/2023/03/24/dronykamikadze-dlya-unichtozheniya-tankov-na-svo-ispytali-v-novosibirske.html>
Dambiev Telegram channel, March 29, 2023, t.me/ChDambiev/22981;
“The Designer Spoke About Domestic Components in the Dobrynya Drone (Конструктор рассказал об отечественных комплектующих в дроне ‘Добрыня’),” RIA Novosti, December 1, 2022, <https://ria.ru/20221201/dron-1835529052.html>.
- 20 “DNR drone caused Ukrainian militants to flee near Avdeevka, (Беспилотник ДНР обратил в бегство украинских боевиков под Авдеевкой),” *Izvestia*, December 25, 2022, <https://iz.ru/1446312/2022-12-25/bespilotnik-dnr-obratil-v-begstvo-ukrainskikh-boevikov-pod-avdeevkoi>.

AERIAL DRONES IN THE UKRAINE WAR: AN ASSESSMENT OF RUSSIAN CAPABILITIES

- 21 Drones (drones, UAVs, UAVs) (Беспилотники (дроны, БПЛА, UAV), Telegram, March 29, 2023, https://t.me/uav_tech/13628.
- 22 UAV Observer (Обозреватель БПЛА), Telegram, February 5, 2023, <https://t.me/dronesrussia/21199>.
- 23 Two Majors (Два майора), Telegram, January 7, 2023, https://t.me/dva_majors/7536.
- 24 Isabel van Brugen, “Ukraine Downs Barrage of Shahed-136 Drones in Overnight Assault—Kyiv,” *Newsweek*, March 22, 2023, <https://www.newsweek.com/ukraine-downs-barrage-shahed-136-drones-assault-1789505>.
- 25 David Hambling, “Will Ukraine deploy lethal autonomous drones against Russia?,” *New Scientist*, November 1, 2022, https://www.newscientist.com/article/2344966-will-ukraine-deploy-lethal-autonomous-drones-against-russia/?utm_source=rakuten&utm_medium=affiliate&utm_campaign=2116208:Skimlinks.com&utm_content=10&ranMID=47192&ranEAID=TnL5HPStwNw&ranSiteID=TnL5HPStwNw-tL1BmSH7lwV74GmIafi2xw.
Will Knight, “Ukraine’s Quest for Homegrown AI Drones to Take On Russia,” *Wired.com*, April 13, 2023, <https://www.wired.com/story/fast-forward-ukraines-quest-for-homegrown-ai-drones-to-take-on-russia/>.
- 26 Maksim Panasovskiy, “Russia’s Lancet kamikaze drone is equipped with an NVIDIA Jetson TX2 computer and an Xilinx Zynq chip,” *gadget.com*, March 20, 2023, <https://gadget.com/en/226952-russias-lancet-kamikaze-drone-is-equipped-with-an-nvidia-jetson-tx2-computer-and-an-xilinx-zynq-chip/>.
- 27 Samuel Bendett and Jeffrey Edmonds, “Russian military autonomy in Ukraine: four months in,” *CNA*, July 2022, <https://www.cna.org/reports/2022/07/russian-military-autonomy-in-ukraine-four-months-in>.
- 28 Dronnitsa (ДРОННИЦА), Telegram, September 26, 2022, <https://t.me/dronnitsa/135>.
- 29 “Russia to possess whole family of domestic drones shortly, says Medvedev,” *TASS*, March 23, 2023, <https://tass.com/defense/1593327>.
- 30 UAV Observer (Обозреватель БПЛА), Telegram, February 5, 2023, <https://t.me/dronesrussia/21199>.
- 31 UAV Observer (Обозреватель БПЛА), Telegram, February 5, 2023, <https://t.me/dronesrussia/21199>.
- 32 UAV Observer (Обозреватель БПЛА), Telegram, February 5, 2023 <https://t.me/dronesrussia/21199>.
- 33 Game of Drones, Telegram, December 22, 2022, <https://t.me/droneswar/5218>.
- 34 Bendett and Edmonds, “Russian military autonomy in Ukraine.”

