What Iran's Drones in Ukraine Mean for the Future of War

by Michael Knights **(/experts/michael-knights)** , Alex Almeida **(/experts/alex-almeida)**

Nov 10, 2022

Also published in ***New Lines***

ABOUT THE AUTHORS

Michael Knights (/experts/michael-knights)

Michael Knights is the Jill and Jay Bernstein Fellow of The Washington Institute, specializing in the military and security affairs of Iraq, Iran, and the Persian Gulf states. He is a co-founder of the Militia Spotlight platform, which offers in-depth analysis of developments related to the Iranian-backed militias in Iraq and Syria.

Alex Almeida (/experts/alex-almeida)

Alex Almeida is the head security analyst at a leading risk advisory firm.

Articles & Testimony

Russia's effective use of inexpensive Iranian aircraft points to challenges that other states may soon face elsewhere.

In the 1930s, future adversaries in the Second World War—Nazi Germany and its Italian allies, and the Soviet Union under Josef Stalin—fought a proxy war. The Spanish Civil War was a testbed for many of the technologies and tactics used in the subsequent world war, particularly aerial bombing of civilian and military targets. Today, the conflict in Ukraine is being used by the Islamic Republic of Iran for the same purposes and has been added to the regime's other testbed training environments, such as Lebanon, Iraq, Yemen, the Gulf states, Gaza and even international shipping lanes.

As in the Spanish Civil War, the great powers today will learn some lessons from Ukraine correctly and misinterpret others. Exposing capabilities will come at a cost, both diplomatically and in terms of better preparing Iran's adversaries in future conflicts. Nowhere is the testbed nature of the Ukrainian war clearer than in Iran's supply of unmanned aerial vehicles (UAVs), or drones, to the Russian military.

Iranian drones have become an increasingly important weapon for Russia in its war in Ukraine, where they are used to strike a range of civilian and military targets. According to U.S. officials, Iran has also sent trainers to Crimea to teach the Russians how to use them correctly. Their usage offers a glimpse into a future where cheaply-made attack equipment is able to grind down expensive and sophisticated materiel.

Iranian-made drones of the Shahed-131 and Shahed-136 series first began turning up in Ukraine in mid-August

2022. Initially, the Russian military appears to have employed them primarily as battlefield loitering munitions (also known as “one-way attack” or suicide drones), using them to strike at Ukrainian artillery and other mid-value tactical targets. Then came a change: Since mid-October, the Shaheds have formed a key component of a coordinated campaign of strategic strikes against key nodes of Ukraine’s electricity distribution grid and power-generation capacity.

Russia has designated the Shahed-131 as Geran (Geranium)-1 and the Shahed-136 as Geran-2 in Russian service. Russia needed them to supplement its fast-depleting stocks of air- and sea-launched cruise missiles, which rely on a diminishing amount of imported electronic components. With an effective range of several hundred miles, the Shaheds have allowed the Russian military to strike at targets deep inside western and central Ukraine from launch points in Crimea and southern Belarus. In October, Russia managed to fire the low-flying Shahed-136s into Kyiv, where they killed several civilians, including a woman who was six months pregnant. After months of denial, in early November Iran admitted to selling a small number of drones to Russia before the invasion of Ukraine took place.

The first wave of strategic strikes on Ukraine’s electricity infrastructure took place on Oct. 10-11, shortly after Gen. Sergei Surovikin took over as the overall operational commander of Russia’s war in Ukraine. Since early October, the Russian military has launched hundreds of cruise missiles and Iranian-supplied Shahed drones against electricity targets, focusing on the cluster of large power stations that supply electricity to Ukraine’s major cities along with dozens of local distribution hubs—the so-called lateral switching yards, where high-voltage current is transformed to lower-voltage current for local distribution. Additional waves of strikes using dozens of Shahed-series drones and cruise missiles followed on Oct. 16-17 and Oct. 30.

These attacks on Ukraine’s dense and resilient power grid have been much more systematic, coordinated and focused than previous attacks. According to the Ukrainian authorities, the Russian campaign shows signs of being directed by Russian personnel with extensive knowledge of Ukraine’s electricity grid, much of which dates to the Soviet era. Though the Shahed drones can carry only a small warhead of around 33-66 pounds of high explosives (compared to around 100 pounds for a small-diameter aircraft bomb), they are reliably accurate and can be aimed to target critical nodes or subcomponents within a larger facility. While most of the sites damaged by the strikes have been brought back online fairly quickly, repairs at some facilities may take months or up to a year because of the need to receive “long-lead” items that must be made to order.

As a result, while Ukrainian power stations are still generating an energy surplus, electricity distribution across the country has begun to break down because of the persistent targeting of key transmission hubs. The initial wave of strikes temporarily knocked out about 30% of Ukraine’s power plants and substations, forcing Kyiv to impose rolling blackouts across the country. Kyiv has attempted to play down the impact of the disruptions, but Ukrainian officials are already warning the population will need to prepare for serious electricity, heating and water shortages during the winter. Ukrainian refugees in Europe have been instructed to delay any returns home in order to reduce the strain on the power grid.

Ukraine’s ability to defend against the attacks is limited by the sheer number of sites that must be defended, which include dozens of local substations. Nevertheless, defenses have evolved quickly. As the drones fly in, spotters and ground-based radar are able to direct manned fighter aircraft to them. This has resulted in a number of “tail chases,” in which Ukrainian fighter pilots fly low and slow to fire heat-seeking missiles at the drone engine exhausts. Ground-based interceptor missile batteries also cover the major cities and will be supplemented by the arrival of additional systems, including the German IRIS-T, the pan-European Aspide, the U.S. National Advanced Surface-to-Air Missile System (NASAMS) and Crotale and Hawk surface-to-air missile (SAMs) from France and Spain. For final “point defense” at the target, the Ukrainian military has only a limited number of short-range radar-guided gun systems, such as the German-supplied Gepard anti-aircraft cannon, which they supplement with local manned machine-gun

positions providing a last line of defense.

As Ukrainian forces have refined their counter-drone and cruise missile tactics, their intercept rates have risen steadily. The Ukrainian military claims to have intercepted between 65% and 85% of Shahed and cruise missile strikes, but this figure—even if accurate—conceals the real impact of the attacks. First, Ukraine has been forced to divert Western aid and internal military efforts to defensive measures, and thus away from the counter-offensive. Second, even if a majority of strikes were intercepted, this would still mean a sizeable number of the highly accurate systems got through. Finally, Russia is on the winning side of the "cost imposition curve," since the Shahed-series drones appear to cost about $20,000 each, whereas air-to-air missiles or ground-based interceptors cost between $400,000 and $1.2 million each. This suggests Iranian drone use is a net gain and will be scaled up if Russia can do so.

According to Kyiv, Russia has ordered between 2,000 and 2,400 drones from Iran. Current Iranian production figures for the Shahed series are unknown, but there are reports the Russian defense industry is already moving to establish its own licensed production lines for the drones. The Kremlin may also order large numbers of other Iranian drone models, such as the heavier and longer-ranged Arash-2. If Russia can draw on most of Iran's output along with its own production, the Russian military may be able to sustain a relatively high strike tempo indefinitely. Russian variants may also evolve to include traits that give them greater survivability. As a result, Russia could exploit the cheapness of Iranian systems to undermine the long-term viability of Ukraine's defensive strategy.

For Iran, the Ukraine crisis offers a way to enjoy a more equitable relationship with a great power—Russia—even though supplying the drones to President Vladimir Putin has come at significant cost to Tehran, triggering a cooling of interest from U.S. President Joe Biden's administration in a renewed nuclear deal with Iran and pushing the European Union into Ukraine-related sanctions on Iran. Aside from geopolitical fruits and any currency or barter provided by Russia, which may include military or nuclear technologies, the Iranian supply of drones to Russia will also provide a rich learning environment that may inform future Iranian design and employment of drones. Ukraine is an environment in which Russia is subsidizing Iran's military experimentation, making the process not only free for Iran but potentially profitable. At the very least, Iran will offload its older drones and can use any revenue from Russia (or payment in kind in military materials and technologies) to "recapitalize" its drone fleets with more modern and improved models. A mass export scheme to Russia, as well as lessons learned from Russia's own license production and adaptation of the drones, will give Iran's drone industry a huge boost.

In recent years, Iran has experimented with real-world use of explosive-tipped drones in numerous environments. First, Iran supplied drones to Lebanese Hezbollah and, since at least 2021, has set up licensed production facilities in both Lebanon and Syria. The Houthi rebels in Yemen also received a similar package beginning in 2015, including local production facilities and a variant of the Shahed known as the Waid. Indeed, the Yemen war provided Iran with its first and best Spanish Civil War-type testbed for military technologies and tactics. It took multiple technical reports on Iranian drones by the U.N. Panel of Experts and arms control consultancies to convince skeptical critics that Iran was supplying drones and ballistic missiles to the Houthis, by which time the number of rocket and drone attacks on Saudi Arabia had risen to as many as 70 per month by 2021. Since 2015, Iran has undertaken a slow and steady experimentation process in Yemen, yielding particularly useful lessons about how to overcome foreign-supplied defensive apparatus, such as the U.S. Patriot and Russian Pantsyr systems.

Other battlefield experimentation has taken place elsewhere in the Middle East. On July 30, 2022, an Israeli-linked ship, Mercer Street, was struck by Waid drones near the Omani port of Duqm, killing the captain in a precision strike. In Iraq, militias have also been gifted Iranian drones, including the Shahed-136, known as Murad-6 in Iraq. On May 14, 2019, Iranian and Iraqi fighters launched Shahed-136 drones from Iraq to strike the Aramco east-west oil pipeline in central Saudi Arabia. Iraq was then used again as a launch point for Shahed-136 drones to strike Saudi

Arabian oil processing sites at Abqaiq and Khurais, with lines of storage tanks neatly punctured by Shahed warheads employing directed explosive charges. Other types of Iranian drones have also been provided to Hamas in Gaza, where they have been used against Israel.

Where Ukraine differs from these environments, however, is that Iran will get to see its drones used in a high-intensity war, not in small numbers but en masse. In Yemen—previously the most intense drone-testing environment for Iran—the highest number of drones fired in any single month was around 70, in March 2021, up from the usual 25-30 in other months. In Ukraine, by contrast, the rate has been as high as approximately 200 Iranian drones used per month. If Russia were to start producing Iranian drones locally, as well as receiving them from Iran, that figure could soar further.

In an environment where not dozens but hundreds of drones are being used each month, Iran will learn important lessons about the saturation of defenses and the exhaustion of more expensive and slower-to-build air defense systems. These lessons will be extremely useful for Lebanese Hezbollah as it plans methods to swarm Israel's defensive systems, as well as for the Houthis and Iran itself as they perfect their multidirectional threat against Saudi Arabia and the United Arab Emirates. For observers the world over, the mass use of cheap drones is the key feature of the deployment of Shaheds to Ukraine, offering a glimpse into the future of warfare. As though to emphasize this point, on Nov. 2, Iranian propaganda accounts on social media released a computer-simulated video showing some 30 Shahed-136 drones swarming a Middle East energy site.

Though earlier concerns had focused on some of Iran's more advanced drones—re-usable Unmanned Combat Aerial Vehicles (UCAVs) such as the Shahed-129 or the Mohajer-6—the Ukraine conflict has shown the relative value of loitering munitions guided by GPS, such as the Shahed-131 and Shahed-136. UCAVs such as the U.S. Predator or the Turkish Bayraktar (which dominated conflicts in Libya, the Azeri breakaway region of Nagorno-Karabakh and Syria) are important for militaries which face limited anti-drone defenses and negligible risk that these radio-controlled drones might be tracked by radar back to their base, giving away its location. UCAVs can loiter for long periods, can be precisely maneuvered and their onboard munitions are able to strike moving targets such as cars. As a result, they are exactly what the U.S. needed to hunt and kill terrorists, and still play that role against terrorists and less advanced opponents. However, against the U.S., Israel or even Western-supported Ukraine, the UCAV has fatal downsides. Adversaries can jam or interfere with their radio-control signals or even track the drones back to their high-value operators and mechanic workshops. The Shahed-131 and Shahed-136 are "fire and forget"—programmable and then self-guiding. As they evolve, it may become more difficult to disrupt their GPS signal and thus their terminal guidance at the end of their flights. For rapid integration, such "fire and forget" systems are ideal because they do not require operators to be trained. The aircraft are not so much flown as merely programmed with waypoints.

For the defenders, the extensive deployment of Shaheds to Ukraine—the 300-400 already used and the thousands that may follow—should also be a wake-up call. The drones that have impressed the most in previous conflicts were the expensive reusable UCAVs with a team of operators sitting in a distant pod, playing real-time Playstation with human targets. The Ukraine war is showing us something else: significantly cheaper single-use drones that can do much of what a cruise missile can do but are smaller, more cost-friendly and deployed in larger numbers. Their use shows us the future of swarming and slow-burning attritional war, in which a defense is ground down over time because attack is simply so much cheaper.

Iran's drones are utilitarian: As far as Russia is concerned, they are "good enough" to get the job done. From Iran's perspective, the Shahed-136 has adequate range for most of the targets it might want to strike. With a range of 1,200 to 1,500 miles, it can hit any target in the Middle East from Iran, let alone from Iran's "axis of resistance" partners in Lebanon, Yemen and Iraq. If these outposts are factored in, then Southern Europe, East Africa, the Caucasus,

Pakistan, parts of India and the maritime choke-points at Hormuz, Bab el-Mandeb, Suez and the Bosporus are all well within range. While Ukraine is a country at war, with a large and resilient infrastructure, there are many smaller and more fragile states within range—such as the UAE, Kuwait and Bahrain—who would lose their reputation for stability and safety if they were attacked repeatedly.

Defense currently appears to be prohibitively expensive, so the example of the Shaheds may spur even greater efforts to reduce the cost of counter-missile and counter-drone defenses. The country or bloc of countries that can invert the cost disparity between defense and attack will emerge as a powerful and resilient player. Sensor networks will need to identify smaller and smaller drones and communicate their positions to a central command system, which requires advanced computing or artificial intelligence. The per-unit cost of longer-ranged and air-launched guided missile interceptors will need to be reduced. As the remaining drones approach a target, a new option may be guided "smart" bullets, or hypersonic guided interceptor munitions that can be fired from conventional "tube" artillery such as howitzers and naval guns.

Combatants like Ukraine will now dig out retired anti-aircraft cannon systems like the radar-guided ZSU-23-4 Shilka and seek out new radar-guided cannons. Further defense may be provided by counter-drone drones, such as the Switchblade. Short-range energy weapons using high-energy lasers and high-powered microwave devices will top up these systems where high-value targets are clustered together and where the swarms of enemy drones may have been sufficiently thinned. Finally, the targets themselves will slowly be hardened through the use of stronger composite materials and high-tensile strength netting. By forcing the attacker to over-engineer their drones—to be faster, more maneuverable, smarter and more destructive—the per-unit cost of the attack can be pushed upward just as defense becomes cheaper.

Deterrence will also require a rethink. For those still on the wrong side of the cost curve, deterrence can augment defense by increasing the overall costs paid by the attacker—regardless of the specific cost imbalance between drones and defense systems. To illustrate the point, for Russia, there is no additional cost to destroying Ukraine's infrastructure using drones, and for Iran there is no cost to providing the drones. What if Ukraine deployed an exact or better equivalent of the Shahed-131/136, as Ukrainian arms producer Ukroboronexport claims it is doing, and what if that kind of inexpensive system eventually armed all the states surrounding Russia and Iran? What if, in the meantime, Russian infrastructure suffered equivalent damage via cyber-attacks and sabotage, and what if Iranian aircraft delivering the drones or key components began to explode in mid-air? Factories in Russia and Iran might also suffer from unusually high numbers of industrial accidents—such as that which befell the Iranian drone factory in Kermanshah in March 2022. In southern Russia and Belarus, more effort could be put into striking drone units "left of launch"—military parlance for the period before they send over their swarms. Using cyber-attacks, the "fire and forget" pre-programming of GPS-guided drones could be an ideal means of sending such enemy systems right back to their owners. Developing and employing a drone would thus not be the only costs an enemy might bear. If the adversaries of Russia and Iran are prepared to go beyond sanctioning, naming and shaming, the costs of undertaking strategic attacks could become unbearably high for the rogue states of the world.

Michael Knights is the Bernstein Fellow at The Washington Institute and cofounder of its ***Militia Spotlight (https://www.washingtoninstitute.org/policy-analysis/series/militia-spotlight)*** *platform. Alex Almeida is the head security analyst at a leading risk advisory firm. This article was originally published* ***on the New Lines website (https://newlinesmag.com/argument/what-irans-drones-in-ukraine-mean-for-the-future-of-war/)***. ❖

RECOMMENDED

BRIEF ANALYSIS

Biden Heads to Egypt Amid Economic Protests and Libyan Gridlock

Nov 10, 2022

◆

David Schenker,
Ben Fishman

(/policy-analysis/biden-heads-egypt-amid-economic-protests-and-libyan-gridlock)

BRIEF ANALYSIS

Re-evaluating Turkish Nationalism: A Bulwark Against the Religious Establishment

Nov 10, 2022

◆

M. Bahadırhan Dinçaslan

(/policy-analysis/re-evaluating-turkish-nationalism-bulwark-against-religious-establishment)

BRIEF ANALYSIS

The Sectarian Shadow Over Bahrain's Election

Nov 10, 2022

◆

Simon Henderson

(/policy-analysis/sectarian-shadow-over-bahrains-election)

TOPICS

Great Power Competition (/policy-analysis/great-power-competition)

Military & Security (/policy-analysis/military-security)

Proliferation (/policy-analysis/proliferation)

REGIONS & COUNTRIES

Iran (/policy-analysis/iran)