Moving Targets: Implications of the Russo-Ukrainian War for Drone Terrorism

By David Hambling

Small and commercially available drones in the hands of violent extremists pose a rapidly growing terrorist threat. This article examines that threat in the light of the invasion of Ukraine. Consumer drones such as DJI Mavics, FPV racing drones, and Shahed-style one-way attack drones have become potent weapons. Their affordability, accessibility, and adaptability enable precision strikes, bypass traditional defenses, and democratize air power for state and non-state actors alike. This article details how these drones have been used in Ukraine—from grenade-dropping quadcopters to long-range strategic attacks—and highlights their potential adoption by violent extremist organizations (VEOs). The second part of the article assesses the implications for global counterterrorism, emphasizing the psychological impact, scalability, and low operational risk of drone attacks. It concludes by outlining countermeasures, including electronic jamming, physical barriers, kinetic interception, and the growing role of drone-on-drone defense, urging a comprehensive and adaptive response to this multifaceted and accelerating threat.

A trailer towed by a truck pops off a false roof, releasing dozens of miniature kamikaze drones that wreak havoc on a nearby military airbase. Dozens of aircraft are severely damaged or destroyed, amounting to billions of dollars in losses. This scenario used to be the stuff of Hollywood action movies but has now played out in real life, specifically in Ukraine's Operation Spiderweb against Russia at the beginning of June 2025.[1] More importantly, the underlying capability is based on commercial, commodity hardware and software that is available to everyone. Any actor can acquire and fly drones, carry out precision strikes from a significant range, and bypass legacy defensive measures. This reality has significant implications for terrorism.

Small drones first entered the terrorism discussion in 2014.[2] In Iraq, the Islamic State utilized a number of different drone types, including consumer quadcopters[3] and Skywalker X-8 hobbyist fixed wing drones carrying explosives.[4] These caused alarm and delayed operations, but inflicted little serious damage and were largely countered by U.S. jamming.

But since then, the threat has evolved. A combination of technology and expertise has transformed small drones into the deadliest threat on the battlefield. According to a recent report by RUSI, small drones now "currently account for 60-70% of damaged and destroyed Russian systems" in the conflict with Ukraine.[5] To put it another way, small drones are inflicting twice as much damage as everything else—artillery, rockets, tanks, missiles, mortars, aircraft—put together. And these are drones that, unlike advanced military hardware, are available to, and affordable by, everyone.

At the same time, larger, low-cost drones assembled from commercial components[6] have become the most common weapon for long-range strikes, with aircraft, ballistic, and cruise missiles featuring less on the battlefield.[7] Many one-way attack drones are assembled in dispersed garage workshops,[8] and the technology is within the reach of well-supported violent extremist organizations (VEOs).

A complete account of drone use in the Ukraine conflict would be prohibitively lengthy. This article instead examines three major types of drones that are most relevant in a counterterrorism context: modified consumer drones, FPV kamikaze drones, and Shahed-type long-range attack drones. This first part of the article describes each of these types and their use and production. The second part examines how these drones contribute toward the terror threat and how the risks from terrorist drone attacks might be mitigated. The article closes with an outline of proposed countermeasures to combat the threat.

Part 1: Three Types of Threat Drone

"Mavics": Combat Quadcopters

Dai Jing Innovations, universally known by its initials DJI, is the biggest drone maker in the world, commanding approximately 70 percent of the global market.[9] Based in Shenzhen, China, DJI was not the first company to make a consumer quadcopter, but it was the first to realize its full potential as an aerial camera in 2013 with the Phantom (now Phantom 1).

The Phantom 1 quadcopter[10] was an immediate success. Flight time was just 15 minutes and top speed 22 mph, but the stabilized video camera and simple user interface gave operators an unprecedented ability to start flying immediately and capture footage previously only possible with a helicopter. The drone autopilot did most of the work, and the Phantom could automatically hover in place even in windy conditions. The control range was a modest 300 meters, and it was priced at $629 ($867 today).

DJI plowed early profits into R&D and developed a high level of vertical integration as well as economies of scale and quickly

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A fiber optic-controlled drone is designed for the Ukrainian Armed Forces in the Kyiv region, Ukraine, on January 29, 2025. (Maxym Marusenko/NurPhoto via Getty Images)

overhauled the competition. They brought out new, more capable drones on an annual basis, much like the smartphone industry of the same era.

In 2016, DJI brought out the first of its Mavic series, which has become the company's flagship product. These fold up small enough to fit into a cargo pocket for easy transport but boast impressively capable cameras and other features. The latest version, the 2025 Mavic 4 Pro,[11] has a flight time of 51 minutes, a top speed of 54 mph, and three cameras including a specially engineered 100 MP Haselbad and can shoot 6K video. The Mavic 4 can be operated at a range of more than 20 miles. All this capability costs under $2,500, although it is not available in the United States due to a variety of issues including tariffs.[12]

In Ukraine, Mavics have become the de facto standard for small unit reconnaissance[13] and artillery spotting, and 'Mavik'/Mavic is used generically as a term for consumer quadcopters on the battlefield. These are modified on an industrial scale with 'hacks' to prevent the drone broadcasting its identity and location.[14]

In addition to providing eyes in the sky, Mavics are also light bombers or 'drop drones.' While they are not designed to carry a payload, they have abundant spare power for the task. There was some small-scale use of quadcopters as bombers in the Donbas region before 2022,[15] but both sides now used them extensively. The typical drop drone is an unmodified Mavic with a 3D-printed harness strapped to it. The drone has an external LED light controlled by the operator; a sensor on the harness uses this light to trigger bomb release. Similar kits are sold to consumers for dropping fishing bait.[16] Mavics were initially armed with modified 30mm grenades[17] or hand grenades, but increasingly, both sides are fielding custom-made munitions. The Russians produce factory-made drone bombs,[18] while the Ukrainian effort is more artisanal.[19]

The most commonly seen drone bomb is a modified antipersonnel Vog-17 grenade weighing 350 grams (less than one pound). This has tail fins added for stability, and the usual setback fuse (armed by firing from a launcher) is replaced with a simple impact fuse. The warhead is high explosive/fragmentation. Although the effective radius is claimed at six meters, it frequently fails to incapacitate the target and multiple drops are needed. Mavics typically carry two Vog-17 type munitions or one larger grenade. This is typically a fragmentation hand grenade like the F1, but drones have also been observed with thermobaric grenades,[20] thermite,[a] shaped charges such as modified US 40mm M433 'Golden Egg' grenades,[21] and tear gas.[22]

There have also been examples of drop drones armed with

a Thermite is a mix of powdered metal and powdered metal oxide that burns at very high temperature. It is used for industrial welding and military demolition as it can melt/burn through metal. See David Hambling, "Why Thermite Is Drone Bombers' New Favorite Weapon," *Forbes*, July 12, 2024.

Molotov cocktails[23] or other incendiary mixtures.[24] A civilian version of this incendiary drone technology is used for controlled burns in the United States.[25] The drones can also act as minelayers, with one Mavic carrying up to eight PFM-1 "butterfly" antipersonnel mines.[26]

A skilled operator can drop grenades with great accuracy, thanks in part to the rock-steady hover function that allows the drone to be precisely positioned above a target. Abandoned vehicles are routinely destroyed by drone-dropped grenades through open hatches.[27] Uncovered foxholes and trenches, which provide protection from other weapons, become deathtraps when there are drop drones around. There are also videos of Mavics pursuing and bombing foot soldiers running away at speed. More recently, Mavics have been equipped with improvised shotgun attachments.[28] These fire a standard 12-gauge cartridge and are used to shoot down other quadcopters,[29] though they could also be employed against ground targets. One Mavic can carry two shotgun tubes.

Fast First Person View Drones

While the Mavic is affordable compared to military hardware—comparable military drones cost 10 times as much—the Ukraine conflict saw a demand for something even less costly for one-way attack missions: the first person view (FPV) drone. In the civilian world, FPV drones are racing quadcopters. They lack the complex sensors, control, and software of the Mavic in favor of more powerful engines. The operator wears viewing goggles, which gives them a drone's eye view essential for rapid maneuvering, which is the essence of FPV racing. Contestants negotiate a small track and fly through hoops at speeds of over 100 mph.

In Ukraine, soldiers who had been FPV enthusiasts in civilian life modified the racing drones into guided missiles by adding warheads,[30] typically RPG-7 or RKG-3 anti-tank grenades. These are much larger than the munitions carried by Mavic, thanks to the drones' more powerful engines. A typical FPV carries two kilograms, but there are larger versions such as the Queen Hornet[31] with a payload capacity of over seven kilograms depending on requirements. Such drones typically cost less than $500 to assemble.[32] The FPVs proved extremely effective and were produced first by the dozen, then by the thousand, and now in massive quantities. Ukraine aims to purchase 4.5 million FPV drones in 2025.[33]

FPVs have become the main anti-tank weapon in the Russo-Ukrainian war and also account for a large proportion of other targeted armored vehicles. With a range of 20 km and high precision, they are used for counter-battery fire against artillery.[34] To destroy an artillery piece, the FPV has to hover a few inches away from the barrel before detonating a shaped charge. The ability to hit fast-moving targets makes them effective against light vehicles—from trucks delivering supplies to Russian assault troops on motorbikes and ATVs. Their low cost and abundance mean FPVs are used freely to target individual Russian foot soldiers.

FPV payloads range from RPG warheads and other shaped charge munitions to fragmentation and thermobaric rounds capable of leveling buildings.[35] "Dragon drones,"[36] FPVs using thermite dripping red-hot material, can set alight hundreds of meters of tree line in a single mission. There are also Claymore-type antipersonnel fragmentation munitions,[37] which are carried on a drone and triggered by an operator at a distance to cover a wide area. In the last year, there has been growth in FPV interceptor drones[38] used to bring down fixed-wing scouts, and there have been a number of reports of FPV drone attacks on helicopters.[39]

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Basic FPVs can be assembled in a few hours from commercial components, mainly Chinese. Ukraine's Victory Drones effort teaches civilian volunteers how to assemble drones[40] from scratch using nothing more than a screwdriver and soldering iron, with a list of parts that can be purchased online. One volunteer might, for example, make 10 drones a month, which are sent for quality control checking before being shipped to the front.[41] Additional features, such as thermal imagers, significantly add to the cost, with even a low-grade imager costing $250 or more.[42]

In the last year, makers have introduced FPVs controlled via a fiber-optic cable rather than radio. This also adds $200 or more to the cost,[43] and the weight of the fiber spool reduces the FPVs payload capacity. But these fiber drones are immune to radio-frequency countermeasures and detection. Early fiber drones had limited range, but 10-20 km is now standard and the Ukrainians claim to have to destroyed targets from 42 km away with fiber drones.[44]

In another development, increasing numbers of FPVs are fitted with machine vision and lock-on-target lock.[45] Again, these add a few hundred dollars to the price but allow the operator to lock on to an objective so that even if communication is lost, the drone will still hit the designated target. More advanced versions of this capability will automatically select the most vulnerable point of the target.[46] Some makers, such as Ukraine's Saker, produce systems that are able to spot, identify, select, and engage targets without human intervention.[47]

Battlefield FPVs are still evolving quickly in Ukraine, and there is no sign of an end stage. Battlefield FPV drones were used in the well-known Operation Spiderweb against Russian airbases in June 2025.[48] In this case, the drones were piloted remotely by a 4G LTE connection over the Russian cellphone system. They also had backup AI targeting, which in some cases completed the task of guiding the drone to a target aircraft. Even a few kilos of explosive were enough to set four-engined aircraft ablaze. Israel carried out a similar attack with drones smuggled into Iran[49] at the outset of Operation Rising Lion, also in June 2025. While a similar operation would be highly ambitious for VEOs, all of the elements required are easily available. A smaller-scale effort using pre-positioned drones against a soft target such as an airport could be executed with much less effort than Spiderweb.

Shahed-Style One Way Attack Drones

The Iranian-designed Shahed-136, known in Russia as Geran-2,[50] is a low-cost, long-range, one-way attack drone with a wingspan of seven feet. Driven by a propeller, it flies at a modest 120 mph and typically carries a 45-kilogram warhead. Russia has built these drones by the thousands, and Ukraine experiences nightly barrages of Shaheds targeting civilian buildings and energy infrastructure.

The Shaheds have evolved rapidly throughout the campaign. Although there have been no major changes, modifications include improved, increasingly jam-resistant satellite navigation[51] and a variety of different warheads.[52] Later versions are credited with 'stealth' properties[53] with a black exterior that makes them harder to see at night and is claimed to reduce their radar signature.

The claimed range of the Shahed-126 is 2,500 km. Actual range is unknown but, in some cases, exceeds 1,200 km, and longer ranges are certainly possible.[b] The drones typically follow an indirect route to avoid air defenses and remain at high altitude—5,000 to 8,000 feet or more[c]—until they are over the target area.

Some Shaheds have been found fitted with 4G modems and Ukrainian SIM cards. Rather than enabling remote piloting, the purpose of these appears to be to determine which drones complete their mission or where they are downed[54] so that follow-up attacks can avoid air defenses. They may also allow drones to be rerouted in flight. Individually, Shaheds are easy to counter, but stopping hundreds of them is another matter. Shaheds cost perhaps $35,000 each[55] and can easily be mass produced. A surface-to-air missile like the Patriot PAC-3 costs millions and the United States can only make several hundred a year.[56] Even the shoulder-launched Stinger missile costs $480,000 per shot[57] and stocks are limited, while Russia is launching thousands of Shaheds per month.

Ukraine has countered the Shahed with a layered array of defensive systems. In addition to surface-to-air missiles, there are hundreds of mobile fire units equipped with anti-aircraft machineguns with thermal imagers and tablet computers. These teams are moved into position to intercept the slow-moving Shaheds. High-flying Shaheds may be intercepted by F-16s, others by helicopters using machineguns or automatic cannon. These are supplemented by large-scale electronic warfare systems and supported by networks of radar and acoustic sensors that track incoming drones. At one point, these were intercepting over 90 percent of the Shaheds,[58] though this had dropped as the barrages became heavier.

Ukraine has developed its own equivalent attack drones such as the AN-196 Lyutyi[59] and UJ-26 Bobr,[60] and has used them to set Russian oil refineries and storage facilities ablaze.[61] Ukrainian drones have also hit military factories, airbases, and other strategic targets. The warhead of such drones is much smaller than the 500-kilograms-plus of a typical cruise of ballistic missile. But it is more than sufficient to damage or destroy anything except the largest and most heavily hardened targets. As terror weapons, multiple small drones can create a much greater effect, and have a much greater chance of getting through, than a single missile. And a group that could never aspire to acquire a ballistic missile could acquire attack drones comparatively easily.

While such drones are significantly more challenging to acquire than Mavic or FPVs, they can still be assembled from basic components in a garage workshop. Ukraine's drone production is highly decentralized. One maker, Terminal Autonomy,[62] uses wooden airframes manufactured the same way as flat pack furniture.[63] And even the Russian state manufacturer uses commercial electronics, many of them smuggled in from the West,[64] rather than expensive custom electronics.

Part 2: The Terror Drone Threat, And Countering It

The three types of drones discussed above all present particular terrorist threats. Mavic-type quadcopters with drop drone kits are the most easily accessible and can be acquired by anyone with nefarious intent. In fact, there has already been at least one notable case of drone bombing in the United States, when Jason Muzzicato used a DJI drone to drop home-made bombs on his ex-girlfriend's house in 2019.[65] It is only surprising that such attacks have not been more common.

VEOs could use Mavics to scout a site in preparation for an attack, identifying and locating security measures. It is now easy enough to build a detailed 3D model of an area[66] by flying a drone over it and feeding the camera data into an app. But most concern will be over drones used for attacks. Mavics can bypass walls, fences, and other barriers against terrorist attack, fly (in many places) over security personnel with impunity, and reach into supposedly secure areas including sports stadia and airports.

Mavic-type drones, even without warheads, also present a significant terror risk to aircraft in flight. The most obvious danger is that drones would be deliberately flown in the approach to an airport, in the path of incoming airliners. Impact at 200+ mph is likely to cause severe or possibly catastrophic damage.[67] Bird strikes are relatively mild because birds are essentially soft, low-density organic material. Drones, however, which have higher density and include hard components like batteries, are a much greater hazard to both jet engines and cockpit glass.

FPVs require more resources to acquire and greater skill to operate than Mavics. They can carry out a precision attack from many miles away, even reaching across national or other borders. Again, most security methods that keep attackers at a distance away are ineffective against attackers with drones. The high speed means there may be little warning of an FPV attack.

The larger payload of FPVs compared to Mavics means they can inflict significantly more damage. This applies with fragmentation weapons to cause mass casualties, with thermobaric warheads to damage structures, or with other payloads such as chemical agents. "Dragon drone" attacks might be spectacular rather than dangerous, though there is a risk with flammable targets and they could cause sudden massive wildfires under the right conditions. Fiber drones present the added threat of infiltrating buildings to seek targets inside. In Ukraine, this is mainly a matter of locating vehicles inside garages and hangars[68] but could equally be applied in an urban environment.

b "The range of the 136 version has been estimated by various analysts as anywhere between 1,000 and 2,000 km … If the fuel tanks are located in the fuselage, then its increase in length from 2.6 to 3.5 metres provides a 35% increase in fuel volume. Hence, it stands to reason that the Shahed 136 has a range somewhere between 1,350 and 1,500 km." See Uzi Rubin, "Russia's Iranian-Made UAVs: A Technical Profile," RUSI, January 13, 2023.

c "Starting from February-March 2025, the Russian occupation forces began using Shaheds not in the traditional lowpass format—flying at extremely low altitudes—but instead at average altitudes of 1,500 meters over mainland Ukraine and 2,000–2,500 meters from maritime directions." Alexander Kovalenko, "Alexander Kovalenko: Russia has changed its tactics of "kamikaze" drone strikes on Ukraine," Odessa Journal, April 14, 2025.

Increasing autonomy opens the possibility of an attack without a human operator on the spot. Drones could be pre-positioned for an attack, with the perpetrators leaving the country before it is carried out. It also means that multiple drones can be flown at once without the need for skilled pilots. In principle, a single terrorist could activate dozens of autonomous drones and send them to seek targets simultaneously.

Both Mavic and FPV drones can create a considerable psychological effect just by their presence. The buzzing of rotors carries well, and in Ukraine, the presence of drones is enough to keep troops lying low in their dugouts. They would likely have a similar effect on civilian targets and might be able to trigger panic behavior crowds. This psychological impact could be dangerous even if the drones are unarmed or deliver a dummy payload such as smoke bombs or harmless white powder.

Drones have a further appeal to VEOs in that attacks are self-documenting. Drones shoot video constantly in flight, so attacks are recorded in detail. FPVs only show attacks up to impact, but follow-up FPVs or accompanying Mavics can show the aftermath. The political impact of a terrorist incident is measured in part by the amounts of news coverage it receives. By filming their own attacks, VEOs can release their own version of an attack on social media or other platforms, and this is likely to gain attention. Again, in Operation Spiderweb, without Ukrainian video Russia could simply have denied the attacks did any damage. The dramatic footage went viral, though, and made front pages and TV opening headlines worldwide.

Shahed or Bobr type drones represent a different type of threat, one which is more likely to come from large organizations such as Hamas, Hezbollah, or the Houthis, all of whom have access to Iranian drone technology. Iran in particular has supplied clients with drone hardware. (Note that the Houthis used long-rang attack drones to successfully strike airports and oil facilities in Saudi Arabia in 2022,[69] and reportedly against targets in the UAE that same year.[70])

There is no specific limit to the range that such drones can reach. While the current generation seen in Ukraine are currently reaching around 2,000 km, a U.S.-made drone with a 36-foot wingspan with global reach developed for the U.S. military by a commercial company has been seen.[71] Ultra-long range strikes drones could carry warheads far enough to start fires at oil or gas storage or processing sites, destroy parked aircraft, or cause mass casualties in a crowded area. In the next few years, VEOs around the world may be able to threaten targets in the United States from their own countries.[72]

While some may focus on the larger systems and more elaborate possibilities suggested by Operation Spiderweb and Shaheds, the low end may be more important. In Ukraine, the small drones did not come from the aerospace industry but from the soldiers themselves.[73] Drone users appreciated the possibility of drones on the battlefield. Soldiers with FPV experience before the conflict put their FPV knowledge to use after hostilities erupted.

There has been a rise in opportunistic terror attacks with actors using the tools on hand, such as motor vehicles.[74] Munitions tend to be the most challenging aspect of an operation, and skilled bomb makers are usually in shorter supply. But there are millions of drone users, and drones enable attacks without explosives. Incendiaries, including thermite, are easier to acquire and deploy than bombs, as are shotguns and other firearm attachments. Even at the lowest level, the kinetic effect of an FPV armed with nothing more sophisticated than a two-kilogram metal spike should not be underestimated.

Drones also give the appearance of being able to carry out risk-free attacks. Unlike the suicide bomber, the shooter, or the perpetrator of a car-ramming VAW [vehicle as a weapon] attack, the drone operator may feel there is no immediate personal risk. Forensics may allow such drones to be traced to their source, but this may not deter a reckless or foolish drone terrorist.

Countering Terrorist Use of Drones

As the war in Ukraine shows, there is currently no good single solution to the drone threat on the battlefield. Defense is even more challenging outside of a war situation where readiness is lower, and rules may not allow defenders to engage drones. That said, there are three main methods of defense: electronic, physical and kinetic.

Electronic defense consists of radio-frequency jamming of the control signal or the drone's satellite navigation, or other techniques to interfere with or even take over control of the drone. In Ukraine, jammers are universal, from portable 'trench jammers'[75] to vehicle-mounted systems.[76] Reportedly something over 50 percent of FPV drones are downed by jamming, many by friendly fire.

In the United States, jamming is more difficult because of legal restrictions. The FCC only allows GPS signals to be jammed by a few specified authorities, and there are severe limits of other types of jamming.[d] Bad actors are likely to select frequencies that authorities will be reluctant to jam such as those used by cellphone or emergency services. In addition, according to FAA rules, it is illegal to interfere with an aircraft in flight, which includes uncrewed aircraft.[77] While four federal agencies have the power to down drones[78] under some circumstances, this is tightly restricted. Hence, there were hundreds of unauthorized drone flights over U.S. military installations in 2024 without being downed.[79]

In Ukraine, jamming is already being countered by a variety of methods. In addition to jam-resistant communication and navigation receivers, some are abandoning radio frequency completely. Optical navigation systems, which do not require a satellite signal,[80] are becoming more common. Fiber drones, which communicate via a cable, are now used at scale by both sides, leading to a landscape draped with glittering fibers.[81] And AI-enabled drones that are immune to jamming are also being fielded in larger numbers.[82]

Physical protection against small drones generally means netting.[83] In Ukraine, there have been all sorts of anti-drone nets from basic camouflage netting to repurposed fishing nets to chain-link fences and industrial steel mesh. These are intended to counter FPVs by catching them and preventing them from exploding or making bombs from Mavic-type drones explode prematurely. In some cases, miles of roadway are now enclosed by netting.[84] There have also been some far more ambitious examples of counter-drone protection with entire buildings fitted with steel cages[85] intended to stop larger long-range drones.

There are two problems with netting. One is that FPVs in

d According to current U.S. law, four federal departments—DHS, DOJ, DOD, and DOE—have "express statutory authority to conduct drone detection and counter-drone operations" in the United States. For background, see "Aviation Safety: Federal Efforts to Address Unauthorized Drone Flights Near Airports," U.S. Government Accountability Office, March 18, 2024.

particular have demonstrated an ability to go through any small gaps,[86] limiting the protection it provides. The other is that nets can be damaged by one drone, leaving a gap for others to go through.[87] On the battlefield, any possible protection from drones is seized upon eagerly. It is not clear how well this type of protection will work outside of a war zone. However, in high-security locations where, for example, exposed windows are already fitted with bulletproof glass or blast curtains, it is possible and advisable to add protective measures—netting or other coverings—to prevent drone ingress through any openings.

Kinetic means—shooting down drones with guns and missiles—are widely used in Ukraine. Troops are issued shotguns for close-range defense,[88] and most of the defense against Shaheds is indeed kinetic.[89] But small drones are difficult targets. Shotguns may be a useful last-ditch defense, but there are few reports of them being used successfully. They cannot be considered reliable. The only effective use seen so far is with shotguns carried in interceptor drones to shoot down the opponent's Mavics, which appears to have a high success rate.[90]

As mentioned above, legacy air defenses are useful against single Shahed-type drones but will be quickly exhausted against waves of them. Traditional anti-aircraft guns have been widely used in Ukraine for point defense, including everything from the twin 35mm automatic cannon on German Gepard vehicles[91] right down to antique Maxim guns on anti-aircraft mounts.[92] These work because defenders are networked to the command-and-control system, which detects incoming Shaheds with radar, acoustic, and other sensors so that mobile fire teams can be positioned to tackle them.[93]

Perhaps the most promising protection against Shahed-type drones is new interceptor drones.[94] These vary from basic FPVs to larger fixed-wing models, but are still all essentially small, portable drones, generally with explosive warheads, that can bring down a drone from several miles away. Again, effectiveness relies on a good sensor network so the interceptor can be vectored in on a target in good time. Such drones may be safer in a counterterrorism context than guns or missiles in civilian areas. In particular, net-firing interceptors like those supplied by Fortem[95] (and used successfully in Ukraine) offer a minimum risk of unintended damage. In general, military planners favor a layered kinetic defense incorporating multiple C-UAS weapon types across different ranges. In the very near future, they are likely to be augmented by high-energy laser and microwave weapons with a low cost-per-shot.

Conclusion

Drone warfare has evolved fast during conflict between Russia and Ukraine, and the war has generated drone weapon systems that are directly applicable to terrorism. It is clear from the foregoing analysis that drones present a variety of new threats ranging from an intercontinental drone strike to a mass attack using smuggled drones similar to Ukraine's Operation Spiderweb, right down to domestic terrorists carrying out individual attacks of opportunity with consumer quadcopters.

Countering each of these threat types will require a wide range of responses, and there is considerable work ahead. This will require at a minimum: a comprehensive review of the current threat and how it is likely to change with emerging technologies such as AI-enabled autonomous drones and long-range drones with global reach; a consideration of the threats that these pose and what vulnerable targets need to be protected; a review of the defensive measures that are available and emerging; and a plan of action to put these measures in place and ensure that they are regularly reviewed in line with the changing threat. Plus, of course, adequate funding is required for all these efforts. CTC

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