Trained raptor cripples a drone

WEAPONISED DRONES: AN AIRBORNE THREAT

DISHAN JOSEPH

Modern technology which is impressive can also be used for future terrorist attacks. The most prescient current technology that will enable future terrorist attacks is the drone. Drones have the ability to provide standoff, which can enable terrorists to conduct multiple attacks nearly simultaneously, magnifying their overall effect.

A terrorist attack is meant to create an atmosphere of fear to influence a target audience—a civilian population or a government. The massive increase in the number of form factors, capabilities, ease of access and operation of drones at low cost has made them the weapon of choice for terrorists.

In1994, Aum Shinrikyo attempted to use a remote-controlled helicopter to spray sarin gas, but tests failed as the helicopter crashed. In 2013, a planned attack by Al-Qaeda in Pakistan using multiple drones was stopped by local law enforcement. By 2014, the Islamic State began using commercial off-the-shelf and homemade aerial drones against the military in Iraq and Syria. In January 2018, a swarm of 13 homemade aerial drones attacked two Russian military bases in Syria. Terrorist groups have used aerial drones to conduct many different types of operations: including intelligence collection, explosive delivery (either by dropping explosives or the drone having an equipped rocket-launching system) and chemical weapons delivery. A particularly frightening application of drones is the distribution of chemical and biological agents.

Many terrorists and extremist groups typically conduct attacks with the expectation that their members will sacrifice themselves during the attack. The use of drones, however, can allow an individual or a small group to conduct multiple attacks without self-sacrifice. Professional militaries have used large, unmanned, aerial vehicles to support combat operations since World War II. Their limited initial success as weapons systems during World War II had expanded into intelligence collection by the time of the Korean War. Beginning in the early 2000s, the use of airborne drones by private individuals began to increase rapidly. This was possible primarily due to the higher energy capacity of drone batteries, reduced motor size and enhanced motor power output.

These factors enabled a much smaller form factor, with many drones being less than two feet across, which allowed them to be produced commercially at a significantly reduced cost. The increase in energy-dense batteries and high-efficiency electric motors, combined with the decrease in the weight and size of necessary electronics, began the modern quadcopter "boom." These small forms with limited lift capability, soon led to the development of eight-engine copters, capable of lifting 500 lb (227 kg) at a speed over 80 mph. In 2013, a targeted attack against a power distribution facility in California almost sent a significant portion of the state into darkness. The attack against this unmanned facility caused 15 million USD in damage.

In 2020, the Federal Aviation Administration (FAA) approved the commercial use of drones beyond the pilot's line of sight. Lifting this restriction, combined with the introduction of regular commercial drone flights in the continental United States, will make countering weaponized drones a challenge. Current commercial uses for aerial drones include inspection of roofs with thermal cameras, surveying large areas (such as agricultural fields or acting in response to disasters), chemical application on agricultural fields, product delivery, photography, videography and drone racing. Many early-model drones were difficult to control; they operated on simple one-way radio control from pilot to drone, which meant they required a direct line of sight.

Speed is not limited to large drones, though; drone-racing leagues have been created with small aerial drones reaching 80 mph (129 Kmph) for three- to five-minute flight times. Control of these high-speed drones is maintained by a pilot using video goggles to utilise a first-person view from the drone itself. Increased battery energy density has also enabled the creation of micro-drones, small enough to fit in the palm of someone's hand. Some drone models are equipped with optical cameras and are capable of ranging hundreds of meters at speeds up to 15 mph (24 Kmph), either autonomously or under pilot control - all for less than 200 US dollars. The price range of most commercial off-the-shelf drones that are capable of lifting a weapon-sized payload is between 1,000 and 2,000 USD.

One of the most recent developments in drone technology is the ability to coordinate multiple drones simultaneously. These so-called "swarms" can overwhelm defensive capabilities. In 2018, a drone swarm attacked a pair of Russian bases in Syria. In the attack, 13 fixed-wing drones attempted to deliver aerial bombs from a distance of more than 50 km. Drone movement techniques are advancing. For example, some drones can now imitate animal movements, with several companies using biomimicry in their technology. Biomimicry has progressed to the point where some drones can operate in and around wild animals without disturbing them, moving in the water, air and on the ground with natural motions. In addition to improved capabilities, in-flight automation and visual object recognition capability, optical and sensor capabilities have also improved rapidly. The capability of drone sensors is crucial for increasing their functionality and allows for the use of facial-recognition technologies. Optical sensors can now visualise and transmit videos at 4K resolution, including infrared and night vision.

Countermeasures

Detecting airborne drones is crucial for interdiction**.** This falls within four categories: RF analysis, acoustic sensors, optical sensors and radar. RF analysis monitors the RF spectrum and detects the signals by which drones are controlled. RF analysis systems are incapable of detecting drones that are preprogrammed or that operate fully autonomously. Detection also becomes more difficult in high-population areas, as the spectrum becomes noisier and congested. Optical detection is the use of video cameras and computer algorithms to detect a drone. These systems are subject to high rates of false alarms and limitations in low light or weather interference.

Radar is capable of detecting low-flying and small drones, although difficulties are encountered in high-clutter environments. Most radar systems are incapable of differentiating between a bird and a small drone. The first layer of defeat for most commercially-purchased systems is built-in software limitations, such as geofencing for GPS-enabled drones. During RF jamming, communication between the drone and the pilot or GPS is disrupted.

RF-jamming systems range in size and portability, from rifle-size jammers to those mounted on vehicles or buildings. These systems transmit a radio signal that overwhelms the GPS signal or the operator's transmitter.

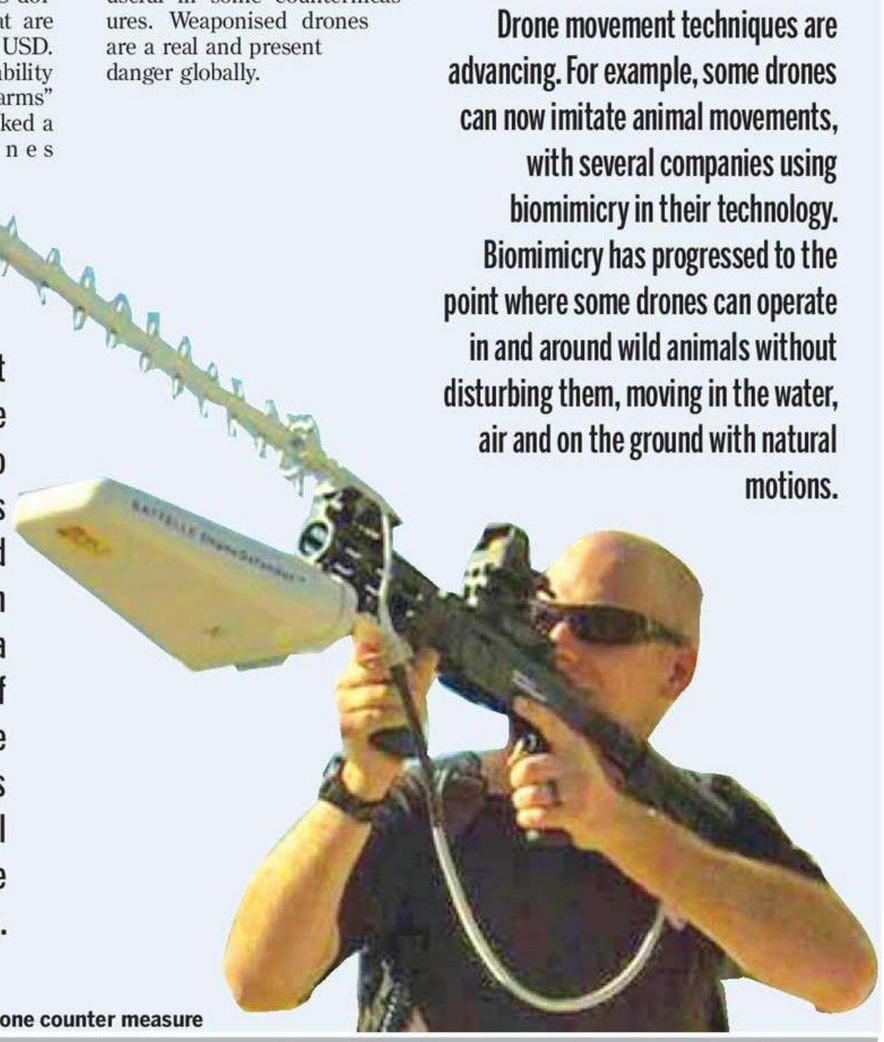
The Common Remotely Operated Weapon Station (CROWS) is a series of remote weapon stations used by the US military on its armoured vehicles. It allows weapon operators to engage targets without leaving the protection of their vehicle.

Nets are more advantageous. They create a larger contact area against a moving target and are thus more likely to entangle and disable an aerial drone's rotating blades. Birds of prey were utilised for a short time as a natural countermeasure but due to their limited operational hours, territorial nature and other complicating factors, they have been retired from drone countermeasure operations. The use of flocking birds is being tried in some countries. For example, pigeons are being conditioned to be attracted to the sounds and motions of aerial drones and may soon be useful in some countermeasures. Weaponised drones are a real and present danger globally.

Drone movement techniques are advancing. For example, some drones can now imitate animal movements, with several companies using biomimicry in their technology. Biomimicry has progressed to the point where some drones can operate in and around wild animals without disturbing them, moving in the water, air and on the ground with natural motions.

One of the most recent developments in drone technology is the ability to coordinate multiple drones simultaneously. These so-called "swarms" can overwhelm defensive capabilities. In 2018, a drone swarm attacked a pair of Russian bases in Syria. In the attack, 13 fixed-wing drones attempted to deliver aerial bombs from a distance of more than 50 km.

Death-Ray (anti-drone system)



Drone counter measure