

How can drones influence global security?

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Summary

The term "drone" is a buzzword right now. In the news, it is mentioned regularly for reasons both good and bad. This is the paradox of this kind of unmanned vehicle, which became popular and accessible in the 2010s. It can help companies be more precise, reach unreachable places, and save lives. Unfortunately, it can also be used as a lethal weapon in battlefields. What does this look like? How is it used in the current wars around the globe? How does it affect our daily life as citizens? What can we do to address the subject? This article elaborates on those questions. In any case, with the constant evolution of innovations, drones are an endless topic which is and will be influencing all of us.

Intro

Nowadays, the daily news is, unfortunately, full of battlefield reports. Russia versus Ukraine, Israel in the Gaza Strip and conflict in the Red Sea, to name only a few examples.

In the context of these unspeakable wars, one word is often mentioned: drone. In the previous decades, we heard that the next world war would be digital. And so it is. Soldiers are now IT geeks able to hack international organizations' computer systems, flood fake news on social media and conduct business in the dark web. However, physical wars are still filling cemeteries. Drones play a role in increasing or decreasing this deadly number.

The history of the drone

To understand how we have reached this point, it is important to understand where we came from. The very first powered flight occurred in 1905 thanks to the Wright brothers. Since then, many people have spent days and months manufacturing flying objects. Ideas from George Conrad Westervelt and William Boeing gave birth to today's second-biggest plane manufacturer (Boeing, 1916; Airbus being the biggest). Next to this famous success story, how many citizen fans of model aircraft designed and built remotely piloted flying systems just for fun?

The very first Unmanned Aerial Vehicle (UAV) had a military objective. The aim of Max Boucher when his plane took off from Avord in France in 1917 was to prove that this machine was capable of carrying out reconnaissance missions without endangering the lives of the pilots. Results were promising, but the end of the First World War slowed down the development of drones [1].

In the 2010s, a Chinese company named DJI created a multicopter drone that was easier to pilot than the small helicopters they used to build. The French company Parrot also entered the game at that time to become a pioneer in the drone business. The official business model was

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based on skilled and trained professionals using drones with embedded cameras to record and photograph places and athletes with a bird's eye view at affordable costs compared to the only competitor at that time, the helicopter.

Lawmakers around the world were not ready for this newcomer in the sky. Of course, rules do exist at a national and international level to monitor and regulate air traffic. In 1944, 54 countries signed the "Chicago Convention" to establish the core principles permitting transport by air, and to create the International Civil Aviation Organization (ICAO). It was not until 2012 that the first national laws (in France) were carved in stone. Belgium had to wait until 2016 and Serbia 2019.

Inspired by civil aviation, initial rules were highly restricted and forced future pilots to attend theoretical, physical and practical courses and to pass a lot of exams. Back in those days, 10 drones were available on the market; they were very expensive and required hours of training.

Inspired by GoPro portable cameras and the constant evolution of technologies, DJI invested millions of euros in research and development to reduce the cost, facilitate piloting and diversify uses. They now address both the B2B (Business to business) and B2C (Business to consumer) markets and claim 70% of the worldwide market shares. They offer ready-to-use solutions for various industries in agriculture, security, entertainment, and logistics just to name a few examples.

B2C DJI drones are nowadays so easy to fly thanks to their stabilization sensors, piloting support with DJI app and user-friendly pre-made scenarios for professional applications that you only need 15 minutes to learn how to maneuver the drone.

New European legislation launched in January 2021 completely changed the game. [2]

We said goodbye to expensive, lengthy training sessions: now anyone can visit an appliance store and buy a drone under 250 grams for about €400 and start to fly right away without a license or training. The goal of the Commission was to open the drone market while limiting constraints for small drones.

This regulation is evolving and Europe presented its "Drone strategy 2.0" in December 2022 [3]. Currently many gaps remain in the text giving opportunities to Member states to fine-tune the law as they wish but above all creating vagueness in certain respects.

With a global point of view, Europe is seen as quite restrictive compared to Asia where innovation is encouraged and flight authorizations given freely or Africa where, in many countries, there are no drone-related laws. The American continent is somewhere between Europe and Asia.

Defense as a leading provider

One of the advantages of unmanned vehicles is to keep the pilot safe. The most dangerous situation is certainly during wartime. Drones then sound like a perfect solution for collecting information, transporting food and goods and conveying (lethal) weapons.

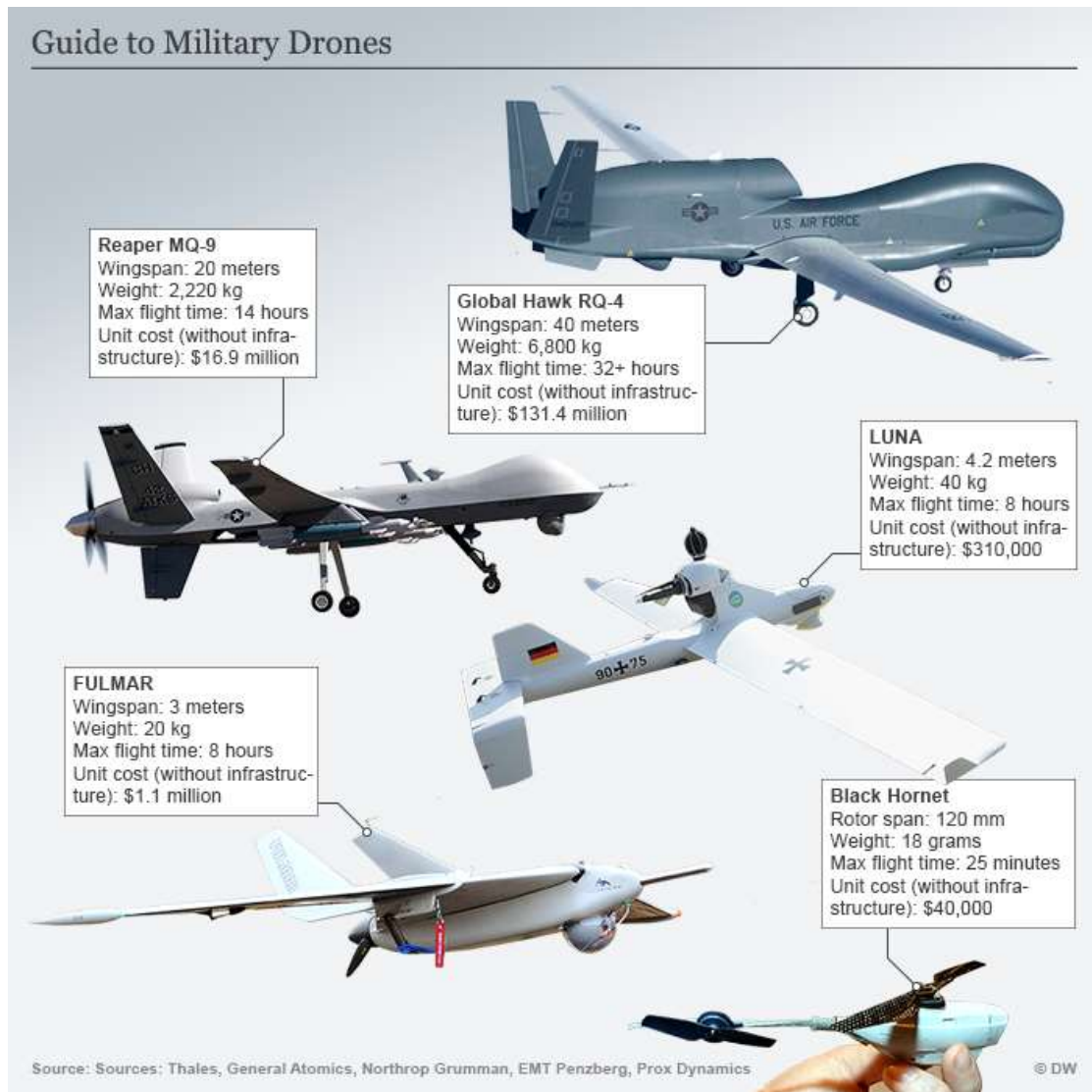
Defense departments all over the world have invested and are still investing a lot into drones. From impressively sized ones like the US 40-meter-wingspan Global Hawk by Northrop

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Grumman to nano-drones like the Black Hornet, a 12 cm and 18 gram-rotor drone designed by the Norwegian company Prox Dynamics now owned by the American company FLIR.

The main advantage of defense-oriented drones, at least in Europe, is that they are not suffering from any restrictions. Innovation is key and any hardware, software, sensor or system improvement can save lives.

In any case, the list price seems to leave the use of drones to wealthy nations only. Global Hawk RQ-4 costs 130 million US dollars.



Picture 1 – Guide to Military Drones – Source: www.dw.com - Creator: Ben Knight

Social acceptance

There are not a lot of studies on drone social acceptance but just ask those around you what they think about drones. It is a safe bet that they will answer that they are afraid of drones flying above their house and garden. That's why pilot projects take place in empty spaces or for public safety or medical purposes.

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Let's have a look at the three sectors that have taken initial control of the drone:

- Agriculture: drones can help manage cultivated land by informing farmers about the growing process (including weeds), fertilizer spraying management, etc. Those pieces of land are usually far away from homes.
- Medical transport: cargo drones can support the healthcare industry by delivering important goods/drugs/fluids while avoiding traffic jams and winding roads. To name just an example, organ transfer faces a huge problem: the time between collection and implantation. When an organ cannot be transplanted it is usually because it has remained outside of the body for too long due to road congestion. For this use-case, social acceptance is high.
- Security: the bird's eye view offered by drones is a great benefit for surveillance. This can include securing a strategic factory, borders, seashores, natural reserves to detect the arrival of poachers and so on. The drones used can fly for hours (sometimes tethered with electric cables) and record images. With an extra artificial intelligence layer, the UAV can detect intrusions. This is publicly acceptable because it guarantees security to a country or region. Unless the drone becomes a lethal weapon.

The war in Ukraine is a game-changer

When the war in Ukraine started in February 2022, drones soon entered the headlines when Russia bombed their neighbors with Lancet drones manufactured by the Russian company ZALA Aero Group. First tested in Syria in 2021, Lancet-1 acts like a kamikaze drone with a 1kg-explosive payload and a flight endurance of 30 minutes.

Lancet-3 is even bigger, and can carry a 3-kilogram payload for 40 minutes with a maximum speed of 300 kilometers per hour [4].

The most impressive and creative use of drones came from Ukraine. They realized that small and cheap off-the-shelf drones can be used as a means of transport for grenades and, with a skilled pilot, could be sufficient to destroy a tank. Compared to Lancet drones, they can be used again and again. The price/efficiency ratio is incredibly good for the underdog country that would not have been able to fight for so long without aerial support from drones.

Online tutorials popped up to show how to attach an explosive device onto basic drones and how to drop it and let it bomb the target.

Slightly more sophisticated drones with thermal cameras are also of big support for troops. As mentioned above, only 15 minutes are needed to be able to pilot DJI drones. Any citizen can then fly the drone to a specific point, activate the thermal camera, watch the remote controller screen (often their own smartphone) and inform the military command of any suspicious movement. They could then better direct tank or infantry attacks.

FPV drones (First Person View) and their pilots became the most wanted human resources for Ukraine. These people are able to pilot drones that fit in your hand with an incredible dexterity at a speed around 100 kilometers per hour. More powerful batteries allow flights of over 10 kilometers. Thanks to the camera embedded on the drone and a wave amplifier (and

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an explosive charge), they can crash with precision onto the weakest part of a vehicle or building. All this for around 100 euros.

After emptying the global stocks of FPV, (second-hand) DJI (thermal) drones during the first 6 months of the conflict, the Ukrainian industry turned into an impressive drone manufacturer. At the time of writing these lines, 50 different drone models are produced by 200 companies in Ukraine, with a flabbergasting 120,000 units going out every month! [5]

The evolution of artificial intelligence will also be scrutinized. We can expect drones to automatically send geographical positions of the enemy (people, equipment and buildings) and make decisions too. The advantage is twofold: avoid human mistakes and make the most of soldiers where they are the most useful.

"This war will be won thanks to drones" said Mykhaïlo Fedorov, Ukrainian Minister of Digital Transformation. He is probably right!

Counter-drone

Every positive technological development always has bad uses. There are many examples in history. Drones are one of them.

Companies and defense departments are now working on countermeasures. The main goal is to maintain a level of security by preventing warlike (or other) drones from reaching a dedicated airspace.

Let's go back for a moment to the first part of this paper. The EU regulation of 2021 dedicated to drones allows more people to have access to easy-to-use drones without any license or training. It means that many pilots around the world are unaware of the national legislation for drones and they do not know if they are in a "no-fly zone" and the risks they may cause.

This implies that, most of the time and outside of armed conflicts, security problems are caused by lambda citizens playing with their toys in places they are not supposed to fly over. The most telling example is in Gatwick airport in the United Kingdom. Back to December 2018, all flights were grounded for three days due to two drones near the runway. Police investigations led to nothing and the case remains unsolved even after researching and ruling out 96 people of interest. It was probably just neighbors of the airport playing with their drones to take some nice front-row pictures of the planes. In any case, the damage was done: 1000 flights had been canceled impacting 150,000 passengers. The financial losses are estimated at around 63 million dollars. [6]

This true story shows the importance of counter-drone systems (also known as CUAV). It is useful for strategic places like airports, military fields, some industries (nuclear, chemical, etc.), prisons or major public events like music festivals, national parties or open-air sport competitions. A good illustration is the city of Paris that ranked protection against drones in its top security list for the 2024 Olympic Games.

The counter drone systems can be divided into four elements:

- Detection: the very first thing we need to know is if there is a drone in the sky or not, how far away it is and how fast it is going.

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- Radar technology as it is already used for civil manned aviation proved its benefits. The main advantage is that the system is not disturbed by weather conditions or time of day.
- Cameras seem like an overly simplistic solution but they work. Furthermore, they can be equipped with a night vision mode and/or a motion detector system.
- Other types of sensors can also offer good solutions for tracking: acoustic sensors can detect the sound of a drone and thereby its arrival direction, and a radiofrequency sensor will detect the radio frequency of the drone to estimate its altitude and arrival direction.
- Tracking: the first two systems detailed above can also be used to track flying objects.
- Identification: once detected and tracked we need to know if the UAV is belligerent or not. This will influence the next point: countermeasures.

All the drones publicly available in drone and appliance stores are equipped with an identification system that allows you, with the right tool, to learn the brand, the model, the registration number if it is registered and the name and position of the pilot. They are called cooperative drones.

If this information is willingly hidden by the pilot ("non-cooperative drones") conclusion can be drawn that the drone is not in the airspace by accident.

- Countermeasures: depending on the results of the previous step, different kind of measures can be taken:
 - Jamming: the protective system emits waves to disconnect the link between the drone and the remote controller. The UAV will then fall like a stone (which could be very dangerous if it happens in a populated area) or automatically activate the "Return to home" mode (the drone flies back to where it took off making the identification of the pilot easy).
Jamming is hard to set up in populated areas because waves are emitted indiscriminately and disturb all the electronic devices in the area (phones, computers, internet and so on). This can create a big mess (and disapproval) among inhabitants and workers.
 - Hacking or takeover: tapping and demodulating the data link of drone to take over its control. Same system as a hack on the internet, the hacker is able to control the machine from where they stand.
 - Interception, also referred to as "soft kill": a UAV will take off and track the unwilling drone. Once next to it, different options are available: capturing by using a net (this solution is also available from the ground with portable net guns) which offers a safe solution to bring back the drone on the ground; crashing into the drone (the kamikaze method), this will lead to two destructions and debris on the ground.
 - Remote destruction or "hard kill" with anti-drone ammunition shots from the ground or from a fighter jet or with a high-power laser that will shoot the drone down (electronic destruction).

All of these options have pros and cons. At present, there is not one single answer. This means that a range of militaries around the world are investing large sums of money to develop and test new solutions. For example, American Defense spent \$50 million in 2022 to

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thwart small drones, including \$18.73 million for the development of a new system based on super-powerful microwaves (HPM in English for High Power Microwaves). [7]

The European Commission has also expressed its interest in the subject and it will publish two documents (handbooks) on the issue. A "Counter-UAS Policy" bill should also be voted on in 2024.

In addition, via DG Home, an interest group was created and a program to test C-UAS systems was established (code name: Courageous). Project Courageous is developing a standardized methodology for testing and selecting countermeasure systems that can be used to detect and track a drone that enters protected airspace or a no-fly zone.

This methodology is based on a series of standard scenarios that represent a wide range of locations and situations, for example, security at prisons, airports, critical infrastructures and borders, and countering drug and human trafficking.

Three specific drone threat scenarios have been created, according to the operational and functional needs defined by the end users. Three validation trials are carried out in Belgium, Greece and Spain respectively, against which counter-UAS technology is used to attempt to locate and identify both drone and pilot.

Using the results from the validation trials, a comprehensive test methodology is under development to allow an objective qualitative and quantitative comparison between different counter-UAS tools.

In the short term, the standardized test methodology will lead to a much better understanding of the capabilities needed to counter UAS among law enforcement agencies, not only among Courageous partners, but also within the European Union network of law enforcement agencies and on a global scale via INTERPOL.

In the medium-to-long term, a more extensive set of commercial counter-UAS will be tested using the Courageous methodology, which will also allow developers of such systems to make design decisions based upon quantitative data. [8]

The war between Ukraine and Russia offers the perfect playground for commercial companies to test and prove the robustness of their systems. Every day, journalists report on how many drones have been destroyed by counter-UAV systems on both sides of the border.

Finally, it is interesting to know that for companies/research centers/universities that would like to develop new CUAV solutions in a more academic way, funding can be obtained through the European Internal Security Fund (ISF) and the Horizon Europe program.

Privacy

Another kind of security-related topic coming from the use of drones is privacy. Even the cheapest drones available on the market are equipped with cameras. This "add-on" gives the opportunity to every single pilot to see places/persons they should not be able to. Usually, neighbors are the first target. Curiosity is a human trait. Once you have the opportunity to

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gently spy on what is happening in your neighbors' house or garden you can satisfy a guilty pleasure without feeling as you are doing something wrong.

As mentioned above, the EU legislation of 2021 allows this kind of behavior. The only obligation with a drone under 250 grams is to stay 150 meters away from buildings (houses, factories, public buildings). Which is, with the high resolution of cameras, not a problem when it comes to making observations. European citizens must also comply with the now-famous GDPR legislation [9]. This implies in the case before us – that of drones – not using pictures and videos of other citizens without their consent. Forget about publishing videos of your neighbors enjoying a little sunbathing. You can get into some big trouble if they discover it.

Privacy and protection of sensitive data made headlines in the news recently. Remember the ban on using the Chinese-owned application TikTok for employees of public administrations and politicians. Having Chinese drones around the world used by citizen as well as defense departments or for public area management (forest monitoring, police surveillance during strikes or events, etc.) can be frightening for some countries (remember, DJI has 70% of the market shares and some other Chinese brands like Yuneec get part of the remaining 30%). The problem is that no one can prove where the recorded data goes and how it is or could be used. Chinese manufacturer DJI claims that they are not doing anything with the pictures, videos, flight data or geographical positioning recorded by their drones. Many do not believe them.

The United States of America took this as an opportunity to strengthen one of former President Trump's mottos: America first. Nowadays Chinese companies are forbidden to bid on American public tenders. Only American (or European) manufacturers are welcome. Following in the footsteps of the USA, governments around the world implemented the same kind of decision. Unfortunately, this bothers many organizations for several reasons: DJI drones are the premium choice for their quality/price ratio, it is somewhat impossible to buy a drone manufactured without any Asian-made spare parts (e.g., microprocessors, rotors), the price of non-Asian drones is much higher, with a direct impact on public organizations' budgets.

In addition, Chinese businessmen are clever and reactive. Some are now creating brand new drone companies in the US with some Americans on the Board to make them look like a local company while some others are selling millions of drones by helping Ukrainians to safeguard their border. That's one way to thumb your nose at the geopolitical situation!

Conclusion

Drones are everywhere. From the voyeur neighbor to the war fields. European legislation from 2021 facilitates the situation but future laws still need to be written. Now that the process is up and running, with companies and states investing a lot of money and technology evolving fast, there's no going back. Counter drone measures need to be designed, developed and implemented to guarantee to the population that drones will not violate privacy and will not become the lethal weapon of the coming years. Two major issues at the local, regional and global level, depending on what star you were born under.

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Picture

Picture 1, Ben Knight (2017). A guide to military drones <https://www.dw.com/en/a-guide-to-military-drones/a-39441185> (February 6, 2024)