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Drones – challenges and chances concerning the security environment

Introduction

From the initial unmanned „*balloons*” that Austria used to attack Venice in 1849 to the sophisticated models we have today – remotely-guided aerial missile deployers – drone technology has come a long way. Today, the same technology is employed in numerous applications ranging from entertainment to military – drones are used for a wide range of functions, including monitoring climate change, security surveillance and law enforcement, delivering goods, aiding in search and rescue operations, and in filming and photography. However, understanding drones, their benefits, the challenges they face, and the threats they pose, is essential in order to entirely adopt them in our lives.

Definition

When talking about drones, conceptual uniformity should be introduced for these machines. Currently, there are many different definitions in everyday use: drone, UA/UAV/UAS, RPAS.

As defined by the US Department of Defense an Unmanned Aerial Vehicle (UAV) is a „*A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles*”¹. In addition, the US Department of Defense defines the terms UA (*an aircraft or balloon that does not carry a human operator and is capable of flight under remote control or autonomous programming*) and UAS

¹ Department of Defense Dictionary of Military and Associated – https://irp.fas.org/doddir/dod/jp1_02-april2010.pdf, dostęp: 11.10.2021.

(that system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft)².

ICAO (International Civil Aviation Organization), in its „*Manual on Remotely Piloted Aircraft Systems*” (RPAS - ICAO, 2015)³, has defined a number of terms that are important to know in order to better understand the RPAS domain. The following is a list of examples taken from this document:

Remote pilot: A person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.

Remote pilot-in-command: The remote pilot designated by the operator as being in command and charged with the safe conduct of a flight.

Remote pilot station: The component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft.

Remotely piloted aircraft (RPA): An unmanned aircraft which is piloted from a remote pilot station.

Remotely piloted aircraft system (RPAS): A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design.

To sum up, different names appear in the public space⁴:

Drones - the name that appears most often, mainly related to machines used in military operations. Clear associations with operations in Afghanistan or Pakistan may contribute to society's opposition to the use of these machines - therefore entities that are supporters of greater the use of drones, they want the debate to use other, less emotionally charged terms.

Unmanned Aerial Vehicle/System (UAV / UAS) - one of the proposed substitutes for the word drones, currently used by the authorities of individual countries (including the US Department of Defense) and in academic publications.

Remotely piloted aircraft (RPA) - the term drones appearing in the documents of international organizations, including the International Civil Aviation Organization (ICAO), also used in European Union publications.

² As above.

³ <https://skybrary.aero/sites/default/files/bookshelf/4053.pdf>, dostęp: 11.10.2021.

⁴ J. Niklas, A. Walkowiak, *Drony - nadzór z powietrza*, https://panoptykon.org/sites/default/files/publikacje/panoptykon_drony__nadzor_z_powietrza_11.07.2014_2_0.pdf, dostęp: 11.10.2021.

European Union Regulations on Drones

Unmanned aerial vehicles (drones, etc.) are a rapidly growing aviation sector⁵ with enormous employment and growth potential in the European Union. That is why the EU has adopted a regulation that will safely integrate remote-controlled drones into European airspace. The regulation sets out common safety rules in civil aviation and modifies the mandate of the European Union Aviation Safety Agency (EASA). On 26 June 2018, the Council adopted new proportionate and risk-sensitive rules that will allow the EU's aviation sector to grow and increase its competitiveness. They include, among others the revised mandate of the EASA, as well as the regulation of civilian drones of all sizes - the first such regulation with an EU-wide scope. The reform introduces proportionate rules, taking into account the different types of risks, to enable the development of the EU aviation sector, increase its competitiveness and foster innovation. „*Thanks to the new regulations, flying will remain safe despite increasing traffic in the sky*” - as summarised by the Bulgarian Minister of Transport, Information Technology and Communications. The drone law introduces basic principles to ensure safety, privacy, personal data protection and environmental protection. Regarding the registration requirement, operators of drones that can hit more than 80 joules of kinetic energy in a collision with a human will need to register. Based on the principles set out in the regulation, the Commission has developed further detailed rules on drones with the assistance of EASA.

These provisions are contained in „*Easy access rules for unmanned aircraft systems (regulation (EU) 2019/947 and regulation (EU) 2019/945)*”⁶ (revision from September 2021). This publication contains the rules and procedures for the operation of unmanned aircraft, displayed in a consolidated, easy-to-read format, with advanced navigation features through links and bookmarks. It covers „Commission Implementing Regulation (EU) 2019/947”, and the related acceptable means of compliance (AMC) and guidance material (GM), as well as „*Commission Delegated Regulation (EU) 2019/945*” on unmanned aircraft systems (UAS) and on third-country operators of UAS.

This Revision from September 2021 incorporates the changes introduced by „*Commission Implementing Regulation (EU) 2021/1166*” amending

⁵ The reform of aviation regulations was also necessary, as EU air traffic is estimated to increase by half over the next 20 years. The European Commission predicts that by 2035 the European drone sector will:

- it will directly employ over 100,000 people
 - it will have an economic impact of more than EUR 10 billion per year, mainly in services.
- <https://www.consilium.europa.eu/pl/policies/drones/>.

⁶ <https://www.easa.europa.eu/document-library/easy-access-rules/easy-access-rules-unmanned-aircraft-systems-regulation-eu>, dostep: 11.10.2021.

„*Commission Implementing Regulation (EU) 2019/947*” as regards postponing the date of application for standard scenarios.

EASA has introduced the main recommendations on how to use drones:

Keep in mind:

- keep the drone in view at all times;
- plan a flight and choose an open seat;
- in the case of commercial use of the drone, obtain a permit;
- carefully read the manufacturer’s instructions.

The aircraft cannot:

- fly in a way that is dangerous to others;
- fly at a distance of less than 50 m from people, buildings or vehicles;
- fly higher than 150 m above the ground;
- approach airports or airstrips.

38 Ways Drones Will Impact Society⁷

Drone technology has been used by defense organizations and tech-savvy consumers for quite some time. However, the benefits of this technology extend well beyond just these sectors. With the rising accessibility of drones, many of the most dangerous and high-paying jobs within the commercial sector are ripe for displacement by drone technology. The use cases for safe, cost-effective solutions range from data collection to delivery. And as autonomy and collision-avoidance technologies improve, so will drones’ ability to perform increasingly complex tasks. The emerging global market for business services using drones is valued at over \$127B, according to *PwC (PricewaterhouseCoopers)*. And as more corporations look to capitalize on these commercial opportunities, investment into the drone space has grown.

In recent times, UAVs have been used extensively for various purposes like aerial photography and film-making, rescue operations, wildfire mapping, crowd monitoring, etc. The COVID-19 pandemic led us to witness the application of UAVs in the efficient and safe delivery of food and medicines.

From the fearsome MQ-9 Reapers used by the US military to the nimble delivery octocopters Amazon is looking to deploy, organizations across a wide range of industries are finding uses for drones. For example, small, lightweight drones are helping engineers on industrial sites conduct safety inspections in spaces that would be too small or dangerous for a human to navigate. They also have the potential to bring internet connectivity to remote areas, which was the goal of Facebook’s *Aquila* project. Drones are even being used for entertainment. During the opening ceremony of the 2018 Winter Olympics, Intel put on an air show featuring a synchronized flight of 1000+ drones.

⁷ <https://www.cbinsights.com/research/drone-impact-society-uav/>, dostępi: 11.10.2021.

From Fighting War To Forecasting Weather, UAVs Change Everything – this short sentence describes the various possibilities of using drones, which I will try to present below in detail. I will only refer to the spheres that currently have and may have an impact on the broadly understood security environment. I will only mention other areas of possible use of drones.

Defence

While military drones have been used for over a decade (the Predator UAV is among the most well known), smaller, portable drones are now being used by ground forces on a regular basis. Military spending for this technology is expected to grow as an overall percentage of military budgets, providing an opportunity for specialized drone manufacturers and software developers. In addition to the use of new aerial technologies, militaries continue to use unmanned ground vehicles (UGVs), and underwater unmanned vehicles (UUVs) to lead tactical initiatives. Drones are employed to carry out various types of missions. These include intelligence, surveillance, and reconnaissance (ISR); search & rescue (S&R); logistics; mine-sweeping and destruction of improvised explosive devices (IEDs); armed patrol; and even targeted killing.

Emergency Response

Innovations in camera technology have had a significant impact on the growing use of drones. UAVs outfitted with thermal imaging cameras have provided emergency response teams with an ideal solution for identifying victims who are difficult to spot with the naked eye. Startup companies and universities are also designing systems intended for search and rescue. Flyability Company offers a collision-tolerant UAV designed to function in confined areas with limited lines of sight – environments often encountered by emergency response teams.

Additionally, Delft University of Technology has tested an ambulance drone that could deliver defibrillators on demand. By extending existing emergency infrastructure, drones may be able to dramatically increase survival rates in both rural and urban areas around the world.

Humanitarian Aid & Disaster Relief

In addition to emergency response, drones have proved useful during times of natural disaster. In the aftermath of hurricanes and earthquakes, UAVs have been used to assess damage, locate victims, and deliver aid. And in certain circumstances, they are helping to prevent disasters altogether.

Demand for this kind of technology is growing. In 2019, the Department of Defense made an official request for drones that can be deployed during a natural disaster⁸ to distribute food and water to affected areas.

⁸ <https://taskandpurpose.com/news/drone-swarm-hurricane-relief/>, dostęp: 11.10.2021.

Conservation

Poaching and climate change have a dramatic impact on the health of wildlife worldwide. Thousands of species are estimated to go extinct each year, according to the World Wildlife Fund. To help combat this trend, conservationists are adopting innovative methods to protect and study our global ecosystems. In combination with geospatial imagery, drones are now used to monitor and track animals⁹.

Disease Control

Tracking animals also allows researchers to track disease. Drones with thermal imaging cameras have been used by the London School of Hygiene and Tropical Medicine to track macaque movements in the province of Palawan in the Philippines — a region where malaria is an active threat¹⁰. The ability to follow these animals provided further insight into the possible movement of infectious disease and its jumps from animals to humans. In a similar vein, Microsoft is leveraging drone technology to capture and test mosquitoes for infectious disease. Ideally, this intelligence could be used to protect local residents, and in the future could help prevent epidemics before they begin.

Healthcare

A lack of access to all-weather roads is one of the biggest challenges facing affordable healthcare provision in rural areas in the developing world. Since many roads in these rural areas are inaccessible during rainy seasons, their population are hindered from life-saving and critical health products. This challenging terrain and gaps in infrastructure contribute to why at least half the world's population lacks access to essential health products and services.

Unmanned Aerial Vehicles (UAVs), generally known as drones, can be a viable option to bridge healthcare access gaps and address the last-mile delivery challenges and infrastructural inadequacies. In 2018, UNICEF commissioned a study that integrated drones in the health supply chain in two hard-to-reach districts in Malawi¹¹. The study found that the benefits of introducing drones as additional modes of transport included increased equity and access for patients, responsiveness to urgent needs and potential use in emergencies and catastrophes. Based on these results, the Ministry of Health (MOH) moved forward with integrating drones into the health system in the two districts.

Agriculture

Farmers across the world are continuously striving to reduce costs and expand yields. With the use of drones, agricultural workers are able to gather data, auto-

⁹ <https://wildlifedrones.net/conservation/>, dostę: 11.10.2021.

¹⁰ <https://blogs.biomedcentral.com/bugbitten/2021/08/06/eyes-in-the-sky-how-drones-can-be-used-in-malaria-vector-control/>, dostę: 11.10.2021.

¹¹ <https://www.gsma.com/mobilefordevelopment/blog/are-drones-suitable-tools-for-delivering-medical-supplies-in-developing-countries/>, dostę: 11.10.2021.

mate redundant processes, and improve efficiency. In a research capacity, drones have also been used to pollinate flowers. This approach could one day prove helpful in compensating for the declining bee population.

Weather Forecasting

Scientists are leveraging new forms of hardware and software for data collection to help study the climate and better predict future changes to global weather systems. Today, most data is collected through stationary structures or captured with geospatial imaging solutions. Drones, however, offer a versatile option that can physically follow weather patterns as they develop.

In addition to aerial vehicles, water-based unmanned surface vehicles (USVs) are changing the way data is gathered.

Maritime

Navigating oceans and ports requires an immense amount of expertise and labor from the estimated 1.65M people serving on international merchant ships today. But with increasing amounts of oceanic data and innovations in autonomy, unmanned marine vehicles could become the standard for maritime shipping.

Drones are already being used in countries like the Netherlands, Denmark, and Norway to find ships committing emissions infractions¹². The unmanned vehicles can travel miles out from port to detect emissions and identify offenders.

Waste Management

Recycling and biodegradation have improved global waste management. However, innovations in waste collection are still emerging, including drones that have help to clean oceans. RanMarine operates a Roomba-like unmanned marine vehicle¹³ used to collect waste in ports and harbors, while RedZone Robotics focuses on robots used to help maintain systems for wastewater management.

Energy

While alternative sources of energy are becoming increasingly popular, fossil fuels still remain a key energy source for the world. Inspection of the infrastructure used to extract, refine, and transport oil and gas¹⁴ is an important part of the industry and often needed to ensure compliance with regulations and standards.

With the use of drones, much of this inspection work can be done remotely and safely. Using specialized thermal sensors, some drones can find leaks faster than a human inspector, while onboard high-resolution cameras enable some issues to be diagnosed remotely.

Another area where drones have shown promise is in setting up new sites for the production of energy. Drones that survey areas and gather topographic

¹² <https://newsroom.ucla.edu/stories/drone-monitoring-of-ship-emissions-could-save-lives-protect-health>, dostep: 11.10.2021.

¹³ <https://www.ranmarine.io/products/wasteshark/>, dostep: 11.10.2021.

¹⁴ <https://www.airbornedrones.co/pipeline-monitoring/>, dostep: 11.10.2021.

detail can be used to help oil & gas companies identify new drill sites, or they can be used by solar utilities to design configurations for new arrays.

Underground economies and fighting Crime

Though drone technology has many positive uses, it has also been used to conduct illegal activities. In particular, drones have been used to transport drugs across international borders¹⁵. Large drones can span nearly 5.5 feet and are designed to carry equipment like heavy Hollywood cameras. With flight times of 18-40 minutes (depending on the weight of payload) and top speeds of around 40 mph, drones can be well-suited for transporting illicit cargo.

Drones have also been involved in bombings, cases of voyeurism, and smuggling goods into US prisons. In 2015, a drone even flew into the grounds of the White House undetected.

On the flip side, drones are also used by law enforcement for surveillance and crime prevention. In 2019, there were about 600 law enforcement departments around the United States that employed drones as a crime prevention and response tool, according to the Center For the Study of the Drone at Bard College.

Security

Security companies are using drones to provide more comprehensive surveillance systems for industrial, commercial, and residential properties.

One company, Nightingale Security, enables clients to establish repeatable pathways that the drones can travel daily, monitoring key security areas. The same service deploys drones with live streaming capabilities immediately after an alarm is triggered, allowing the security team and clients to obtain key footage of a potential breach.

Other areas of drone use may be as follows: Mining, Construction Planning, Infrastructure development, Insurance, Realty, Urban Planning, Personal Transportation, Airlines, Telecommunications, Internet, Outdoors, Tourism & Hospitality, Live entertainment, Sports, Hollywood, Advertising, Retail, Manufacturing & Inventory Management, Fitness, Food Service, Journalism and News Coverage, Air Travel, Gaming, Space, Education.

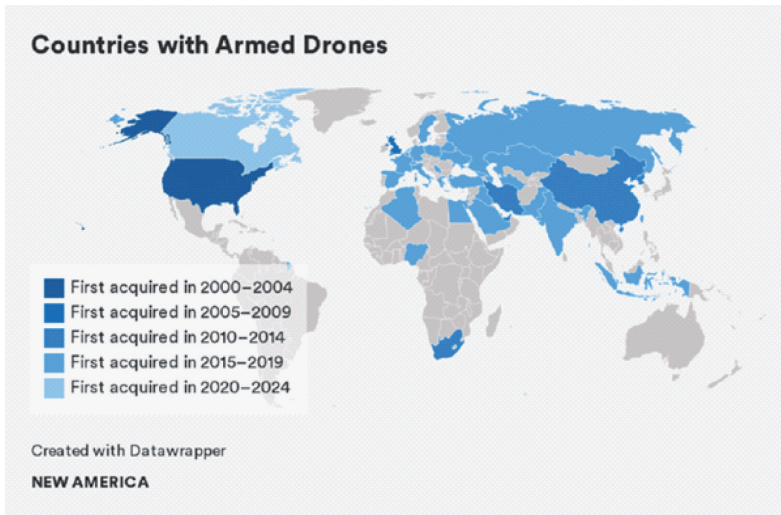
Pros & Cons

Drones are currently used primarily for military purposes. Held by military personnel unmanned aerial vehicles are, among others USA, Great Britain, Iran, China, Israel, Russia and France. The number of countries introducing armed drones to equip the Armed Forces with drones is constantly increasing¹⁶ (dia-

¹⁵ <https://dronedj.com/2020/12/21/drug-smugglers-turn-to-drones-advancing-operations/>.

¹⁶ <https://www.newamerica.org/international-security/reports/world-drones/who-has-what-countries-witharmed-drones/>, dostęp: 11.10.2021.

gram below). The recent military conflicts in Syria, Nagorno-Karabakh and Libya show that drones are becoming one of the main tools used to conduct reconnaissance and combat operations. In this context, use of drones in Syria and Nagorno-Karabakh is crucial on four parameters – cost, technology, firepower, tactical edge in the battlefield. The United States used drone strikes against „technologically weaker” terror groups such as *Hakkani network* and *ISIS*.



Military actions with the use of drones cause enormous ethical and legal controversies. In a debate there are arguments that the use of unmanned aerial vehicles for the so-called “*targeted killings*” operations may be contrary to international standards for the protection of human rights. According to the public drones are mainly associated with military operations.

Unmanned aerial vehicles have enormous potential. They can be used for many different purposes, e.g. for preventing crime, extinguishing fires or carrying postal items. However the use of drones can also lead to significant limitation of rights and freedoms civic. Monitoring cameras are already making our every step monitored and controlled. Drones - which by definition are equipped with them - can only aggravate this problem. The violation of private space is, moreover, one of the basic controversies related to it with unmanned aerial vehicles. However, drones aren't just cameras. They are equipped with various other tools, including weapons, make these machines a visible and tangible manifestation of power.

A question is asked very often: Do we want the “*flying Big Brother*” to hover above our heads?

The dual use of drones (military and commercial) show that, on the one hand, they are both a very practical tool in human hands, and on the other hand, they can pose a challenge and threat to them. The drone industry is growing rapidly. More and more businesses are utilizing drone technology to manage their business and deliver services. In the near future we may be receiving products and services delivered to us via drone. With this new technology, drones have their own advantages and disadvantages. Among the advantages are mentioned: drones are cheap, drones are fun to use, they enforce security and provide surveillance, drones can save lives, faster delivery system using drones, they can be used in agriculture, you can take aerial view photography, capturing incredible moments in sports, drones can easily make 3D maps, surveying dangerous places. However, the disadvantages include: they have short flight times, weather can easily affect drones, precise operation is difficult, drones will take away future jobs, drones can be easily abused, accidents can easily happen, they can be used for hunting animals, drones are vulnerable to hackers, drones can get in a legal „Gray Area“, they are threat to airports.

Drones are here to stay, whether you like it or not. And our society will have to continue to grapple with the pros and cons of this technology and determine how we can best use it. There is no doubt that our businesses and lives will continue to be impacted by drone technology. During the development of drones, we often emphasize only the pros of new technologies in order to increase the number of supporters and advance the development. However, we should also pay attention to the legal framework, rules and safe use of this technology and its “*cooperation*” with all other areas of human life, which may be affected in the near future. So that their advantages are not overcome by possible disadvantages.

Swarm of Drones

This is the next stage in the development of drone technology, the implementation of which we have been observing for several years. Currently, it mainly concerns entertainment and military applications. A kind of “*arms race*” has started in these areas, who can launch more drones into the air and successfully steer them.

Militaries all over the world are moving ahead with swarming attack drones. Unmanned systems with a variable degree of autonomy, have become commonplace in the world’s advanced militaries. In their various aerial, maritime, and ground forms, these vehicles are used to perform a wide spectrum of roles. Yet advances in new technologies such as artificial intelligence (AI), robotics, and data fusion may revolutionize their employment by enabling large numbers of drones to operate in a coordinated and reactive manner. If fully developed, this concept –

known as “*swarming*” – could have profound tactical and strategic effects; possibly to the point of changing the nature of warfare in the 21st century¹⁷.

Recent we have seen a slew of new swarm announcements, including the French Icarus project, the Russian Lightning, the Spanish RAPAZ, the U.K.’s *Blue Bear* swarm and the UAE/South African *N-Raven*, as well as a drone swarm on show hitting targets at India’s Army Day. Armenia, which suffered heavy casualties from Azeri drones in the recent conflict, announced its own new swarming attack drone. Proliferation is well under way even before swarms have been used in action.

Meanwhile the U.S. Marine Corps is progressing with kamikaze drone swarms, while the Army, Air Force, Navy and DARPA (Defense Advanced Research Projects Agency) are pursuing separate swarm initiatives, with some services working on multiple projects. Needless to say, China also has a number of swarm programs.

A paper by the US Air Force¹⁸ defines swarming as “*a group of autonomous networked SUAS (Small Unmanned Aircraft Systems) operating collaboratively to achieve common objectives with an operator on or in the loop.*” Drones operating in a swarm are all interlinked and in constant communication with each other. There is no clear threshold on the quantity of drones that must be connected to create a swarm, with figures ranging from a few hundreds to billions, also depending on their type and size. What is important is that they share information from their sensors and take AI-driven collective decisions toward the achievement of a single goal. This datalink and the AI software are therefore essential in creating the ‘hive mind’ that defines a swarm and allows it to effectively function; and each single drone forming a swarm is just a small component playing a specific role in a greater system which self-coordinates the actions of its elements in a dynamic manner. Certain drones would use their sensors to locate and track targets, sharing the information with the rest of the swarm; others would perform jamming and electronic warfare tasks; another category would engage hostile forces, etc. The swarm as a whole would react dynamically to changes in the battlespace by performing complex non-linear and counter-intuitive maneuvers.

It is therefore clear that swarming holds an immense potential, to the point that it may revolutionize warfare. Since they can patrol large areas with greater efficiency and shorter reaction times than human personnel, thus speeding up operations without risking the loss of lives, swarms would be particularly suited for search & destroy missions against enemy air defenses, submarines or mobile missile launchers; but also for ISR as well as counter-insurgency, over-the-horizon targeting, air combat, and anti-access / area denial (A2/AD). Of course, creating a func-

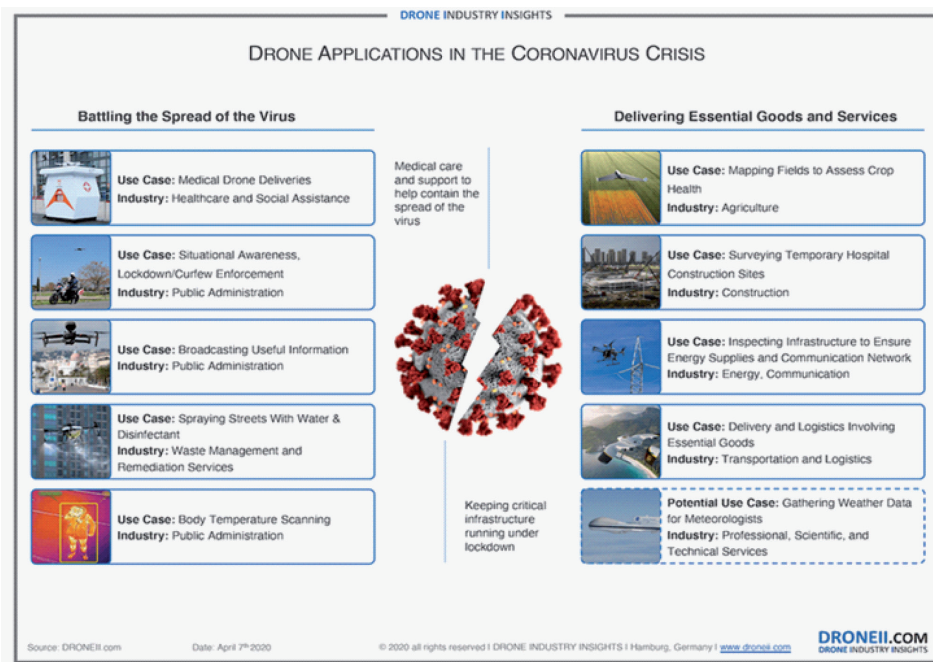
¹⁷ <https://www.geopoliticalmonitor.com/warfare-evolved-drone-swarms/>, dostep: 11.10.2021.

¹⁸ https://www.af.mil/Portals/1/documents/isr/Small_UAS_Flight_Plan_2016_to_2036.pdf, dostep: 11.10.2021.

tioning and effective swarm requires top-tier technology in terms of both software and hardware; as it needs a powerful AI, advanced sensors, and powerful data links. Accordingly, swarms will probably take decades before being deployed and they will likely remain exclusive of high-tech militaries of developed countries.

Drone Applications in the Coronavirus Crisis

The crisis related to the spread of the Coronavirus in the world has shown that drone technology can also be used to help people and counteract this phenomenon. Its use can be divided into two areas: combating the spread of the coronavirus and providing necessary goods and services¹⁹.



Summary and Conclusions

Drones have become an inseparable element of human life in many areas of both private and professional activity. The last 10 years or so have seen a huge explosion

¹⁹ <https://droneii.com/project/drones-and-covid-19> - This infographic gives an overview of drones and COVID-19 applications, i.e. the drone use cases most pertinent to the global efforts to curb the spread of COVID-19.

in drone innovation and commercial interest. While prior to this, drones were primarily used for military purposes or hobbyists, beginning in the early-2010s, a host of new uses were proposed for drones, including their use as delivery vehicles and even taxi-drones as well.

In summary, drones will always support human activities as well as a threat to its safe functioning. Equipping them with artificial intelligence will only multiply the benefits and risks. We must be prepared for this in legal, technical and functional dimensions.

Man is the creator of the drone and he should be aware of the advantages and disadvantages of this technological solution that offers great opportunities in many areas of life. Awareness of this must underpin the further development of the technology and possible application.

As humanity, we are ready to benefit from the development of technology that can bring us profits and perhaps even determine our further functioning. However, are we ready to incur the costs that we may encounter on the path of drones development related to their capabilities, which we are ready to give them by equipping them with artificial intelligence and newer and newer possibilities, especially those related to military use?

* * *

Drony – wyzwania i szanse dotyczące środowiska bezpieczeństwa

(streszczenie)

Technologia dronów ewoluowała od wykorzystania wyłącznie do celów wojskowych do zastosowania w codziennych działaniach cywilnych i rządowych. Aktualnie znajdują one szerokie zastosowanie w wielu dziedzinach życia i aktywności człowieka: fotografii i filmografii (np. krajobraz, imprezy sportowe, rozrywka), zarządzaniu katastrofami, zwłaszcza w miejscach niedostępnych, nadzorze bezpieczeństwa w warunkach domowych, komercyjnych oraz egzekwowania porządku prawnego, misjach poszukiwawczo-ratowniczych, inspekcjach budowlanych dachów i kominów, badaniach rolniczych, inspekcjach podwodnych, badaniach morskich oraz wielu innych.

Wykorzystanie dronów, dające w codziennym życiu człowieka ogromne możliwości, wiąże się z również z wieloma wyzwaniami. Przy rosnącej w postępie geometrycznym popularności tych statków powietrznych, takie ich cechy jak ograniczona ładowność i długotrwałość lotu, niedostosowane do ich potrzeb zarządzanie ruchem lotniczym, szczególnie na obszarach o jego dużej intensywności, możliwość wykorzystania do działań niezgodnych z prawem (przemyt, naruszanie własności prywatnej), stwarza także wiele zagrożeń dla bezpieczeństwa.

Jak w każdym przypadku nowej technologii, moneta ma dwie strony. Oczywiście jest, że chociaż drony mogą być bardzo użyteczne, ich wykorzystanie wiąże się również z ogromnym ryzykiem. Aby zniwelować zagrożenia należy stale rozwijać sposoby udoskonalania charakterystyk technicznych i lotnych dronów, przepisy i zasady regulacyjne oraz szkolić operatorów tych urządzeń. Dopiero wówczas będzie można mówić o pełnej synergii człowieka i maszyny, co w perspektywie wprowadzenia sztucznej inteligencji w obszarze dronów nabiera jeszcze większego znaczenia.

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