

# On Unmanned Aircraft as a Security Threat

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**Abstract:** *This paper represents a continuation of the ongoing research of authors who, in the framework of interdisciplinary scientific research, deals with several aspects of ensuring the safety of the Slovak Republic and the European Union in connection with aviation, aircraft, air traffic and airspace protection. In their current research, following these and constant developments in the field of innovation and introduction of new technologies in the field of aviation, the authors deal with unmanned aircraft, which are gradually used not only in the military, but are increasingly penetrating the commercial sphere of civil aviation. Due to the fact, that the unmanned aircraft market is the fastest growing market of all categories of aviation, the authors in the article provide a theoretical and terminological view of the researched issues, including a brief historical view of the development of unmanned aircraft.*

**Key Words:** *aviation, unmanned aircraft, development, theory, terminology*

## 1. INTRODUCTION

Given the complex, unstable and changing security situation in the world, the increase in tensions between states and the number of armed conflicts in which various violent non-state actors (terrorist organizations and groups, paramilitary and guerrilla armed groups and various individuals) are often involved, as well as in view of the constant more available and more powerful various technical/technological means, which undoubtedly include unmanned aircraft, and the increasing popularity of these machines among radical activists, extremists and various violent non-state actors, unmanned aircraft in the hands of such organizations or individuals can be misused for violent and other illegal purposes.

The possibility of the misuse of unmanned aircraft is even more serious because attacks led by violent non-state actors can be directed at non-military targets, especially the civilian

population and critical infrastructure. At the very beginning, it is necessary to emphasize that this is a very topical, globally widespread, and problematic topic due to the speed of technological development, the difficulty of protection against unmanned aircraft attacks, and also due to the insufficiently fast and flexible response to the introduced legislative changes.

Unmanned aircraft in the hands of various violent non-state actors can be a significant security threat to states, their interests, and citizens. This hypothesis is based on the history of the use of unmanned aircraft by violent non-state actors, the relatively easy and cheap availability of unmanned aircraft today, as well as the specific capabilities of unmanned aircraft that allow these machines to bypass many conventional barriers and measures.

The aim of this work is therefore, in accordance with the principles of qualitative interdisciplinary research methodology and using relevant research methods, to determine whether the stated hypothesis is valid and whether drones in the hands of violent non-state actors are really a security threat. Considering the limited range of the article, we will focus our attention, in order to fulfil the goal of the article, on defining unmanned aircraft, violent non-state actors, security threats, critical infrastructure and the so-called soft targets. At the same time, we answer the question of what targets are most at risk from the point of view of the use of drones by violent non-state actors and whether violent non-state actors use drones for violent purposes that have a negative impact on the security of the state, or for other purposes harmful to society. We are based on our own research findings and on the works of renowned foreign and domestic authors, who in their works and research dealt either primarily or secondarily with the investigated issue.

## 2. THEORETICAL BACKGROUND FOR INVESTIGATING THE ISSUE OF UNMANNED AIRCRAFT

Unmanned aerial vehicles, which are the subject of our research in this thesis, have been referred to by different names since the very beginning, and even today there is still no 100% universal consensus on the definition of what is most referred to as a “drone”. It is generally understood as an unmanned aerial vehicle used for any purpose and controllable in any way [1]. Although this term – drone – is widely used in common social interaction, this term is hardly used in professional literature and especially in legal documents. The reason is based mainly on the negative connotations that have been associated with drones in recent years, especially in connection with targeted airstrikes as part of their military use. As a result, the term “Unmanned Aerial Vehicle” (UAV) came to the fore for a while, which was used both by the public and in some professional publications [2]. It was gradually replaced by new terms such as “Unmanned Aerial System” (UAS) or “Pilotless Aircraft” (PA). Today, primarily used is the general term Unmanned Aircraft (UA), which means “*aircraft intended to operate without a pilot on board*” [3]. From the point of view of their use, until the end of the 20th century, UA were, with some exceptions, exclusively military material used for military purposes. At the beginning of the 21st century, however, commercial UA models, intended mainly for the purposes of government organizations and large companies, began to appear to a greater extent [4]. Today, at the beginning of the third decade of the third millennium, the development of UA continues at a very fast pace, their sizes and prices are decreasing, and they are available even to small companies and individuals. Currently, there is a large variety of models that differ not only in size, but especially in capabilities and equipment, and are used for different purposes. They are still used by armies mainly for combat tasks as missile carriers and for espionage, reconnaissance, logistics and other tasks [4], [5]. At the same time, there are many UA intended for civilian use, most of which can be equipped with a video

camera, camera, or other equipment; therefore, it is possible to observe their rapid onset in many areas, from their use in meteorology, cinematography and journalism, to recording sports or cultural events. events, inspection of buildings, protection of buildings, crop spraying or mail delivery, up to their deployment as support stations to ensure Internet connection in remote locations. It is assumed that the next stage of their development will probably be the functional transportation of people, which the developers are currently trying to achieve.

Also in the public sphere, we can see a rapid transition today from purely military to non-conflicting uses, such as geographical exploration, infrastructure control, monitoring of animal migration, monitoring of natural disasters, or searching for missing persons. However, the main focus of their public activities remains in the field of security and defence, such as protection of state borders or direct military deployment.

However, the era of UA does not only bring positive consequences, but also potential threats and challenges, such as their possible misuse for illegal surveillance of persons and invasion of privacy in general, potential damage to property due to e.g., collisions with other aircraft, harassment of the population or smuggling of prohibited objects and substances. From the point of view of public security, UA represent a risk, e.g., for air operation and protection of military bases, cultural monuments, or nuclear power plants [6]. And as we have already indicated above, they can also represent a security threat in case of their abuse by violent non-state actors.

### **3. VIOLENT NON-STATE ACTORS**

As with many other concepts, there is no unified and generally accepted definition for non-state actors. Currently, there are several definitions. In general, it can be said that these are any entities that have sufficient power to influence the political or power system and cause changes in them by their actions or mere existence. It should be added that it is not about states or their institutions. However, some non-state actors may be either covertly or overtly connected to or supported by state actors. Violent non-state actors are those non-state actors who, among other tools, use violence in various forms to advance their interests and goals. There are several violent non-state actors who use different means, have different interests, scope, and goals [7], [8]. Violent non-state actors generally arise because of regional security insecurity and instability, political or religious unrest, and violent conflict [9]. Due to current security developments, violent non-state actors have become a permanent problem for states in the 21st century [10].

Violent non-state actors around the world use a variety of methods and means, not only violent or illegal, to advance their goals. A large part of their activities undermines and weakens the authority and sovereignty of the state on whose territory these activities are carried out. Violent non-state actors thus play an important, often destabilizing role in a number of humanitarian and political crises [11], [12], [13], [14]. Violent non-state actors challenge the state's monopoly on violence and offer some alternative to state rule. In most African countries and in Central Asia, the so-called warlords have considerable influence in both politics and the economy at the expense of state power and authority. Some violent non-state actors may cooperate with the state, while they are not interested in destabilizing or replacing the state. On the other hand, some have destabilization and disintegration of the state as their goal, they want to penetrate its structures and control the state. In other cases, various violent non-state actors compete, while the state does not participate in their competition and is rather a passive observer. However, most violent non-state actors are a threat to national security and some violent non-state actors to international security [8] [10], [15], [16].

Despite the fact that certain unifying elements can be found among most violent non-state actors, it is a highly heterogeneous group. Some violent non-state actors have obvious political aspirations and motivations, some do not and they are mainly concerned with their own profit from illegal activities. Some violent non-state actors can firmly rule over a certain territory and its population and for this purpose even establish their own administrative structures and bodies in parallel with state authorities or even instead of them, while other violent non-state actors do not control any territory and have no fixed organizational structures. Some focus on rural and some on urban environments, some attack military targets and others attack civilian infrastructure and civilian populations. Some violent non-state actors may use violence as the main means to achieve their goals, while others resort to it only out of necessity or when there is no other option [8], [16].

There are several different typologies of violent non-state actors, for example Williams divided them into warlords, militias, paramilitary units, insurgents, terrorist organizations, criminal organizations, and gangs [10], [13]. Violent non-state actors can include, for example, various tribes or ethnic groups, drug smugglers, drug cartels and others [17].

A specific group among violent non-state actors consists of terrorist organizations, especially those with a transnational character [12], [14]. Transnational terrorist groups are those groups that carry out their activities on the territory of several states, regardless of borders, and that have religious, ideological, or similar goals, despite the fact that these groups differ considerably in terms of organization, origin, and goals. They often strive for political change, which they want to achieve with the help of violence, which accompanies a large part of their activities. However, violence can directly be their main means, while they use it with the aim of instilling fear and exposing the weaknesses of the adversary, usually the state. These organizations primarily attack the civilian population, which is one of their defining features. Although the total number of victims of their attacks is usually less than the number of victims of insurgent or criminal organizations, their activities and tactics still attract a lot of media attention, which is also their goal [9], [15], [18], [19]. It is necessary to add to this that it is often not easy to determine which type of violent non-state actors are involved, because some organizations or groups can show the characteristics of several groups of violent non-state actors, use different means to achieve their goals or, during their activities their goals and used tactics to change. Such hybrid violent non-state actors are, for example, the Islamic State, Hezbollah, Hamas, and other actors that have evolved over the years and used different tactics and means, including UA [20], [21], [22], [23].

#### **4. CRITICAL INFRASTRUCTURE**

Critical infrastructure is generally understood as infrastructure that is key to the operation of society, the state, and its economy. Critical infrastructure can be characterized as an essential system of the state, whose inability to fulfil its functions or its partial or complete destruction could have adverse effects on national security, economic prosperity, the environment, health, and safety of residents [24]. Critical infrastructure represents a collection of selected production, non-production, telecommunication and transport facilities and objects, with the help of which the basic functions of the state are fulfilled in crisis situations [25, 26].

Directive 2008/114/EC of the Council of the European Union similarly defines critical infrastructure as “resources, systems and their parts located in a member state of the European Union, which are essential for the preservation of the most important social functions, health, safety, security or good economic and social conditions inhabitants and the disruption or destruction of which would have a serious impact on the Member State as a result of the failure

of these functions” [27]. Reducing the vulnerability of critical infrastructure and increasing its resilience is one of the main tasks of the European Union. The European Critical Infrastructure Protection Program (EPCIP) deals specifically with this issue, which establishes a general framework of activities for increasing the protection of critical infrastructure in Europe. The program targets all threats such as terrorism, criminal activities, organized crime, natural disasters, industrial accidents, and others [28], [29].

## 5. SOFT TARGETS

It is a security term that is not precisely defined but is generally used to refer to a vulnerable or unprotected non-military location. These are mainly places with a high concentration of people and a low level of security against violent attacks, such as various social, sports and cultural events, churches, shopping centres, stations, theatres, sports stadiums, and others. Such places, the protection of which is considerably problematic, are frequent targets of attacks by violent non-state actors, especially various terrorist groups [30]. The opposite of soft goals are the so-called hard targets, which are well-guarded and protected places, are mainly military buildings, buildings of the security forces, some state buildings, but also some non-state or commercial buildings.

According to the United Nations, the term soft targets generally describe public spaces and other places that are easily accessible and predominantly civilian in nature, often with limited security. These cities are numerous and have long been popular targets for terrorist attacks because they give terrorists and terrorist organizations the opportunity to maximize casualties and achieve high publicity [30]. Soft targets can also be characterized as objects, spaces or actions characterized by the gathering of many people, the absence or low level of security against violent attacks and not being classified as critical infrastructure objects.

## 6. SECURITY THREATS

The term security threat is not uniformly defined and there are several definitions of it. It can be based on the general concept of threat, for which there are also several definitions made by several authors. According to some of them, a threat can be defined as the proximity of something unpleasant, dangerous, to which a person is exposed and the environment in which he lives, and as an imminent danger [31], [32]. According to another definition: *“A threat represents a primary, independently existing outside of us, external phenomenon that can or wants to damage some specific value. The severity of the threat is proportional to the nature of the value and how we value that value. A threat can be a natural phenomenon, defined physically - such a threat is referred to as a non-intentional (unintentional) threat; its implementation is stochastic in nature. A threat caused or intended by an element endowed with will and intention is of a completely different origin - such a threat is referred to as an intentional threat - it is intended, prepared, launched and implemented by a human individual or a collective actor”* [33].

Based on the above information and definitions, it is possible to define security threats as specific phenomena, actions or events that pose a danger to individuals, groups of people, states, groupings of states or the whole of humanity. From the point of view of external, international security, this means a threat of violation of the freedom, sovereignty, independence or territorial integrity of the state, or alliance or union. From the point of view of internal, national security, this represents a threat to the lives, health and property of citizens,

the environment, democratic establishment, political stability, internal order or human rights and freedoms, to the extent that the security of the state may be threatened [34].

From the point of view of the member states of the European Union, a security threat can be understood mainly as the weakening of cooperative security mechanisms and political and international legal obligations in the field of security, instability and regional conflicts in the Euro-Atlantic area and its surroundings, terrorism, the spread of weapons of mass destruction and their carriers, cyber-attacks, extremism, radicalism and the increase of inter-ethnic and social tensions, organized crime, especially serious economic and financial crime, corruption, human trafficking and drug crime, as well as threats to the functionality of critical infrastructure, interruption of supplies of strategic raw materials or energy, natural disasters, industrial disasters and other extraordinary events.

## **7. POSSIBLE USE OF UNMANNED AIRCRAFTS BY VIOLENT NON-STATE ACTORS**

Until a few years ago, UAs were very expensive, there were not many of them, their capabilities such as length of flight, payload, size, and ability to transmit live video were very limited, and they required considerable skill and practice to build and operate. However, this has changed in recent years, as UA prices have fallen significantly, there are many models available on the market today, and their features, parameters, hardware, and software are constantly improving. Many UAs are capable of independent flight, their route can be pre-programmed, they are able to recognize obstacles and avoid them, and take off or land independently [35], [36]. UA is used more and more by individuals and non-governmental organizations for recreational, commercial, humanitarian, research, or other purposes [5], [37].

However, the operation of UA is associated with various threats, which can be unintentional or intentional on the part of their pilot. Unintentional ones include the fall of a UA, collision with a person, object, means of transport or other object, and disruption or endangerment of airspace, traffic or a guarded facility or similar object. Intentional threats include the use of UA to obtain sensitive information, intentional use to disrupt or endanger airspace, traffic or a guarded or important object or equipment, smuggling or transporting prohibited material and objects to a prison or other guarded objects, across state borders or too difficult-to-access locations, transportation of drugs, weapons, and similar items, and last but not least, intentional threats include the use of UA for terrorist and military purposes. Terrorist threats include UA raids on facilities belonging to critical infrastructure or attacks on soft targets, the dropping of explosive devices, the contamination of places with a high frequency of movement or presence of people or entire areas with radioactive, biological, or chemical substances, electromagnetic interference of facilities, assets, attacks on military targets or on important persons and other attacks [35], [38].

Due to the easy availability nowadays, small size, low financial cost, easy access of UA to most places and the anonymity and safety of the pilot resulting from the remote control of UA, they are also very attractive to violent non-state actors, such as various terrorist organizations and drug cartels, but also for individuals, for the purpose of abusing them against citizens, society or the state or for the implementation of their own, often illegal, criminal and other illegal activities [36], [37], [39], [40].

In this context, it is appropriate to return to the beginning of the 21st century, when Christopher Bolckcom, a specialist in military aviation, testified before a US Senate committee, giving seven reasons why UA have become attractive to various violent non-state actors. They belong here:

- low financial costs,
- various numerous ways in which UA can be procured,
- potential for high accuracy attacks,
- flexibility of their use,
- a great chance to overcome air defence,
- a great chance to achieve your goals and
- low requirements for infrastructure and resources for UA operation [41].

Compared to the military models of UA used by the armed forces, which cost from ten to several hundred thousand US dollars, common civilian UA are available for a few hundred US dollars [37]. Many of such models can stay in the air for up to half an hour without problems before the batteries need to be recharged, while they are able to transmit live video over up to 7-8 km [42]. However, these commonly available UA models still have significant limitations, especially regarding their range and payload, and therefore their use for violent activities is limited. Some violent non-state actors have even started producing their own UA. Such UA can be made for a specific purpose with a specific intention, for example to carry more loads, be stronger, have smaller dimensions, fly faster, or have a longer range, etc. [35].

## **8. THE USE OF UNMANNED AIRCRAFT FOR VIOLENT PURPOSES**

Converting a UA into a carrier of missiles or explosive charges requires a certain level of skill and ability, but it can be achieved without major problems with the help of commercially available equipment and tools and with the appropriate instructions. Today, even UA or additional devices with remote control are sold, which are intended for dropping e.g., water balloons, plastic or rubber objects. They are intended for modelers or for children, but they can also be used to drop explosive charges, contraband, etc. [35].

Although the payload of conventional UA is limited (they cannot carry a large amount of explosives), this disadvantage is compensated by their ability to get directly to their target and hit it with great accuracy, the ability to overcome obstacles such as enclosures or fences, and also the ability to reach higher floors of high-rise buildings [43].

Another potential misuse of UA with a low-weight explosive is their use as a detonator. In such cases, the charge can be detonated near another explosive object, e.g., a gasoline tank, a petrol station, a refinery, a nuclear facility, a warehouse with fertilizers, chemicals, pyrotechnics, ammunition, etc., which can cause a secondary, much larger, and more destructive explosion that can cause much greater material and financial damage and bring also a greater number of human victims. [43].

Great concern is currently caused by possible attacks by UA modified to spread radioactive, biological, or chemical material, or UA to which a charge with this content is attached. The use of UA for such attacks can be attractive to violent non-state actors, especially against soft targets. Although unlikely to be used in this way, it cannot be taken lightly due to its potential impacts [44]. In such a case, there may be numerous victims of the attack itself, but the subsequent loss of life caused by the resulting panic and aftermath may be even greater. The psychological effect of such attacks can also be huge [42]. Also of concern is the fact that larger UA may also be equipped with remote-launched firearms or larger explosives to attack crowds [44].

UA can also be used to attack flying aircraft or helicopters, especially during take-off and landing, when these machines are most vulnerable. In the event of a UA impacting an airplane or helicopter, machinery may be damaged, or the pilot or crew may be injured, which may lead to the damaged machine falling. Although no successful cases of such attacks have yet

been recorded, there are hundreds of confirmed cases of UA flying very close to flying airplanes or helicopters [42]. Additionally, UAs cannot be fooled by decoy targets, and it is often problematic to intercept their sensors against missiles or radar systems. Likewise, it is difficult to see (observe) UA from a helicopter or from an airplane [35].

Another reason why UA can be very dangerous in the hands of violent non-state actors is their ability to hit the target precisely and selectively, which can be used, for example, in attacks on airports, ships, important facilities, objects, oil pipelines, gas pipelines, power plants, communications, control points army and police, vehicles and also on individuals [43].

## **9. USE OF UNMANNED AIRCRAFT FOR OTHER PURPOSES**

In addition to violent activities, UA can also be used for other harmful and criminal activities. One of the most widespread is the smuggling of drugs and other objects. In this way, they are used by drug cartels, smugglers, various criminal organizations, and individuals. Documented cases include, for example, drug smuggling across state borders, smuggling of contraband through checkpoints or into freely inaccessible places such as prisons.

Information extraction is another widespread way of exploiting UA. For example, the Islamic State used conventional UA models for reconnaissance in war zones using video, photos, and live action from UA cameras. For this purpose, UA was and still is used by a number of other non-state actors and individuals [45]. The collection of information is associated with the misuse of UA for propaganda purposes. For this purpose, records and photographs from UA were used by the Islamic State and other non-state actors in Iraq, Libya, Yemen, and other countries [45].

UA can also be used in case of disruption of the functionality or security of certain critical infrastructure facilities, the destruction or disabling of which as a result of an attack will endanger or disrupt the political and economic functioning of the state or endanger the lives and health of the population. It can be, for example, power plants, factories, pipelines, various sensitive facilities for processing or research containing chemical, biological, or radioactive substances, as well as communications, airports, etc. Just the simple disturbance of such an object by the presence of UA can result in significant financial damages and a great psychological effect [38], [45].

For example, in December 2018, UA was seen at Gatwick Airport in London for three days in a row, resulting in the cancellation of a number of flights. The estimated damage caused by this incident is in the millions of British pounds. There were flight delays, which unpleasantly affected around 140,000 passengers. The perpetrator was not revealed [46]. A similar incident occurred in 2019, when a group of environmental activists tried to disrupt the functionality and operation of Heathrow Airport in London [47]. Similarly, at the beginning of 2020, UA disrupted the operation of Europe's largest airport in Frankfurt am Main for several hours [48].

## **10. CONCLUSIONS**

In conclusion, based on the facts and information presented in the text, it can be concluded that UA in the hands of violent non-state actors represent a real security threat both for military targets and for soft, civilian (non-military) targets, the civilian population, and the critical infrastructure of the state. Therefore, considering the actual use of UA for violent or other harmful activities, it is necessary to propose and adopt effective security, legislative, organizational, as well as technical and other measures mainly by the state, and simultaneously



by relevant organizations. At the same time, it is necessary to introduce effective procedures for the detection and control or eventual destruction of UA.

The aforementioned soft targets and elements of critical infrastructure are particularly at risk. Protecting such places and objects is not easy due to the huge number of potential targets involved. Protection against drone attacks already takes place today in some larger industrial enterprises, energy plants, airports, etc., but mostly on an individual level. At the state level, the issue of protection against UA is solved mainly by the armed forces of the state, primarily armed forces and the police.

First of all, it is always necessary to detect and locate the UA, or even to identify it, if the basic means is direct visual observation, which is the most used so far, even at airports and other threatened areas. However, due to the small size of several UA, its high speed and demanding attention of staff and citizens, it is an unreliable means. It is necessary to use more reliable and efficient systems and means. The currently used means of detection can be divided into two groups: a) active means of detection, which include active radar detectors and laser scanners, and b) passive means of detection, which include passive radar detectors, passive receivers of electromagnetic waves, TV scanners, thermal scanners and microphone arrays. Localization of UA is also possible using, for example, optoelectronic systems with a range finder and a direction manipulator.

In addition to the position of the UA, it is possible to find out by some means its type, size, and the position of its pilot. This makes it possible to detect a potential threat before the UA takes off, thanks to the UA's remote-control system carried by its pilot. However, many problems arise in the detection and localization of UA. For example, there is a big difference between open space and built-up areas, because it is much more difficult to detect UA in them. Another problem with some types of detection means is distinguishing UA, especially from birds.

Measures aimed at preventing violent non-state actors from abusing UA to commit violent or other illegal activities include UA disposal methods, which can be destructive or non-destructive. In this context, it should be noted that even with the use of non-destructive methods, the UA may be destroyed in the event of a subsequent fall or impact, but this is not the primary purpose of these methods.

In the case of destructive methods, this mainly involves the use of various anti-aircraft techniques and combat equipment, which are, however, more suitable for military purposes against large UA. Their use against small UA is very uneconomical. Small firearms, especially shotguns, are also included here, which depend on shooting skills, are unsuitable for buildings or spaces where people are located, and their use is limited by the small effective range of weapons and high demands on shooting ability. Furthermore, directional electromagnetic pulse or laser weapons can be used, either to directly destroy the UA or to disable its sensors. However, laser weapons are very large, expensive and require a lot of energy. Moreover, they are not commonly available.

Non-destructive methods include, for example, the disposal of UA using a net. The net can be fired from ground weapons by personnel or from another UA. In this case, however, it is necessary that the speed and carrying capacity of the UA with the net be greater than that of the caught UA. It is also possible to use trained birds to neutralize small UA, which capture small UA and carry them to the ground. Another method is to disrupt the communication of UA with the pilot, which can be achieved by using an electromagnetic wave sent towards the UA or by using a device that continuously emits a jamming signal. The disadvantage is that this method also interferes with other types of transmission and could damage or disable other

electronic devices. Jammers are therefore currently banned in most states, their use is limited only to the police and other state security forces.

One of the interesting options within non-destructive methods is taking control of the UA, which works on the principle of sending fake GPS information that the UA evaluates as correct, or by intercepting the transmission between the UA and its control device and then sending its own instructions. The disadvantage of this method is low efficiency in the case of encrypted connections and the impossibility of use against UA, which do not receive any signal and do not follow programmed instructions.

Regardless of whether destructive or non-destructive methods are used to disable UA, they need to be continuously improved, including through interdisciplinary scientific research, because, as we have shown, UA are undergoing a very dynamic development and in the hands of violent non-state actors they represent a real security threat for society and its citizens. Further scientific investigation of this issue is therefore highly desirable.

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