Przegląd Europejski
vol. 2019, no. 4
doi: 10.5604/01.3001.0013.7888

Legislative changes regarding unmanned flights as an opportunity for professional empowerment of persons with disabilities

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Abstract
The turn of the 20th and 21st century was the time of flourishing of many modern technologies, among which was the popularisation of unmanned aviation in civil applications. This article aims to presentation of the genesis of this technology and the opportunities, which it offers in the context of people with disabilities. This paper is a synthesis of academic literature of the research subject, legal regulations on international and national levels, as well as the author's own reflections on the ways, in which drones can be used for the needs of people with disabilities in the context of contemporary law and its possible changes.
Keywords: unmanned aviation, drones, disability, labour market, professional empowerment

Zmiany legislacyjne dotyczące lotów bezzałogowych jako szansa na aktywizację zawodową osób z niepełnosprawnością

Streszczenie
Przełom XX i XXI wieku to czas rozkwitu wielu nowoczesnych technologii, wśród których wskazać można m.in. na upowszechnienie się lotnictwa bezzałogowego w zastosowaniach cywilnych. Niniejszy artykuł ma na celu przedstawienie genezy tej technologii oraz możliwości, jakie ona oferuje w kontekście osób z niepełnosprawnością. Praca jest syntezą literatury przedmiotu, przepisów prawnych na poziomie międzynarodowym oraz krajowym, a także własnych rozważań autora na temat sposobów, w jaki drony mogą być wykorzystane dla potrzeb osób z niepełnosprawnością w kontekście obowiązującego prawa i jego ewentualnych zmian.
Słowa kluczowe: lotnictwo bezzałogowe, drony, niepełnosprawność, rynek pracy, aktywizacja zawodowa

The turn of the 20th and 21st centuries was the time of flourishing of many modern technologies, among which was the popularisation of unmanned aviation in civil applications. The aim of this article is to present the genesis of this technology and the opportunities, which it offers in the context of people with disabilities. Particularly important seems to be the issue of professional empowerment of this social group – this is an important social problem, for which there are no unequivocal solutions. The hypothesis of this research is that unmanned aviation may be a new, hitherto unnoticed opportunity for people with disabilities on the labour market. The research methods are: analysis and synthesis of the scholar literature, legal regulations on international and national levels, as well as the analysis of the ways, in which drones can be used for the needs of people with disabilities in the context of contemporary law and its possible changes.

1. The technology of unmanned flights

1.1. The history of unmanned aviation

The concept of "drone" has entered into the language and is widely understood. However, it is worth considering, how unmanned flights were understood until recently. Already in ancient times people created objects that floated in the air without a crew. The Chinese people used lanterns and balloons in their rituals, as well as used them in a way of transmitting signals at a distance. The first attempt to use unmanned objects in a controlled manner took place in 1849 during the Austrian attack on Venice (see: Prisacariu 2017). Balloons with bombs were released from the ships towards the nearby city. The time of explosion was controlled, but the wind caused the balloons didn't hit the target in the most cases. However, the military potential of technology was noticed. In 1917, the first flight of the automatic Hewitt-Sperry aircraft took place, detonating the bomb at a given distance from the start (see: Prisacariu 2017). It was one of the controlled ways, that the US planned to use for fighting against German submarines.

Before the World War II, unmanned aerial vehicle technology was developed by the military, especially in the field of possible types of autopilots. In 1939, the Radioplane OQ-2 was flown - the first unmanned aerial vehicle that entered mass production (Whitmore 2016: p. 16). Since then, this technology has developed in the US, Europe and the Soviet Union as exercise aircraft, reconnaissance aircraft, and also explosive aircraft.

Only since 2010 year drones began to become more popular and also more available for civilian applications. In 2013, the Chinese company DJI produced its first drone, the Phantom model, which quickly gained great recognition. Currently, this company controls over 85% of the global drone market (see: French 2017), and only in the United States 2 million of such civilian devices are registered. For now, annual sales increase of 40-50% is observed (Gartner 2017), and legislative processes are not keeping pace with such a fast-growing market, which only ten years ago was very niche in the area of civil applications. Initially, the issue was disregarded and the rules applicable to passenger flights were applied. Once work began to regulate this area, draft legal regulations were prepared that were adequate to the current level of technology development and the

nature of its use. Consequently, if the technology is at an early stage of development and changes occur quickly, then the proposed provisions become outdated even before they enter into force.

1.2. The terminology and law concerning drones

The most important international organisation dealing with civil aviation is the International Civil Aviation Organisation (hereinafter ICAO). It has been operating since April 4, 1947 as a specialised organisation of the United Nations under the *Convention on International Civil Aviation* of 1944, also known as the *Chicago Convention* (see: ICAO 1944). An aircraft is defined in this convention as "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface" (ICAO 1944: Annex *Definitions*).

Aircrafts can be manned and unmanned. Unmanned aircrafts have many similar terms, that is why it is necessary to systematise the terminology used for further analysis. This will allow to determine, whether specific aviation regulations can be applied in a given case.

NATO's dictionary defines the *Unmanned Aerial Vehicles* (UAV) as "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 non-lethal payload." (NATO AAP-6 2011: p. 386).

The concept of UAVs can be extended to the *Unmanned Aerial System* (UAS). The replacement of the term "vehicle" with "system" stresses the fact, that in the case of unmanned vehicles, ground control (e.g., an operator) constitutes an important component of their functioning. According to NATO, an UAS is a "system whose components include the unmanned aircraft, the supporting network and all equipment and personnel necessary to control the unmanned aircraft" (NATO AAP-6 2011: p. 413).

Since year 2013 the notion UAV no longer appears in the NATO dictionary, because it has been replaced by UAS, which is currently the most common term in this field (NATO AAP-6 2013: p. 4–9). The unmanned aerial system includes a control station that allows the operator to control the flight of the drone. To make it possible, there must be constant communication between the control station and the aircraft (e.g. by satellite or radio). The last element of the system is the aircraft, which receives communication from the control station and can also send its own data stream, e.g. a camera view or sensor data. The system is supplemented by an operator, who controls the flight of the unmanned aircraft.

The word "unmanned" means that there is no crew on board of the machine. As already mentioned, however, for the UAS functioning, often personnel is needed, who control the aircraft. They are not on board, but they steer the machine in the same way as pilots of manned aircraft do. Should not such personnel also be called "crew" then? These nuances are important, when we are interpreting legal regulations. It affects the health requirements that a person must meet. For example, a person in a wheelchair may have a lot of troubles, while piloting a passenger plane (due to narrow space, stairs and

overloads), but these problems may not exist in the case of the drone's remote control personnel – even though the regulations currently treat these two groups (disabled and non-disabled people) equally. The existing law is adapted to manned aircrafts, hence definition issues may be crucial for identifying the area, where changes are needed or for completely new regulations, so that people with disabilities can be included in the aviation environment.

In 2011 ICAO introduced in its Circular 328 the concept of a *Remotely Piloted Aircraft* (RPA), which constitutes an element of the *Remotely Piloted Aircraft System* (RPAS) (see: ICAO 2011, Cir. 328). Thus, RPAS is a system that comprises RPA and a *Remotely Piloted Station* (RPS).

The terms UAV and RPA, as well as UAS and RPAS, are often used interchangeably. However, the most often used term is "drone", to define all unmanned aerial vehicles[1]. The drone can be understood as a synonym of the UAV (Australian Certified UAV Operators Inc. 2016).

In the context of drones, the terms "autonomous" and "automatic" often do not mean exactly the same. An automatic system is defined by T.Zieliński as one that "in response to input data from one or more devices, is programmed to perform specific tasks for achieving the intended results. Knowledge of previously defined and entered data allows prediction of specific results. In turn, the autonomous system is able to predict the changes of the circumstances and modify its behavior in a way that allows achieving previously assumed goals. Therefore, it is able to alternate, and make alternative decisions without human interference and control, despite the fact that it is available" (Zieliński 2014: p.35). From the above definition follows that the autonomous system is a kind of development of the concept of an automatic system that has been enriched with elements of artificial intelligence.

Modern drones are now able to fly off and land automatically, as well as the follow a marked route. After equipping them with sensors (gyroscopes, cameras, infrared sensors), these machines are able to perform predefined sets of commands, e.g. move between obstacles or photograph objects and people, who meet the given requirements. Little is missing for the drone to develop its own patterns of operation, based on previous "experience" acquired through interaction with the environment. It should be noted, that in the era of the "Internet of Things" it is simple to connect many aircrafts into one network with a shared server. Thus, the learning process does not take place in the context of one device, but behavioral patterns can be immediately transferred to other drones in the same network. It is currently used e.g. for monitoring pipelines and other large industrial installations. Connecting drones into a common network not only allows them to be managed effectively, but also offers the opportunity to optimise flight routes for more effective tasks (Knight 2017).

The regulations of the Chicago Convention and secondary EU law (until the entry into force of Regulation 2018/1139 in September 2018), in principle, did not allow the use of autonomous systems. The term RPA (remote piloted aircraft) used in these regulations

[1] "drone – a land, sea, or air vehicle that is remotely or automatically controlled. See also: remotely piloted vehicle; unmanned aerial vehicle" (Joint Publication 2001: p. 171)

clearly indicates, that there must be a person, who manages the device manually by the means of communication. Pursuant to this limitation, RPA does not set the direction of its flight itself, (which could raise problems e.g. when indicating the entity responsible for a given event in air traffic). It is worth noting, that this position is not uniform at all. In order to be consistent with the existing regulations created in the context of manned flights, it is necessary to introduce new terms, such as *"remote pilot".*

Keeping this in mind, some of the current regulations do not fit the specificity of unmanned flights. These are primarily requirements related to the presence of personnel on board, as well as, for example, requirements related to physical condition, which have a completely different meaning in the case of manned flights than unmanned flights. The consequence is the assumption that drones will not carry out passenger flights anytime soon (ICAO 2011, Cir. 328: p.4), this would primarily involve the need to adapt unmanned safety regulations and mandatory equipment. In this example, however, you can realise, how difficult it is to develop legal regulations in a field, which is developing so dynamically. The Chinese company Ehang presented in 2016 a model of the passenger drone, which is controlled fully autonomously (the passenger only gives the destination location) (Gruber 2016). Currently the introduction of such drones for use in Dubai is under preparation. Airbus and Uber are also developing their solutions in this field (Belton 2017).

In 2020, Uber's passenger drone testing is expected to begin in Melbourne, Australia (Business Day 2019). As a part of this preparation, the first law in the world to allow unmanned autonomous passenger flights is also being developed (Langton 2017). This trend can be seen as an opportunity, e.g. for people with limited mobility. This fact clearly demonstrates that the inadequate adaptation of current legislation to reality affects the development of more adequate regulations by individual countries. Over time, this will lead to widening differences, including fragmentation of the EU internal market (European Commission 2017), and, therefore, maintaining the coherence of these legal systems will be an increasingly difficult task. If technological progress is faster than legislative processes, then even such coherent regulations may require further adaptation already at the time of entry into force. Therefore, the more important is the coordination of lawmaking between various entities (states and international organisations) and the efficiency of its adoption. This problem has been noticed, and such adaptation of the law to changing technology occurs, although it is a long-term process. The American FAA agency regulating federal airspace, has allowed semi-autonomous systems since 2016, i.e. such systems, where the pilot has the ability to take over manual control of the aircraft at any time, but does not have to do it all the time (Connot 2016). In the Regulation 2018/1139 of the European Parliament and of the Council from July 2018, unmanned aircraft is defined as "any aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board" (Regulation 2018/1139: art.3, par. 30).

Such adaptation is desirable, but at the same time it leads to the situation, in which the subject scope of the regulations in a given legal system depends on how long ago the amendment was carried out. Since legislative processes are not synchronised with each other, this type of difference is inevitable.

2. Law on unmanned flights

2.1. Application of the Chicago Convention to unmanned vehicles

The Chicago Convention of 1944 is "the basic treaty law system regulating multilateral public law issues of international air navigation" (ICAO 1944; Żylicz 2011: p.46), 191 countries are its parties, including all European countries. On the basis of the Convention, the International Civil Aviation Organisation (ICAO) was established as a specialised agency of the United Nations. The regulations of the Convention apply exclusively to civilian vessels, i.e. not used by the public service (army, police and customs services) (see: ICAO 1944: art. 3, point b). All subsequent regulations should take into account the provisions of the Convention. From this perspective, the Convention can be regarded as a "primary law". The most important provisions of the Convention in the context of drones are presented below, as they affect the shape of other legal systems, including the European Union.

An integral element of UAS is the communication system between the aircraft and the control station. According to the art. 3-*bis* of the Convention, it is required to establish communication with any civil aircraft. Theoretically, this condition is met, but communication in unmanned flights has a different nature – the specific transmitter is defined, that gives the aircraft direct commands, however this is not communication between the flight control tower and the pilot on board.

In accordance with art. 8 of the Convention, RPA may move in the airspace of a given country only after obtaining the appropriate authorisation and providing flight control in the movement area of civil aircraft (see: ICAO 1944: art. 8). In Circular 328 from the 2011 year, ICAO specifies: *"All UA, whether remotely-piloted, fully autonomous or a combination thereof, are subject to the provisions of Article 8. Only the remotely-piloted aircraft (RPA), however, will be able to integrate into the international civil aviation system in the foreseeable future. The functions and responsibilities of the remote pilot are essential to the safe and predictable operation of the aircraft as it interacts with other civil aircraft and the air traffic management (ATM) system. Fully autonomous aircraft operations are not being considered in this effort, nor are unmanned free balloons nor other types of aircraft which cannot be managed on a real-time basis during flight"* (ICAO 2011, Cir. 328: p. 3).

The above mentioned citation demonstrates, that all unmanned systems are subject of the Chicago Convention, but only remotely piloted aircrafts will be integrated in the airspace in the near future. It is worth noting, that Article 8 of the Convention raises interpretation doubts – it says about the lack of a pilot, but it is not specifically indicated that this has to be a pilot on board. Therefore, one of the interpretations could be, that the convention can only be applied to autonomous vehicles (Scott 2016: sec. 4.05).

It is important to determine, by which regulations the aircraft is flying. In accordance with Article 12, the regulations of the country in which the aircraft is located are applicable. However, this means that national legislation must be compatible with the regulations established from time to time under this Convention (ICAO 1944: art. 12). This fact requires

ensuring inter-state cooperation in creating regulations in this field, which is confirmed by Article 37 of the Convention.[2]

In particular, all EU countries are also parties of ICAO, so the *acquis communautaire* (the EU legal order) should be consistent with the regulations of the Chicago Convention.

In 2015, ICAO published a *Manual on Remotely Piloted Aircraft Systems (RPAS)* and presented proposals for amendments to the Chicago Convention and its selected annexes (2 – air traffic regulations, 7 – national and registration signs, 13 – accident investigation and aviation incidents).

The Manual "provides readers with analyses of how the existing regulatory framework developed for manned aviation applies to unmanned aircraft and provides insight into the changes that will be coming. It serves as an educational tool for States and stakeholders, it supports the development of SARPs and guidance material by ICAO and it gives a basis for other standards-making organizations to harmonize their activities" (Cary 2015).

The document addresses to the problems that come out from the lack of adaptation of current regulations to unmanned flights. The manual contains a list of all areas, where unmanned flights differ significantly from manned ones, and presents proposals (more or less detailed) to address these differences in new legal regulations, but the Manual itself has no legally binding force.

2.2. Drones in the European legal system

In the second decade of the 21st century, the European Union faces numerous difficulties (such as the migration crisis). As a result, activities in less discussed areas, including in the field of unmanned aviation, are coming to the background. Legislative processes in the EU can be long-lasting and require a consensus to be reached between many groups. In the case of drones, it is more difficult, because international regulations (ICAO), which should be adapted, are still being developed. Accordingly, the regulations of the Chicago Convention are still binding at UN level. On the other hand, due to the lack of EU regulations, individual Member States are forced to prepare their own law in this field to be able to control the rapidly growing drone market. In situation of excess of ideas and solutions, it may be increasingly difficult to develop EU-wide standards that should be implemented by all Member States (it results from the principle of the primacy of EU law over national law).

Due to the "layered" structure of the EU legal system, it is very important to complete the work on common regulations as soon as possible. The longer the arrangements last, the greater the risk of non-compliance, which is very important in aviation. Manufacturers of aircrafts try to reach as many target markets as possible, and the prevalence of international flights means that any differences in regulations (technical standards, required qualifications of personnel, etc.) lead to major difficulties. Moreover, new aviation

[2] „Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation." (ICAO 1944: art. 37).

technologies threaten people with qualifications adapted to existing solutions, so these people (in defense of their own particular interests) can lobby for delaying the implementation of regulations in areas not yet regulated (Perritt, Sprague 2016).

The first consultations regarding the regulation of the drone area in the EU took place in 2011-2012 (under the name of the UAS Analytical Process). It is worth paying attention primarily to the potential of the drone market estimated at that time (35,000 drones in global production during the next 10 years). (Council of the EU 2012: p. 4).

Already in 2015, global sales exceeded 6.4 million units (see: Statista.com 2018), i.e. almost two hundred times more than forecasted for the entire decade. Such a large disproportion between estimates and the actual number of drones is primarily due to the specific of the Chinese market. The sale of relatively technologically advanced products at low prices caused the market to open to consumers using drones for recreational purposes. Prices have become so affordable, that small drones have become an excellent commodity bought, e.g. as a gift for a child. The rapid development of this market and strong competition cause that low prices persist (Belton 2015).

It was originally assumed, that the inclusion of unmanned flights in the Single European Sky (SES) means the need to apply exactly the same rules to them as for manned aviation: „controllers should not be expected to do anything different [for unmanned flights] than they would do for other aircraft under their control, not should they have to apply different rules or work to different criteria" (Calleja Crespo, Mendes de Leon 2011: p. 258).

Until 2018, the European Aviation Safety Agency (EASA) only supervised remotely controlled aircrafts with an operating mass over 150 kg, in accordance with the Regulation of the European Parliament and the Council 216/2008 on common rules in the field of civil aviation.

The exclusion from the Regulation the UAS weighing less than 150 kg meant applying national jurisdiction to them. In July 2018, Regulation (EU) 2018/1139 of the European Parliament and of the Council on common rules in the field of civil aviation and establishing the European Union Aviation Safety Agency was adopted, repealing, *inter alia*, the Regulation 216/2008.

The basic regulation extends EU competence to create regulations for unmanned aerial vehicles, abolishes limiting the take-off mass to over 150 kg. In June 2019, Commission Delegated Regulation 2019/945 and Commission Implementing Regulation 2019/947 were published, which systematically define requirements for individual elements constituting unmanned flights, such as aircraft's registration and technical requirements regarding them, reporting and monitoring flights, and certification of pilots (which is very important from the point of view of including disabled people in tasks related to unmanned flights).

3. Drones *vs.* professional empowerment of people with disabilities

3.1. Activities for people with disabilities

The topic of people with disabilities remain overshadowed by other problems in national and international politics. However, it can be noticed, that this is one of the key

issues, which, if addressed properly, leads to building an efficient economy and reducing social inequalities. Within this topic, we can indicate many issues concerning the people with disabilities. One could mention, for example, the role of national and international legislature in stimulating professional empowerment of social groups with the risk of exclusion, activities for social integration, raising education standards, medical care, information campaigns aimed at disseminating knowledge about people with disabilities, actions to improve accessibility, e.g. adaptation of communication or removing architectural barriers, as well as many other aspects.

As a part of the abovementioned tasks, professional empowerment can be indicated as one of the most important. Its effects can be observed on many different levels. From the disabled person's point of view, the financial aspect is certainly important, because employment gives them the chance to achieve financial independence. This is an important psychological effect, because a person does not have to rely on external financing sources that are uncertain and require a lot of formalities. In addition, indirectly it is possible to relieve the budget allocated to support people with disabilities, if some of them will be able to support themselves. These people can integrate with the rest of society through work, which reduces their social exclusion and can have a therapeutic effect: "apart from financial security and at least the basis of existence, professional work is a form of integration for disabled people, a way to regain self-confidence and success in personal life. Hence, occupational rehabilitation (through work) should be one of the main priorities in the state's activities to support the subpopulation of people with disabilities" (Politaj 2008: p. 228).

What is the most effective way to support people with disabilities in the labour market? To answer this question, it is necessary to analyse the problems of the people trying to enter the labour market. One may start with the fact that in developed countries the labour market is changing. Every year there are fewer jobs requiring physical work, while the number of intellectual workers, whose work tool is a computer, is growing. Theoretically, this fact should make the access to the labour market for people with disabilities easier, because in many cases disability will not be a big limitation for this type of professions. In addition, social trends supporting tolerance, diversity and the fight against social exclusion have been developing strongly in recent decades. This trend should also contribute to easier access to the labour market for the disabled, from a socio-psychological point of view.

One of its manifestations is the concept of Corporate Social Responsibility (CSR) in business. This responsibility is expressed, *inter alia*, through various social actions connecting the world of business with the world of people with disabilities. The potential for change in this area is very high. According to the data of the Central Statistical Office of Poland for 2018, among the disabled people of economic working age the economic activity rate is 28.3%. In absolute terms, this means over 1.1 million people with disabilities outside the labour market. The same ratio for non-disabled people is 80.5% (see: GUS 2018).

Therefore, it is worth asking the questions: how should the professional empowerment of people with disabilities look like? What is the role of new technologies in this

process? There are two basic approaches to this subject in social policy, which are not necessarily mutually exclusive. The first approach is financial, assistance and legally stimulating employers to employ people with disabilities more willingly. This way requires allocating a specific budget for such purpose and very deliberate determination of aid rules and legal regulations in these aspects, in order to avoid abuse. The second approach is to promote self-employment and remove barriers. Activities in this dimension do not have to focus on people with disabilities, and they will still be among the beneficiaries of changes in regulations that streamline the process of setting up their own business, running it and accounting. Of course, it is also possible to additionally support disabled people choosing this form of employment, e.g. in Poland subsidies are paid by PFRON (National Fund for the Rehabilitation of the Disabled). Legal regulations should allow people with disabilities to take all kinds of actions, as long as it is not a threat for themselves and other people (Giełda, Raszewska-Skałecka 2015: p.119). This is directly indicated by the *UN Convention on the Rights of Persons with Disabilities*, where in art. 27: "States Parties recognize the right of persons with disabilities to work, on an equal basis with others; this includes the right to to the opportunity to gain a living by work freely chosen or accepted in a labor market and work environment that is open, inclusive and accessible to persons with disabilities." (United Nations 2006).

It should be mentioned, however, that the prolonged use of drones might have a significant impact on the psychological and emotional well-being of the pilots. The area is not thoroughly researched yet, as the topic is relatively new, but there are still studies which suggest that being a drone operator might have negative consequences for that person's health condition. In this paper the military uses are not discussed, but those obviously can lead to psychological trauma, similar to what the regular soldiers go through, eg. in the form of PTSD (Post-Traumatic Stress Disorder) (Christen 2014).

The same effect, although probably weaker, can be experienced by non-military, e.g. during rescue missions, security surveillance or even aerial photography. One moment the operator feels to be in the sky, in the middle of action, at the same time physically sitting or standing still. This is not a natural situation for the body, as it receives mixed signals – the eyes detect motion and the mind needs to react quickly, but the body stays still. This might not be a problem for a 5 minute long flight, but being a professional would require that state to persist every day, for long periods of time. This, in turn, requires special preparation and using stress-relieving techniques, so that the person's health is not impacted (Kille 2019). For people with disabilities further health deterioration is an even more serious matter, as they might be more vulnerable and easier affected. Keeping this in mind, one also has to think about the alternatives, such as sitting day after day in front of the TV. Any form of activity can be better than no activity at all. It has to be done responsibly, so that it is beneficial instead of harmful. Professional guidance might be useful for such people, to instruct them on how to prepare for drone flights, behave during them and deal with any physical or psychological problems which might result from such activities.

3.2. Drones as an opportunity for people with disabilities

The drones can have great potential in the area of empowerment of disabled people, primarily in terms of mobility. The vast majority of people with physical disabilities have the ability to remotely manage a drone just like a non-disabled person. By undertaking this activity, disabled people get a chance to open themselves to the world, to experience the feeling of flying and speed, as well as to socialise with other people. So, apart from the financial aspect, we can consider drones as one of the forms of rehabilitation. Nothing prevents the disabled people from joining the labor market as drone operators. Unmanned flights are a rapidly growing field, and the demand for operators is high, in the USA the demand for one hundred thousand drone operators by 2025 is estimated (Farrelly 2017).

Depending on the type and degree of disability, it may be necessary to adapt the remote pilot station to the capabilities of a particular pilot. However, these adjustments are relatively low cost, e.g. an appropriate joystick. For people with only one functional hand, there are specially adapted gloves on the market (Wepulsit.com WWW). More advanced technologies are also available, such as e.g. drone control using thoughts – the *Emotive kit* (Werenn 2012).

In 2016, the French charity organisation LADAPT in cooperation with Kindai implemented the project *HandiDrone*, in which drones adapted to the disabled people were prepared, and demonstrative flights were conducted for these people (Kindai.fr WWW).

This example demonstrates, that people with disabilities can be drone operators, in some cases they may require some adjustments, but it is not very expensive and complicated. However, there are also a few less obvious benefits, that unmanned aerial vehicle technology can give to disabled people. In the literature they are referred to as *Assistive Drone Technology* (Fall 2018), i.e. applications that make it easier for people with disabilities to function daily, but these people do not actively manage drones themselves.

An interesting example is the digital mapping of buildings, e.g. university campuses (Keppler 2016). We can set the programme for the drone to cover a specific route and save a three-dimensional image of the rooms. The drone can even automatically respond to unexpected obstacles and dynamically adjust its flight path (Passifiume 2017). Flights can be made cyclically, so the information will be updated. The three-dimensional map can be used by people in wheelchairs. Thanks to this, they are able to locate the desired point on the map and mark a route to it, on which they do not encounter barriers. If any part of the route is temporarily closed or new facilities appear, the map will be updated on a regular basis. In the case of large complexes, this effect would not be possible without automation. Such plan would also be useful for blind and visually impaired people, who, thanks to appropriate voice messages, would be able to navigate through this type of places more easily. Of course, this application benefits not only people with disabilities, it can be used, for example, for regular building inspections. The idea sounds a bit abstract, but there are already companies offering the simplified version of such services, e.g. *Industrial Skyworks* (Waterson 2016).

The drone can also be used as a "drone guide" for blind and visually impaired people. Attempts have already been made to use technology for this purpose, among others for

blind runners (Al Zayer et al. 2016). The response of the environment and acceptance for such use of this technology is also analysed in the literature. Respondents declare rather curiosity and positive attitude, so this technology has a chance for rapid popularisation (Avila Soto, Funk 2018).

At the University of Nevada, a prototype device was prepared that navigates the visually blind person in real time, but at the moment the regulations do not allow its use by the blind person, which results directly from the definition of VLOS flights – in Visual Line of Sight.

The popularisation of unmanned flights has contributed to the creation of a new sport - drone racing. Disabled people (e.g. deaf representative of Spain, taking part in the World Championships in Shenzen in 2019) are already taking part in such competitions (see: World Air Sports Federation 2018). It is worth noting, that being a sports player is often associated with specific health requirements and fitness tests. Even if the sport discipline in itself enables full participation of persons with disabilities, such participation must also comply with the regulations (regulations of competitions, association of athletes, as well as general national and international regulations specifying e.g. requirements for drone pilots).

It can be assumed, that other applications for drones will appear with the development of this technology. An example of such futuristic applications may be dog walking. This simple activity can be a really big challenge for a disabled person in a wheelchair. The use of a drone for this purpose, however, raises doubts, whether this situation is actually safe enough for both the dog and bystanders. For some time, even such devices were offered for sale, although it turned out later, that it was only a joke (Luna 2017). It caused a wide discussion, in which both supporters and opponents of the product spoke. In practice, this application will probably not become a reality, but it shows a certain direction, in which the inventors and producers are going to improve daily activities, that can be particularly helpful for people with disabilities.

3.3. The law and the access of persons with disabilities to the unmanned aerial flights market

At international level, unmanned flights are regulated by the Chicago Convention, but this convention does not deal with the issue of the possibility of disabled persons to play the role of unmanned aerial vehicle operators. At the level of the European Union, relevant regulations are being developed. The approach to people with disabilities contained in these regulations is not yet fully known.

In the Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircrafts the only condition is, that the drone operator (remote pilot) cannot "perform duties under the influence of psychoactive substances or alcohol or when it is unfit to perform its tasks due to injury, fatigue, medication, sickness or other causes" (Regulation 2019/947: Annex, part A, point UAS.OPEN.060)

From this regulation we can draw the conclusion, that if a person is able to fly despite the disease, then such a flight can be carried out (this regulation will enter into force on

1 July 2020). In Polish law, at the moment there are no restrictions for flights for sport and recreation purposes with drones weighing less than 150 kilograms, within visual visibility. If these conditions are not met, you must obtain a UAVO qualification certificate. One of its elements is a valid medical and aviation certificate on the absence of contraindications to perform the function of a member of the aviation staff, in accordance with art.105 of the Aviation Law (Prawo lotnicze 2018/1183).

It is interesting, that when paying for the exam, there is a discount for disabled people, which would indicate that they are allowed to use unmanned aerial vehicles. It is important, however, to analyse what health conditions are required by the medical aviation certificate. Finally, the medical practitioner decides about the admission of the person, but there is a regulation listing the contraindications to performing the role of aviation personnel.

The Regulation of the Minister of Infrastructure from December 20, 2018 amending the regulation on excluding the application of certain regulations of the Aviation Law to certain types of aircraft and determining the conditions and requirements for the use of these vehicles introduces a significant change in this issue: "in the case of unmanned aircraft, take-off mass of no more than 5 kg, used only in operations within the visual visibility range of VLOS for purposes other than recreational or sporting purposes (...) physical and mental fitness of an unmanned aircraft operator used for purposes other than recreational or sporting purposes, shall be determined on the basis of this person, a written statement that the persons' state of health allows them to perform their aviation activities safely" (Rozporządzenie Ministra Infrastruktury 2019/94).

3.4. Health requirements in aviation law

The Polish regulation of the Ministry of transport, construction and maritime economy defines the requirements for the mental and physical condition of aviation personnel, and therefore also drone operators. Such persons may not have a history of psychiatric, mental illness or clinically diagnosed nervous system abnormalities, including injuries; bone, joint, tendon and muscle diseases; abnormalities in body height, length of upper and lower limbs, and weakness in muscle strength that prevent safe flight operations; disorders of the eye and its appendages, resulting from congenital or acquired diseases and following surgical procedures or eye injuries; disorders in the correct perception and recognition of colors; disorders of the functions of the ears, nasal cavity, collateral sinus of the nose, throat, mouth, teeth and larynx, resulting from congenital or acquired diseases and as a result of surgery or injuries. This means that the majority of people with disabilities are excluded from aviation activities under this regulation. This regulation does not distinguish between manned and unmanned aviation. Similar guidelines also exist at European level, such as Commission Regulation (EU) No 1178/2011 and its annexes.

In this case, there is also no differences between manned and unmanned aviation, the Polish translation even suggests that the Regulation applies only to *"aircrew"*. An attempt to definitively answer the question of whether a person with a disability may legally be an unmanned aircraft operator, does not bring results today. It is understood that the re-

quirements for aviation personnel are relatively restrictive, but the drone operator would theoretically no longer have to meet such criteria, as long as air traffic safety is ensured at all times. This issue has been included in ICAO Circular 328 – pilots must "be proficient in the language used for radiotelephony and meet medical fitness levels, although the latter may be modified as appropriate for the UAS environment" (ICAO 2011, Cir. 328: par. 2.14).

Conclusion

Drones have recently become available for civil flights. Until now, this technology was available only for the military purposes, but over the last few years it has been rapidly popularised for civilian applications, such as sports, recreation and commercial use. At the same time, aviation law is very complex and difficult to change. As a result, legal regulations for unmanned flights at the European Union level are still under development.

During this time various legal regulations were created in national legislative systems, however, not always consistent with each other. This fact introduces additional complications, when attempting to harmonise this law at the international level. At the same time, however, drones bring new opportunities for professional empowerment of the disabled people. As was mentioned earlier, drone operators are in great demand, currently the specialists on the market are scarce. This means attractive working conditions and an opportunity for people with disabilities, if they could obtain the required qualifications and meet the conditions of physical and mental health. At least theoretically, full physical health is not necessary to be a drone operator. In addition to professional empowerment, drones are also a chance for improvement in everyday life. New ways of using drones will probably appear in time, but their adoption depends on whether the law allows these new, previously unknown activities. From the presented analysis we can draw the major conclusion, that in order to use the opportunity, which the unmanned flights provide for the mankind, and for the people with disabilities in particular, the precise regulations need to be developed.

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