Műszaki Katonai Közlöny

XXVII. évfolyam, 2018. 3. szám

Tibor Tóth[1]

THE USAGE POSSIBILITIES OF UNMANNED AERIAL VEHICLES IN THE ACTIVITY OF THE VOLUNTARY RESCUE ORGANIZATIONS

(A PILÓTA NÉLKÜLI LÉGIJÁRMŰVEK ALKALMAZÁSÁNAK LEHETŐSÉGEI AZ ÖNKÉNTES MENTŐSZERVEZETEK TEVÉKENYSÉGÉBEN)

The voluntary rescue organizations cooperating with the professional disaster management organizations and accepting their leadership have a significant role in the quick and efficient elimination of the natural and man-made disasters. Most of these rescue organizations posses an unmanned aerial vehicle (UAV)[2] *that enable the immediate aerial reconnaissance and data collection at large-scale damages and flood protection tasks. The technical parameters of UAVs and the sensors and cameras they carry are constantly evolving. The "bird's-eye view" exploration reduces the intervention costs and gives a quick decision to the intervention managers.*

Keywords: *disaster management, voluntary rescue organization, unmanned aerial vehicle, drone*

A hivatásos katasztrófavédelmi szervezetekkel együttműködő és ezen szervezetek vezető, irányító tevékenységét elfogadó önkéntes mentőszervezetek jelentős mértékben hozzájárulnak a természeti és civilizációs katasztrófák gyors és hatékony felszámolásához. Ezen mentőszervezetek többsége ma már rendelkezik olyan pilóta nélküli légijárművekkel (UAV), amelyek lehetővé teszik a nagy kiterjedésű káreseteknél, árvízi védekezési feladatoknál, az azonnali légi felderítést, adatgyűjtést. Az UAV-k és az általuk hordozott szenzorok, kamerák technikai paraméterei folyamatosan fejlődnek. A „madártávlatból" végrehajtott felderítés csökkenti a beavatkozási költségeket, gyors döntési lehetőséget biztosít a beavatkozás irányítóinak.

Kulcsszavak: *katasztrófa védelem, önkéntes mentőszervezet, pilóta nélküli légijármű, drón*

INTRODUCTION

The purpose of the establishment of voluntary organizations was to provide more effective, multifaceted and cost-effective ways of saving lives, natural and material assets, by involving these rescue organizations in the damage control and rescue. The voluntary rescue organizations have national classification, recognize and accept the leadership of a professional disaster management organization. During the establishment of the rescue organizations, one of the primary considerations was to develop the technical and personnel conditions of the rescue organization, taking into account the territorial dislocation of the site of establishment and the disaster threats. In most cases the rescue organizations posses skills, technical equipment and skilled managers that professional organizations do not posses or only to a limited extent. Such equipment of the volunteers is the unmanned aerial vehicle.

[1] National Directorate General for Disaster Management, Ministry of Interior, E-mail: tibutoth66@gmail.com. ORCID: 0000-0002-7029-7423

[2] Unmanned Air Vehicle is the denomination of an aerial vehicle that has no personnel on board, commonly used name: DRONE.

The events of the recent years and the natural and civilizational disasters of the recent past clearly point out that we can only effectively tackle the devastating effects of disasters if, besides state organizations, voluntary and charitable organizations also play a role in creating a unified level of security. The right to security is a fundamental human right, which is proclaimed by the Fundamental Law of Hungary. The prevention and protection of disasters is a national matter and a duty of citizenship. [1]

Voluntary rescue of human life, natural and material resources has centuries-old traditions in Hungary and worldwide.

The voluntary rescue organizations closely cooperating with the Hungarian disaster management developed progressively from 2009 onwards. Local, district, and municipal voluntary rescue organizations were established. They have been established in different organizational forms, based on the territorial features and the threat of their area of operation. Within the organizational framework, there are volunteers working in associations, foundations, charitable forms, but numerous volunteers joined to a fire or civil protection association. The organizational form significantly influences the opportunities for achieving technical development opportunities, but by today all voluntary rescue organizations have reached the organizational structure that makes it possible to use the state procurement opportunities to obtain the latest technical tools. [2]

"Voluntary rescue organization: a voluntary civil society organization with specially trained personnel with special technical equipment to prevent and eliminate disasters, emergencies and their consequences, execute disaster management tasks and save human lives" [1]

The special composition, preparedness, and high flexibility of voluntary rescue organizations makes them able to keep pace with the development of technology, incorporate them into their work and apply it in everyday practice. Voluntary rescue organizations put a special emphasis on staff training and besides that to develop their detection and rescue capabilities, along with the development of their technical equipment.

My goal is to explore the aerial reconnaissance capabilities of the voluntary rescue organizations in Hungary. I compare the traditional discovery and decision support results with unmanned aerial vehicles, examining domestic and international exercises and real deployments.

By studying the relevant domestic and international literature, I look for new opportunities and further development directions with the opportunity to involve volunteers. I regularly consult on the experiences of applying national and neighboring countries' voluntary rescue organizations and on the results they have achieved in this area. I participate regularly in conferences on aerial photography and remote sensing for civil purposes, sharing my results with the participants. These conferences are a particularly good opportunity to get acquainted with new domestic and international developments to discuss development opportunities.

The development of civilian use of unmanned aerial vehicles (UAVs) also opened new opportunities for voluntary rescue organizations. In Hungary the pioneer of the application of

unmanned aerial vehicles for disaster management purposes was Ágoston Restás, associate professor who first examined the applicability of UAVs in the exploration of forest fires in Hungary and put into operation unmanned aerial vehicles to observe forest fires for the first time in the world. [3]

Many voluntary rescue organizations already have the ability of local aerial reconnaissance, as they mainly use UAVs either by procuring or using own-development or custom-built UAV. The experience of aerial vehicles use differs considerably, as the capacity, the development of the vehicles, and the intelligence, data capture, remote sensing and other devices they carry are extremely diverse. There is also uncertainty among disaster management and voluntary rescue organizations due to the lack of ethical, legal and aviation regulation of applicability.

In Hungary, according to the relevant regulations, a voluntary rescue organization can participate in the defense against the effects of disasters and emergencies if it has obtained the qualification in the National Qualification System, in compliance with the specified basic qualification and preparedness requirements. The qualification must be renewed every five years. The requirements of the National Qualification System are defined by the Governmental Decree on the Implementation of the Act on Disaster Management [4].

In order to carry out the national qualification exercises, the National Directorate General for Disaster Management, Ministry of Interior defined the organizations' professional requirements in its Organizational and Operational Guidelines, as a recommendation for the following capabilities:

- flood and water rescue capability,
- diving activities,
- rope rescue specialty,
- dog search specialty,
- urban search and rescue (USAR), technical rescue specialty,
- management and logistics capabilities,
- basic water damage prevention activities. [3]

Using the experience of practical application so far and the guidelines of the UN's International Search and Rescue Advisory Group (INSARAG)[4], I propose to develop training and operational guidelines for the use of unmanned aerial vehicles in the operational area. In this article, the reader receives a brief overview of the development of unmanned aerial vehicles. At the same time the article also seeks to find out that in which areas the drones can play a greater role through the development of equipment of the voluntary rescue organizations.

[3] Online: http://www.katasztrofavedelem.hu/index2.php?pageid=polgarivedelem_minositesek
[4] International Search and Rescue Advisory Group (INSARAG)

THE SHORT HISTORY OF DEVELOPMENT OF THE UNMANNED AERIAL VEHICLE SYSTEMS (UAS)[5]

Nowadays the unmanned aerial vehicle systems are increasingly widespread and being used, thanks to the advanced and safer technologies and their declining prices. For the 1960s, this system, like many other modern tools, first appeared in the army. Then the destruction or the promotion of it was its main task and not the user's needs. As a result of the acceleration of technical development, a wide range of devices with various size and purpose were created that are part of our daily life. Among the development of aircrafts, perhaps the most dynamic is the development of the unmanned aerial vehicles. It is almost impossible not to hear media news about the tasks carried out by such devices. [5]

The "profession" of aerial reconnaissance, observation and control was born immediately - as the first flying device raised the man to the air - and still exists when one does not have to fly - just to look at us with "big brother's eyes" from the sky. In the 21th century, robots were clearly involved in the armaments' toolbox and it would turn out sooner or later when they will fight each other. Pilotlessness is not only exacerbated by the overwhelming burden of losing a lot of professionally trained personnel, but the hand is also easier to move - with the big finger down - when "just" one button needs to be pressed. [3]

The first attempt was in 1849 when the then Austrian troops attacked Venice with flammable explosive substances and balloons with timers, as illustrated in Figure 1.

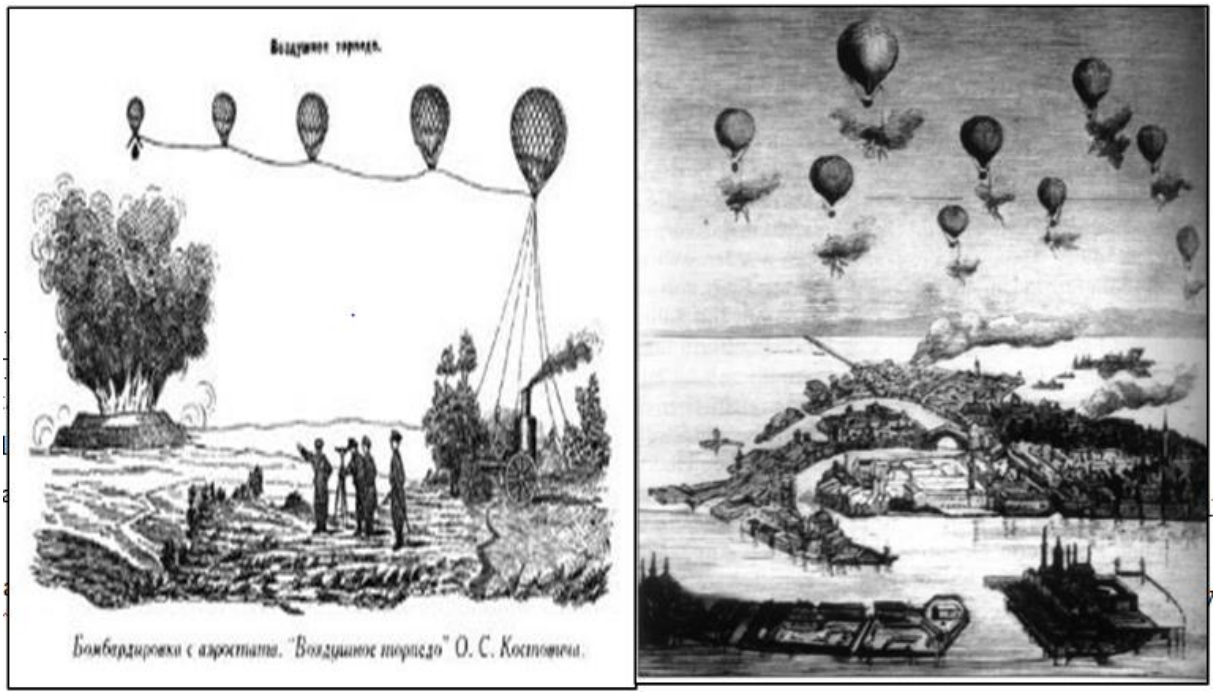

Figure 1: Contemporary drawings about the bombing of Venice[6]

[5] UAS – Unmanned Aircraft System, the environment that ensures the operation of the unmanned aerial vehicle
[6] Source: Palik M.: The development of unmanned aviation, Ludovika Open University, presentation

The so-called aerial torpedoes appeared in the 1910s, which were still inaccurate devices. By the late 30's, the British Army already used radio-controlled aircrafts against warships, which had a range of 150 to 180 kilometers. The first successful remote controlled machine was basically embodied by Reginald Denny[7]. The machines used by the army at that time served even less warlike goals. They were used especially as "target" tools for military exercises and training, since they did not just fly well, but were also relatively inexpensive. The Germans and Allies also made significant improvements in this area in the Second World War: the US Navy, for example, produced tools capable of carrying torpedoes that were finally not involved in the war.

The unmanned devices were used in battle conditions in the Vietnam War for the first time; over 10 years the American airborne reconnaissance machines were involved in over 3400 missions, which were able to fly up to 14,000 feet high. It was a major step forward that by the end of the war these drones were able to transmit real time information to ground units. Unmanned aircrafts appeared in the Arab-Israeli war and after that in the Gulf Wars. In the latter, the drones were also used for multiple tasks, among others, they assisted the deployment of combat helicopters and the night observation of the bases was carried out with these devices. In their Hungarian aspect, it can be mentioned that during the South Slav war reconnaissance machines were stationed in Taszár, which were controlled from the United States during the deployment. [6]

These aerial vehicles have served well (and are still doing) in the anti-terrorism operations, so these machines appearing in ever-smaller sizes were and are still used in Afghanistan and Iraq. However, one must not forget the important fact that the majority of the drone is still operating with human control. For example, in civilian life, almost exclusively such devices can be found. There are very significant differences between each types; from the hand launched 1-2 kg aircraft to the multi-tensile flying structures there are many tools available for civilian and military use.

The latter is a good example of the US Global Hawk unmanned reconnaissance aircraft (Figure 2), which task is to observe the battlefield. It can carry out its task efficiently for a long time and at high altitudes. Unmanned aircrafts nowadays perform their duties with greater accuracy and precision than man-made air deployed devices. Tiredness and various psychological effects have a significant influence on the decision-making capabilities of pilots, especially when they are engaged in long stakes. An example of this is the South Slav war, when the US B2 bombers flew up to 30 hours in a single mission.

[7] English movie actor (1891-1967).

Figure 2: MQ-4C Triton drone[8]

Soldiers use the drones most often for intelligence, observation, and attack on ground targets.

In addition to its public service function, unmanned aerial vehicles can be used for trade (for example, in Figure 3, we can find a solution in farming) and research purposes in civilian life. However, more and more people use them in the private sector thanks to their rapid technical progress.

Figure 3: The spraying drone[9]

[8]Source: https://www.bing.com/images/search?view=detailV2&ccid=8685smaH&id=7340BE1AAAB496CEC4FA6BC2BB23B22291EEA669&thid=OIP.8685smaHPzOsNqLabX9NTAHaFj&mediaurl=http%3a%2f%2fwww.blogcdn.com%2fwww.engadget.com%2fmedia%2f2012%2f06%2fmq-4cbamstriton.jpg&exph=450&expw=600&q=mq-4c+triton+maritime+drone&simid=607995276383159192&selectedIndex=1&ajaxhist=0 (Time of download: 23.04.2018)

[9] Source: https://www.bing.com/images/search?view=detailV2&ccid=Q0CMO8Em&id=657BDB339BE97B0438768EB2995498D05504C5C8&thid=OIP.Q0CMO8Emqnq6VCLYzP1B5gHaFj&mediaurl=http%3a%2f%2fstatic3.businessinsider.com%2fimage%2f598b5e4b76084a26008b760c-2400%2fdrns.jpg&exph=1800&expw=2400&q=business+drone+use&simid=608008762562710013&selectedIndex=0&ajaxhist=0 (Time of download: 23.04.2018)

For the purpose of voluntary rescue organizations, due to the nature of the special tasks, the relatively small electrically driven multiple rotor drones spread. Currently, the most widely used models are DJI Phantom 3 Professional and DJI Phantom 4, of which value-for-money ratio corresponds to the opportunities and needs of voluntary organizations. The scale of data recording and data transmission devices carried by a flying device moves on a much wider scale. Here one can find a range from the millions of Hungarian forint night vision cameras to a couple of ten thousand forint digital cameras.

Figure 4: DJI drone in use of Körös Rescue Team[10]

UAV PRACTICAL APPLICATIONS

In this article, I do not have the opportunity to provide a complete, comprehensive analysis of the possibilities of UAV applications through the classification of disaster situations in the UAVs for disaster management purposes, as this goes beyond the limits of this article. I intend to focus only on a few areas. We have achieved remarkable results with UAVs in these areas, thanks to our well-prepared and committed voluntary rescue organizations.

UAV APPLICATION DURING USAR[11] ACTIVITY

During the exploration in the ruined area of damage in densely built urban or industrial environments, a low-altitude aerial reconnaissance is indispensable besides the instrumental reconnaissance and dog searching carried out by rescue personnel.

[10] Source: Tibor Rosta Körös Rescue Team
[11] Urban Search and Rescue (USAR)

Advantages of UAV air observation:

- almost immediate deployment after the disaster,
- relatively large areas can be explored in a short period of time,
- immediate, inline information for the decision makers,
- immediate analysis of the transmitted data,
- completely safe for the operator carrying out the exploration,
- by dividing the area to be explores many drones can be used simultaneously,
- can be simultaneously used with other search and exploration methods,
- can be used in areas of chemical, biological and radiological contamination,
- it is possible to deliver "survival package" to inaccessible areas,
- cost efficient.

In most cases buildings and infrastructure injuries in urban environments make human exploration extremely difficult and slow. Professional and voluntary rescue organizations with traditional rescue techniques can only get a realistic picture of the real dimensions of damage and the extent of destruction with a certain loss of time.

As the voluntary rescue organizations are able to access the damage area in a short time due to their territorial dislocation, they are able to provide real-time, relevant information to rescue managers by means of their aerial reconnaissance tools.

In the event of the destruction or damage of medium-high and high buildings or hall-type buildings, the use of high-altitude fire-fighting equipment can only be initiated after a safe installation. Installing these tools near the damage sites is extremely time-consuming or unmanageable. Therefore scanning from high-altitude applications would also be delayed or impossible.

The costs of the high-altitude rescue vehicles used by the fire services exceed the cost of the drone, and in any case at least two specially trained personnel are required to operate them.

Drone purchasing and standby costs are steadily decreasing and are now available for everyday use. Figure 5 shows the UAV image taken after the earthquake of 6.1 magnitude in 2014 in Yunnan, China. In Figure 6, the traces of the destruction of a local storm that is common in Hungary, which was formed in Orosháza in 2017.

Figure 5: Earthquake in Japan[12]

Figure 6: Destruction of the storm in Orosháza[13]

UAV APPLICATION IN CASE OF INFJURIES OF CRITICAL INFRA-STRUCTURE ELEMENTS

After saving human lives and material assets in disaster areas, one of the most important tasks is to detect and repair the damage to vital networks and infrastructure elements. The attribute of the disaster is that in most cases it is also difficult to transport the rescue forces and equipment to the venue, or it can be achieved with a significant loss of time in case of a road and railway network damage. In these cases, the use of UAVs is invaluable in exploring opportunities for access and rescue forces to arrive at a venue before commencing primary detection.

The drones of the district and municipal voluntary rescue organizations may provide accurate data on the accessibility of the damages before the arrival of the professional rescue forces.

[12] Source: https://www.csmonitor.com/Science/2011/0311/8.9-earthquake-The-science-behind-Japan-s-quake (Time of download: 23.04.2018)
[13] Source: Krisztián Melega Körös Rescue Team

Figure 7 shows a damaged railway infrastructure due to a storm in Orosháza in 2017. This local and short-term wind storm generated nearly 300 cases of intervention to the professional rescue forces involved. Due to the high number of cases, there was a need for rescue forces and devices from the neighboring cities. Roadblocks significantly slowed down the rescue forces' arrival at the scene. Therefore it was of great importance to the immediate detection of a voluntary rescue organization in the city by UAV.

As a result, the arriving rescue forces knew exactly where and by what distance they were to be contacted. Moreover the operational management could make well-founded decisions about the prioritization of interventions and the forces and assets needed for the elimination of the consequences.

Figure 7: Exploration of railway network by UAV[14]

The vulnerability of the line systems above the ground - electrical and telecommunications wires - has serious consequences both for the supply of the population and for normal living conditions and for the industrial sector. It is particularly difficult to determine the extent of damage to ground-based networks away from populated areas without a viable road network. In 2013 in Szabolcs-Szatmár-Bereg County, the overload caused by the drizzle and thunderstorm caused the fall of twenty 400 kV high-voltage lines. Determination of the location of fallen columns was hampered by the overgrown and mostly swampy area. Therefore, the involvement of heavy-duty military off-road vehicles and voluntary rescue organizations was already required to identify the damage. In similar cases, drone exploration along the track reduces the boundary location and its costs by order of magnitude.

Devices that can be carried by UAVs are limited only by imagination and the mass of devices.

[14] Source: Krisztián Melega, Körös Rescue Team

Figure 8: Fault detection of electric network by UAV[15]carrying thermo camera

UAV APPLICATION DURING FLOOD AND INLAND WATER PROTECTION

Hungary's flood hazard is the highest in Europe[16]. Inland water hazards affect 45% of our country. Volunteers and voluntary rescue organizations cooperating within an organized framework are used in a massive amount of number to protect the devastating effects of floods. From the recent past, a number of national and cross-border examples can be outlined of the role that volunteers have played in the successful flood protection. In case of the floods in Hungary, during the flood of the Danube River in 2013, the Disaster Management has already used drone aerial reconnaissance in many cases and almost all voluntary rescue teams in Hungary took part in the defense. In my view, the most and most effective application of UAVs is flood protection.

If only the period of operational protection is examined, it can be clearly stated that current and widely used drones can be successfully applied to a number of flood and inland water protection activities.

[15] https://www.drone-thermal-camera.com/drone-uav-thermography-inspection-highvoltage/ (Time of download: 24.04.2018)
[16] https://www.vizugy.hu/index.php?module=content&programelemid=62 (Time of download: 24.04.2018)

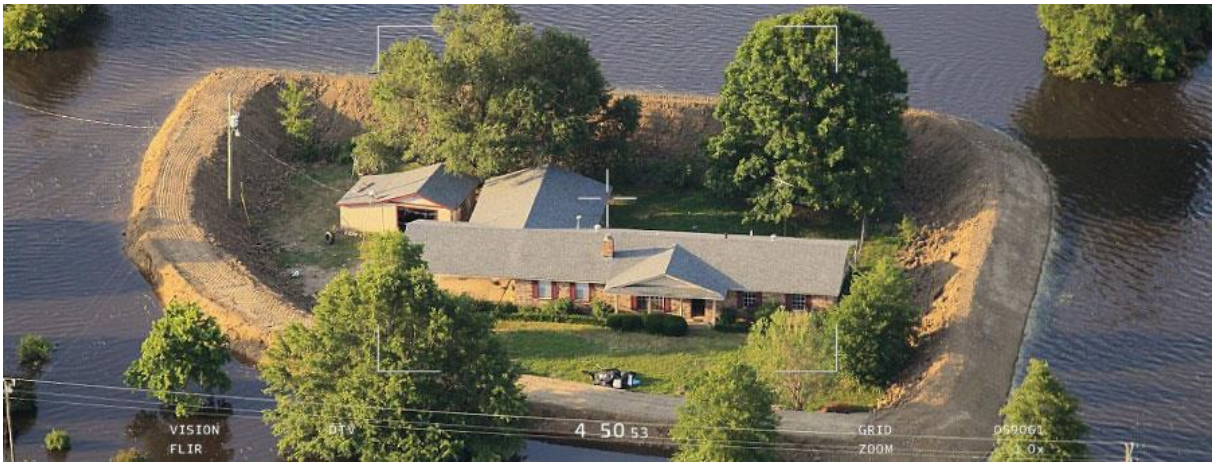

Figure 9: House surrounded by flood[17]

Most of the flood protection facilities in Hungary are earth dam and only a small part of them are built buttress. In case of the earth dams, there are a number of problems during the protection, the causes of which are found in the establishment, the lack of development and the aging. The causes are due to different and not always suitable building materials, incorrect technology, and the so-called "aging, when mineral and organic corrosion" of the built earth is progressing, resulting in swelling, shrinkage caused by watering, jerking and dehydration. Harmful changes can also lead to reduced compactness. Serious problems may also be caused by the holes in the animal and animal nests. Earth dams are often covered by a solid covering, but most of them use lawn cover to protect their copper.

Damage or deterioration of lawn coverings may also weaken the safety of earth dams. The flood protection experts - and decision-makers responsible for the effective protection - face the most serious professional task of flood control, which is the regular monitoring of the various land areas, the assessment of the flood phenomena, and the necessary interventions to be defined, carefully implemented and monitored. It is very important to observe the phenomena, the timely detection and the rapid action. [7]

Professional and voluntary rescue organizations involved in flood protection had a very limited number of times available to involve the UAVs to carry out the above-mentioned observation tasks. Observations were carried out by "guardians", who were often tasked to monitor and guard protection ramparts, often with pedestrian crossings of several kilometers of holes, equipped with a shovel. Before the spread of mobile phones, there was often no radio connection between supervisors and decision-makers, so the information was transmitted with an extremely high loss of time for the managers of the protection.

Today, we've got the opportunity to establish an online real-time connection between the drone and the driving point using many UAVs and special data recording and data transfer tools. It's up to the software developers and customers to decide whether computers should make comparisons between the expected and real-world instead of people.

[17]Source: https://www.embention.com/en/news/drones-for-flood-prevention-operations/ (Time of download: 24.04.2018)

The protection of inland waters is characterized by long-lasting activity, so there is time to plan and carry out the necessary detection and remote sensing tasks. In case of inland waters, the most important task of the disaster management and the cooperating voluntary organizations is to protect housing and facilities surrounded by inland waters, thus providing housing and operating conditions. For this purpose, in cooperation with water management organizations, water drainage should be solved, which can be done by using gravity or through forced pumps. In exploring the possible alternatives, aerial reconnaissance means a great deal since the use of the available maps can be significantly affected by the excavation work from the cultivation branch.

The use of unmanned aerial vehicles in the flood protection deserves a separate dissertation, since the airborne examination of flooding phenomena and the possible inundations are rapidly gaining momentum with the development of the devices.

UAV APPLICATION DURING PERSONAL SEARCH

The assistance of voluntary rescue organizations in the application of UAVs is now being sought by the co-operation authorities in the search for missing persons. Personal search is not clearly the responsibility of the disaster management, but as voluntary rescue organizations perform their indispensable tasks under the supervision of the disaster management, this task is the greatest part among their duties carried out by drones.

When looking for missing persons, time factor is the most critical. The success of the task is largely influenced by the time between the disappearance and the start of the search, the age, physical and mental condition of the missing person(s), the size of the area and the time of the day, the weather and terrain as well as the area of the claimed location.

Our practical experience shows that drones equipped with thermo cameras will compete with dog search in research.

Drone application has many advantages over live and dog search. The drone can be applied to all terrain - that can be explored from height -, whether it is open-flooded areas or swamps. Wild animals living in the area do not interfere with the drone, which can fly the pre-programmed route during the exploration. Of course, disadvantages should also be considered. The climatic conditions affecting the flight conditions and the coverage of the research area - with a high density of vegetation - should be mentioned first of all.

Figure 10: Picture of a thermo camera[18]

In real deployments, drone exploration proves to be excellent in water-surface research. In many cases, the available boat cannot be used on water surface research. This may be due to the low water depth, the strong drift or the dense water vegetation.

Promising attempts are being made in the area of water rescue with the delivery of the rescue equipment - e.g. life jackets, rescue hammers, life rafts - to the persons in trouble. These experiments mean a very fast and safe solution for the rescue forces, especially when it comes to people in the frozen and broken water surface.

Figure 11: Delivery of life jackets to troubled persons[19]

[18] Source: Krisztián Melega, Körös Rescue Team
[19] Source:https://www.google.hu/search?q=uav+in+action+fire+extinguishing&client=firefox-b&dcr=0&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjonp2hup_XAhWRyKQKHS3yDnYQ_AUICigB&biw=1366&bih=659#imgrc=PlQzPioQnpW47M (Time of download: 24.04.2018)

UAV APPLICATION DURING FIRE EXTINGUISHING

The professional and voluntary firefighters who are always open to technical innovations, and who also need to be in fire at high-rise buildings, are perhaps concerned about the question most whether drones can be used over the range of platforms in order to prevent the spread of fire, to localize fire and possibly to save people. If the answer is yes then what is the extinguishing performance, how much useful loads can be transported, how the continuous fire extinguisher supply is ensured, how the air exchange on fire and the turbulence of the drone's flight characteristics are affected. Besides that, several questions must be answered, as long as firefighting with drones becomes a day-to-day practice. The exploration of the magnitude and spreading directions of outdoor fires, and the location of natural and artificial fire extinction features was carried out by Ágoston Restás first time in the world, a former firefighter commander of Szendrő, who was mentioned earlier in the introduction.

At present, experiments are being carried out to develop drones that can be effectively applied to the fires of high buildings and skyscrapers. The development of the drones is mostly promoted by the developed countries of the Arabic region, as in case of skyscrapers many fires seem to be overwhelmingly paralyzing several floors, fading on the facade and spreading there. If these fires cannot be extinguished by the automatic fire extinguishers installed in the building, it is necessary to develop high-performance and coordinated fire extinguisher drones. Figure 12 shows the concept of how the drone can be applied to the high buildings fire and how to ensure the extinguishing material supply. This experiment has successfully been tested in several countries in experimental conditions.

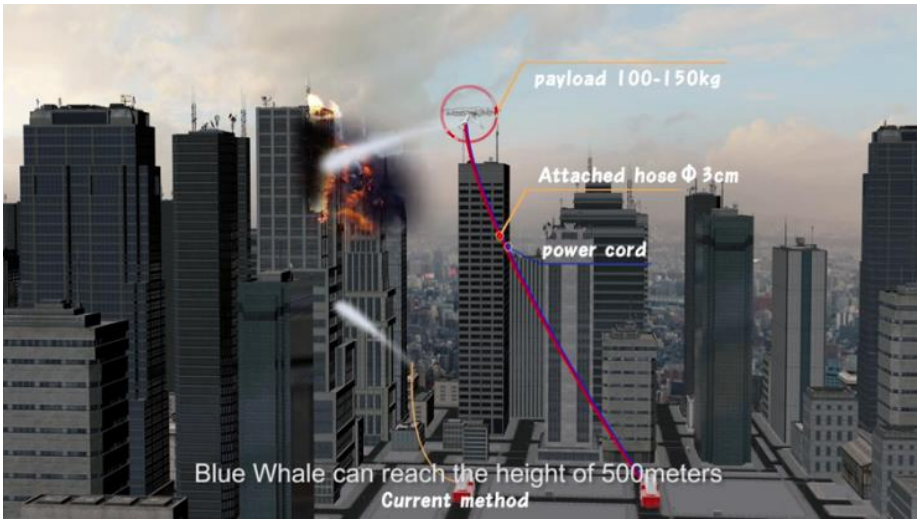

Figure 12: Fire extinguisher drone[20]

[20] Source: https://techcrunch.com/2016/04/27/mmc-drones-indiegogo/ (Time of download: 24.04.2018)

CONCLUSIONS

Voluntary rescue organizations represent our society and our community. Volunteers contribute greatly to the effective management of problems through their activities and engagement. This can only be achieved if we can involve as many people as co-workers and supporters as possible in the rescue groups.

A rescue team is viable if it is able to present committed volunteers to its mission and the pursuit of its goals. The more volunteers we can engage in our work, the more support of the society and the local community we can experience.

During the community work, responsibility, civil engagement, trust, respect for others, mutuality and solidarity are strengthened within the participants in most cases. Technological progress is inherent to the fact that the equipment used in industry and services is increasingly complex systems, so their management and supervision is greater. The power of volunteering can be stronger and more effective in addressing the local problems. Participation in active local help provides an opportunity to develop proactive skills. These are also core values of the community development work that require attention and professionalism.

According to our experience, the disaster management and voluntary rescue organizations can effectively call and invite into their roles those - mostly young - experts who are committed to their professions or hobbies and who are interested in the specialty of unmanned aerial vehicles. The ability to help our fellow human beings and the experience of success attract these people to become volunteers.

The widespread use of UAVs, including disaster management applications, has huge opportunities. Our task is to integrate the research and development results into our system, increase the efficiency of the use of these tools with innovative developments, and further reduce the cost of systemization and system maintenance.

Overall, it can be stated that the detection and rescue capabilities of the unmanned aerial vehicles used for disaster management purposes have many opportunities for decision-makers. With conscious research and development work, involving volunteers dedicated to this subject, it is certainly recommended to focus on this area.

In Hungary we have to reckon with a number of disaster risk. The disaster at the nuclear vulnerability's establishments is one of the most serious hazards in our country. The possible occurrences of accidents ignore the national borders. At the prevention of disasters, in the defense against them, and in the occurence of remediation after they occur, the technical tools are becoming more involved. Such devices include the air vehicles which can be used in carrying out the tasks disaster widely, within the radiological detection of nuclear accidents. [8]

PROPOSALS

I am convinced that specific regulation on unmanned aviation should be developed. At the present time, in case of handling, flight exercises and real applications, if there is no special legal

order in the area, the airspace license required under the civil aviation rules must be obtained. According to our practical experience, a voluntary rescue organization has not yet requested an airspace license for either exercise or real application. Occasional airspace license is already available online [9], but this license is not yet available quickly enough for a real application.

Using the experience of practice so far and the UN International Search and Rescue Advisory Group's (INSARAG) guidelines, I propose to develop training and operational guidelines for the use of unmanned aerial vehicles in the operational area. I also propose to develop a Code of Ethics for the use of unmanned aerial vehicles for voluntary rescue organizations.

REFERENCES

[1] 2011. évi CXXVIII. törvény a katasztrófavédelemről és a hozzá kapcsolódó egyes törvények módosításáról.

[2] Voluntary rescue organizations can apply for procurement this year as well. http://www.katasztrofavedelem.hu/index2.php?pageid=szervezet_hirek&hirid=4244 (Downloaded: 2017. 10. 30.)

[3] Mátyás Palik, Dr. (editor): Unmanned aviation for professionals and amateurs. National University of Public Service, Budapest, 2013. ISBN 978-963-08-6923-2. pp.22.

[4] 234/2011. (XI. 10.) Kormány rendelet a katasztrófavédelemről és a hozzá kapcsolódó egyes törvények módosításáról szóló 2011. évi CXXVIII. törvény végrehajtásáról

[5] Gábor Major: Is the usage of drones ethical? Honvédségi Szemle 144. HU ISSN 2060-1506. p.100.

[6] Mátyás Palik, Dr.: The development of unmanned aviation, Ludovika Open University, presentation, 20.10.2015 http://uni-nke.hu/uploads/media_items/7-palik-matyas-eloadas.original.pptx 2015.10.20. (Time of download: 29.10.2015)

[7] László Nagy, Lajos Szlávik, Dr. (editor): Flood management in practice Transportation Documentation Ltd. 2004. ISBN 963-552-381-5. pp.137.

[8] Manga László, Kátai-Urbán Lajos, Vass Gyula, Csurgai József: Unmanned Aerial Vehicles In The Radiological Reconnaissance VÉDELEM TUDOMÁNY : KATASZTRÓFAVÉDELMI ONLINE TUDOMÁNYOS FOLYÓIRAT II. (2): pp. 63-75. (2017)

[9] Ágnes Török: Unmanned aerial vehicles: legal background and its application. presentation 2017. Szeged, Aerial photo day http://www.geo.u-szeged.hu/index.php/hu/122-szegedi-legifoto-nap-2k17 (Time of download: 01.11.2017)