LUDOVIKA UNIVERSITY OF PUBLIC SERVICE

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The possibilities of Unmanned Aerial Systems (UAS) for national security purposes, technical constraints and ethical issues

Review of the doctoral (Ph.D.) dissertation

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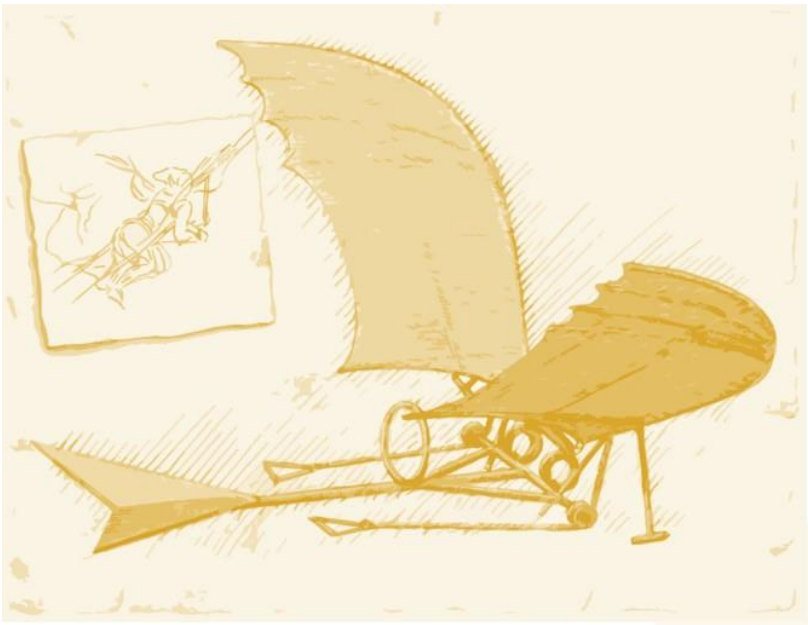


„The General, if he knows where the battle will take place, has to watch that particular place from a distance in order to be able to direct his troops properly."

Szun-Tzu

1. JUSTIFICATION AND ACTUALITY OF THE CHOICE OF THE THEME

Ever since the aircrafts were designed, built and took to the skies for the first time, they have been reaching new heights, sometimes dazzling and sometimes terrifying people with their capabilities and perhaps their size. Progress has not stopped since, and the explosive growth. of aeronautics industry has started. Faster, larger, more powerful, longer-range, and then more economical, more environmentally friendly aircraft were developed, until the point was reached where the pilot was no longer on board, piloting his vehicle and doing everything he could do in his aircraft that he had previously done in the cockpit. What could led them to "take the stick" out of man's hand and fly the plane without a crew on board?

In nearly 300 years since the start of the technological revolution, more and more efficient objects, tools and vehicles have been produced than in the millennia before. Even so, despite more than 2,000 years of human history, despite the technical, technological and scientific boom, the history of powered flight is barely 120 years old.

The development of automated structures would not be at its current level without the revolution in microelectronics and the "knowledge growth" of computational architectures, which is accompanied by the growing use of physical and software-based artificial intelligence, even in everyday life.

Artificial intelligence is a fast expanding field of computer science and computer engineering, which aims to develop intelligent machines and solutions that are capable of performing tasks that require human intelligence. People working in this field are creating algorithms and models that can learn from the information provided, reason and make decisions, recognising patterns and interacting naturally and intuitively with people and their environment.

Since the wars of the 1990s, UCAVs[1] have played an increasingly important role. In these years, remotely piloted reconnaissance, surveillance and armed UAS, occasionally mentioned in news reports of these armed conflicts, became known to the world as an element or tool of warfare. In the last year, with the Russian-Ukrainian war, it has become almost commonplace to see them in the news. The developments and the hiding combat potential of unmanned aerial vehicles have made drones an accepted part of conventional warfare.

[1] Unmanned Combat Aerial Vehicle - (a detailed description of the type and its use and development in the [S1], [S4], [S9], [S11], [S12], [S20] in my publications)

An assessment of the events of the Russo-Ukrainian war so far shows that unmanned aerial systems are (perhaps increasingly indispensable) tools used in modern armed confrontations to create a favourable air conditions. However it should also be noted that the combat applications of these air assets are not sufficient to win a victory. They have become an inseparable part of military operations, and have evolved and will continue to evolve in an unprecedented way, being barely detectable, accurate, equipped with weapons, radars, optoelectronic search and rescue devices, sensors and modern communication and computer systems. Large UAVs (e.g. Predator, Reaper, Global Hawk, Avenger, Triton), which have been the preferred and highly accurate tools in counter-terrorism operations, have not proven to be effective enough over the Ukrainian battlefield. The main reason for this may be that none of the adversaries have full control of the airspace, making their use in this situation risky and their mass loss costly. By contrast, the use of smaller drones has completely transformed the dynamics of low-altitude airspace, which for the most part is used to assist ground forces in operations. Inexpensive (compared to the cost of drones typically developed and used for military purposes), commercially available unmanned aerial vehicles, which fall into the hobby drone category, can be tracked in the combat operations of both combatants, having cameras mounted on them and various, sometimes homemade, explosive devices that achieve their destructive, deterrent purpose. It is true that these hobby-level drones are less powerful and more vulnerable than military devices of the same category, but their nonkinetic, psychological impact is not significantly different from the military version. Even today, but especially in the future, the actions of drones and artillery countermeasures will become indispensable for effective military operations, while modern armies must have the active and passive means of combat and counteraction to effectively defend their military forces.

Unmanned aerial vehicles can reach hard-to-reach places faster, cheaper and with less risk than it is possible with traditional means of control. It also allows the device to stay online while working, providing real-time information when needed. The growth of computing capacity will facilitate the development and coordination of drone swarms, and the autonomous operation of the assembled groups, supported by AI, will be able to perform increasingly complex tasks more complex.

My personal motivation to work on this topic is based on certain phases of my military career and the events and situations I lived through during this time. During my life's journey, I have had the opportunity to peer into a narrow but fascinating segment of the work of the domestic national security services. During this short period, the question was raised in my

mind how the increasingly complex and professionalised equipment of the burgeoning unmanned aviation could be integrated to perform a specific task, how to make the work of the secret service, full of dangers, challenges and superhuman endurance, more efficient and safer.

2. FORMULATING THE SCIENTIFIC PROBLEM

Unmanned aerial vehicles play a significant role in today's military operations, with a combat presence dating back to the Vietnam War. The ever-changing geopolitical situation in the world creates a number of security challenges in the 21st century, which can be effectively prepared for with the most modern land, sea and air assets, weapons arsenals and the combined effects of these combat tools, and modern combat procedures. Global terrorism, asymmetric warfare, the presence of non-state actors, hybrid warfare and the emergence of cyberspace as a theatre of war are all a product of the modern age, and can be found in the everyday warfare of our time, whether in their own right or in combination, as the war currently taking place along our borders perfectly illustrates.

Among these factors, Prof. Dr. István Resperger defines hybrid warfare as follows: *"Conceptually, we can say: Hybrid warfare is the flexible application of the soft, medium and hard methods and procedures of conventional regular (linear, conventional) and irregular (non-linear, unconventional) warfare with the aim of disabling and defenselessness of the enemy's state and armed forces and imposing its will, mainly with the strategic objective of keeping the level of violence during the conflict below the level of war. "*

From this formulation, we can conclude that this form of war, warfare, terror and other acts of deterrence is a new manifestation and method of inter-state confrontation, based predominantly on the combined use of non-military resources. Its aim is to weaken the target country in various dimensions of security. We can look at the final declaration of the 2014 NATO Summit in Wales, or the viewpoint of 2022 which states that *"hybrid threats combine military and non-military, overt and covert means, including disinformation, cyber-attacks, economic pressure, use of irregular armed groups. Hybrid warfare aims at confusing war and peace, destabilising and undermining society and creating doubts in the minds of the target."*

Digging further into the theories of the historically opposing parties, we can read that in 2007, an American point of view by an expert Frank G. Hoffmann which states that *"...hybrid threats encompass many forms of warfare, including conventional capabilities, irregular warfare and training, as well as terrorist actions and criminal activities using indiscriminate violence. Hybrid warfare can be conducted by both state and a wide variety of non-state actors."*

Thereafter, in 2013, former Russian Chief of General Staff General Valery Gerasimov declared what he called a "new generation" of warfare, based on the combined use of political, diplomatic, economic and other non-military instruments in combination with military force, rather than the direct use of military force. He stated that *"the role of non-military means in achieving political and strategic goals has increased and often exceeds the power of arms in terms of effectiveness."* In Gerasimov's view, the predominance of non-military means over military means is preferable, in a ratio of 4:1. Consequently, the 2015 Russian National Security Strategy already declares this dominance of non-military means.

The knowledge and understanding of all this are important for my thesis because it is clear that military confrontation has long been more than just a military one, so once the adversary image has been defined, guaranteeing the security of a given nation or country is an even more complex and complicated process. These definitions were of a *military-paramilitary-non-military* nature, but a different, more complex, more mysterious, more chiselled threat was brought about by the awakening and burgeoning of the information age. The enemy of the 21st century, whether it is a territorial conqueror, a usurper of minerals, a dominator, or even an industrialist seeking to uncover secrets, connections and networks of interest, is not a person who appears in physical reality and fights a contact battle, but an alien battling in the blissful haze of cyberspace.

On this cyberspace, a metaphorical space of computer systems and networks in which electronic data is stored and online data traffic and communication takes place, Prof. Dr. László Kovács writes, *"That the moment any device that the average user uses and connects to the network, the moment it becomes part of the internet. The Internet of Things, or IoT, is a very good illustration of this point of view, as we can now connect a significant number of IT and electronic devices to a network and therefore to the Internet."* But this brings the question of what is essentially a security issue: To what extent and by what methods (what philosophy) can we secure this massive, networked device that can be accessed from anywhere in the world?

How and what tools can we use to ensure the safety of individuals, communities, factories, companies, or even the whole nation? Of course, the secret services, which have been operating for decades, centuries, and have been doing so effectively, are and will continue to

operate with similar methods, tools and effectiveness, but like any profession, any science must and should expect to incorporate the innovations brought by the times and the technology of the age. It is necessary to examine the possibility of how and in what way the innovations of the times can and should be incorporated into practice, in what legislative context it is reasonable to integrate them and what procedures should be developed in accordance with the principles of effectiveness, necessity and proportionality.

In my thesis, I research and investigate how existing national security principles and activities can be complemented with the capabilities of sensor systems adopted for unmanned aerial vehicles, and therefore how drones can be "sent into combat" to overcome the challenges they face.

3. OBJECTIVES OF THE RESEARCH

Based on my long-standing theoretical research and practical experience, I formulate the following objectives (KC):

[KC-1] **I examine** the context and technical requirements of the national security task system and analyse the enforceability criteria.

[KC-2] **I present** the dynamics of unmanned aircraft development and the task-specific sensor system that can be used.

[KC-3] **I define** those tasks, group of tasks, the execution of which defines the technical need, and then I select and summarize in a task matrix those tasks that can be performed by an unmanned aerial vehicle or a drone team, keeping in mind the principle of necessity and proportionality.

[KC-4] After **examining the need** to perform the tasks defined by the National Security Act and their technical requirements, **I define** the basic contexts to determine the carrier platform and the sensor system to be used for the task.

[KC-5] The current regulatory environment makes it difficult for law enforcement, defence and national security organisations to use drones in a non-public, covert or even covert manner, so I believe it is important and necessary, and therefore **I propose** a "user-friendly" version of the regulation that would make it easier and smoother to carry out all these activities under the laws of the relevant ministry.

[KC-6] **I analyse** the environment surrounding the operation and use of drones and the technical, intellectual and scientific elements that may be interdependent in this ecosystem and, because of their cohesive structure, form a system.

4. FORMULATING RESEARCH HYPOTHESES

Based on the statements made in my objectives, the following hypothesis (HIP):

HIP-1: The unmanned aerial vehicle, as a carrier platform, can be used effectively to carry out national security missions with an appropriate set of sensors.

HIP-2: The technical parameters of the drone depend on the task and the mass data of the sensors required.

HIP-3: Depending on the mission and the sensors installed on the carrier aircraft, UAS used in national security activities may be unlicensed and may also be a means of gathering secret information subject to an external authorisation.

HIP-4: The use of drones should not be governed by the legal provision on the ethics and personal data protection of activities carried out in the course of national security tasks, but should always be subject to the National Security Act.

HIP-5: The operation of drones cannot be understood as a stand-alone, individual element. In all cases, they can perform tasks autonomously or under human control as a component of a system, forming an ecosystem.

5. IN THE PREPARATION OF THE THESIS THE RESEARCH METHODS USED, RESEARCH ACTIVITIES

For my thesis, both primary and secondary methods were used in my research.

Based on a deductive research strategy:

- I researched the published international and domestic literature covering unmanned aviation, the technical feasibility of these airborne assets, and the mission statement for national security work.
- I have searched, studied, collected, reviewed, analysed and researched the relevant regulatory background, laws, regulations, orders, decisions, measures and recommendations related to the areas covered by my thesis, investigations and research.
- I have collected, organised, analysed and explained the concepts I consider relevant to my research topic.

Based on an inductive research strategy:

- A questionnaire was used to collect data on the use and perception of unmanned aircraft.
- I evaluated the answers to the questionnaires, analysed them and drew conclusions related to the topic.
- During the period of the research, I regularly published my partial results in relevant Hungarian professional publications and participated in Hungarian conferences to present my current research results to a competent professional audience.

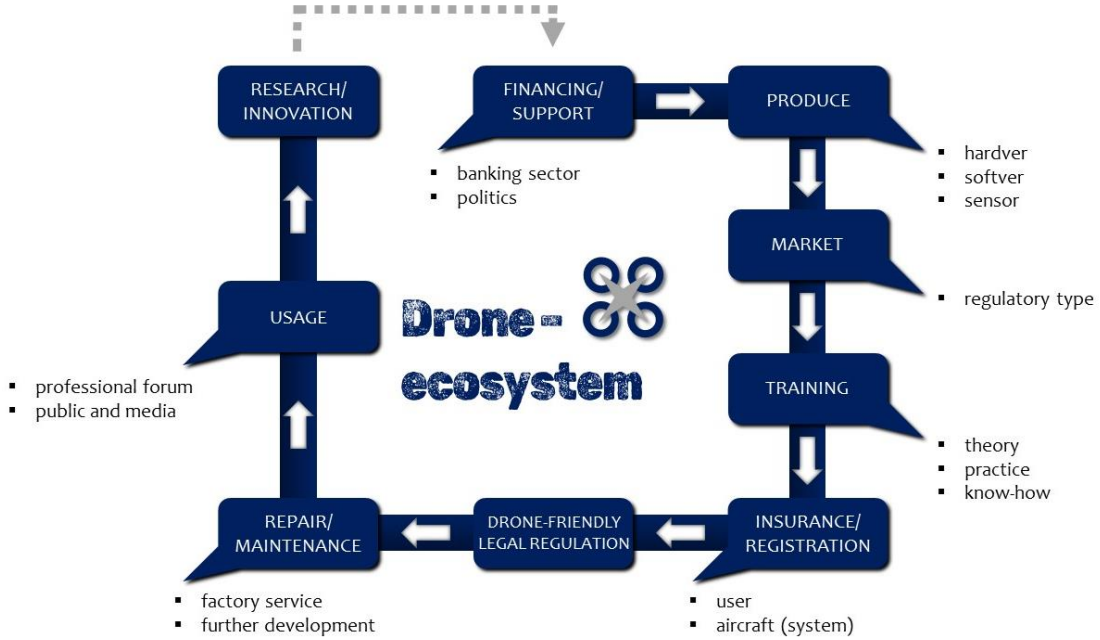
6. A CONCISE DESCRIPTION OF THE STUDY CARRIED OUT PER CHAPTER

In the introduction to the thesis, I presented the current situation of unmanned aerial vehicles and the indicators through which I supported the positive prospects for the future use of this device. This rapid and dynamic development has come at precisely the time of the technological revolution, when developments in both the carrier platform and the sensor park have made sense. As a result, it is becoming increasingly clear that a new alternative to the traditional, well-established "manual operation" has emerged, and that its adoption will be one of the great challenges and triumphs of the future.

Following the introduction, the justification of the timeliness of my topic, the formulation of the research objectives and research methods, and the summary of the review of the relevant literature, in the second chapter I examined security, national security issues derived from the Constitution, and the issue of national security in the context of the system of tasks. I have presented a comprehensive picture of how we move from the security items laid down in the law to guaranteeing security, what tasks we are able to perform with the help of regulation. I presented the current data and information protection concerns related to the use of unmanned aerial devices. I have grouped together the tasks that can be carried out more efficiently, quickly and unobtrusively than with the traditional methods known and used so far, by using an airborne platform, after selecting and diversifying the right sensors.

I then continued, **in the third chapter** of the thesis, by presenting some of the key milestones from the pages of history that demonstrate the major milestones in the development of unmanned aviation and its applications in the field of national security. In the meantime, I've presented some grouping options to help equip drones with knowledge from the past straight into the future.

In the following **fourth chapter**, based on the grouping of the first chapter, I have created a drone ecosystem (graphically illustrated and defined below) that shows synergies in the efficient and effective execution of these two areas. Its components are the most suitable unmanned aerial vehicle structure equipped with the most efficient sensor system, the most secure communication channel and the most capable artificial intelligence backbone infrastructure to manage the task, and an ethical legal environment to ensure the efficient execution of the task system, as well as well-trained, continuously trained and backed up by constant support.



Also, in this chapter, I have presented an imagined scenario of a possible national security drone operation, supported by a structured flowchart that provides insight into the potential for effective use of unmanned aerial assets.

7. SUMMARISED CONCLUSIONS

Intelligence is a profession that goes back as far as humanity itself, and its main principles are paradigms set in stone. It is not necessary to change the well-established, efficient and goal-oriented system, but it is worth renewing the tools and equipment according to the requirements of the times, and with a little skill and foresight, it is also worth trying out and learning about platforms and sensors that are ahead of their time in order to achieve the objective. If there is also some initiative and a desire to maximise efficiency, the next step is to add the systemic system of these modern tools to the palette of deployable, usable tools.

Based on the thesis, I have clearly **proved** that drones can be equipped with tools and sensor packages that greatly facilitate our own reconnaissance and information gathering, thus effectively assisting intelligence and counter-intelligence activities. However, if the same is to be used against us by the opposing parties, we must be able to defend against these capabilities. In the course of my research, **I have established** that it is essential to incorporate national security considerations into the regulatory background for defensive use. As a result of the rapid development of modern technology, the mass appearance of unmanned aircraft, which can currently only be operated in occasional airspace, has led to regulatory requirements being placed on the lawmakers in Hungary. The main reasons for these regulatory requirements were the unmanageability of the occasional airspace request procedure and the reduction of high safety risks.

I pointed out the importance of further refining existing legislation and enforcing the legislation in order to protect the country and facilitate the work of law enforcement agencies. As much as UAVs are an advantage for the state authorities, they have exactly the same potential for organised crime groups, other groups working against our country forces.

Today, UAS systems are in the arsenal of almost every army, police force and national security service, waiting to take to the skies with a special payload for another mission. Whether it's a simple surveillance mission, the monitoring of a section of terrain, the tracking of a person or vehicle, or even a covert operation, it can easily be, and is slowly becoming, an indispensable part of the ever-evolving airborne organism system.

In my thesis **I presented** the historical background of UAVs and the possibilities of their definition and classification. My work shows that the use of drones has opened up new dimensions in many areas of life, from civilian applications to warfare, intelligence and counter-secret service intelligence work alike. Their existence is a fact, their systemisation, their continuous development, their connection with artificial intelligence is inevitable, it is just a matter

of time. Setting up professional departments to work with and continuously develop drone technology cannot wait. ***Action, or the lack of it, will determine whether our country is one step ahead or one step behind the opposing secret services.***

I pointed out that the law is currently still in the wake of the development of unmanned aircraft technology, but the rapid expansion of the range of uses of these systems requires continuous fine-tuning and regulation to promote their meaningful and effective use. Through recent experiments, I have shown that this aerial device is perfectly suited to observe protected persons and objects, and even to attack them.

My conclusion is that, in order to assure the national security interests of the country, the national security services must be given the opportunity to create drone sub-units with the most modern airborne platforms and the professionally necessary indispensable sensors. It is important to manage the drone application on a systemic level, accordingly to think about its use, development and further purchases. The combination of systemic technology with artificial intelligence is inevitable, and this requires the creation of the necessary background services. It is therefore in the national security interest that as many elements of the outlined system as possible are **researched-developed-fabricated** on a domestic basis.

The creation of a drone *strategy for the national security sector* is essential for the realisation of this national security interest, which coordinates at the highest level the existing human, physical and material resources that need to be developed in line with the requirements of the times. In this way, all the actors in this sphere can carry out their intelligence activities in a more coordinated and effective way, based on the same principles, ideas, knowledge and tools.

In view of the continuous technological development, it is necessary to create a legal environment that is able to reflect the situation to be regulated, regardless of the technical solutions at hand. The European Union regulations and the national regulation adopted by the Parliament are the means to register drones and the persons connected to them, so that they can be controlled.

On this basis, it is conceivable to have a public web application that would allow citizens to check and control the drone in their environment, which is a welcome and highly innovative solution for civilian use.

As far as national security, law enforcement, law enforcement and military uses are concerned, other solutions are of course needed.

Obviously, the increased controllability of a UAV involved in a national security operation in this way can be a source of deconspiration. In these cases, it is also necessary to ensure

that data protection aspects are enforced, including through monitoring by the civilian population, and a solution could be to register the drone with cover data to prevent deception. Yet, in this case, the deployment of the airborne asset, its covert use, must also be a priority, because no matter how much covert data the vehicle itself and the remote pilot have, the asset is in the vicinity of the operation, which can be easily detected, which foreshadows the failure of the operation.

8. NEW SCIENTIFIC RESULTS

[TE-1] As a result of systematic investigations, **I have established** that unmanned aerial vehicles equipped with mission-specific sensors and sensor systems are inevitable components of the technical elements of the national security mission system. **I have defined** the circumstances and conditions under which effective drone task execution can be guaranteed.

[TE-2] **I analyzed** the dynamics of the development of unmanned aerial vehicles and the task-specific sensor system required to perform effective national security tasks, **concluding** that drones as delivery platforms are technically capable of performing these types of tasks, sensors and sensor systems have reached the stage of miniaturisation where the question is no longer whether a sensor diversified to UAS is the right solution for the operation, but how many different systems we want to use at the same time, in a coordinated way, during the task.

[TE-3] **I have defined** the tasks, task groups, the implementation of which defines a technical need, and then **I** have selected and **summarized** in a task matrix, which can be carried out with an unmanned aircraft or a drone team, keeping in mind the principle of necessity and proportionality.

[TE-4] Following an analysis of the tasks defined by the National Security Act and **the technical requirements** of these tasks, **I defined** the basic contexts that can be used to determine the carrier platform and the sensor system to be used for the task.

[TE-5] The current regulatory environment makes it difficult for law enforcement, defence and national security organisations to use drones in a non-public, covert or even hidden manner of drone operations, **I have** therefore **proposed** a concept of "user-friendly" regulation to make the implementation of all these activities easier and smoother within the framework of the relevant departmental regulation.

[TE-6] **I have examined** the components of the drone ecosystem, their individual and cohesive functioning, and **formulated** a definition of a drone ecosystem in which these components function symbiotically.

9. THE PRACTICAL APPLICATION OF RESEARCH RESULTS

The practical applications of the research findings detailed in my thesis are summarised below:

1) In the future, the thesis will be further developed into a professional guide, which can be followed to quickly and efficiently select and assemble the right unmanned aircraft for law enforcement, defence, disaster management and national security services and organisations.
2) Some of the chapters of my thesis can be used as a teaching material for the students of the Ludovika University of Public Service, Faculty of Military Science and Defence Studies, the National Air Defence Academy, the Institute of National Security, and the Faculty of Law Enforcement.

10. RECOMMENDATIONS

I recommend the following individuals and organisations to consider my research findings and incorporate them into their everyday work:

1) Personnel of civil and military national security services engaged in technical intelligence and counterintelligence activities.
2) For personnel of law enforcement and defence agencies and organisations working in aviation.
3) For students and lecturers of the Ludovika University of Public Service.
4) For students of the basic unmanned aircraft operator course.
5) A refresher, additional and specialised training course for students who have completed the basic unmanned aircraft operator course.

11. FURTHER RESEARCH DIRECTIONS

I continue my research on the topic presented in this thesis in the framework of the TKP2021-NVA grant programme of the Ministry of Innovation and Technology, funded by the National Research Development and Innovation Fund of the Ministry of Innovation and Technology, in the framework of the Integrated Model Observatory (IMA) Priority Area Sensor (SEN) research group of the project TKP2021-NVA-16.

For the rest of the project, I and my fellow researchers in the research team are looking for ways to integrate the use of airport work drones and the tasks they can perform into the everyday life of an airport. In the course of my research, I will further investigate the application and applicability of unmanned (airborne) devices in airport infrastructure and security surveillance, in the development, classification, categorisation and specification of task-specific carrier platforms and their sensor system adaptability.

12. THE DOCTORAL CANDIDATE'S PUBLICATIONS ON THE SUBJECT

ENCLOSURE

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[S2] B. KISS, G. MAJOR: Aerial help against Covid-19, in *Aeronautical Studies*, (2021) pp. 279–306. Online: https://www.repulestudomany.hu/kiadvanyok/RepSzem-2020.pdf

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[S3] B. BÉKÉSI, G. MAJOR: Configurations, applications and fields of drones, in PÁY G. (*author*) *Technical Science in the North-Eastern Hungarian Region 2022.* University of Nyíregyháza Institute of Technical and Agricultural Sciences, Hungarian Academy of Sciences (MTA) Debrecen Regional Committee (DAB) Technical Committee, *Acta Academiae Nyíregyhaziensis 7.*, Nyíregyháza, (2022) pp. 301-307. (ISSN 2416-2981) Online: https://www.nye.hu/sites/default/files/u5/KFI/Acta7.pdf

[S4] B. BÉKÉSI, G. MAJOR: The potential of unmanned aircraft in wartime in the shadow of the Russian-Ukrainian conflict, in *Polgári Védelmi Szemle*, Vol. 15. DAREnet Project Special Issue, (2023) pp. 297–324, Online: http://www.mpvsz.hu/pv-szemle

[S5] B. BÉKÉSI, L. SZILVÁSSY, G. MAJOR, L. GAJDÁCS, K. JÁMBOR: Working drones in the everyday life of a modern air port in *Honvédségi Szemle*, 151. évf. 3. sz. (2023) pp. 27–41. Online: https://doi.org/10.35926/HSZ.2023.3.3

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[S7] L. GAJDÁCS, B. GERVAI, G. MAJOR: Unmanned aircraft systems and defence yesterday, today and tomorrow, in *Repüléstudományi Közlemények* 32. évf. 1. sz. (2020) pp. 87-100. Online: https://doi.org/10.32560/rk.2020.1.6

[S8] L. GAJDÁCS, G. MAJOR: The risks of using UAVs in the security field, in *Repüléstudományi Közlemények*, 30. évf. 2. sz. (2018) pp. 101–112. Online: https://www.repulestudomany.hu/folyoirat/2018_2/2018-2-09-0497_Major_Gabor-Gajdacs_Laszlo.pdf

[S9] G. MAJOR, Z. TÓTH: Being a drone pilot is not stressful in any way... or is it? in PÁY G. (author) *Műszaki tudomány az északkelet-magyarországi régióban 2022.* University of Nyíregyháza Institute of Technology and Agricultural Sciences, Hungarian Academy of Sciences (MTA) Debrecen Area Committee (DAB) Technical Committee, *Acta Academiae Nyíregyhaziensis 7.*, Nyíregyháza, (2022) pp. 322-326. (ISSN 2416-2981) Online: https://www.nye.hu/sites/default/files/u5/KFI/Acta7.pdf

[S10] G. MAJOR, M. TAMÁS: Protecting nuclear power plants from drones, in *Repüléstudományi Közlemények* 33. évf. 1. sz. (2021) pp. 69-83. Online: https://doi.org/10.32560/rk.2021.1.7

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[S14] G. MAJOR: The use of unmanned aircraft systems in electronic warfare, in *Repüléstudományi Közlemények*, 29. évf. 3. sz. (2017) pp. 301–315. Online: https://www.repulestudomany.hu/folyoirat/2017_3/2017-3-22-0490_Major_Gabor.pdf

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[S21] G. MAJOR: Finding a way out of the drone clustering jungle, in *Műszaki Tudomány az Észak-kelet Magyarországi Régióban 2021. Konferencia*, (2021) pp. 63–69. Online: https://tab.mta.hu/files/9816/3241/4622/DAB_Muszaki_Tudomany_az_Eszak-kelet_Magyarorszagi_Regioban_2021_konferencia_Kornyezet-_es_Foldtudomanyok_Muszaki_Hidrologia_es_Repulestudomanyok_szekcio_eloadasok_kiadvanya.pdf

[S22] T. TÓTH, G. MAJOR: The role of aerial reconnaissance and data collection in the work of volunteer rescue organisations, in *Műszaki Katonai Közlöny*, 28. évf. 2. sz. (2018) pp. 204-220. Online: https://folyoirat.ludovika.hu/index.php/mkk/article/view/1650

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[S23] B. KISS, G. MAJOR, M. PALIK: Migration from a bird's eye view, in *Repüléstudományi Közlemények*, 29. évf. 3. sz. (2017) pp. 189-202. Online: https://www.repulestudomany.hu/folyoirat/2017_3/2017-3-15-0440_Kiss_Bela-Major_Gabor-Palik_Matyas.pdf

[S24] G. MAJOR: Does an autonomous drone return home at all time? in *Repüléstudományi Közlemények*, 30. évf. 2. sz. (2018) pp. 275-284. Online: https://www.repulestudomany.hu/folyoirat/2018_2/2018-2-23-0499-Major_Gabor.pdf

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[S25] B. BÉKÉSI, L. SZILVÁSSY, G. MAJOR, L. GAJDÁCS, K. JÁMBOR: Working Drones in a Modern Airport's Daily Life, in *TRANSPORT MEANS 2022. Sustainability: Research and Solutions* PROCEEDINGS OF THE 26th INTERNATIONAL SCIENTIFIC CONFERENCE (2022) pp. 836–841. Online: https://doi.org/10.5755/e01.2351-7034.2022.P2

RELATED CONFERENCE PRESENTATIONS IN HUNGARIAN, PUBLISHED IN HUNGARY

[S26] B. BÉKÉSI, G. MAJOR: Drone configurations, applications and areas, in Kocsis I., Dezső G. (author) *Műszaki tudomány az északkelet-magyarországi régióban 2022.* Abstracts of conference presentations, Nyíregyháza, MTA TABT (2022) pp. 71-71. Online: https://tab.mta.hu/debreceni-teruleti-bizottsag/esemenyek/muszaki-tudomany-az-eszak-kelet-magyarorszagi-regioban-2022

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[S29] G. MAJOR, B. BÉKÉSI: Drones on the battlefield and behind the front line, In Bodnár L.; Heizler Gy. (author) *Nemzetközi Tudományos Konferencia a Katasztrófák Csökkentésének Világnapja alkalmából,* Budapest, Rádiós Segélyhívó és Infokommunikációs Országos Egyesület, (2022) pp. 333-337. Online: https://vedelem.hu/letoltes/document/544-isbn-978-615-01-6985-9-konferenciakotet.pdf

[S30] G. MAJOR: Mapping and protecting natural aquifers using drones, in Bodnár L.; Heizler Gy. (szerk.) *Nemzetközi Tudományos Konferencia a Katasztrófák Csökkentésének Világnapja alkalmából*, Budapest, Rádiós Segélyhívó és Infokommunikációs Országos Egyesület, (2021) pp. 131-136. Online: https://vedelem.hu/letoltes/document/500-konferenciakiadvany.pdf

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[S32] G. MAJOR: Military drone developments in the witch kitchens of the two military superpowers, in Kocsis I., Szodrai F. (szerk.) *Műszaki tudomány az északkelet-magyarországi régióban 2021.* Abstracts of conference presentations,
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13. THE DOCTORAL CANDIDATE'S PROFESSIONAL-SCIENTIFIC CV

Lt. Col. Gábor Major
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Email: major.gabor@uni-nke.hu
Phone: +36 30 249 47 32; HM: 43 79 24
Place and date of birth: Heves, 16.04.1974.

„Just as water has no permanent shape, so in warfare conditions are not constant."

JOBS AND POSTS

2017 –	Ludovika University of Public Service Faculty of Military Science and Military Officer Training Department of Airborne Systems ***Assistant lecturer***
2012 – 2017.	Military National Security Service ***Chief operations officer***
2010 – 2012.	Military Security Office of the Republic of Hungary ***Chief security officer***
2007 – 2010.	Kinizsi Pál NCO Training School ***Radio and locator instructor*** ***Deputy Head of Avionics***
2001 – 2007.	Kinizsi Pál NCO Training School ***Rádió és lokátor szakoktató***
2000 – 2001.	HDF 89. Szolnok Mixed Transport Aviation Regiment Aircraft repair squadron ***Radio and locator mechanic***
1994 – 2000.	Szolnok Flying Officer College Training Flight Operations Officer Training School ***Avionics mechanic***

STUDIES

2019.	FESTO P111 - Introduction to pneumatics
2018.	Hungarian National Bank ***Financial services intermediary***
2014 - 2018.	University of Public Service Military Doctoral School of Engineering ***PhD education*** *Field of research: Unmanned aircraft and national security issues*
2012 – 2014.	University of Science, Pécs Faculty of Adult Education and Human Resource Development ***Certified human resources consultant***
2006.	Szent István University Centre for Adult Education ***Developing e-learning materials for professionals and teachers in the field of public education***
2006.	Miklós Zrínyi National Defence University Kossuth Lajos Faculty of Military Science ***Flight notifier***

2005.	Miklós Zrínyi National Defence University Kossuth Lajos Faculty of Military Science ***Flight instructor***
2002 – 2004.	Budapest University of Technology and Economics Faculty of Economics and Social Sciences ***Engineer-teacher***
2001.	European Computer Driving Licence (ECDL)
1995 – 2000.	Budapest Technical College Kandó Kálmán Faculty of Electrical Engineering Department of Electrical Engineering, specialisation in Instrumentation and Automation ***Electrical engineer for process automation***
1992 – 1994.	HDF Szolnok Aviation Officer College
1988 – 1992.	HDF Aircraft Mechanic and Aircraft Technician NCO Training College ***Aircraft radio and locator mechanic***

OTHER PROFESSIONAL (HONOURS, AWARDS, SCIENTIFIC) ACTIVITIES

2001.	Scientific Association for Engineering, Automation and Information Technology Diploma competition, MATE Prize

FOREIGN LANGUAGE SKILLS

Hungarian	native language	
Italian	Intermediate „ARMA”	(2002)
English	STANAG 1111	(2008)
English	Intermediate (B2) complex	(2023)

RESEARCH, PROJECTS

GINOP 2.3.2 15 2016 00007 "Increasing the interdisciplinary scientific potential related to aviation security and integrating it into the international research and development network" at the University of Public Service (VOLARE) – **aviation expert**

TKP2021-NVA-16 "Applied research in military, military and social sciences in the field of national defence and national security at the Faculty of Military Science and Military Training" **Integrated model airfield** - priority research area - **researcher**.

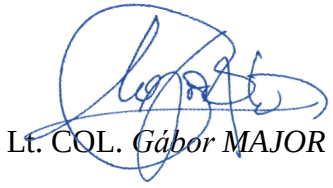
EKPPF/922/2021-ITM_SZERZ number of identification "Sustainability, resilience - the societal challenges of climate change and adaptation" - **researcher**.

OTHER

2022 - Elected member of Ludovika-UPS Senate

My publications: https://m2.mtmt.hu/gui2/?type=authors&mode=browse&sel=authors10047342

Szolnok, July 2023.



Lt. COL. *Gábor MAJOR*