**NATIONAL UNIVERSITY OF PUBLIC SERVICE**
**DOCTORAL SCHOOL OF MILITARY ENGINEERING**

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# Principles of application of technical machinery in the areas of catastrophic disasters and possibilities of establishing a uniform registration system

Doctoral (Phd) dissertation thesis booklet

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## DEFINITION OF THE SCIENTIFIC PROBLEM

The country's disaster vulnerability can be said to be geographically constant, but of course both natural and civilization factors are constantly changing. As a result, new or reinterpreted sources of danger are emerging, which also necessitates constant re-thinking and redefining of defense procedures.

Today, in all areas of life, security procedures, security plans, and associated protective equipment, technical equipment ensure that no catastrophic events occur, and that the resulting damage does not escalate into a catastrophe. This, on the one hand, increases security and safety, but the focus should never be shifted towards prevention to the detriment of operational work. Existing protection principles need to be updated and new methods developed to take account of new factors in order to maintain effective protection.

Today, however, major changes have also taken place in the field of disaster management. The Fire Brigade and the Civil Protection were merged, during which inevitable retirements and fluctuations caused serious losses to the profession. The picture is further aggravated by the fact that the average age of the available technical machines, despite continuous improvements, is still high and their scrapping has resulted in a considerable loss of ability.

The Hungarian Defense Forces involved in disaster prevention have also undergone several reorganisations and transformations, which have brought about significant changes not only from the human, but also from the technical point of view and generated similar problems as in the case of Disaster Management.

Large, unified disaster management exercises (in which different organs have worked with organizational elements) are rarely, or at all, available. As a result, these organs and organizations often become acquainted with each other's capabilities and capabilities in a "live situation", which can adversely affect the success of the defense.

In my professional opinion, two factors hamper the effectiveness of the defense most:

- differing professional cultures and languages;
- lack of knowledge of each other's capabilities.

Although the same concepts are used in the various fields of expertise, professionals still approach them from a different perspective, which leads to misunderstandings. Due to differences in interpretation, cooperation between organizations becomes difficult, which affects and may affect the efficiency of operational work.

Beyond the differences in interpretation, the other significant problem I see is that the experts involved in the defense - due to their diverse tasks and the constant changes - do not know and do not know enough about the resources and capabilities of other organizations. As a result, in the case of a real task, the organization and execution of the defense in the area of the damage may be problematic, so that depending on the given circumstances the utilization and efficiency of the applied resources is the greatest.

Based on the above, it can be stated that the organs involved in the defense can cooperate effectively if they understand each other and the planning and organizing professionals are aware of the necessary amount of resources involved in the defense and their capabilities. This requires a system that eliminates differences in approach so that the capabilities available to management are transparent, predictable and accessible during damage response. I wish to contribute to the achievement of the above objectives by developing this dissertation.

Without knowing the resources available in a disaster situation, there is no optimal way to organize defense and emergency management, so a single and complete inventory of assets that can be integrated into a defense or emergency management system needs to be established.

## HYPOTHESES OF THE TOPIC RESEARCH

In order to objectively examine what is described in the title of my dissertation and in the section entitled *"Formulating a Scientific Problem"* to define the central topic of the research and to present the approach of the research problem, I have made the following research hypotheses:

- *in my opinion*, if the experts work with the same conceptual system in the planning and organization of the tasks in the field of damage prevention, it can be the pledge of the quick and proper reaction ability, which leads to successful defense;

- *I believe that*, since technical machinery is widely used in damage prevention and remediation, they must be applied in a uniform manner by all the forces involved to carry out their task effectively;

- *I am convinced that* in order to make maximum use of the capabilities of technical machinery used in damage prevention, it is necessary to have a unified registration system that facilitates decision-making processes and the implementation of operational processes;

- *I assume* that in order for the accounting system raised in the previous hypothesis to work, the bases must be fixed taking into account the principle of unity of application and operation;

- *I believe that* the operation of this filing system requires the creation of a national database, which must be vertically split (in terms of access) so that a number of other tasks (legislative, cooperation, administrative and organizational) can be carried out.

## OBJECTIVES OF THE TOPIC RESEARCH

In my dissertation, in accordance with the hypotheses of my research, I undertake to examine how technical machines can be operated in a unified registration system, from the point of view of bodies and organizations involved in damage prevention, liquidation, and their capabilities (by developing a common registration system).

I consider it important to realize the following research objectives in order to confirm or reject the hypotheses:

- in order to establish the topic, briefly present Hungary's disaster vulnerability, drawing a parallel between the country's geographical, climatic and economic characteristics and the possible disasters that can be inferred from them;
- review the responses of the government to the domestic vulnerability, the unified disaster management system and the factors influencing its establishment;
- systematise disaster management periods and related tasks, with particular reference to technical tasks;
- review what technical equipment the government agencies involved in disaster response (primarily the Disaster Management and the Hungarian Defense Forces) are capable of assigning to the tasks involved;
- systematise the concepts of the technical machines to be used, their definition, the differences that can be found, and, if necessary, formulate new definitions;
- to present the criteria for grouping technical equipment of 'professional' disaster management bodies and economic operators and to find out what requirements are relevant to the planning of tasks;
- in order to achieve the above, to propose the specification of the registration system (s) necessary for the coordination of the joint activities of the bodies and organizations participating in the defense, and to introduce any new elements.

## RESEARCH METHODS AND RESEARCH ACTIVITIES USED DURING THE DISSERTATION

My research was carried out using several research methods to prove or reject the set objectives and hypotheses, which were as follows.

In the majority of my research work I applied general research methods. Within this I carried out the analyzes using inductive and deductive methods and researcher synthesis. During my research work, I studied and processed the relevant domestic literature, taking into consideration the relevant legal environment and the internal regulations of the organizations examined (presented). I have compared the collected previous and current literature with analytical methods both within the individual fields and with the requirements of other fields.

I have consulted with experts in the field who have helped me to develop my thesis by presenting the context of their respective fields. I would like to highlight the professionals here † Prof. Dr. Sándor Szabó Eng. Col., Prof. Dr. József Padányi MSc. Maj.Gen., Dr. Rudolf Tóth eng. Brig.Gen., Ferenc Zsóry eng. Lt.Col., Zoltán Horváth ff. Maj..

In order to understand the essence of practical activity, to gain knowledge of the parameters and capabilities of technical machines, I gained field experience. Thus, the 5th Bocskai István Shooting Brigade Operational Support Technical Battalion, MH 37. II. Rákóczi Ferenc Technical Regiment, BM OKF Business Supply Center, Ferihegyi str. central warehouse.

During my research work I visited and participated several times in the operational work of the National Emergency Management Center of the Ministry of the Interior and the BM OKF Industrial Safety Emergency Management Center, where I was able to get acquainted with and investigate the decision support system of Disaster Management. The foregoing inspired me to develop my dissertation so that it can be used to develop operational support systems.

I regularly published my research results in relevant Hungarian professional publications, and participated in national conferences to introduce and introduce my topic.

## STRUCTURE OF THE DISSERTATION

I divided my dissertation into four main chapters, in which I evaluated the catastrophe vulnerability of Hungary based on the events that have already occurred, and introduced the

operation of our country's disaster management system and the capabilities of the participants in the light of possible tasks. In the light of the implementation of the technical tasks, I examined the concept of technical machines and their grouping possibilities. In the last chapter of my dissertation I approached from a practical point of view the development of a possible registration system for the technical machines involved in disaster management.

In Chapter I, in the context of the analysis of the catastrophe risk of Hungary, I found in connection with the available literature that due to the geographical location and climate of the country, floods, inland waters, heavy storms, The action of disaster management organizations is essential to counteract its consequences. Resources (including technical equipment, technical machinery) must be provided to carry out this activity. In the same chapter I pointed out that neither the natural nor the civilization of our country requires the establishment of an organization which is capable of preventing disasters and eliminating its effects independently (without cooperation).

Using the conclusions of Chapter I, Chapter II. Chapter I introduced the necessity of a unified disaster management system of Hungary, and during the systemic interpretation I introduced its sub-systems and their relation to each other. In this chapter I also emphasized the description and grouping of his technical tasks during the backup. I considered it important to develop a system of conditions for technical machinery, which determines which technical machinery is suitable for work in the given area of damage. In the course of this I came to the conclusion that applicability is determined by personal, material and environmental conditions. In accordance with the above, I have demonstrated the technical capabilities of the Disaster Management and the Hungarian Defense Forces with the technical equipment at their disposal.

In III. Chapter I presented the concept and grouping of technical machines based on the information and data collected. In order to clarify the conceptual background, I elaborated on basic definitions such as "technology", "machine", "device". Among the grouping possibilities, I examined the grouping and registration possibilities of the actors of the Disaster Management, the Hungarian Defense Forces and the national economy with regard to technical machines. I have proved that technical machines need to be registered on a capacity basis for their efficient and economic application. I have also proved that the organizations that can be involved in the defense do not have, or only partially, have a capability-based record that can be interpreted and applied by any body or organization.

My dissertation IV. Chapter I, in line with what was stated in the previous chapters, examined the need for reinsurance systems and the functioning of registries within these

systems. First the national system records, then the disaster management and the Hungarian Defense Forces insurance system and records. In the course of my work, I found that neither the Defense Economics Master Plan nor the Hungarian Defense Forces and Disaster Insurance Insurance System has a comprehensive register that contains all the technical machinery that can be involved in disaster prevention. In connection with this work I proved that the existing organizational unit is able to perform tasks related to a single database based on the existing structure. So after that I worked out the structure of a unified registration system and described a possible operational version of it.

## CONCLUSIONS

My dissertation was inspired by personal experiences. During my professional work, I have repeatedly experienced that in the process of disaster prevention, decision makers try to assign as many technical devices (technical machines) to the area of damage as possible, in order to successfully defend themselves. It is clear that their performance, technical condition (and a number of other criteria) greatly influence the success of the intervention. That is why I decided to prove that in most cases the quality factor cannot be replaced by a quantitative factor. As I am convinced that knowing the capabilities and opportunities available and their systematic use can be the key to a successful and effective defense. As a result, I decided to explore the possibility of developing this activity with regard to technical machinery.

During my research, I realized that this picture is further complicated by the fact that the different systems of the organizations involved in the intervention have not been coordinated, which can lead to anomalies. My work has proved that the root of this has to be found in the different professional language, the different preparedness of the application organizations, the application of different technical machines and the differences in application. That is why, in the context of this dissertation, I have decided to examine how a common professional fund, which is implemented here in the register of technical machinery, can contribute to the most effective disaster management.

To solve the problems outlined above, I set research objectives. These objectives included examining the co-ordination of the activities of the co-operating organization, developing the possibilities of a new common registration system and making proposals for its application. In line with my objectives and my research hypotheses, I have demonstrated that Hungary's natural and civil disaster risk is negligible. As a result, I have proven that it is

not necessary to set up and operate a disaster management organization that can solve every disaster on its own. From this statement, I have come to the conclusion that potential catastrophic situations can only be resolved through full-scale social cooperation. From this conclusion, I came to the conclusion that - professional and non-professional organizations involved in disaster management - can only solve these tasks in a collaborative way, knowing each other's capabilities.

In order to substantiate the essence of my dissertation I have summarized the system of unified disaster management and introduced the operation of the subsystems included in it.
In order to provide the basis for my further research work, I have compiled the content of the technical tasks occurring during the implementation of disaster management tasks and grouped them. In doing so, I have come to the conclusion that the performance of these works requires the use of technical machines provided with specified parameters, in sufficient quantity and with rapid availability.

In order to justify the above statement, I systematized the influencing factors that can be taken into account and appear in the damage area, thereby proving that the applicability of the technical machinery is created by those involved in the defense, while the other part is given. This work has proved that a combination of these conditions determines what and how much technical equipment can be used in the damage area.

In order to develop an appropriate database (other than the ones described above), I had to systematize the capabilities of the Disaster Management and the Hungarian Defense Forces in their potential tasks during the rescue operation. In doing so, I found that both organizations have special technical capabilities for performing rescue work. Nonetheless, I have come to the conclusion that they do not know each other's capabilities in depth, which can lead to disproportionate demand and allocation of their resources. With this statement, I have demonstrated the need to develop a registration system that provides clear, immediate, usable information on technical machinery to defense participants.

It was essential to clarify the concepts of technology, machine, tool, material and technical equipment in order to make my suggestions for the development of a unified registration system for technical machinery. This work also proved that Disaster Management, the Hungarian Defense Forces and business organizations work with different concepts, which also supports the establishment of a unified registration system.

Following the clarification of the above definitions, I systematized the system for recording technical equipment of professional and non-professional organizations, especially technical machinery. In the course of this work I have proved that the ability and capacity

based records are the decisive factor in any organization, so this is what I have to consider when developing the unified records system.

In order to make my suggestions, I also had to look at the registers of technical machines, which proved that Hungary does not have such a uniform registration system.

By performing my previous investigations I proved the necessity of a unified registration system. In the course of this I elaborated the requirements for the register and proved that it must be implemented within the framework of our defense administration system.

I also proved that the defense administration is able to operate a national database without organizational changes. Based on the results of my research work, in accordance with the research objectives, I have developed the foundations of a national system of technical machinery registration, which ensures the more efficient execution of operational work. Within the framework of this work I have prepared a sample document which is the basis of the database. In doing so, I have come to the conclusion that a single database in itself has the potential for more new innovations, such as decision support and decision preparation.

I am convinced that with the research I have done, I have been able to compile a material that can greatly facilitate (in some specialty) the preparation of decision-making and decision-making operational work to make the defense more effective.

## SCIENTIFIC RESULTS

1. I have developed a system of conditions for the applicability of technical machines, thus establishing the possibility of more effective and faster and more economical intervention in disaster prevention.

2. Based on my research, I discovered the lack of capability-based records, which I used to define a set of requirements and develop a version of the structure and operation of the records system.

3. I have proved that the defense management system is able to operate the unified registration system without any organizational changes, and in line with this I made a proposal for the tasks of the existing organizational units.

4. In the current system of defense administration, I defined the tasks related to the operation of the unified registration system, which, if adopted, could make the preparation and implementation of defense more effective.

5. Based on my previous results, I developed the structure of this registration system and the basics of its operation, for which I prepared new sample documents.

## RECOMMENDATIONS

If I accept my dissertation, I consider it useful in several areas:
- if implemented, it will provide a single framework for disaster management organizations, improve cooperation and dialogue between organizations;
- reduce administrative burdens and strengthen the overall nature and complexity of a unified disaster management system;
- inspires further research work on the topic under study and highlights further topics to be developed.

## PRACTICAL USE OF RESEARCH RESULTS

I consider my research results useful in the defense administration of Hungary, for those professionals who are responsible for planning and organizing the rescue by providing technical machines and in the event of a disaster. The dissertation states that the Hungarian Defense Administration is capable of operating such a register without organizational changes. As a result, it is essential for the CBC National Emergency Response Center, which focuses on disaster management, to have adequate quantitative and qualitative information on the resources available in the country and their deployability. In addition, the work of the County Defense Committees in the event of a catastrophe is also greatly facilitated if they are able to request from an online database the technical machinery that is essential for their intervention personnel in the given situation.

The work of defense planners is greatly facilitated by a database and record system, which contains all the technical machines necessary for the protection of the country against disasters, filled with data content, which is informative enough to speed up the planning process and provide a professional basis.

In addition, the implementation and operation of the records system I have developed can provide the basis for a decision support system that incorporates the resources of all national organizations involved in disaster management, in terms of technical machinery. Creating an appropriate GIS background can not only operate a decision support system that reflects the equipment used in the damage area and its state, but can even be made suitable for decision preparation. The latter provides intervention planners with a possible alternative to the resources needed for the intervention and the tasks to be performed.

## MY PUBLICATIONS ON THE TOPIC

1. Laczik Balázs: A tűzoltóság műszaki mentési és kárelhárítási feladatainak célja, területei, helye, szerepe a katasztrófa-elhárítási feladatok között, Műszaki Katonai Közlöny XX. évf. 1-4. szám 2010, pp. 39-57

2. Laczik Balázs: Speciális műszaki technikai eszközök alkalmazási lehetőségei a kárelhárítási és kárfelszámolási feladatok végrehajtása során a katasztrófák sújtotta kárterületen, Műszaki Katonai Közlöny, XXI. évfolyam 1-4. szám 2011, pp. 213-228

3. Laczik Balázs: A hazai és az oroszországi mobil laboratóriumi összehasonlítása, Műszaki Katonai Közlöny, XXIII. évfolyam 2. Szám 2013, pp. 5-18

4. Laczik Balázs: A speciális műszaki technikai eszközök fogalma, lehetséges csoportosítása, a katasztrófák elleni védekezés szempontjából I., Műszaki Katonai Közlöny, XXIV. évfolyam 1. Szám 2014, pp. 31-43

5. Laczik Balázs: A speciális műszaki technikai eszközök fogalma, lehetséges csoportosítása a katasztrófák elleni védekezés szempontjából II., Műszaki Katonai Közlöny XXIV. évf. 3. szám 2014., pp. 30-40

6. Laczik Balázs: A speciális műszaki technikai eszközök fogalma, lehetséges csoportosítása a katasztrófák elleni védekezés szempontjából III., Műszaki Katonai Közlöny XXIV. évf. 4. szám 2014., pp. 43-50

7. Laczik Balázs: A hivatásos katasztrófavédelmi szervezetek műszaki és technikai fejlesztésének irányai és lehetőségei napjaink új kihívásainak tükrében, Társadalom és Honvédelem XIX évfolyam, 2. szám 2015, pp. 137-150

8. Laczik Balázs: Methods and principles of unifiedpersonalprotectiveequipmentduringchemicalindustrialcatastrophes, Academic and Applied Research in Military Science Volume 13, Issue 3 2014, pp. 443-457

9. Laczik Balázs: A tűzoltóságok műszaki mentési feladatai, azok végrehajtása, formái, eszközei és felszerelései, New challenges in the field of military sciences konferencia 2010, 9 p.

10. Laczik Balázs: Polgári és katonai repülőgépek tűzoltásának taktikája, követelményei, módszerei, Repüléstudományi konferencia Szolnok – Véget ért a MIG korszak c. konferencia kiadvány 2011, 18 p.

## CURRICULUM VITAE OF DOCTORAL CANDIDATE

Captain Laczik was born in 1986 in Hatvan. Following his primary and secondary education, 2004-2007. Between 2000-2006 he studied at the Ybl Miklós Faculty of Civil Engineering, Department of Fire Protection.

He graduated here in 2007, and later that year he was employed by the Fire Prevention Department of the Gyöngyös Professional Municipal Fire Department, where he received his first officer's appointment in February 2008.

For the sake of his professional development, the Civil Engineering János Bolyai Military Technical College of the Zrínyi Miklós University started its first course in 2007 in the field of Disaster Management.

In 2008, he was entrusted with the duties of the head of the Fire Prevention Department of the Gyöngyös Professional Municipal Fire Department, and was appointed head of the department in February 2011, following the completion of the specialization in Law Enforcement.

During his studies, he also emphasized his foreign language studies, having completed the English 'C' intermediate level exam in high school in 2003, and then started studying Russian in addition to his work, from which he took the 'C' basic language exam in 2014.

From 2010 to 2013, correspondent at the ZMNE Military Technical Doctoral School.

During the organizational restructuring of Disaster Management in 2012, the National Directorate General for Disaster Management was transferred to the Department of Dangerous Operations, where he had the opportunity to conduct unified professional management of the county organization and also served in the Central Coordination Committee of the Ministry of the Interior. During his time at the national agency, he had the opportunity to take part in national tasks related to Disaster Management Mobile Laboratories, as well as international NATO-related exercises and training in the field.

Since 2016, he has been in charge of the "C" service of the Disaster Management Mobile Laboratory deployed at Ferenc Liszt International Airport.

He was a regular contributor to various scientific conferences, including as a speaker.

He regularly lectures in his field, at various levels of further training.

His main areas of research include technical machinery, record keeping systems and, due to his position, chemical, radiological and biological detection methodology.