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Árpád Győző-Molnár,[1] Lajos Kátai-Urbán,[2] János Bleszity[3]

# Possibilities for Improving the Technical Equipment of Disaster Management Mobile Command Points

## Abstract

*The use of disaster management command centres is typically implemented in a static way, however, the experiences of the past period have shown that for their effective operation, it is necessary to use solutions that enable the monitoring of events, as well as rapid relocation and deployment. An obvious solution for creating the aforementioned capabilities is the use of mobile command centres to support driving groups. Currently, the professional disaster management organisation has several devices that can be used as mobile command points, but their capacity does not allow the work of larger teams. The purpose of this thesis is to examine capabilities, with the implementation of which both the capacity of the disaster management organisation and the effectiveness of the interventions can be increased, taking into account domestic and international development trends.*

*Keywords: disaster management, mobile command centeres, development, technical equipment, Hungary*

[1] Civil Protection Supervisor, Disaster Management of Orosháza, e-mail: arpad.gyozo@katved.gov.hu
[2] Associate Professor, Head of Department Ludovika University of Public Service Institute of Disaster Management Department of Industrial Safety, e-mail: katai.lajos@uni-nke.hu
[3] Professor Emeritus, Ludovika University of Public Service Institute of Disaster Management, e-mail: bleszity.janos@uni-nke.hu

## Introduction

The use of operational work units or command groups and mobile command points (MCPs) is common in the armed forces and various law enforcement and crisis response agencies. In the Hungarian professional disaster management organisation, the National Directorate General for Disaster Management, Ministry of the Interior (NDGDM), there are groups working in a complex, interdependent, hierarchical, but also independent and autonomous way for the operational control of emergencies. The operational work units follow the organisational structure of the NDGDM, which allows for the creation of operational groups at national, regional (county) and local levels.[4] However, the operating place of these groups is static and predefined.

Given the nature of the damage, there may be a need for equipment capable of dynamically tracking events, which can be deployed quickly and allow groups of at least limited numbers or tasks to work. In support of operational management, NDGDM and its subordinate bodies also have equipment that can be used as MCPs.[5]

The accelerated activity of elimination of damages and the increased information requirements, both in terms of reporting obligations as well as data provision and information, require that the persons responsible for the management of elimination of damages – the staff of the potentially established operational working bodies – start their activities with the help of modern MCP systems equipped with pre-configured computer workstations. This avoids delays in the core work related to the elimination of damages, in the establishment of the command centre and disruptions in the flow of information. These advanced systems, due to their mobility, can be of great help in starting the command activity as soon as possible.[6] In our view, the use of the above-mentioned state-of-the-art equipment can take disaster management operations to a new level and make them more efficient. Examining these MCP systems and suggesting improvements that also take into account cost effectiveness, and dislocation characteristics could further improve the effectiveness of the elimination of damages.

In view of the above, the research examined the experience of using MCP systems in disaster management and formulated recommendations for possible directions of development of operational work units and command points, taking into account domestic possibilities and conditions.

The objectives of the research included the following. To analyse and systematise the operational work units of national disaster management and the defence and security organisation system and their functioning, as well as the related legislative and internal regulatory environment, in order to formulate proposals for improving the organisation of the operational work units with the aim of increasing the efficiency of operational management and thus improving the effectiveness of elimination of damages.[7] To analyse and evaluate the existing MCP systems of the disaster management services, the domestic aspects of their deployment, the main requirements for

4 Muhoray 2019.
5 Győző-Molnár 2022.
6 Érces et al. 2023a.
7 Érces et al. 2023b.

their design and the experience of their use. Domestic and international experiences with MCP vehicles were systematised and, taking these into account, the development options for disaster management MCP systems were elaborated, considering the framework of the professional disaster management organisation.

The research topic is based on the study of the operational work units for the management of defence activities, the MCP vehicles and equipment that can be involved in operational management – already in use at the professional disaster management organisation – and other systems that support the mobility of the operational groups, in particular the possibility of operating the command groups in containers or tents.

## Summary of the research results and conclusions

The professional disaster management organisation has undergone significant development in terms of its vehicle fleet and equipment over the past decade. As part of this development, the Disaster Management Radiation Reconnaissance Unit (Hungarian abbreviation: KSE) was established in seven counties in 2014.[8] In 2019, the Critical Infrastructure Protection Unit (Hungarian abbreviation: KIBE) was added to all county-level NDGDM disaster management directorates.[9] Both vehicles can be used as MCPs and, based on user experience, can be used effectively to support the activities of command groups during minor, containable damage events. However, the problem encountered with both equipment is that the limited capacity of the working space – designed to accommodate two people – prevents the work of larger groups or those scheduled for longer periods of use. Both vehicles are multi-purpose, and are therefore involved in the day-to-day activities of the disaster management services, primarily in relation to official procedures – inspections and surveys.[10]

The tents and tent systems currently used by the disaster management organisation:

- the 63M squad tent, which is commonly used by disaster management services
- so-called "party" tents without type designation, which can also be found in significant numbers in various organisational units
- pneumatic tents of various types (e.g. LGZ-5) or tents that can be quickly deployed, mainly for the HUNOR rescue services
- a limited number of advanced TAG 42 type pneumatic tents[11]

We believe that all tent systems are capable of meeting the MCP criteria. However, the disadvantages of tented systems are the heterogeneous nature of their types and the need to dismantle them before moving them to a new site, and then reassemble

[8] Győző-Molnár – Négyesi 2019.
[9] Győző-Molnár 2021.
[10] Cimer et al. 2021.
[11] Horváth 2013.

and reinstall them at the installation site. Another disadvantage is that a transport vehicle may be required to move not only the tent but also the equipment to the site.

The disaster management services have no MCP system installed in a container at present, but its development and implementation has started. Therefore, this article examines the specifications of the planned operational group container on the basis of the tender for its procurement.

Recommendations for development are based primarily on the current disposition of the disaster management organisation and the existing infrastructure and equipment. These would significantly simplify the acquisition and deployment of equipment and would be highly cost-effective and sustainable.

The three key requirements for the planned MCP equipment are as follows:

- the MCP equipment must be capable of accommodating at least two subordinates and a commander at one time, with the capacity to be expanded to allow larger teams to operate in suitable conditions
- the equipment can be quickly deployed on site and is operational within 4 hours
- it is capable of operating autonomously for at least 72 hours regardless of external conditions

An examination of the structure and functioning of the operational work units revealed the absence of a separate unit dedicated exclusively to reconnaissance tasks. In view of this, the creation of such a post in the operational groups is proposed in order to increase the efficiency of the groups' work.

### *Command point in a container*

First of all, the potential applications of containerised operational work units should be explored, as container transport vehicles are currently available in the disaster management organisation. Based on their location, a nationwide network of stations can be established from which a group container can be dispatched to the site of the incident or group within 1 hour and be operational within 2 hours. The container transport vehicles and their personnel act as a stand-by unit for the professional disaster management organisation, which means that they are ready to start their journey to their designated destination as soon as possible after being loaded following an alarm, 24 hours a day.

At the time of writing, the professional disaster management organisation had 22 container transport vehicles of various designs, operated by the regional bodies shown in Figure 1.

The figure illustrates and confirms that the regional transport capacity to deliver the planned group container to the site of the incident is already available. The purchase of a transport vehicle is therefore not justified.

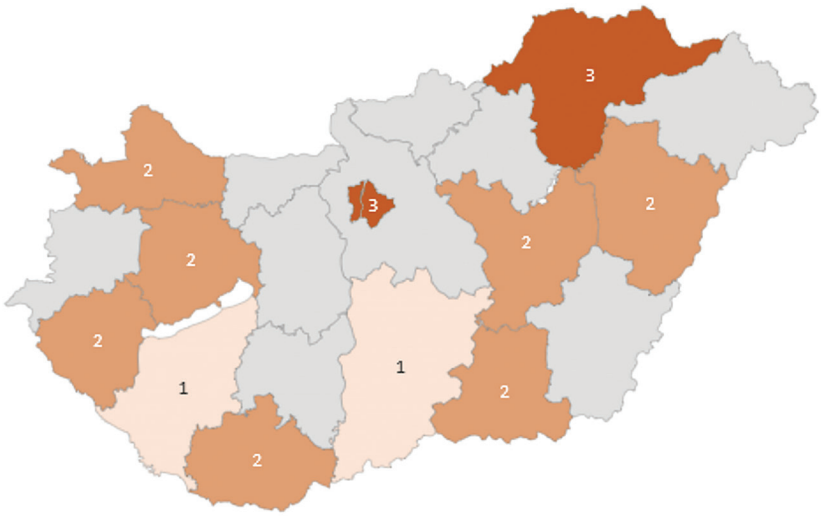


*Figure 1: Number and disposition of container transport vehicles operated by the NDGDM and its regional bodies*

*Source: compiled by Árpád Győző-Molnár*
*Note: Measure No. 33/2020 of the NDGDM.*

Moreover, it is not necessary to purchase new transport vehicles, as container transport vehicles have been continuously delivered in recent years, for example, two modern transport vehicles were delivered in 2021 within the project *KEHOP-1.6.0-15-2016-00021, EU Civil Protection Complex Modules.*[12] As a result, the vehicles that can be used for container transport generally meet the technical standards of their respective times.

In any case, the planned group container should have sufficient capacity to provide a reasonable number of workstations for the operation of the group, consisting of one main leader and two main subordinates, considered to be the basic staffing level, and, if necessary, for the liaison officers of the partner intervention agencies.

The common specifications for the main MCPs described earlier in this chapter should be compared with the requirements of the *KEHOP-1.6.0-15-2016-00021 Mobilizable Command and Control Point* tender, which is currently being implemented.[13]

The characteristics and the two main components of the planned command point container were formulated by the NDGDM in the above-mentioned public procurement tender as follows:

- one container transport system with sufficient load capacity to be placed on a semi-trailer, from a deployment control container system
- and associated IT system components

[12] BM OKF 2021.
[13] See: www.kozbeszerzes.hu/ertesito/2022/0/targy/portal_403/megtekint/portal_12424_2022/

When manufacturing and installing truck superstructures capable of autonomous operation, the units will incorporate the following:

- stand-alone power supply
- stand-alone air conditioning
- stand-alone camera system
- uninterruptible power supply
- remote access to IT and camera systems
- workstation for at least 6 people working simultaneously

where the work to be carried out includes installation tasks, meaning that the successful tenderer will also be responsible for the installation of the container and the associated IT system.

The MCP is a command-and-control support system for the NDGDM that is deployed at a safe distance from the incident site in a disaster situation. It serves as a communications node during prolonged operations such as major fires, floods and other natural and civil disasters that require the continuous and efficient work of the disaster management staff in the area.

"With a rapidly deployable command and control point, all the necessary IT and telecommunications functions and services can be brought together in a single area in a short period of time and moved to higher priority locations as required. The command-and-control point can be used effectively to hold meetings and coordinate tactical operations. All of these tasks are supported by state-of-the-art infocommunications equipment that provides direct network connectivity to the NDGDM's IT and telecommunications systems."[14]

The command centre includes several workstations, a videoconferencing system, presentation equipment and video surveillance functions to support analysis, operational control and decision making. The equipment provides the necessary conditions for the uninterrupted work and rest of the damage elimination leader and the personnel involved in the management.

There are many international examples of good practice in the use of container command points for disaster management. Among these, the German *Technisches Hilfswerk* (THW) should be considered and compared with the one planned for domestic implementation, as it operates a container MCP system with a high degree of operational autonomy. Power is self-supplied by a solar panel system with a capacity of six kVA. If the solar system does not produce enough electricity, a 10 kVA diesel generator is available to provide the necessary power supply.[15]

The system operated by THW is housed in two 20-foot containers with a command and meeting room and an operations control/communications room. The command and meeting room is primarily used for briefing and command work, but also offers the possibility of video conferencing. The operations control area is equipped with a range of analogue, digital and satellite communications equipment. Both emergency

[14] See: www.kozbeszerzes.hu/ertesito/2022/0/targy/portal_403/megtekint/portal_12424_2022/
[15] Bundesanstalt Technisches Hilfswerk 2018.

and long-range communications are provided by a retractable radio mast and a 2.4 m diameter ground satellite dish.

From a cost-effective point of view, a containerised command point is clearly advantageous. The group container, properly secured and loaded, can already contain all the equipment and fittings necessary to carry out the group's activities. This means that no extra time needs to be spent equipping the container, and it can be ready for use within a very short time of installation.

It is therefore worth continuing to study and develop in this direction, as the studies carried out show that there is no need for a set of units per county, but rather a regional approach covering several counties and taking into account the disposition of existing container transport vehicles. *Figure 1* clearly shows that the regional transport capacity required to deliver the planned group container to the site of the damage event is already available. In view of this and the procurement of recent years, there is no need to acquire a large number of transport vehicles.

### *Command point in a tent*

The tents and tent systems used by professional disaster management services have already been described. A common feature and advantage of the tents systemised by NDGDM organisations is that their installation does not require significant prior training or preparation. It is essential to emphasise that the tents, which meet the technical specifications and operator requirements of the 21st century, are significantly lighter and consist of fewer elements than the previous generation of tents (e.g. the 63 M squad tent), thus simplifying logistical tasks, especially transport.

Modern, air-conditioned inflatable or pneumatic tents, such as the TAG 42 used by the disaster management body, have a net weight of only 180 kg and a floor area of ~42 $m^2$.[16] These specifications make it possible to transport the tent and its accessories to the site by 4 people and a truck with a sufficiently large loading area and, taking into account the experience gained during the installation, to have an equipped command point available within 4 hours to control the defensive operations. A significant advantage of this type of tent is that its interior space is highly variable and can be divided into several sections if necessary, allowing the different segments of the group to carry out their activities separately. An in-tent command point can be a good choice if the aim is to quickly establish national coverage, as all NDGDM county-level disaster management directorates have a set of this type of tent. A particularly positive aspect of the use of the tent is that, in conjunction with the KIBE, which is available on a countrywide basis, or the limited number of KSE vehicles, the MCP system, which is particularly suitable for independent operation and complies with modern principles, can be made available to disaster management.

A negative aspect of using a tent is its lower resistance to external weather conditions. A clear disadvantage compared to vehicle superstructures or container solutions is that the equipment and tools needed to assemble the tent have to be

[16] TAG 42 Inflatable Tent 2020.

transported separately to the site, so that once the tent is set up at its destination, it needs to be properly equipped. This solution also has a negative impact on the mobility of the command points designed in this way, as even the self-inflating tent can take at least 2 hours to dismantle, taking into account practical experience. The time required to evacuate the tent, which varies considerably depending on the number of items and equipment installed, must also be considered.

When examining international examples, it can be stated that self-inflating and inflatable systems, such as the TAG 42 system described above, are clearly gaining ground in disaster and crisis management operations.

### *Command point in a vehicle superstructure*

The KIBE and KSE currently in operation belong to this family, as in all cases, the technology and equipment required to run the operational work units have been installed in the loading area.[17] There are several advantages to having the MCP in a vehicle superstructure, the most important of which is that it is easy to obtain commercially available base vehicles that can be later used as MCPs with only minor modifications.

The superstructure design allows for the availability of a ready-to-use MCP without any special preparation, with all the necessary equipment for command and control as well as communications installed, thus eliminating the need to install equipment prior to starting operations.

A very significant advantage of the MCP in a vehicle superstructure – similar to those already in service – is that it can be used continuously in peacetime to perform various tasks for disaster management services, such as the following:

- primarily, to support the conduct of official inspections
- secondly, passenger transport or
- freight transport after minor modifications

Consistent with Attila Zsitnyányi's findings, the disadvantage of the disaster management MCPs installed in the current vehicle superstructure is that the ability to expand the floor space is relatively limited by the superstructure's capacity and the vehicle's payload. The mass and space requirements of the IT and other communications equipment needed to manage the operation also severely limit the possibilities for expansion.[18] However, the dimensions of the current vehicles only allow for the deployment of the repeatedly mentioned smaller groups of personnel and thus the on-site management of defence tasks resulting from extreme weather events.

Consideration should be given to the procurement of vehicles with greater capacity and working space to complement the existing MCP vehicles, taking into account the space requirements to accommodate groups with larger numbers. There are a number of international examples of the use of MCPs in vehicle superstructures for disaster management purposes and the potential for their development, but there

[17] Győző-Molnár 2022.
[18] Zsitnyányi 2022.

is no typical size or capacity that clearly characterises this equipment. Depending on the dimensions of the base vehicle, the user's requirements and the intended application, the size range can vary from a passenger car to a semi-trailer.

*Table 1: Comparison of KSE and KIBE vehicles*

| | Vehicle | |
|---|---|---|
| | **KSE** | **KIBE** |
| |  |  |
| Year of entry into service | 2014 | 2019 |
| Number of systematised units | 7 pcs | 20 pcs |
| Type of vehicle | Fiat Ducato | Volkswagen Transporter |
| Core task | radiological reconnaissance, detection of illegal transport of radiological materials and prevention of release of dangerous substances | acting as a command-and-control point for incidents involving critical system elements |
| Operator staff | 2 persons | 2 persons |
| Permanent crew | none | none |
| Air-conditioned working space | yes | yes |
| Power supply from an external power source | yes | yes |
| Aggregator loaded | none | yes |
| Built-in EDR | yes | yes |
| Number of workstations in case of an MCP | 2 pcs | 2 pcs |
| Expandability of the number of workstations | no | yes |
| Off-road capability | exclusively built road network | limited |

*Source: compiled by Árpád Győző-Molnár*

## *Reconnaissance post in operational work units*

When examining the regulations of the disaster management organisation, it can be noted that there is no separate *reconnaissance* post in its operational work units.[19]

[19] Measure No. 12/2023 of the NDGDM.

In our view, it is essential to have an independent person or team to carry out specific (remote) reconnaissance activities (e.g. by using drones), to coordinate the reconnaissance tasks and to analyse and classify the data received from the reconnaissance activities in the event of incidents.

The studies show that although the groups are specialised in evaluation-analysis or operations control, and the tasks of these elements include the evaluation and management of reconnaissance data, the filtering of the data and information received by the group requires a separate division, given its heterogeneous nature, in order to receive information and data:

- from own organisation
- from partner professional intervention services
- and from other organisations involved

The person or organisational unit specialising in reconnaissance in the operational work unit is capable of filtering and organising this heterogeneous and diverse data from different sources in a consistent and systematic manner, based on principles defined in advance or by the leader, and then passing the synthesised data either directly to the leader or to the assessment analysis or operations control component for further action.

In addition to filtering, analysing and organising the data, it is important for the reconnaissance personnel to be able to manage the remote reconnaissance equipment that can be provided from the location where the groups are deployed or from the MCP. The most important of these, and increasingly used by operational forces, are drones, which have undergone significant development over the last decade. Along with this, the personnel handling the data obtained during reconnaissance can also carry out filtering, as already mentioned.

The main principles of the use of drones and aerial reconnaissance for disaster management, which are still relevant today, were formulated by *Rudolf Tóth* in an earlier work.[20] These include, but are not limited to, the following:

- fly or hover at low speed over the area of damage
- if necessary, take off and land within the damage area with little space, without technical personnel, technical equipment or external power source
- avoid, as far as possible, the need for runways or special control equipment, which can only be installed at high cost in or near the damage area
- the aircraft structures chosen and used in the damage area shall not require special operating conditions, it shall be simple and cost-effective to operate them
- they should be capable of continuous use, possibly on a rotating basis

The use of drones for aerial reconnaissance is well suited to both minor and major damage events. In such a case, if the drone is carrying out an activity that cannot be postponed in time, the drone pilot must consider the outcome of the operation. From a risk perspective, the performance of disaster management tasks is critical during and after a disaster. Prior to any aerial operation, it is always advisable to identify

[20] Tóth 2011.

the risk factors for the flight and, based on this, to communicate the risk factors of the operation to the operation commander or damage site commander in order to obtain a realistic picture. Following a risk assessment, if the drone can support the mission and contribute to the success of the operation, then it should be deployed. In addition to problems caused by the weather, other obstacles can affect the execution of operations, such as the release of hazardous substances into the air. For example, a toxic substance that adheres to the drone's frame structure and infects personnel upon return to the launch site, or even severe radiation contamination, which may result in irreversible malfunctions.[21]

This is particularly important when the technical equipment is at the disposal of the professional disaster management organisation in the form of drones, the acquisition of which is also included in the *KEHOP-1.1.0-15-2016-00003 operational programme*. The training of professional disaster management personnel in the use of drones was organised in 2022 with the support of the Ludovika University of Public Service, Faculty of Military Science and Officer Training, where the participants – including the author – were able to acquire the theoretical knowledge for the effective use of drones to be procured in the future.

The main tasks of the reconnaissance post with regard to the operational units are as follows:

- operating systemised reconnaissance equipment, such as drones, in order to conduct long-range reconnaissance and associated intelligence gathering
- analysing the reconnaissance data received from the intervention agencies involved in defence and from the professional intervention agencies
- gathering reconnaissance data from various sources and filtering it according to specified criteria for the analytical-assessment and operations management staff of the operational groups
- specialised management of the activities of the personnel carrying out reconnaissance at the damage site
- liaising with other members of the group/work units
- liaising with the reconnaissance personnel of partner agencies

In any case, the following minimum professional requirements are recommended for the staff to be assigned to the post of reconnaissance officer:

- at least an A1-B2 qualification to operate unmanned aerial vehicles, namely drones with a maximum take-off weight of 25 kg
- 3 years of professional experience in fire-fighting, technical rescue, civil protection or industrial safety
- at least a category B driving license
- access to disaster management databases and operational support applications

All this provides a good basis for groups with this capability to have access to continuous and accurate reconnaissance data. The volume of data and information coming in

[21] Hell 2022.

from the damage sites requires processing by specialised staff capable of interpreting and organising the information received.

## Summary

We have focused primarily on domestic development opportunities that are feasible from a cost-effectiveness and organisational point of view, and on this basis, we make the following summary recommendations.

The disaster management MCPs currently installed in vehicle superstructures basically meet user requirements, but due to the limited capacity of their working space, it is necessary to purchase systems of larger dimensions.

For this reason, we believe that the use of group containers, which are already being systematised, is the right way forward. The container can be equipped with the operational tools and equipment ready for use, similar to the MCP installed in the vehicle superstructure. The only disadvantage of the planned systemisation of the group container is that the procurement of only one system is planned, which may delay the deployment due to the time needed to transport the MCP to the site of the incident and the time needed for installation.

On the other hand, the installation of technical, IT and communications equipment should be taken into account as a factor that increases the length of the installation period when using a tent. However, the use of a tent, together with the two MCPs already established, is a way forward and an option, which, using a hybrid system, can be used to temporarily extend the available working space to accommodate groups with larger numbers. Capacity for this is currently available in the system or planned for systemisation, but efforts should be made to acquire more advanced self-inflating systems when further tent systems are procured, as their installation time is significantly shorter than the previous types in the system.

Based on our investigations, the operational staff lacks an individual or organisational element solely responsible for reconnaissance tasks, for analysing complex reconnaissance data from multiple directions and channels, and for managing the reconnaissance assets at its disposal. In view of this, it is recommended that such a post be created in the operational groups in order to increase the efficiency of the groups' work.

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Measure No. 12/2023 of the NDGDM on the establishment of disaster management operational working units, the conditions under which they operate, their organisational structure and their tasks