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Preparations for VR Tactical Training Simulator Efficiency Measurements

Tamás MARLOK,[1] Márk György TAKÁCS[2]

After investigating the applicability of VR simulators in the Hungarian Defence Forces, we searched further for a specific training location in time and place, where VR tactical simulation can be effectively applied. We hypothesise that the effectiveness of infantry soldier training can be made cheaper and thus more efficient if it is properly thought through. For this purpose, we have prepared a measurement. The scientific background to this measurement is presented in this article, together with an examination of the practical potential of the technology and training. The measurement will be conducted based on this research, experimentally embedded in the training plan of officer candidates.

Keywords: *VR simulation, rifleman training, infantry training, tactical training, virtual reality training, simulator effectiveness*

Introduction

In our previous article,[3] we have reviewed some of the fundamentals of VR-based training and tactical-level military training. We have examined the training needs of the Hungarian Defence Forces at the tactical level at the infantry. Subsequently, we have examined the options of the VR based training, and we have found, that there are numerous possible options for enhancing the quality of the training by implementing VR tools into the tactical level training.

To obtain empirical evidence on the transfer of skills and training effectiveness of VR training, we had to find its appropriate place in the tactical and shooting training curriculum and develop a testing framework.

In this article, we will present a series of experimental training tasks. With these tasks, our goal was to create exercises for the shooting range allowing soldiers to be trained with the help of VR based tactical training software, and we will present the theoretical background of these tasks, and the tasks themselves.

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What are the infantryman's fundamental skills?

It should be a scope of another thorough study to determine the exact system of skills needed for an infantryman, mainly because the immense number of interdependent skills needed to persevere in the brutal nature of the tactical level armed conflicts. Therefore, in this study, we will just focus on the individual tactical skills, which are also very complex. However, if we start the analysis from the question "What does the infantry man has to be capable of?", we can have a good picture of our goal.

A well-trained infantryman has to be able to handle his gun at a professional level, hence it is his most important tool. Handling a weapon and shooting with it accurately requires both physical and cognitive skills. Of course, these skills are not valid only for the main weapon (most of the time, assault rifle), but for the secondary weapons, such as pistols and hand grenades, and of course the collective weapons, like machine guns, shoulder-fired anti-tank missiles and MANPADs (man-portable air-defence systems).

Besides handling weapons, it is also important to be able to handle other equipment. A large part of them is out of our scope, hence, they cannot be practiced in the VR environment (e.g. shovels, explosive charges, tourniquets and other medical equipment). But also, there is equipment that can be practiced with ease and with a great effectiveness in the VR environment. These are the radios, optical sights and night-fighting devices (NVGs and laser sights). In this regard, in this article we will only focus on these.

Regarding these skills, the programming and handling of the radio device itself (e.g. Harris PRC-152), can be practiced in the VR, but it is not necessary, it can be done in a classroom with a radio device. However, what is even more important: the proper radio communication and the implementation of radio-silence regulations can be practiced at ease. It seems to be an easy task ("I just tell them what I want in the radio"), but to send and receive short and accurate radio messages is a difficult task to execute in the stressful environment of the battlefield (even virtual), hence it needs to be practiced.

Figure 1: The authors with the VR training device
Source: the authors' photo

Now we can see just the very basic skills (only which can be practiced in our VR simulation) needed for an infantryman. To see the details and to have a well-structured view, we constructed this prototype skill set.

Skill set

1. Weapon handling
   - appropriate firing position
     – does he use an appropriate firing position? (stability, correct aiming, using cover)
   - correct handling of the weapon
     – utilising it against the appropriate target to a proper distance
     – using the appropriate type of ammo
     – respecting safety regulations (especially reactive weapons and hand grenades)
     – respecting the operating conditions of the weapon (in case of small arms, it only means not wasting ammo and fixing the jams)
   - appropriate magazine changing and reloading (no jamming, no dropping of magazines, no unnecessary loading, etc.)
2. Marksmanship
   - aiming
     – aiming errors (e.g. low, high, left, right aim); however, this part is under development, because the current VR technology cannot simulate correct aiming, but it is still applicable for teaching the necessity and the process of it
   - shooting
     – correct trigger work (pull gently with one move)
3. Basic tactical skills
   - individual soldier
     – understanding and using the terrain (can they select the appropriate cover at all?)
     – with the changing of the tactical situation, can he change the cover accordingly (at least the firing position)?
4. Communications
   - understanding the received order
   - appropriately reporting the detected targets in his field of fire

Capabilities of the VR simulator used in the measurement

We started to build training and exam scenarios for the Infinit Simulation company's GTS VR tactical simulator. This system has been described in more detail in our previous article.[4] This solution is a professional level system under development, with a dedicated instructor workstation integrating an accurate and detailed scoring and statistical subsystem. We already tested it on soldiers to prove that the simulation sickness and prior

[4] Takács–Marlok [s. a.].

IT knowledge are not factors when the trainees use this simulator. At the time of writing this article, the test results are still under final evaluation. The simulation of firing with firearms (rifle, pistol) is getting closer to reality, but some important elements are not yet perfect, such as the simulation of recoil. For this reason, transfer of skills learned in the simulation into reality will not yet be 100%.

Figure 2: VR familiarisation test at the MH Kinizsi Pál 30th Armored Infantry Brigade in October 2023
Source: the authors' photo

The jarring effect, fear of gunshot sounds, the weapon held incorrectly or with insufficient power in live firing can cause discrepancies, even when simulations are carried out with very good results. For this reason, the training and practice of some basic shooting elements are only a secondary objective while testing the current simulator. Therefore, the selected testing trainees should have already participated in at least one basic shooting exercise beforehand. Of course, several elements of basic marksmanship, such as safe weapon handling, adherence to safety rules and the parameters listed above (e.g. selecting firing position, proper use of cover, etc.) are measured, evaluated, and subject of skill development even in this phase.

Previous research[5] has shown that simulation-based training can improve cadet performance even in basic pistol training. With our framework of exercises below, we aimed to provide and test higher level of training using VR technology, taking into account its limitations.

The original goals of the simulator development were to develop the good tactical decision making and the connected skills in combat situations. In a high-risk situation such as a firefight, cognitive skills and attention can be narrowed by the ever-changing environment and the trainees can develop their own techniques to counter it. Such techniques include stress management or attention-sharing techniques that can be demonstrated by the instructor and practiced with the soldiers for better results. Of course, it is important that training with a simulator should not lead to bad habits, i.e. the simulation of the complexity of the combat situation should always vary and preferably be adapted to the level of the practitioner's skills.

The experiment

We have implemented the VR based tactical training tasks into an actual training cycle of the HDF. The soldiers are participating in the same training program, however a half of the soldiers receive VR based training also, while the other half don't. After completing all tasks in the training program, the soldiers' performance is measured against each other, in order to get information (backed up by numbers) from the necessity and the usefulness of the VR based tactical training.

As we have mentioned above, the actual VR software we use supports best the training in the skills of identifying and acquiring targets, properly using the terrain, proper aiming, fast decision-making (at a very low tactical level) and communication.

Furthermore, we are convinced, that if we create gradually more difficult tactical tasks for the trainees, we can exploit the capabilities of the VR software, hence they are getting used to use their obtained knowledge (regarding using the terrain, marksmanship, decision-making, communication) while they are facing even more difficult tasks.

In order to have a valid picture for the effect of implementing of VR training into an actual training program, we have created sample tasks that can be practiced both in an actual shooting range and in the VR environment.

The measurement is multipurpose; therefore, we have focused on the followings while planning the sample tasks:

- knowledge transfer should be measurable: VR tasks have to resemble to the real-life shooting tasks, in order to support the practice
- the trainees could understand the necessity of employment of the previously learned tactical knowledge, and they could practice it in an immersive virtual reality
- we have tried to determine as many measurement aspects as we could, in order to have an even more accurate picture of the trainees' performance

[5] Krätzig–Hudy 2012.

- the sample tasks must be able to be executed the same way both in VR environment and both at the shooting range

For this purpose, we found the following tasks will suit the best.

The sample tasks

As highlighted above, trainees arriving to this stage of their training must have previously passed (at least) the basic shooting exercises of the basic training and the basic infantryman's training. In each task except for the first and second, trainees can obtain 20 points and if they make certain mistakes, they will receive deductions.

Shooting from a stationary position at different targets

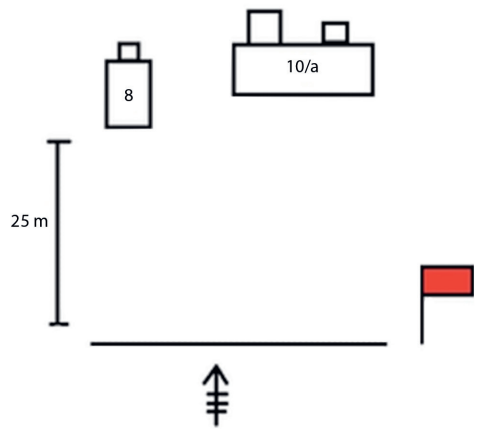

Figure 3: Schematic of "Task 1"
Source: compiled by the authors

Figure 4: Visual representations and environments of "Task 1", "Task 2", and "Task 3" in the VR simulator
Source: captured in Unreal Editor by the authors

The trainee stands behind a cover with the rifle at low ready position. Target 8 (standing rifleman) will appear first, and the trainee has 4 sec to hit it. After 4 sec, the target 10/a (machine gun fire team) will also appear, and it becomes the priority target.

The goal here is to measure the trainee's ability to quickly acquire and shoot an easy target and subsequently another at a fast pace. The other factor is whether, if the trainee cannot hit the first target (8), he will recognise the second (10/a), and realise that it is more important and act accordingly.

Scores:

- if he hits the first target (8) in 4 sec, then the second (10/a) in the next 4 sec, the trainee receives 10 points
- if he hits the second target (10/a) first, then the first (8), he receives 5 points, therefore he understood the priorities but the poor shooting skills prevented him hitting the first target first
- if he hits the first target (8) first but after 4 sec, then the second target (10/a) second, he receives 4 points, hence he failed to hit them fast and misunderstood their priority, but at least hit them
- if the trainee cannot hit both targets in 10 secs, he fails

Our goal with this task is to measure the marksmanship skills of the trainee by facing him with relatively easy (close range and stationery) targets, but he has to use his marksmanship skills fast. The trainee also has to retain his cognitive skills to acquire multiple targets and make quick tactical decisions according to their importance.

Shooting exercise in pairs at multiple stationery targets at a changing distance

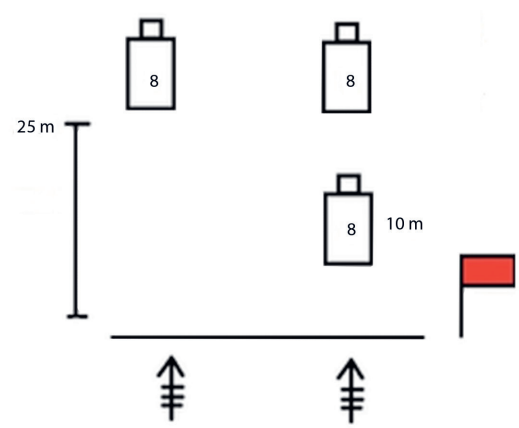

Figure 5: Schematic of "Task 2"
Source: compiled by the authors

The trainees are standing behind cover with their rifles at low ready. At first, the more distant targets appear, and the trainees have 4 sec to hit them. After 4 sec, the closer target appears.

Scores:

- if they hit the farther targets (25 m) in 4 sec, then the closer (10 m) in the next 4 sec, each trainee receives 10 points
- if they cannot hit both farther targets in 4 sec, but when the closer one appears, the one shooter that facing it hits it, while the other continues firing the farther, and they still hit both in 8 secs, they still receive 10 points each
- if they falsely identify the priorities and they hit the farther targets out of 4 secs, and only subsequently the closer one, they receive only 4 points
- if they cannot hit both targets in 10 secs, they fail

Our goal with this task is to measure the marksmanship skills of the trainees by facing them with relatively easy (close range and stationery) targets, but they have to use their marksmanship skills fast. They have to retain their cognitive skills to acquire multiple targets and make a fast tactical decision regarding their importance.

It is important to note that one of the two trainees is the commander, therefore he has the right to give orders on how to hit the targets. The points are divided equally though, because each trainee's life depend on their effectiveness.

Practice in pairs at stationary targets but in different distances and with different priorities

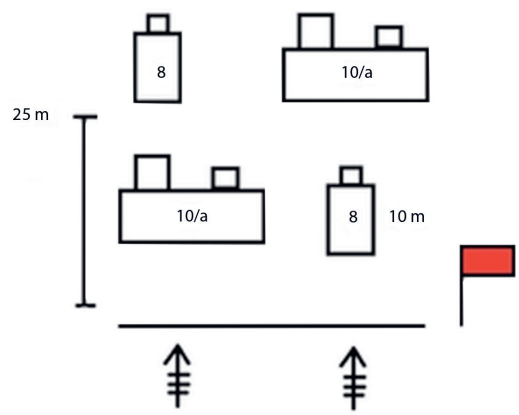

Figure 6: Schematic of "Task 3"
Source: compiled by the authors

The trainees are standing behind cover with their rifles at low ready. At first, the targets on the left appear, and the trainees have 5 secs to hit both. After 5 sec, the targets on the right appear and the trainees have another 5 secs to hit them. The ideal sequence of hitting the targets is: left 10/a, left 8, right 10/a, right 8. They have 10 secs altogether to hit all targets.

Scores: the max is 20 points, if they make mistakes, they will have minuses as follows:

- targets 10/a have higher priorities. If they hit both targets but one of the 8s goes down first, then it is –1 point (if the difference is less than 1 sec, there is no minus, hence it means that they have practically shot at once)
- if the targets on the right appear, there are targets still standing on the left, there are deductions as follows: if the 8 stands, –2; if the 10/ stands –4; if both are standing –10
- both trainees have a fully loaded magazine (30 ammunition). If they fulfil this task with less than 6 ammos per person, there is no deduction. If they fulfil it with 7–10 ammos, then –2 points. If they fulfil it with more but in time, then –4 points
- if they fail to hit all targets in 10 secs, they fail

Our goal with this task is to measure the marksmanship skills of the trainees by facing them with relatively easy (close range and stationery) targets, but they have to use their marksmanship skills fast. They have to retain their cognitive skills to acquire multiple targets and make a fast tactical decision regarding their importance.

It is important to note that one of the two trainees is the commander, therefore he has the right to give orders on how to hit the targets. Although, the points are divided equally, because each trainee's life depend on their effectiveness.

Exercise in pairs, moving forward with the coordination of fire and manoeuvre

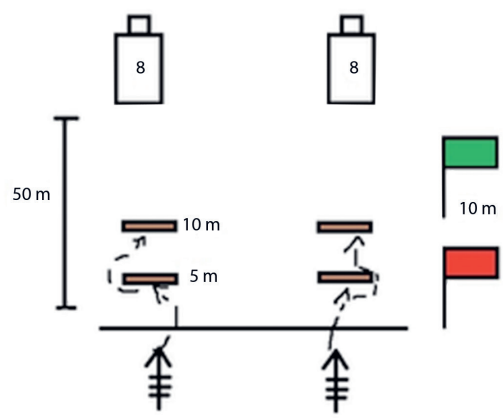

Figure 7: Schematic of "Task 4"
Source: compiled by the authors

The trainees are standing behind a knee-high cover with their rifles low ready. They have 12 bullets in 2 magazines (6 bullets in each magazine) per person. When the two targets appear, they have to use the cover appropriately (kneeling firing position). The one in charge has to give orders to commence movement with coordinated fire and manoeuvre (the actual correct order depends on the SOP of the training unit).

After the order is given, one of them has to safe his rifle and start moving forward, while the other starts shooting at the target. When the first trainee reached the first cover, he starts shooting at the targets, while the other commences the movement forward. This is repeated to the second cover (in line with the green flag, this is the limit of advance, LOA). The task is finished when the two trainees have reached the second cover and they have hit both targets 4 times (the targets will remain laying down after 4 hits).

Scores:

- if both targets remain standing, they failed
- if any of the targets remain standing, –10 points
- if there is a moment, when they are changing magazine simultaneously, there is also a deduction. If this period is longer than 5 sec, they failed. If it is 3–5sec, –8 points. If it is 1–3 sec, –3 points
- if there is a moment when one trainee commences movement while the other is not ready to fire, they fail

With this task, we also have multiple goals. First, we can measure the trainees' weapon handling skills, hence they have to switch between safe mode and single shots fast and accurately. Without mastering this skill, they will pose more threat to their comrades than the enemy.

Then there is the marksmanship, because, they will have easy targets, but they will have to shoot after a short rush (panting and gasping) from a swiftly occupied firing position. Then there is the ever-important communication, hence they have to coordinate their fire and movement.

Exercise in pairs, simulating clearing a part of a trench

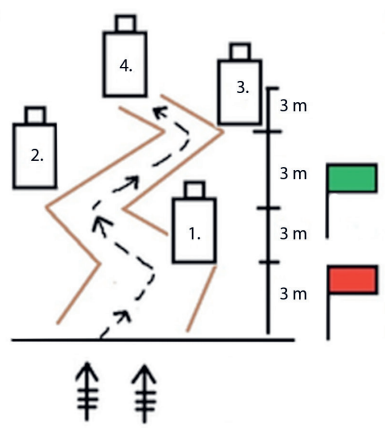

Figure 8: Schematic of "Task 5"
Source: compiled by the authors

Figure 9: Visual representations of "Task 5" in VR simulator
Source: captured in Unreal Editor by the authors

Trainees are kneeling in a trench (or rather in a corridor made from light materials, looking like a part of a trench), behind each other. One is in charge, and he decides the formation and he gives orders for the movement. The exercise starts when they are all set, and the "Line hot!" or "Harchoz!" orders have been given.

The first target appears in the trench, and the first shooter hits it. Subsequently, the first shooter (Shooter A) reports the "tango down" and orders the second shooter (Shooter B) to move forward to the closest corner of the trench. When the Shooter B passes Shooter A, Shooter A switches his gun into safe mode. In parallel, he becomes responsible for the security of the area above the ground level (against targets outside the trench).

When Shooter B achieved the first corner, the second target appears over the edge of the trench and Shooter B hits it. Subsequently Shooter B reports the hit, and Shooter A reports him that he has started moving forward to the next (second) corner. When Shooter A passes Shooter B, B switches his gun into safe mode, while A switches his gun into semi mode.

When Shooter A arrives at the second corner, the third target appears and Shooter A hits it. From this, everything goes on repeatedly until the last target is hit. At that time, the instructor orders "Ceasefire!" or "Tüzet szüntess!".

The maximum is also 20 points at this task. If one shooter's gun is not in semi or auto mode when the other is moving, then –10 points. If the target is not hit by the forward shooter, then –8 points. If the target is not hit 2 seconds after, it appears in front of the forward shooter, they failed the task.

The training purpose of the developed tasks

In the first task, our goal was to create a simple situation, when the trainee has time to spot and hit the target. But if he does not hit it under adequate time, he will face with another (even more dangerous, thus more important) target. In this task, the instructor can have a clear picture of the trainee's proficiency in weapon handling, shooting and basic tactical knowledge (understanding a very basic tactical situation in an uncomplicated environment).

In the second task, we have made the task a bit more difficult and simpler at the same time. It is simpler, hence there are two trainees for three targets, and more difficult, because the two trainees have to divide the targets between each other, in order to effectively hit them. In this task, we tried to face the trainees with a bit more difficult task, but we wanted them to use the same skills as in the first task: fast aiming, understanding the tactical situation (which target is more dangerous and more convenient for which shooter).

In the third task, our goal was the same as in the second, just in an even more complex environment. The trainees have a relatively short time to hit the first bunch of targets, then the second. They have to understand the tactical situation in two aspects: understand which target is more dangerous, and understand the physical space's layout to find the more convenient targets for each shooter. In this task, they use the same skills as in the previous.

In the fourth task, we have raised the challenge. In this task, we still want the trainees to use their skills of fast aiming and fast target acquisition, but they have to use them after a short rush and in synchrony with their comrade. They have to be able to quickly find an adequate firing position (not too visible but stable) after each short rushes. They have to send and receive easy reports regarding fire and manoeuvre, and they have to handle their guns accordingly (safe mode, fire mode, changing magazine etc.). These necessary activities belong to the skills of weapon handling, marksmanship and basic tactical skills.

In the fifth task, we increased the challenge compared to the fourth. It is a bit easier, though, because the targets appear only in line with the trench, but is also a bit more difficult task, hence the trainees' movement corridor is narrow, and they have to spot targets both inside the trench and on the edge of the trench. In this task, the trainees use the same skills as in the fourth, but they have to have more developed skills in order to be successful.

Conclusion

In the past, there have been measurements of VR effectiveness and skill transfer, but these were conducted on not professionally developed devices or on rudimentary technology. In our experience, the majority of shooting and tactical instructors are still averse to similar technology. They think it is best to learn basic tactical and marksmanship skills only at the firing range. We partially share this opinion, but there are many tasks and situations that simply cannot be practiced at the range on the desired level, mainly because of the lack of ammunition and the limited availability of the firing ranges. We have taken great care to ensure that such trainers can see the potential of the system from a professional point of view. In addition, certain crucial skills can be fully and more easily developed on a professional system with proper instructor supervision.

It is also important to note, compared to previous experiments, that today's young soldiers are no longer averse to the use of such equipment. Besides that, as we developed the exercises above, we have created parallel separate tasks with identical scoring system, but inside a realistic combat situation. This is not simply gamification for the sake of experience, but also to show how the skills practiced during exercises can be used correctly in a real combat environment, e.g. under enemy fire. The tested system did not

start from the technological side, but by putting together a framework that took training aspects into account. As we discussed in our article, VR cannot yet fully simulate the dynamics of firing and battlefield environments, but it gives a huge advantage in tactical training through exercises designed with the right level of sophistication and integrated into training. The VR training possibilities we detailed here are only the tip of the iceberg.

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VR Training Opportunities in the Hungarian Defence Forces[1]

Tamás MARLOK,[2] Márk György TAKÁCS[3]

The aim of our study is to explore the potential of VR technology in the Hungarian Defence Forces. The justification for VR training starts with the classification of xR devices, where VR is a sub-group. Based on the literature and the experience gained so far, we examine what tasks each type of xR device is suitable for. We present the reader with the main technical parameters that may influence the usability of these devices in training. We review the GTS system[4] that we have been able to test, and which forms the basis for further research. To find the optimal placement of VR devices in the training system, we summarise the training practice of the Hungarian Defence Forces and – based on the first tests and according to the purpose of the GTS system – we dig deeper into the individual and sub-unit infantry training. Considering the current state of development, we present the training areas where the introduction of VR can be particularly beneficial.

Keywords: *military training, VR, AR, simulation, immersivity*

Introduction

The well-known fact that military developments bring breakthroughs in technology is still true, but some technologies are spreading and refining much faster in the civilian sector. An example of this is VR (virtual reality) technology. Extensive research was done in this area decades ago, but certain boundaries could not be crossed at that time. A major development started when the hardware and software of Oculus's first VR devices became open source and the potential for entertainment was recognised. As consumer VR devices gained popularity, many companies started to develop headsets and software. Later, these systems have achieved a quality that has allowed their use in critical training, such as

[1] Project no. TKP2021-NVA-16 has been implemented with the support provided by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the TKP2021-NVA funding scheme.

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[4] The GTS System is a VR system for Military and Law Enforcement tactical training developed by Infinit Simulation company (Online: https://infinitsimulation.com/).

firefighter and soldier training and medicine. Small start-ups and game development studios have started to apply the accumulated knowledge and experience of agile software development processes to enter the military market. The quicker feedback in the consumer market has allowed them to move faster than most specialised development companies or research institutes. In addition, products are cheaper to reach the test phase and can be more easily tailored to users' needs within specific projects.

The Hungarian Defence Forces already recognised the potential of the VR technology,[5] and now has the opportunity to use such a system, developed by a Hungarian company that combines military and law enforcement knowledge with half of a decade of VR development experience. Our article examines this company's system and explores in detail the opportunities and benefits of its deployment. To do this, we give an overview of the used VR technology and the system tested. We review the structure of military training and – based on our tests – fit the VR-based training software into the training structure where it is already applicable.

The discussed VR technology

xR head-mounted devices

We will discuss VR glasses, VR helmets, and so-called VR head-mounted displays (HMDs). It is essential to mention that virtual reality HMDs are part of a larger group. As their name suggests, these HMDs are worn on the head with built-in displays and speakers (headphones). The principal purpose of these devices is to make us perceive information generated by a computer.

The group is collectively referred to in the literature as xR devices, where 'x' stands for the variable where the corresponding letter is inserted. They are also called alternative reality devices. These tools have different approaches depending on their purpose, but they are based on a common technology, and their use is similar. Most strikingly, the output channels (image and sound) are placed directly on the senses and provide the user three-dimensional (stereoscopic) image and surround sound. They mainly use natural inputs, which is also a common trait. In case of natural input, the system can process the operator's body movements in human–machine interaction, which can be movements of the head, limbs and hands.

The number of such input channels may vary depending on the sophistication level of the device type and the target market. Some devices only track the movement of the head, but others can use additional sensors to interpret the exact position of the hand and even the fingers as input. The sub-groups will be discussed in the following sections.

[5] Németh–Virágh 2021: 2–7.

Augmented Reality – AR

AR – or augmented reality devices – aim to augment the real space seen by the user with computer-generated and projected information, preferably in sync with the movement of the wearer's head. The projected information can range from a simple two-dimensional compass – or a directional marker – to a complex object projected onto a given location in three dimensions. The point is that the operator is looking at a real space, which could be real-time images from forward-facing cameras or through a transparent lens system like the HUD of an aircraft, which can have computer-generated real-time information projected onto it as a hologram. An example of such a device is the Integrated Visual Augmentation System (IVAS), which uses special Microsoft HoloLens technology and has been tested by the U.S. Army.[6] Previous research has also shown that similar AR (See-Through Near-Eye Displays) with transparent lens systems have physiological limitations because the image projected directly in front of the eye and the space seen through the lens can lead to focusing problems and simulator sickness. Such challenges are addressed using different technological solutions.[7] The AR system could be designed so that the device projects images from its cameras onto the display (pass-through) and places the information on it but this technology is expensive and will be specific to the MR systems discussed later.

Such AR systems should be used in situations where the primary purpose of the activity is happening in the real world, and the device is providing visual cues and information to the user. It could be a checklist for the maintenance of an asset that also shows where to check a particular point, a situational awareness picture in a combat situation, or the current air situation in the airspace. Based on the presentation[8] of the Technical Director of the IVAS program, their device is also able to support fight (sensing, decision-making, target acquisition, target engagement), rehearse and train; however, new developments at the end of 2022 showed that the system still needs to be improved to stop causing nausea and headaches. Accordingly, it seems that the biggest physiological weakness of the see-through AR HMDs is still present.

6 Siter 2019.
7 Xia et al. 2022.
8 Regnier 2021.

Figure 1: IVAS system
Source: Britzky 2022

Mixed Reality – MR

Mixed reality devices are very similar to AR devices as they display real-world images and virtual information together in three-dimensional pictures. The difference, however, is that they can integrate the generated image into the real environment, i.e. real objects can cover out virtual objects and vice versa, and the users can interact with those virtual objects.

Figure 2: Mixed Reality HMD in use
Source: Flight Safety s. a.

It represents a higher technological level, because these kinds of HMDs do not use transparent lenses but create three-dimensional pictures for the user from the image of forward-looking cameras, and they also map the geometry of the surrounding space and superimpose the generated information before displaying it. This operation requires the incorporation of a LiDAR sensor and high-quality forward-looking cameras compared to other xR devices. There are earlier devices listed as MR devices, but we would classify them more as AR since they place virtual objects in space but in front of real-space objects.

Figure 3: Mixed reality from the user's viewpoint
Source: Antunes 2020

MR devices, therefore, allow a form of training where it is essential to perceive real objects, but the virtual space and the generated virtual content are also an essential part of the experience. Figure 3 shows the interior of an F/A-18C aircraft, where the hands, checklist, stick, rudder and throttle are taken from the real world, but all other visual information is computer-generated. Currently, the Varjo XR-3 Focal Edition[9] represents the quality that can be used even for training.

Virtual Reality – VR

The point of VR devices is to obscure the entire field of view, replacing the visual information entirely with a stereoscopic image synthetically created by the computer. Thus, it generates the entire environment, and any scene or audiovisual environment can be simulated. Since the user has no perception of the external space, this device should only be used in special safety circumstances.

[9] Varjo XR-3 Focal Edition (https://varjo.com/products/xr-3-focal-edition/).

Figure 4: The GTS equipment of Infinit Simulation on Hungarian Special Forces Soldiers
Source: GTS Brochure; Pápai Joci Photo

VR devices with additional equipment can be advantageous for training because of the natural input and fully simulated environment. Many such devices are commercially available, such as HTC Vive Pro, HTC Focus, Meta series, Varjo Aero.

Typical technical parameters

The typical technical parameters are similar for all xR devices, but here, we focus on VR devices. For these, the most essential technical parameters are those, which can compromise the experience of reality or the feeling of the presence of so-called immersivity.

The natural input mentioned above is a primary factor, which should be understood as the ability to move one's head in a computer-generated three-dimensional space and look around freely without the need for any other controller (mouse, keyboard, etc.). The movement of the head is detected by the HMD and – by tracking the movement in the virtual space – it generates the image from the viewpoint corresponding to the new position. As it can be seen, it is a complex process, starting from collecting and processing the data from the sensors and ending in displaying the image. This process causes some latency in all systems. It is called the "motion-to-photon latency" or response time, which is now sufficiently fast in today's VR systems. HMDs convey a stereoscopic, three-dimensional image to the user, as the built-in displays show a different image through the lenses to the right and left eye with a proper horizontal shift. Due to the parameters of the lenses and displays, the quality of the visual experience for different devices ranges widely. The most important ones are the size of the field of view, image resolution, brightness, refresh rate, colour and image distortion. In terms of image quality, the size of the field of view is of particular interest for horizontal viewing angles, which can vary from model to model but the generally offered 100–115 degrees are adequate.

Another crucial element is image resolution so that the image is not "pixelated". Very high pixel density should be achieved on these built-in small displays. When looking at monitors, they take up about 50–55 degrees of our field of view with a certain picture resolution. For the same experience, the HMD display would require roughly twice the resolution. It is not yet possible with all devices, which in some cases limits their usability in training. The brightness and 75–90 Hz refresh rate[10] are all adequate in today's available devices. Image distortion can be a problem in training and should be considered on a type-by-type basis. Some VR devices use Fresnel[11] lenses, which can cause a blurred, distorted image at the edges of the picture, so these types should be avoided or upgraded in military training.

In summary, nowadays, most of these devices are adequate for training purposes but how and to what extent these parameters may affect their training capabilities will be examined in specific cases later.

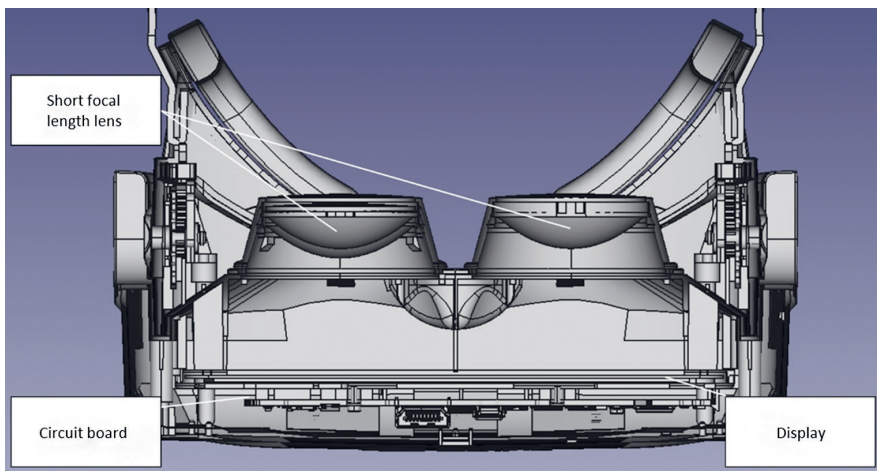

Figure 5: Cross-section of the Oculus Rift DK2 HMD
Source: compiled by the authors using FreeCad 0.19 software based on https://github.com/facebookarchive/riftdk2

Further key factors about VR technology

A key advantage of computer-based training systems is the possibility of complete (detailed) and automatic data collection. VR technology takes this to a higher level thanks to natural inputs. It is easy to see that the detail and volume of data collected in this way provides the potential to be processed by artificial intelligence. With artificial intelligence,

[10] The refresh rate refers to how many times per second the hardware is able to draw a new image to the display. 75 Hz means that the hardware can generate and show 75 different images in one second to ensure moving image perception. Low refresh rates can cause flickering and eye strain.

[11] Merriam-Webster Dictionary: a lens that has a surface consisting of a concentric series of simple lens sections so that a thin lens with a short focal length and large diameter is possible and it is used especially for spotlights.

various branches of machine learning could yield results that could even lead to changes in training methodology.[12] One aspect of a learner-centred approach could be the analysis of task execution data from the trainee's perspective. In addition, the effectiveness indicators of the sub-units can also be sought. Because of the photo-realistic visualisation, VR tools can even be used as input to computer vision systems, but that is a topic for a future article.

VR as a training tool

One of the key elements of successful training is interactivity, something that has been tried to be established even before computer systems. Later, with the development of computer technology, the training simulations became more and more effective.[13] In military technology – as a regular rule – the newest technical developments were tested and used; there were attempts to use VR HMDs in military training way before the technical parameters were sufficient. These systems – such as early DSTS versions – were built and tested, and the results[14] pointed to further opportunities for improvement. It is not surprising, as more than ten years have passed, and nowadays, even commercial products are much more advanced than the tested DSTS configuration. In the last decades, commercial development has outpaced military research in some fields; therefore, many companies have tried to step into the military development market with an agile development approach. Thanks to the sophistication, availability and modularity of the hardware and software tools, soldiers themselves have been able to produce advanced military devices.[15]

Going back to VR training tools, the possibilities are also available in Hungary with the most modern development, the Infinit Simulation GTS system, which is suitable for shooting and tactical training. From the very beginning, the system and software parameters have been designed and developed for a military training tool, considering the higher requirements. For the 2022 GSOF Symposium[16] and for the projects of the Ludovika University of Public Service (LUPS Budapest) we developed, fine-tuned and tested the system and its training scenarios, so we know its main parameters and capabilities. Later in this article, we explore its usability and integrability in the Hungarian Defence Forces (HDF) training. To find the place of optimal use, we review the important parameters of the GTS training system and the training structure of the HDF.

[12] Németh–Virágh 2022: 2–7.
[13] Martirosov–Kopecek 2017: 0708–0717.
[14] Reitz–Seavey 2016.
[15] Stilwell 2020.
[16] GSOF Europe s. a.

Overview of the GTS

As mentioned above, the GTS system is designed for military and law enforcement tactical training from the beginning. The developer – Infinit Simulation – is a spin-off of a successful VR game developer company, and it aimed to bring more than half a decade of VR development experience to military training. They combine academic research, practical–tactical shooting knowledge, and VR software development experiences.

In its current state, the system can simulate the M4 assault rifle in VR using special hardware that looks and handles exactly like the real weapon. VR creates an environment for the user that is well designed to prepare them for situations that are difficult to simulate otherwise. In case of the GTS, this means environments and situations where a personal weapon must be used during training exercises. Beyond the environment – as the situation is created by software – it has complete flexibility. In the framework of a LUPS research and for the GSOF symposium, we had the opportunity to jointly design a checkpoint protection situational awareness exercise. This training exercise was tested, validated and refined before being used in LUPS Budapest research. In the scenario, the soldier loses his fireteam partner and must fight off enemy attackers with his carbine alone, while innocent civilians also emerge.

Figure 6: GTS system Checkpoint scenario observed via GTS Instructor Workstation
Source: screenshot by the authors

The system measures several parameters in addition to hits. The execution can be monitored on an instructor workstation at any angle in real-time and can be replayed.

The GTS was designed to be capable of the following training scenarios:[17]

- weapon familiarisation on virtual models
- shooting tuition, such as aligned sights, reloads, firing positions, piercing and ricochet
- basic tactical skill development, like target acquisition and target engagement order
- CQB practice: relevant angles, tactical advancing and situational awareness
- squad level engagements for team development (jump): contact drills and communication
- improving leadership skills and tactical leadership process
- complex tactical environment simulation with changing adversarial strategies

As well as providing a physiologically affecting, immersive experience, accurate gun hardware also trains muscle memory and helps trainees develop their skills faster through detailed evaluation. After this overview, we now move on to exploring the feasibility of training integration.

Training in the Hungarian Defence Forces

Organising and planning training in the HDF

At the time of writing, the new Chief of General Staff of the HDF has not yet been appointed. As in every military organisation, the usual rule stands here too, i.e. the deputy of the commander is responsible for the training.

There are several inspectorates in the HDF responsible for the development and continuous improvement of a branch or service. In this regard, they have rather a technical and equipment focus than training. Their influence on training is of course via the equipment, technology, and by creating strategy and long-term vision.

Below the commander – and next to the inspectorates – the main organisations at the strategic level are the directorates. The Training and Exercise Directorate (HDF TED) holds the main responsibility for the training with coordination of the Force Planning Directorate (HDF FPD).[18]

The HDF TED plans and organises the training at the strategic level in accordance with the vision of the COM and DCOM HDF. They plan and organise the annual national combined arms training exercises conducted by multiple HDF units and the multinational exercises conducted in Hungary. Furthermore, they inspect and approve the HDF units' annual training plans.

The approved annual training plans of the units are the main documents in which a given unit's commander can find all the necessary training exercises and tasks that his

[17] Quoted from the GTS product brochure.
[18] Honvédelem 2022.

unit has to carry out that year. There are four large types of training in the annual training plan: basic training, individual training, operator training and unit-level training.

Usually, the unit continues its training plan from the previous year. In so far as there is a basic training to be carried out by the given unit, a temporary basic training unit has to be formed. After the basic training – or after acceptance of recruits – unit-specific individual trainings must be conducted (e.g. driver training, para jump, turret gun training, staff officers' training, etc.). As a rule, there is a main training event every year, which is a combined arms (usually multinational) training exercise. This training exercise serves as a goal for the organisation when planning training at lower unit level (e.g. squad and platoon level).

The unit's annual schedule is the document, which specifies the training sessions and exercises for each subordinate unit and individual. The maximum level for each unit is its jump, which is planned and inspected by its superior, e.g. the jump of the platoon is planned and inspected by the company commander (more often the deputy commander). The time by which a given unit or subunit has to be forged together is the deadline. From this deadline, the deputy commanders and the G7 and S7 officers count down the available time for sub-unit jumps and individual training.[19]

Regularly, individual training sessions are planned and organised – and their curriculum is specified – by the battalion and the company.

Reviewing the types of training sessions

In this part of our study, we examine in detail all the four main types of training mentioned earlier.

Basic training

The goal of the basic training is to transform the individual from a civilian into a soldier. To achieve this goal, the most important feature of the basic training is to demolish the personality of the recruit and to rebuild it as a functioning soldier. The units and instructors conducting basic training must have all the necessary skills and rights (e.g. harsh drills, destroying the boundaries of privacy, rigid treatment, etc.).

Therefore, next to this psychological transformation, the recruits must learn a great number of new skills. The bulk of them are not even skills but knowledge and correct employment of certain rules of the military. They then must learn the skills and practical knowledge, especially the handling of individual weapons (assault rifles, pistols and hand grenades).[20]

[19] HVK 2019: 80.
[20] Honvédelem s. a.

Individual specialist training

Normally, after the basic training, the recruits are transferred to their units, where they begin individual specialist training. The goal of this training is to teach the recruits all the necessary knowledge needed to fill the position for which they had been recruited. There are several types of individual specialist training, depending on the branch or service.

For example, at an infantry unit, there is leadership training for junior NCOs, and gunnery training for machine gunners, snipers, marksmen and AT grenade launchers. Basically, all units have some kind of heavy vehicle; therefore, drivers' training should cover all vehicles (tanks, SP howitzers, bulldozers, etc.).

Of course, there are differences depending on the recruit's rank. Enlisted soldiers will learn individual knowledge related to their position. Junior officers and NCOs may also start with learning to use all weapons and equipment they will have under their command, but they also must learn the decision-making processes they will employ as commanders.

Of course, if this unit is not an infantry unit, the individual must familiarise with the special weapon systems in service at his unit such as CBRN decontamination devices, AA missile systems, radars, aircraft, etc. All in all, we can state that this type of training is the one where the individual familiarises with complex weapon systems and equipment.

Crew-served weapon system's crew training

This type of training is a special one. Some would say that it is part of individual specialised training because a crew-served weapon or vehicle (e.g. medium machine gun, APC, or even an attack helicopter) is an individual part of a sub-unit.

These assets are operated by multiple individuals; therefore, we think it is better to distinguish the crew training and discuss it separately. There are two key elements of this type of training. The first is to master the task of each individual crew member. The second is to synchronise the activities of the crew members to perfectly operate the weapon system.

This type of training requires an enormous amount of time for practice with the weapon system that the crew will use. They must learn to use it under all circumstances (day and night, hot or cold, and in good and also extremely harsh weather).

Jumping of sub-units and units

The jump here is a special term for the common training of a given sub-unit or unit. After the successful individual and crew-served weapons training, the goal of the jump is to synchronise the activities of all unit members under the command of the commander, under all circumstances.

The jump consists of mainly tactics and shooting training. Optimally, from the company level upwards, combined arms training comes into focus, where the commanders and

individuals learn the rules of working with individuals and units from different branches (tanks, artillery, engineers, air defence, CBRN, airborne ops, etc.).

This type of training, just as above, requires a lot of time. Firstly, the commanders and staffs must familiarise themselves with each other's branches, and then the units must begin cooperation, preferably in the virtual battlespace. The final step of this training (we can easily call this the peak of training) is the combined arms live fire exercise executed under all circumstances.

Matching the needs of training and the VR's capabilities

As explained above, training has multiple aspects, types and levels. According to the goal of our study, in this part, we briefly present the common part of the training's needs and the capabilities of today's VR technology.

Because of the above-described features of VR technology, we state that the primary role of VR training is now at the level of the individual. Therefore, at this level, there is already a wide range of options available.

Primarily, where the individual soldier employs a complex machine (tank, bulldozer, aircraft etc.), it is useful to teach the handling of the basic switches and handles in the VR because if something goes wrong, the – usually – expensive asset will get damaged. It is a lot cheaper and easier to build the dashboard of the complex machine in the virtual space and practice procedures multiple times than to use the actual military hardware for basic operator training. Furthermore, there are emergency situations (e.g. fire or explosion) that cannot be practised on the actual equipment.

For shooting training, of course, the live fire exercises are indispensable. However, this training requires a lot of resources to organise and execute. It is even more true if we consider that live fire exercises are carried out not just with small arms but with complex missile systems, tanks, etc.

VR is a perfect solution for practising the complex aiming and shooting procedures of artillery systems, AA missiles, etc. In case of small arms, VR can be a good solution for practising certain elements of marksmanship (range finding, target prioritising, giving and executing firing orders, etc.).

As we explained above, after finishing the individual training, the next phase is the crew training and the subsequent jump. At the present state of development, the current VR equipment cannot provide an adequate level of practicality, it needs software upgrade and scale-up. This scale-up is possible with sufficient development resources. The crew training of tank crews, AA missile systems, etc., consists of simultaneously executed individual training, so, VR is still a good solution here. However, in case of beginner jumping squads and platoons, the actually available PC-based tactical simulation software is adequate. So far, we have only been able to test the system at the soldier level, but according to the developers, it is capable for squad level and will be available at a higher level later, up to platoons or even company.

Therefore, here we have to underline, that the individual, who spent hours of training and familiarisation in VR will use the real equipment with greater confidence and less likeliness of causing damage, and with this confidence, the jump will be also more time- and cost-effective.

The most effective field: Infantry individual training and sub-unit tactical training

The subsequently listed features are true to all aspects of individual and small unit infantry and shooter VR training:

- It is not necessary to go out to the actual training ground or shooting range (it saves a lot of time and sustainment of the exercises).
- The soldiers will not get used to the terrain and features of the training ground, hence in the VR simulation, an almost indefinite number of maps can be built.
- The complexity of the terrain can be gradually increased parallel with the complexity of the training exercise and with the progress of the individual.
- Any type of circumstances (day, night, fog, full moon, crosswind, etc.) can be simulated independently of the actual weather.
- All activities of the trainees can be monitored, measured and recorded for later and more objective assessment. The system is also able to visualise certain parameters like field-of-views, direction of barrel, safety zones, pulse and even eye movement.

After considering these common features, we should focus now on individual training. At the current level of development, VR has the most opportunities at this level.

The first field of training is shooting training. With the above-mentioned advantages, the individual can practice:

- aiming (with multiple types of small arms, depending on the special "controller")
- assessing distance of targets and terrain features
- acquiring targets and prioritising them according to the previously received or on-the-spot received orders
- the procedure of the shooting itself (if the controller is authentic, all small-aiming and shooting errors can be monitored)
- while executing these tasks, the level of stress and the complexity of the task can be increased by decreasing the available time for the task with trained muscle memory, more and more difficult targets, decreasing visibility, etc.

If the individual has been trained at the infantry units, the next step is the fire team or the squad. Usually, a fire team consists of 3–5 soldiers armed with assault rifles, machine guns and/or AT grenade launchers. Two fire teams make a squad, but in case of some infantry units (e.g. armoured infantry), the squad is not large enough to form two fire teams. A fire team can be the manoeuvre or the base of a fire element in a tactical situation. The VR currently has a lot of possibilities to practice the following:

- Organising a constant fire. We mean that in case of contact with the enemy, it is indispensable that at least half of the fire team is firing his weapon, regardless of whether someone is changing the magazine, reloading the machine gun, or changing its barrel.
- The core of the fire team is the machine gun. Therefore, the riflemen and the AT grenade launcher must synchronise their fires in time, in the field of fire, and in density with the fire of the machinegun. It requires a lot of ammunition and time at the shooting range, which can be substituted with VR.
- These tasks can be conducted even in difficult circumstances. The number and density of targets, the weather and visibility can be changed in accordance with the training level of the fire team/squad regardless of the actual terrain and weather on the shooting range.

After the squad has been partially trained and their fire has been synchronised, it is time to hit the training field and practice everything with actual manoeuvres with real distances and the weight of the real equipment. At this period of training, the guidelines are the tactical tasks that can be conducted by the infantry squad. It is useful that the training continues with the easier and more basic contact drills: breaking contact and envelopment.[21]

The break contact is a basic defensive contact drill during which an infantry sub-unit (fire team, squad, or platoon) receives fire from a superior enemy, and the sub-unit must break contact, extract itself from the enemy fire, and withdraw to a favourable position to reorganise itself. As with all tactical tasks, this also consists of the close coordination of fire and manoeuvre. There are multiple types of breaking contact, depending on the sub-unit's formation (always determined by the terrain, weather and mission), and the direction and effectiveness of incoming enemy fire.[22] These features can be loaded into the VR simulation much more easily than creating them the training ground with OPFOR.

As we mentioned above, at the current level of development, VR is not capable of simulating tactical manoeuvres in full size. Therefore, we also stated that in all tactical tasks that consist of manoeuvre and fire, VR is perfect for practising firing and constrained manoeuvre skills. During breaking contact, the following skills and tasks can be practised in VR.

- Acquiring the target with 3Ds (direction, distance, dimension).
- Giving and receiving orders and information regarding the enemy and the incoming fire.
- Quickly organising effective counter-fire to suppress the enemy, or at least decrease the effectiveness of its fire.
- Each soldier must use his weapon according to the situation and received orders (finding the designated target, using the capabilities of the weapon with regard of its caveats).

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21 Ranger Training Brigade 2011: 6-1–6-2.
22 Ranger Training Brigade 2011: 6-4.

- The commander – quickly assessing the situation – organises the system of fires (target reference points, firing sectors, high priority targets, concentrations of fires, restricted firing lines, other caveats and limitations, such as ammo expenditure, etc.).
- Coordinating changing magazines, reloading machine gun, changing barrel, and reloading the AT launcher during breaking contact.

After reviewing the basic defensive drill, the basic offensive drill can be the subsequent topic. The basic offensive drill is the envelopment. Conducting the envelopment at the sub-unit level means that the sub-unit gets into contact with an inferior enemy. After the precise specification of the target (with the 3Ds), the commander quickly forms a manoeuvre and a base of fire element. As we stated before, at this moment, VR is more useful in practising firing skills. During an envelopment, the following can be practised.

- acquiring the target with 3Ds (direction, distance, dimension)
- giving and receiving orders and information regarding the enemy and the incoming fire
- quickly organising the two elements
- describing to the base the fire element, the direction of the manoeuvre, the signals of lifting fire, and the ceasefire
- organising the effective suppressing fire for the manoeuvre
- executing the lifting fire and the ceasefire

The last basic drill is the knockout of a bunker, the so-called SOSRA drill. The acronym means Secure, Obscure, Suppress, Reduce, Assault. Again, the VR is more useful for the firing tasks, which are as follows.

- Secure: isolating the bunker from its adjacent forces, practically with effective fire at the flanks.
- Obscure: launching smoke grenade to an adequate place to obscure the visibility of the enemy (this should be practiced thoroughly because of the difficulties of anticipating the wind).
- Suppress: effectively suppressing the enemy with fire, while the breaching element approaches the obstacles.
- Reduce: at this part, also the suppressing fire should be maintained at a high level.
- Assault: the coordination between the manoeuvre and the base of fire element is crucial. It means that all the signals and firing orders should be practiced.[23]

After all elements of these drills, that can be practised in VR, are thoroughly practised in all circumstances, real-life exercises must follow without any shooting at a slower pace. Then comes the real pace, the blank ammunition under all circumstances and finally, the live fire exercise day and night. In this complex and resource-consuming process, VR can save us an enormous amount of time, ammunition and weapon life by providing an opportunity to practise all necessary techniques for effective fires.

[23] Ranger Training Brigade 2011: 6-8.

Of course, not only basic infantry drills should be practised, war is a much complex phenomenon. Therefore, we must underline that by practising these drills, the soldiers and sub-unit leaders can acquire a lot of useful experiences in order to better execute the more complex tasks.

These tasks are fighting in built-up areas (FIBUA) and peace support operations. The FIBUA consists of lots of small individual movement techniques that can be practised even at this level of development of the VR. These are:

- firing from behind corners and windowsills
- entering into rooms (the so-called slicing)

Of course, the main topic is again the fires. Firing in built-up areas often means that soldiers must fire at targets at a vertical angle. This angle largely influences the trajectory of the bullet (in extreme situations, the target is spotted under an obstacle, but the bullet flies over the obstacle to hit the target). These features can easily be programmed into the simulation, and this can provide an opportunity to train these shooting skills without building this complex shooting range.

During peace support operations, firing skills are also essential. Soldiers must thoroughly know the ROE (rules of engagement). These rules define the situation against which targets a soldier can and must use his weapon. In real life, these situations are extremely stressful, and the soldier and the commander must make a decision in a fraction of a second.[24]

VR is perfect for practising this, therefore practically indefinite types of situations can be simulated, from the basic and clear to the insanely complex. The soldier can be put on guard duty, at a checkpoint, or anything else, and the situation can be any kind. From the simple, clear threat of an attacking gunman through complex suicide bomber and small arms attacks, to complex attacks with decoy targets and civilians in an environment full of limitations and restrictions.

The individual in the VR can practice:

- employing the rules of engagement
- when it is allowed to use his weapon, against which type of targets
- carefully avoiding causing collateral damage
- respecting restrictions and constraints (e.g. do not fire churches or orphanages)
- choosing the appropriate amount of destructive power (weapon and/or ammunition types)
- all the basics of firing mentioned above at the tactical drills

Now we can see that at the current level of development, VR can enhance training in multiple situations. We must underline here that VR does not substitute actual real-life training. We think that the greatest opportunity in VR currently is the following:

- classifying threats and targets
- practising giving and executing firing orders

[24] Department of the Army 2010: 5-3.

- organising fire systems of fire teams and squads
- employing the ROE in a peace support operation
- practicing firing with vertical angle

Finally, we must emphasise again that VR can provide these opportunities in an environment that gets gradually more difficult in parallel with the trainees' progress. Furthermore, all exercises can be recorded and replayed for further and more objective assessment.

Conclusion

In our paper, we have examined the capabilities of VR at the current level of development. We have found that in the focus of training, the Hungarian Defence Forces can profit a lot if VR is correctly implemented at the adequate levels. These levels are individual specialist training, sub-unit level training and crew training of complex military hardware.

After reviewing the training options in these training types, we have thoroughly examined the VR's options in the field of individual and sub-unit level infantry tactics training. We have found an enormous number of opportunities where VR can save a lot of time and other resources (money, ammunition, lifespan of weapons, etc.) for the HDF. Furthermore, VR has other advantages regarding the methodology of the training. VR technology enables the difficulty of training to be increased according to the purpose of the unit and the capabilities of the trainees. Furthermore, the training events can be recorded and replayed for more objective assessment and analysis.

All in all, we can firmly state that even at the current level of development, VR-based training can have a lot of advantages and can further help the training process if used at the correct level and at the correct phase of the process.

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National and International Perspectives of the Hungarian Ground-Based Air Defence Forces (1)

Strategic Environment and First Glimpse of Multinational Capability Development Options

Daniel PASSBACH[1]

Considering the current strategic and operational environment, it is obvious that conventional war in Europe became a reality again after a long time through the Russian aggression in February 2022. Robust air defence capabilities obviously play a key role in countering traditional as well as new emerging threats. This article serves as the starting point to discuss the national and international perspectives of the Hungarian ground-based air defence forces in a short series of publications, which intend to reflect this topic area from different perspectives. This part (1) examines the current strategic environment for Hungary – in general as well as from an air defence perspective – and explores first generic options for managing and further developing air defence capabilities in the near future.

Keywords: *strategic documents, operational environment, capability management, air and missile defence, multinational cooperation*

”The power of an air force is terrific
when there is nothing to oppose it.”
Winston Churchill

As Winston Churchill clearly highlighted, air defence capabilities are crucial for protecting populations, territory and forces in an armed conflict against aerial threats. Since a respective surface-based capability is essential for any sovereign European nation and North Atlantic Treaty Organisation (NATO) ally, Hungary (HUN) has invested significantly into rebuilding its ground-based air defence (GBAD) forces.

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National strategic documents

The current National Security Strategy (NSS 2020) entitled "A Secure Hungary in a Volatile World"[2] was published on 21 April 2020 by the Hungarian government. The previous NSS of 2012 had to be considered obsolete, after several incidents and developments – as the Russian annexation of the Crimea, the migration and refugee crisis and the emergence of international terrorism – had considerably changed Europe's security environment.

The NSS 2020 offers pessimistic views on the regional and global development in the current decade and identifies strategic vulnerabilities, prioritising 17 threats and challenges. In consequence, it presents potential ways to pursue Hungarian national interests. Prevention, resilience, rapid and effective response are referred to as fundamental tools against these threats and challenges and the importance of the whole of government approach is explicitly stressed.

The goal of the NSS 2020 is to ensure that Hungary will become one of the five safest countries in Europe and one of the ten safest countries in the world by 2030. This should be supported by creating "modern military of regional significance" and by further developing the Hungarian Defence Forces (HDF) in order to expand the "ability to defend […] fundamental values and interests and to remain an active and credible contributor to Euro-Atlantic security in the future".

NATO is referred to as "the cornerstone of Hungary's security", followed by a clear commitment to the obligations of Article 5 of the North Atlantic Treaty as well as to the values expressed in the NATO and EU treaties. The NSS 2020 mentions the Zrínyi National Defence and Armed Forces Development Programme[3] (Zrínyi Programme) as the foundation for the HDF to become capable, credible armed forces that are significant and able to meet international commitments.

The derived and subordinate document, the National Military Strategy of Hungary 2021[4] (NMS 2021) can be assessed to be an adequate, well-constructed document, based on a thorough analysis of the international and domestic environment. It does not only focus on non-conventional wars and non-state challenges, but also deems the chance of a conventional war realistic. In today's light of Russia's war of aggression against Ukraine, this assessment of early 2021 is particularly noteworthy. However, in Chapter 1 of the NMS 2021, war in the 21st century is thought to be "increasingly extending to the non-military dimensions of security" and states might be "seeking to minimise military confrontation in time and space". Despite this, in modern warfare, it may prove sufficient for the aggressor "to just attack the enemy's […] command and control facilities and critical infrastructure". As a conclusion, collective defence provided within the framework of NATO is contemplated as the prioritised option in the NMS 2021. To achieve this, adequate self-defence and deterrence capabilities are considered vital.[5] The fact that the

[2] Government of Hungary 2020.
[3] Previously: Zrínyi 2026 Defence and Force Development Programme.
[4] Government of Hungary 2021.
[5] Nagy 2022.

use of "strategic strike capabilities and high-precision weapon systems" is particularly emphasised underlines implicitly the importance of adequate air defence capabilities.

In Chapter 2, it is stated that "defending Hungary against possible attacks by […] missile systems would be realised within the framework of the Alliance, with the active contribution of Hungary". The necessity to develop European defence capabilities via strengthening the EU's Common Security and Defence Policy (CSDP) and to cooperate closely in defence matters in multinational formats as the NATO Framework Nations Concept (FNC) is explicitly mentioned in Chapter 3. Subsequently, a clear statement on multilateral defence integration is made, when "multinational military formations" are considered to be "key elements of 21st century defence policy thinking, since they create strategic convergence among cooperating Member States".

Renewal of the HDF is postulated in terms of "approach, organisational culture and defence technology" in the first paragraph of Chapter 4, whilst Chapter 4.4 very clearly elaborates on the various dimensions and conditions of interoperability that are vital for the ability and readiness to cooperate with international partners. Chapter 5.1 of the NMS 2021 comprehensively describes the required capability profile of the HDF. The tasks of "air policing and air defence to uphold the sovereignty of Hungarian and Allied airspace", being an "integral part of NATO's Integrated Air and Missile Defence System (NATINAMDS)" is consequently dedicated to the HUN Air Force. In Chapter 5.1.2, air defence capabilities are envisaged "against conventional aircraft of various sizes, functions and capabilities, including those used in unconventional or mass-deployed ways".

Summing up the NMS 2021, it offers consistent guidelines for the ongoing and upcoming transformation of the HDF.[6] Derived from the NSS 2020, the NMS 2021 also describes the Zrínyi Programme as the central building block that develops the HDF into self-reliant military forces that "remain an effective contributor to regional European and transatlantic security efforts". The importance of modern and interoperable air defence capabilities can be found implicitly as well as explicitly in this strategic document.

Drawing a short interim conclusion on Hungary's two basic strategic documents, I would assess the balancing act between the clear commitment to support multinational initiatives in NATO and EU, and at the same time to meet the challenging national demands of becoming a dominant regional force and ensuring Hungary's security independently as one of the most difficult endeavours. It will be decisive for the success of HDF development in general and for the Zrínyi Programme in particular, how this tightrope walk will be dealt with by political, as well as military leaders in Hungary – not only in terms of actions, but also in prudent communication to the domestic and the international, especially the allied audience.

6 Resperger 2021: 215.

International strategic documents

Turning our gaze to the relevant international foundation documents, it is obvious that the NATO's new Strategic Concept (SC)[7] has been published during a decisive time for the Alliance. Comprehensive, large-scale land warfare operations within a multifaceted conflict of global importance have returned to Europe in February 2022 with the Russian war of aggression on Ukraine. After two decades, during which primarily the fight against terrorism was placed on NATO's agenda and the strategic reverse in Afghanistan (AFG) showed the discomfort NATO experienced with expeditionary operations, it currently appears to be the time to swiftly focus back on the Alliance's original purpose, namely the collective defence of the Euro-Atlantic area.[8] Whilst the last Strategic Concept of 2010 assessed that "the threat of a conventional attack against NATO territory is low",[9] the conclusion today states that "the possibility of an attack against allies' sovereignty and territorial integrity" cannot be discounted.[10] The core tasks remain broadly the same, but obviously the prioritisation has shifted to "deterrence and defence", replacing "collective defence" as the precise wording.

The self-imposed challenge to "defend every inch of Allied territory"[11] implies an enormous political signal to all contestants and opponents, but could also impose risks, if these clear intentions would not be backed up with the respective capabilities and forces. Therefore, next to the overarching significance of the Alliance's new Strategic Concept, for the development of capabilities and forces, the close monitoring of the subordinated – in terms of level, not necessarily in importance – documents, namely the Supreme Allied Commander Europe (SACEUR)'s Concept for the Deterrence and Defence of the Euro-Atlantic Area (DDA) and the NATO Warfighting Capstone Concept (NWCC), will be vitally important from a military point of view. The not completely utopic assessment that the lack of real action and commitment following the 2014 Wales summit declarations[12] might have influenced Putin's decision on starting a war of aggression against Ukraine should teach all NATO members that it has to be time for sufficient credibility now.

Since resilience against any kind of attack on NATO member states and their critical infrastructure is one central prerequisite to implement the 2022 Strategic Concept, the importance of protecting the sovereignty in the air domain appears logically consistent, hence air defence capabilities play a vital role in a robust force structure facing today's global security challenges. Consequently, the document states that the Alliance will significantly reinforce its deterrence and defence posture also "through strengthened integrated air and missile defence".[13]

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7 NATO 2022a.
8 Arnold 2022.
9 NATO 2010: paragraph 7.
10 NATO 2022a: paragraph 6.
11 NATO 2022a: paragraph 22.
12 E.g. NRF, eFP and the 2% GDP defence spending goal.
13 NATO 2022a: paragraph 21.

Parallel to the new Strategic Concept, allies agreed at the 2022 Madrid Summit on the New NATO Force Model (NFM)[14], which is currently being implemented. The ambitious goal is to build up a pool of 300,000 troops in a high readiness state – as opposed to approximately 40,000 NATO Response Force (NRF) troops before – and to pre-assign these to specific defence plans. This naturally includes a robust GBAD posture.

On the EU side, the "Strategic Compass for Security and Defence" (EU Strategic Compass)[15] as the EU's new flagship foreign and security policy document has been published by the EU Council on 21 March 2022. It was intended to point the way forward for the EU's CSDP in the years to come. The official release gained additional importance by the Russian war of aggression against Ukraine, which made determined measures for strengthening the EU's security and defence policy seem indispensable. The document seems to be a clear signal towards the perception that the EU will finally become a separate powerful player in security policy, being integrated into NATO as its capable European pillar. The quote "We need to be able to act rapidly and robustly whenever a crisis erupts, with partners if possible and alone when necessary"[16] proves explicitly that the EU is willing to take on more responsibility for its own security and strives for a certain – and surely necessary – degree of strategic autonomy. At the same time, the EU Strategic Compass emphasises the importance of the transatlantic bond and the prioritised goal of strengthening of EU–NATO cooperation for mutual benefit. The transatlantic relationship can thereby be strengthened, and it is likely that NATO will benefit from more self-confident EU ambitions in security matters and enhanced European defence capabilities.

Not only in my assessment there is now clearly the necessity to swiftly substantiate and operationalise the claims of this new flagship document, to create a shared strategic culture, to improve European defence integration and to increase the coherence in European security policy.[17]

Turning to more specific contents of the EU Strategic Compass with regards to the focus of this article, the air domain is deemed "critical to secure [the EU's] territories and populations" and "uncontested access to the airspace" is explicitly claimed, whilst it "is being challenged by anti-access and area denial (A2AD) strategies of […] competitors".[18] In order to maintain the EU's advantage in the air domain, "the development of next-generation and fully interoperable capabilities, notably future combat systems as well as air defence systems" is considered to be sine qua non, listing "the focus area A2AD capacities and Countering Unmanned Aerial Systems (C-UAS)" as main contributions to the air defence dimension. The document claims that all developments in future combat air systems shall be progressively integrated into the existing force structures, stressing interoperability as the main prerequisite.[19]

Regarding NATO–EU cooperation and the complex challenges of this decade, a further enhancement of the already established strategic partnership is more than

[14] NATO 2022b.
[15] Council of the European Union 2022.
[16] Council of the European Union 2022: 3.
[17] Knutsen 2022: 170.
[18] Council of the European Union 2022: 24.
[19] Council of the European Union 2022: 32.

appropriate. A stronger role for the EU will contribute to more vitality of NATO, especially in managing emerging crises. Following this logic, in January 2023, the third Joint Declaration[20] on NATO–European Union cooperation was signed. The main message contains the symbolism of transatlantic unity in two respects: supporting Ukraine and facing the growing geopolitical competition with China. Thereby, the priorities agreed in NATO's new SC and the EU Strategic Compass are adequately reflected.[21]

Strategic and operational environment

Considering the current strategic and operational environment apart from the related documents, it is obvious that conventional war in Europe became a reality again after a long-time through the Russian aggression in February 2022. Both EU and NATO showed swift and appropriate responses by a variety of measures and based on allied capabilities, including military power. All players seemed to be aware that the alliances could not just return to Cold War setting and concepts, because the political world order and the balance of power have moved further. Generally, the lesson has to be learned that the actions following the 2014 Crimea annexation have proved as insufficient or incredible, even though in theory, various things had changed in the perception and the concepts of NATO and EU. Therefore, from now on, intentions and promises to strengthen the military posture will have to turn into sincere measures, in the respective armed forces of each individual member state as well as for the overall capability spectrum of the transatlantic and European alliances.

Concerning the nature of employed military force and with a focus put on air defence issues, several insights can be obtained. Russia's A2AD strategy and the employment of cruise, ballistic and hypersonic missiles in the war against Ukraine has demonstrated the criticality of air and missile defence capabilities. The respective threat spectrum has significantly changed in the recent years. The "traditional" air assets as aircraft, helicopters, cruise and ballistic missiles have been complemented by unmanned aircraft systems (UAS) of different dimensions, including drone swarms and loitering munition,[22] as well as more modern technologies as hypersonic missiles. Especially the new challenges of UAS and drone swarm employment could not only be observed in Ukraine, but also in other recent conflicts as in Syria, Libya and particularly in the Nagorno–Karabakh conflict[23] in 2020. The so-called LSS (low, slow and small) target threat of micro drones and mini UASs are even available on the civil market and can be converted into weapons by self-construction. Effective air defence against LSS threats can only be achieved by sophisticated sensor and precise effector systems.[24]

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20 EU–NATO 2023.

21 Monaghan et al. 2023.

22 A loitering munition is an aerial weapon system category in which the munition loiters (waits passively) around the target area for some time and attacks only once a target is located.

23 Hecht 2022.

24 Krajnc–Vallus 2021.

Drawing conclusions for air defence capability management, the full target spectrum and all ranges of defensive systems have to be considered. Since the end of the Cold War, especially the lowest layer with short range air defence (SHORAD) and very short range air defence (VSHORAD) systems, often constituting the land forces' army organic air defence (AOAD) capability – to provide immediate and integrated cover for the land forces – have been significantly neglected. The experience in Ukraine demonstrates how important this capability remains in modern warfare to counter remotely piloted threats, particularly in the LSS spectrum.

However, next to the emerging threats in the closest vicinity, ballistic missile defence (BMD) remains an important factor, not only considering Russia and Iran, but also the risk of non-state actors potentially obtaining a respective capability. Therefore, sophisticated missile defence measures are vital as the tool facing these developing threats.[25]

A further area of experience from the Russian aggression is the paramountcy of resilience and critical infrastructure protection. The Russian armed forces have been massively and deliberately attacking Ukrainian critical infrastructure, causing massive damage and long downtimes in the electricity and water supply. President Volodymyr Zelenskyy's conclusion of 30 December 2022 was obvious and remains true: The Ukrainian air defence capabilities need to be further enhanced.[26]

This deduction is even more valid for many European nations, since their critical entities are even more interconnected and interdependent, which makes them more vulnerable. Since not only kinetic attacks, but also cyber or hybrid actions may affect vital processes, action is urgently needed to step up the EU's capacity to protect itself against attacks on critical infrastructure. Incidentally, increasing resilience is not only essential in wartime. Even non-state actors – or also extreme weather incidents – can generate devastating impacts on the continued functioning of a state and its society. Therefore, infrastructure resilience is vital to ensure national security and safety; this includes the awareness about threats and vulnerabilities in the country's or organisation's critical systems.[27] Taking into account contemporary options of UAS employment, comprehensive air defence capabilities constitute an indispensable contribution to effective critical infrastructure resilience.

Summing up the implications of the current environment and the war in Ukraine, the need for a credible deterrent force with a powerful and robust air defence capability as a key element is essential.

Multinational capability management

As extracted from the foundation documents above, NATO's new Strategic Concept and the resulting NFM demand a greater European responsibility and equitable burden-sharing, whilst the EU Strategic Compass calls the EU member states for more strategic autonomy and to thereby strengthen the European pillar of NATO. If the Europeans

[25] Fashola 2020.
[26] Upday 2022.
[27] Grigalashvili 2022.

strive to take on their full share in ensuring security for the transatlantic community, then a coherent military force contingent capable of covering the full military mission spectrum must be developed. It should be obvious that particularly those 22 European nations that are members of both NATO and EU should take most initiative in multinational procurement cooperation, since their investment in modern military capabilities will serve both alliances.[28]

In my opinion, there are several reasons why it makes sense to start capability development multilaterally. No other nation could individually set up similar capabilities to those with which the USA backed up European security during the last decades. The technical solutions for modern military forces are mostly very expensive, thus every option to share investments is useful to make the modernisation process more affordable. Therefore multinational strategic dialogues and partnerships as well as joint armament cooperation and procurement is necessary. Joint acquisitions and integration of forces are already happening on a limited level in Europe. For instance, Danish sailors serve on German naval vessels, Belgium and the Netherlands have joint naval capabilities,[29] and a Dutch armoured brigade is assigned to a DEU army division. Obviously, now more countries must be encouraged to undertake similar efforts. Every European government has to understand that separately thought and planned forces, somehow put together, will never be efficient enough to provide adequate deterrence and defence in and for Europe – no matter how big potential additional investments in military capabilities will be.

However, the argumentation is not solely on financial burden sharing. It is sine qua non that national capabilities must be synchronised into one big comprehensive European force package, guaranteeing not only technical interoperability, but also adequate integration in various aspects.

In this regard, the experience with the EU battlegroups has taught an important lesson. Multinational formations that are brought together only temporarily to stay in a high readiness standby status for several months, do not work properly. Huge efforts were made to bring the artificially accumulated units together. It turned out that the preparation time for the contingent was hardly long enough to overcome the most important cultural and interoperability issues. The goal for similar constructs should be though to share experience, to fully understand synchronised concepts and to create synergies between the constituent national units.[30]

Permanent multinational formations have to be created, which conduct a shared capability management across the DOTMLPFI[31] spectrum. The national building blocks, assumingly brigade or regiment size level, must train and exercise together with their multinational neighbouring units. Doctrines, training, leadership culture can be synchronised properly if the participants are aware that the construct is not only temporary, but designed as a longer term multinational formation.

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28 Brauss–Mölling 2021.
29 Bergmann–Cicarelli 2020.
30 Biscop 2022.
31 DOTMLPFI – Doctrine, Organisation, Training, Material, Leadership, Personnel, Facilities, Interoperability.

Undoubtedly, this massive endeavour requires extensive coordination effort and a lot of mutual trust, but this way forward seems to be the only option to get rid of today's fragmented capability management processes. Moreover, the NFM supports this idea and encourages allies to cooperate and organise their forces in larger multinational formations. In the medium term, the goal is to assign these formations to the different regional defence plans.

From my point of view, it is apparent that often the process of starting multinational cooperation projects is complicating and frustrating due to the diversity of perspectives and opinions. To avoid this, possibly a promising way is to generally start bilaterally. After an initially bilateral cooperation is sufficiently consolidated, selected additional multinational elements could be integrated in a second step. With this procedure, an appropriate pace can be selected to deepen the bilateral cooperation first and to prudently extend the formation by opening it to further nations at a later stage. Ideally, all currently existing binational programmes have to be examined if and how they could serve to build the foundation for a larger multinational formation. However, the final objective has to be a status where a permanent assignment of the respective military forces' building blocks is established and where similar cooperations span across the full capability spectrum of military forces in NATO and EU. Once sufficient mutual trust has developed and the ice is broken, the benefits of such true, integrated, multinational formations will be manifold.

Focusing on the field of Air and Missile Defence (AMD) capability management, multinational cooperation can comprise all layers of air defence and the full DOTMLPFI spectrum. Equipment-wise single components of an air defence capability can contribute to the overall goal, without being a full capability itself. The cooperation potential spans from combined training, exercises, data and information sharing, hosting agreements, doctrine development to common procurement.

Looking at capability development and procurement costs, the upper layer provides the best example why it is reasonable to act together with partners. Due to the sophisticated technology that is necessary to counter ballistic missile threats, the weapon system equipment is extremely expensive. Cooperative capability development could in this example mean that one nation procures the sensor, while the other purchases effectors and a third ally already possesses a suitable command and control infrastructure.

As NATO BMD is one of the Alliance's permanent missions – as a component of the NATO Integrated Air and Missile Defence (IAMD) framework – it will become more important in the future to have C2 sensors and effectors in different locations within allied territory, thus achieving a larger area of coverage and protection. Cooperative efforts permit allies and partners to contribute to these shared deterrence and defence goals more cheaply and more effectively.

In my opinion, the AMD cooperation framework with its existing formats represent the best entry area for formal multinational cooperation. Even though always compromises have to be reached in such a framework regime, it appears to be the only way to achieve common goals in developing or managing a GBAD capability. Therefore, the Hungarian

participation in the Modular GBAD[32] and European Sky Shield Initiative (ESSI)[33] formats, including the clearly perceptible determination of playing an active role in these initiatives must be appreciated. I will provide a closer look into the several formats to facilitate structured multinational cooperations in a separate article within this publication series. But generally, a bilateral intent can be an appropriate and promising starting point, which can develop towards a capable and integrated binational formation. A solid foundation like this can then continuously be complemented by other joining nations to a powerful, multination air defence formation with a permanent assignment.

Conclusion

The Russian aggression in Ukraine substantiated that freedom and prosperity in Europe cannot be achieved solely through economic power and common laws, but primarily through additional and determined defence readiness and the respective capabilities. The European countries will only be able to achieve this through prudent cooperation in capability development and by transnational specialisation. Not every ally has to provide the full spectrum of military options separately, but the EU as a whole has to act as a global and credible player in security matters. Notably, a militarily capable EU does not contradict NATO, but is rather the prerequisite for NATO to continue to act as the main guarantor of security and stability on the European continent.

The logic of cooperating with experienced and still more advanced AMD nations like Germany and the Netherlands will hopefully work for Hungary as well: e.g. in German resources for supporting the developing of the Hungarian GBAD forces were scarce in 2023, due to providing Patriot weapon systems to Ukraine and in parallel operating air defence contingents in Slovakia, Poland and the Baltic states. On the other hand, an "investment" by supporting an emerging and ambitious ally will pay off as a true relief in the medium term, when the assistance and provision converts into being more bidirectional so that future operational burdens can be shared.

Concluding this first portion, I tried to shed some light on the strategic environment and some aspects of multinational cooperation, always keeping the perspective on the GBAD capability spectrum in mind. Having elaborated that any prudent option for future capability development should always include trust-based, multinational cooperation or even integration, an analysis of the national air defence capabilities of the HDF will follow in part 2.

[32] NATO's Modular GBAD High Visibility Project strives for a modular GBAD solution responding to air threats along the entire very short, short and medium range spectrum.

[33] The European Sky Shield Initiative aims at creating a powerful air defence posture through joint acquisition of air defence equipment and missiles.

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National and International Perspectives of the Hungarian Ground-Based Air Defence Forces (2)

Status Quo, Development Plans, Operational Performance and Remaining Capability Gaps

Daniel PASSBACH[1]

Based on the findings of part 1 of my article series, analysing the strategic environment and considering first ideas of multinational capability development options for the Hungarian ground-based air defence forces, the present force structure and already initiated next steps are assessed and remaining capability gaps are identified. It is encouraging to see that prudent procurement decisions can systematically lead the way from a Soviet dominated weapon system landscape to swiftly being on track to becoming one of the most capable ground-based air defence forces nations in Europe and NATO.

Keywords: *Hungarian Defence Forces, ground-based air defence, Zrínyi programme weapon systems, NASAMS, SAMOC*

"New capabilities emerge just by virtue of having smart people with access to state-of-the-art technology."
Robert E. Kahn

The combination that Robert E. Kahn describes will at least form the main prerequisite for a new capability. However, next to smartness and technology, several further steps have to be taken, at least when discussing capabilities in a military sense. Many years of experience in the field of capability development and procurement matters showed me that developing and managing a capability is much more than procuring the system. Definitely, more than one way leads to Rome, but the secret of success is obviously to find and use the right capability development tool in the right moment and constellation.

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Soviet legacy and peace dividend

After having focused predominantly on the strategic environment and on generic aspects of multinational cooperation in the first part of this publication series, the following article will shift the perspective and demonstrate that Hungary is on a very good path to becoming one of the leading air defence nations in the NATO. Therefore, I will turn my gaze specifically to the Hungarian ground-based air defence (GBAD) forces in order to assess the current performance, contemporary developments and remaining capability gaps. As in many allied countries, due to the illusion of gaining a peace dividend[2] after the end of the Cold War, defence spendings have been kept on a low level in Hungary as well. Consequently, capabilities have been reduced, less resources have been allocated to defence matters and no systematic capability development took place. All this shapes the current status quo of the Hungarian Defence Forces (HDF) and thus also their GBAD forces.

During the 1990s, the Soviet legacy systems SA-5 Gammon, SA-2 Guideline, SA-3 Goa[3] were gradually phased out. In 2000, the SA-4 Ganef[4] medium range systems as well as the short range man-portable air defence systems (MANPADS) SA-7 Grail and SA-16 Gimlet[5] have been abandoned as they had reached the end of their operational life. As the only GBAD procurement between 1990 and 2016, the French short range air defence (SHORAD) system Mistral 2 has been acquired during Hungary's NATO accession process in the late 1990s and put into service in a phased manner from 1999–2000. Since the beginning of the 21st century, after a transition phase in 2003–2004, one single surface-based air defence regiment, namely the MH Dánielfy Tibor 205th Air Defence Missile Regiment (until 31 December 2022: MH 12th Arrabona Air Defence Missile Regiment[6]) in Győr, has remained, until recently possessing the SA-6 Gainful[7] and the Mistral 2 as its main weapon systems. During the past years, a life extension programme for the SA-6 has been implemented to bridge the time until the succeeding system (Norwegian[8] Advanced Surface-to-Air Missile System, NASAMS) has achieved Full Operational Capability (FOC).[9] After the Hungarian accession to NATO in 1999, it was necessary to ensure full integration of the HDF SA-6 systems into NATO's Integrated Air and Missile Defence System (NATINAMDS), since its own Soviet fire control system did not allow this. The integration has finally been achieved between 2004 and 2009 with enhancements of the K-1P and K-2PC fire control and distribution centres, that were completed on a domestic industrial base.

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2 The peace dividend describes the economic benefit that was expected after the end of the Cold War, since money formerly spent on military capabilities was suddenly available for other purposes. Despite the fact that most countries have decreased their military expenditures, a noticeable peace dividend has not been accomplished.

3 The Russian/Soviet designations of these systems are S-200, S-75 and S-125.

4 The Russian/Soviet designation of the SA-4 Ganef is "2K11 Krug".

5 The Russian/Soviet designation of the SA-7 Grail is "9K32 Strela-2" and of the SA-16 Gimlet is "9K310 Igla-1".

6 55/2022 (XII. 28.) HM Instruction.

7 The Russian/Soviet designation of the SA-6 Gainful is "2K12 Kub".

8 The acronym NASAMS is sometimes also referred to as "National Advanced Surface-to-Air Missile System".

9 Tömböl et al. 2021b.

Zrínyi National Defence and Armed Forces Development Programme as a paradigm shift

The substantial modernisation was initiated by the Zrínyi National Defence and Armed Forces Development Programme[10] (Zrínyi Programme), which undoubtedly represents the most ambitious defence development programme of the post-change era. It was launched in January 2017 and aims to comprehensively modernise and renew the equipment across all capability areas of the HDF. One of the priorities of the programme was to introduce a state-of-the-art missile operations centre capable of delivering NATO-interoperable strategic command and control of air and missile defence systems. This initiated the first giant leap towards the future for the Hungarian GBAD forces.[11] The procurement of the Surface-to-Air Missile Operations Centre (SAMOC)[12] was contracted in December 2018 between Airbus Defence & Space and representatives of the Hungarian Ministry of Defence.[13] Hungary is the third user nation after Germany (DEU) and Saudi Arabia (SAU), having the SAMOC equipment deployed at the MH Dánielfy Tibor 205th Air Defence Missile Regiment base in Győr. One further prominent goal of the Zrínyi Programme is the restoration of a modern medium-range air defence missile defence capability. As just described, the major technical solution for the GBAD C^2 portion, namely the SAMOC, has already been acquired.[14] Thus an adequate air defence system had to be chosen in the next step. After a deliberate decision-making process including market research, technical analysis and management decisions within the Hungarian Ministry of Defence (MoD), the contract for the purchase of the NASAMS system from the Norwegian defence company Kongsberg and the US defence company Raytheon was signed in November 2020.[15] The first components of the system have already been delivered to the MH Dánielfy Tibor 205th Air Defence Missile Regiment and will finally replace the obsolete Soviet-era system SA-6.[16] The procurement contains the most modern version of NASAMS (NASAMS-3), which was first deployed by the Norwegian armed forces in 2019. While currently 13 nations officially operate NASAMS in total, Hungary has become the sixth NATO member state to use this air defence system.[17] In total, six fire units (FU) are scheduled to be introduced until the end of 2024. Complementing the procurement, 180 Advanced Medium-Range Air-to-Air Missile (AMRAAM)[18] as well as 60 AMRAAM with extended range (AMRAAM-ER)[19] were also purchased for the Hungarian Air

[10] Previously: Zrínyi 2026 Defence and Force Development Programme.
[11] Kolozsi 2022: 30.
[12] See: https://intelligence.airbus.com/industries/defence/c2/air-c2/fortion-samoc/
[13] About Hungary 2018.
[14] The SAMOC communication and relay equipment is part of a separate, central HDF procurement.
[15] See: https://www.kongsberg.com/kda/what-we-do/defence-and-security/integrated-air-and-missile-defence/nasams-air-defence-system/
[16] Kolozsi 2022: 27–35.
[17] Váradi 2021.
[18] DSCA 2019.
[19] DSCA 2020.

Force in 2020 as effectors for the NASAMS system.[20] Next to the Sentinel[21] radar that is integrated into NASAMS, a purchase of a longer-range sensor, the ELM-2084[22] multi-mission radar (MMR), produced by the Israeli (ISR) company Israel Aerospace Industries (IAI) ELTA, was announced in November 2020. This sensor with active electronically scanned array (AESA) radar technology will execute surveillance tasks for the HDF and replace the decommissioned Soviet legacy radar systems.[23] According to current concepts, the ELM-2084 will be operated by the Hungarian Air C2 entities in the Air Operations Centre Veszprém. In parallel, a modernisation of the Mistral system will take place. The intended lifetime extension until approximately 2035 serves the purpose to maintain the VSHORAD/SHORAD capability in the HDF in accordance with NATO requirements. The measures include the upgrade of the link interface to NATO standards (Link 11/JREAP) as well as implementing an Identification Friend or Foe (IFF) mode 5 capacity.[24]

During the recent decision-making process regarding air defence capability development, a clear prioritisation emerged within the Hungarian MoD. First, a powerful medium range air defence should be established. Assessing the recent procurement efforts, owning the SAMOC and now acquiring NASAMS, that aim is on its way to be achieved soon. In the second step, the SHORAD capability should be maintained. With the above-described Mistral upgrades, this goal is settled as well, at least in terms of an interim solution until 2035. The third priority was set to re-establishing an organic air defence capacity within the Hungarian Land Forces, true Army Organic Air Defence (AOAD) forces that should be affiliated to the land forces' troop level. Introducing a missile defence capability is not on the Hungarian defence development agenda yet. However, an Anti-Tactical Ballistic Missile (ATBM) system is considered to be a potential next step in the following decade,[25] after the above steps have been completed, including the build-up of countering unmanned aircraft systems (C-UAS) and counter rocket artillery and mortar (C-RAM) capabilities.[26] Overall, the capability management process and the following development and procurement decisions seem to be very stringent in the light of the national and international strategic foundation documents. The National Security Strategy 2020 (NSS 2020) and the National Military Strategy 2021 (NMS 2021) both refer strongly on the alliances and the NATO–EU framework. My hypothesis and assumption on the "balancing act" between national and international ambitions is: If the assigned NATO requirements for Hungary in terms of air defence capabilities will be met, then the national ambitions – i.e. regarding protection of critical infrastructure – will be accomplished as well.

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20 Baranyai 2020.

21 The AN/MPQ-64 Sentinel, produced by Raytheon, is an X-band electronically steered pulse-Doppler 3D radar used with SHORAD weapon systems.

22 See: https://www.iai.co.il/p/elm-2084-mmr

23 Hungary Today 2020.

24 Expert discussion 2022a.

25 Respective considerations re-emerged in Hungary in reaction of the Polish missile incident on 15 November 2022, cf. Army Recognition 2022.

26 Expert discussion 2022b.

Current operational performance

In terms of operational performance, the high altitude, long and medium range GBAD capability in the HDF had been eliminated by decommissioning the Soviet-era systems SA-5 Gammon, SA-2 Guideline and SA-3 Goa. Through further force reduction processes based on the 1990s' and 2000s' peace dividend thinking, the SHORAD capability and mobile escort protection of land forces against air threats also disappeared. The SA-6 Gainful has been delivering a basic contribution to NATINAMDS, but it operates with only one target channel and is due to uncertain technical conditions of equipment and missiles definitely outdated.[27] The Mistral system is technically more advanced and complements with SHORAD and point air defence protection capabilities. However, despite the mentioned modernisation steps, including a missile upgrade to the M3 missile, and even though it is surely better to have a functioning SHORAD component compared to not delivering this capability at all, the Mistral system represents the technological level of the early 1990s. Due to several of these technical issues and further upgrade requirements, it is not capable enough to counter a modern conflict's air threat spectrum and fulfil NATO's as well as Hungary's self-imposed requirements.[28] Therefore, at present, the air defence tasks in the Hungarian sovereign airspace lie almost entirely in the responsibility of combat aircraft forces.

The SAMOC C2 system is capable of coordinating and supporting the full process of surface-based air defence (SBAD)[29] employment, which includes planning and pre-planning of combat activities, organisation, combat readiness, combat management and fire control functions of an air defence task force. Due to link implementation in accordance with NATO standards and network-based, encrypted communication facilities, the SAMOC fulfils all requirements to be swiftly integrated into NATINAMDS. Its control algorithms enable the management of air defence in all layers and target spectrums, including Ballistic Missile Defence (BMD). Therefore, the Hungarian SAMOC procurement can be assessed as the prerequisite and first key component to reach the desired national air defence capability as envisaged by the Zrínyi Programme. Its extensive interoperability and flexibility from the early planning phase to mission execution represent an inestimable value for the HDF. Especially when it comes to multinational projects or integration of allied air defence weapon systems, the SAMOC serves strategic level goals and will be key enabling equipment to guarantee the handling of the full Battle Management Command, Control, Communication, Computers and Intelligence (BMC^4I) spectrum as claimed in the national and international strategic foundation documents.

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27 Tömböl et al. 2021a.

28 Kolozsi 2022: 25–27.

29 In addition to the land-related expression "GBAD", the term "SBAD" includes naval surface-based air defence operations in the maritime domain.

NASAMS as the future game changer

NASAMS will undisputedly be a game changer, since it is one of the most advanced western air defence systems to date. Its open architecture and highly flexible modular system design meets the requirements of modern, interoperable air defence systems. Via its modern Fire Distribution Centre (FDC), NASAMS is also capable of simultaneously engaging hostile assets in 360°, network-based, multi-target, multi-channel, beyond-visual-range operations. Different types of missiles can be integrated. The target spectrum encompasses the full spectrum of conventional air threats, namely fixed-wing and rotary-wing aircraft, helicopters, UAS and cruise missiles. Further key features of the NASAMS system are state-of-the-art technological solutions in terms of all-weather capability and high mobility with minimised deployment times. The necessary personnel footprint is relatively low, compared to the number of operators required to run older generation weapon systems. The separate system components can be dispersed within a longer area and distances up to 20-25 kilometres, depending on topography and communication links, which ideally supports passive defence measures and increases the survivability of the system. Due to the high level of integration capability, NASAMS fits ideally into an interconnected NATINAMDS structure. With its flexible architecture, the system would be capable of integrating and linking into a multinational and multi-system environment, even without the SAMOC as the higher echelon system. Looking at the ambitions in terms of protection coverage, NASAMS is – given its range and system characteristics – capable of providing area and point protection, comprising critical infrastructure, air bases, airfields, military installations, troops or populated settlements. From my perspective, especially the procurement of the most modern version NASAMS-3, which is even more flexible and interoperable than the previous configurations,[30] combined with the integration of the long range AMRAAM-ER missile next to the standard effector, implies a huge step forward towards a new weapon system generation, owning a modern and flexible air defence asset with capable effectors.

Even if it is planned to primarily operate the ELM-2084 in the framework of the Hungarian Air Force C2 entities, I consider it a prudent move to also investigate the direct Tactical Data Link (TDL) interface connection to the SAMOC and the NASAMS system. It could thereby produce a powerful complement to the planned weapon system configuration. The detection range and altitude of the ELM-2084 radar is considerably higher than the Sentinel radar, hence providing air surveillance of a larger area and early warning. In combination with the Hungarian Air command and control forces, mainly the Control and Reporting Centre (CRC) in Veszprém, the projected GBAD equipment set will be able to share airborne situational information and thus contribute to producing a high quality recognised air picture (RAP) within the area of responsibility. Moreover, the SAMOC in conjunction with the ELM-2084 and the NASAMS Sentinel radar can provide comprehensive situational awareness and real-time airspace surveillance information also in any kind of multinational contingent or formation to the other participating air

[30] NASAMS-3 adds the capability to fire AIM-9 Sidewinder and IRIS-T SLS short-range missiles and additionally introduces mobile air-liftable launchers.

defence forces. The ELM-2084's software algorithms are also capable of parameter-based classification and threat level allocation for airborne targets, which induces warning messages to connected friendly forces.[31] The ELM-2084 is furthermore capable to adjust to multiple missions as air surveillance, C-RAM and fire control mode. These characteristics provide a high degree of flexibility, since lower radar signature targets can also be detected. Additionally, integrating various sensors into GBAD configurations – whenever technically feasible – is always an added value in terms of redundancy, offering increased jamming resilience and continued operations in the case of equipment outages.

Assessing the overall operational performance of the future Hungarian GBAD forces, in my opinion, the combination of the chosen weapon system components represents an extremely modern set of key capabilities for medium-range GBAD operations. As laid down in the NSS 2020 and the NMS 2021, more tangible military cooperation and integration into the international security architecture of NATO and EU has been declared as one prime driver for Hungarian defence policy. Technical and doctrinal interoperability serves as a key prerequisite. Therefore, the ongoing development in the HDF of gradually decommissioning the weapon systems of the Soviet-era and procuring modern interoperable products has to be recognised by all allies as a purposive and determined process.[32]

Interoperability implies operational flexibility

As already noted previously, the SAMOC has in the given system composition been assigned to serve as a reliable management system primarily for joint operations in a multi-service and multinational context, including missions under national, NATO, or EU command. With its tactical data linkages and military message processing algorithms and its open architecture, the system does not only offer full compatibility and interoperability with current weapon systems and C2 facilities, but it is also ready for further developments and future standard messaging protocols. This implies that any upcoming system in the near future can be integrated, which makes the SAMOC the ideal battle management system in both force and engagement operations with regard to allied interoperability. The German GBAD forces have already collected broad experience in operating the SAMOC in various configurations. Most prominent examples during the recent years were the "Tobruq Legacy" (TOLY) exercise series between 2015 and 2020, bi-national German–Dutch live firings, the "Joint Project Optic Windmill" (JPOW)[33] as well as "Ramstein Legacy 2022" (RALY22) exercises. These exercises include the full spectrum of Integrated Air and Missile Defence (IAMD) activities, covering all phases from peacetime across crisis to conflict, namely deployment of the multinational contingent into theatre, establishment of a NATO C2 structure, ensuring full interoperability in air defence operations and integrating of airborne assets and their data flows into a multi-system network-centric environment. Various allied GBAD weapon systems (Patriot, NASAMS, SA-6, SA-8) and

31 Kolozsi 2022: 30–35.
32 Bak et al. 2021: 12.
33 Scharschmidt 2016.

FDCs as well as higher echelon command facilities have been successfully connected to and operated by the DEU SAMOC. Despite the different levels of technical development and configurations of the weapon systems from different decades and several nations, full operational readiness has always been achieved, based on existing experience of the SAMOC specialists and on excellent multinational cooperation.[34]

Next to the SAMOC as the key element, the NASAMS system and the ELM-2084 radar both offer widespread options to finally ensure interoperability for various weapon system constellations. For example, the sensor data of the Sentinel radar can be processed either via the NASAMS system or via TDL to the SAMOC to produce a local air picture (LAP) on SAM wing level and to contribute to the higher echelon's air situational awareness by complementing the RAP. If operating the ELM-2084 within a GBAD constellation, it can – in a functioning TDL network – flexibly be connected in similar configurations. It is also a feature of interoperability that the NASAMS architecture is generally capable of integrating different types of radars and effectors. Additionally, the mere fact that NASAMS has been purchased and deployed by 13, soon to be 15 countries so far, provides a certain degree of interoperability. All new components of the future Hungarian medium range air defence capability have been designed with having flexibility and integration options with other weapon systems in mind. In this regard, the respective system compositions and architectures are perfect and the combination of SAMOC and NASAMS ensures a high degree of interoperability. However, the SAMOC will remain the central building block and the prime guarantor of interoperability for the Hungarian GBAD forces.

Capability gap analysis

The new medium range air defence capability of the HDF will be state-of-the-art and exceptionally flexible. However, even the most advanced system is not capable of countering all current and future aerial threats on its own. Therefore, a short capability gap analysis[35] is necessary to fully examine the Hungarian GBAD forces' capability spectrum. Looking to the upper layer, it is obvious that NASAMS does not possess a BMD capability. The AMRAAM missiles are originally designed to destroy conventional air-breathing targets, but they can effectively be applied against cruise missiles and UAS as well. Due to their launch profile, speed and maximum height of target destruction, they are not considered effective to intercept ballistic missiles.[36] The ELM-2084 sensor will be able to partially contribute to air situational awareness for the upper layer, given its flexibility in different acquisition modes. Frequently has the SAMOC proven its performance in providing command & control in ATBM missions with different weapon systems. Therefore, the HDF will be capable of limited contributions to NATINAMDS within the upper layer, but

[34] Schmidt 2022 and Rasquin–Gottschlich 2019.

[35] The AMD layers according to the European Sky Shield Initiative categorisation will be used for the gap analysis: short range (5–15 km downrange and up to 6 km ceiling); medium range (15–50 km downrange and up to 25 km ceiling); long range (above 50 km downrange and up to 35 km ceiling); upper layer BMD (above 50 km downrange and above 35 km ceiling).

[36] Ismay 2022.

will not possess any organic engagement capacity. In the long range layer, the Hungarian GBAD forces can again contribute with air surveillance data and C2 capabilities, but not with an effector capacity. However, the question is whether a separate long range engagement capability to counter air-breathing targets is necessary, whilst an appropriate medium layer capability exists. Covering this long range layer can therefore be considered to be the lowest priority behind all other capability subareas of AMD.

In the medium range layer, the future capabilities will be state-of-the-art and comprehensive as was pointed out before.

As previously deduced, the Mistral system currently represents the only capability in the short range layer. Even though the modernisation process might mitigate the concerns to a certain extent, the system in the current configuration is not capable to adequately meet the requirements. At the same time, compared to modern weapon systems, it is relatively personnel-consuming. Not actually representing a capability gap – since a SHORAD system exists – but still connected to this topic is the fact that the GBAD competence within the HDF is merged solely in Győr, in the Hungarian Air Force, in one single air defence missile regiment. So there is currently no real air defence expertise in the Hungarian Land Forces. Now that the war in Ukraine has demonstrated how important an organic and accompanying air defence cover is for the land forces, the missing AOAD proficiency has to be considered as a notable capability gap. It is an illusion – and the examples of several other nations like Germany prove it – that air cover for manoeuvring land forces units can easily be provided by the SHORAD air force capacity. Thinking about the layered system, there is definitely a way to coordinate all air defence efforts within a collective defence scenario in this way that protection against air threats is ensured in most areas of the battlefield. From my perspective, however, coordination and deconfliction of all measures with regard to air defence operations is vital, especially with today's multifaceted target spectrum. The land force commanders also need to be aware about the adjacent GBAD troops. Recent experience has shown that, therefore, the solution of having an organic air defence capability, which can counter at least short range assets, helicopters and UAS including LSS and RAM targets will be the best option. In conclusion, a capability that includes mounting a sensor and effector suite on armoured vehicles, ideally with a prudent mix of various effectors like agile short range missiles, cannons with air burst ammunition, is necessary in the current threat environment. The current Hungarian intentions to procure the Skyranger 30 system are intended to close this gap. A more detailed consideration of this option will follow in a separate article, when feasible ways forward will be looked at.

It could appear like a subordinate remark, but assessing the overall air defence capabilities, the lack of training and exercise should not be underestimated. Since large numbers of personnel across the HDF were sent to the Hungarian borders to support the migration control or helped in the organisation to counter the Covid–19 pandemic, the training and thus the professional capabilities of the GBAD specialists have naturally suffered. This is not specifically a Hungarian issue, since in many allied nations, the support by military experts to completely different and often civil tasks has taken place in the last few years. Thus, with the new equipment in place, a strong emphasis has to be put on sufficient training and exercise to finally reach adequate GBAD proficiency for technicians and operators.

Conclusion

The strategic impact of the previously described capability gains for the HDF will be considerable. The current modernisation measures imply that Hungary will join the group of NATO's most advanced air defence nations.

Since a GBAD posture will never be intended to cover the full territory in an area defence mission, Hungary with the final capability will be very well prepared to protect selected centres of gravity and critical infrastructure, either within its or in an allied nation's terrain.

Even though the newly procured equipment will lay the foundations for a very solid air defence capability for the HDF, it is obvious that there are still options to complement SAMOC and NASAMS with capabilities that meet the demands of today's conflict scenarios. Therefore, subsequently potential options of achieving an AMD capability increase, nationally and multilaterally, will have to be identified and scrutinised at a later stage of my publication series.

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Cybersecurity Challenges in the Era of Chinese Electric Passenger Vehicles

A Qualitative Study Investigating Data Security Measures in the European Union

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The present research focuses on investigating the security of data transmitted by electric passenger vehicles originating from the People's Republic of China, particularly when sent for remote processing. Initially, the study examines the factors contributing to the widespread presence of Chinese vehicles in the European market. Additionally, it explores the measures undertaken by the European Union to safeguard the information and data security of its member states. Following this investigation, an in-depth qualitative research method involving semi-structured interviews was conducted. Ten experts in information security were interviewed, and their insights were analysed concerning the identified challenges. The primary objective of this publication is to draw attention to the conceptual deficiencies that impede the protection of data and information, highlighting how a large volume of data collected from a third country, in this case, electric passenger vehicles, may pose national security risks.

Keywords: *qualitative research, cybersecurity, passenger car, information security, data security*

Introduction

In contemporary times, the passenger vehicles utilised bear little resemblance to those of ten to twenty years ago. The industry has undergone significant evolution, with various convenience and safety functions offered by information technology solutions swiftly assuming a leading role in the vehicles' sales considerations. Present-day automobiles, equipped with specialised sensors, gather copious amounts of data, not only about their own technical parameters but also about the passengers and their surroundings. The European Union (and the world at large) endeavours to manage this process through various regulations and standards; however, the rapid pace of technological advancement and ensuing changes present challenges. This poses difficulties for local automotive

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manufacturers and stakeholders in ensuring compliance with regulations. Nevertheless, due to the absence of a global central authority, there is even less influence over ensuring the security of products and their information networks originating from third countries.

As a result of the Fourth Industrial Revolution, smart devices are becoming increasingly prevalent worldwide. The term "Fourth Industrial Revolution" is attributed to Klaus Schwab, who encapsulated it as follows:

> "The fourth industrial revolution, however, is not only about smart and connected machines and systems. Its scope is much wider. Occurring simultaneously are waves of further breakthroughs in areas ranging from gene sequencing to nanotechnology, from renewables to quantum computing. It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions."[2]

The Fourth Industrial Revolution has brought innovations that significantly influence all our lives, from smart home devices controlled by smartphones to smartwatches. As Csaba Krasznay points out, even a simple cable may contain microprocessors, the specific data processing of which we may not necessarily know. The existence of a "digital society" today indispensably involves surrounding ourselves with an increasing number of internet-connected devices. The risks and hazards associated with IoT (Internet of Things) devices, systems, and services are multifaceted, rapidly evolving, and encompass an extremely wide range of areas. Therefore, it is crucial to understand the theoretical frameworks and regulatory environments necessary for ensuring the security of such devices, as well as to develop operational measures to protect them from various threats. As highlighted by the European Union Agency for Cybersecurity (ENISA), the complexity of IoT devices poses a particular challenge.[3] In various reports, ENISA has underscored that the increasing complexity of IoT devices – due to their diverse functions, connectivity, and deployment environments – makes securing them particularly difficult. This complexity introduces a wide array of security and privacy risks, which are exacerbated by the rapid growth and innovation in IoT technology.

In parallel with the increasing prevalence of clean, sensor-based data-collecting smart devices, another significant trend unfolding in the 21st century is the escalating data collection processes by various governmental and non-governmental organisations. Globally, the terrorist attacks against the United States on 11 September 2001 marked a turning point wherein the significance of information derived from cyberspace was heightened. Following the clarification of the circumstances surrounding the globally shocking terrorist attacks, the United States gradually initiated its mass surveillance program, details of which were made public by Edward Snowden. Snowden and other, less-known activists and hacker groups pointed out regulatory deficiencies associated with the comprehensive program.[4]

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2 Schwab 2023.
3 ENISA 2020; ENISA 2018.
4 Deibert 2015; Snowden 2019.

In 2017, a document titled "Vault 7", concerning hacker tools leaked by the CIA, was released by WikiLeaks. The description shed light on the organization actively seeking vulnerabilities in smart devices such as smartphones, smart TVs, and even passenger vehicles. Since modern passenger vehicles are particularly adept at collecting and transmitting large amounts of data, they may be suitable for a state to employ in coordinated covert information gathering. Given the increasing prevalence of electric passenger vehicles in the market due to their advancement and China's notable technological advantage in this area, special attention should be paid to this aspect when developing regulatory frameworks.

The integration of Chinese electric passenger vehicles into the European market has been a subject of increasing interest and scrutiny in recent years. As these vehicles become more prevalent on European roads, concerns regarding the potential misuse of the data they collect and transmit have emerged. This study seeks to delve into the roots and processes behind the proliferation of Chinese electric passenger vehicles in Europe, while also exploring the associated information security challenges and national security risks.

Initially, we provide an overview of the emergence and expansion of Chinese electric passenger vehicles in the European market. Subsequently, we investigate the potential vulnerabilities inherent in the information transmitted by these vehicles, particularly focusing on how they can be exploited for covert surveillance, thus posing significant national security risks. Furthermore, this study highlights the efforts made by the European Union (EU) to enhance and refine its regulatory framework in response to the growing presence of internet-connected products, including electric passenger vehicles. By analysing recent EU directives and initiatives, we aim to assess the adequacy of existing regulations in addressing the information security threats posed by these vehicles.

To complement our analysis, we conducted interview-based research involving ten domestic experts familiar with the European regulatory landscape and automotive industry. Through these interviews, we sought to gain insights into the current state of the regulatory environment and its preparedness to address emerging challenges.

The primary objective of this study is to critically evaluate whether the regulatory environment of the European Union adequately addresses the information security challenges posed by the increasing presence of electric passenger vehicles in the market.

The origin of electric passenger vehicles from the People's Republic of China

The Chinese government has encouraged the production and proliferation of electric vehicles through numerous market regulations and support programs. For instance, vehicle manufacturers were obligated to meet mandatory quotas for the sale of electric vehicles, which facilitated the industry's growth. Additionally, they were provided with tax incentives, purchase subsidies, and state support for the establishment of charging infrastructure.

China's national industrialisation and commercialisation of electric vehicles began in early 2009. Through the provision of financial support, it gradually progressed from

initiatives in public transportation to those in private consumption, from urbanisation experiments to regional trials, and finally to national-level promotion. The aim of this multifaceted, step-by-step policy was to stimulate investment, promote industrial growth, and alleviate the challenges of the initial phase. Simultaneously, the subsidies were planned to be phased out gradually, and the eligibility thresholds, characteristic of their accessibility, were to be raised progressively. This required the establishment of industrial clusters with global competitiveness. The support policies had to undergo three different stages of modification to facilitate industrial development.

In the "12th Five-Year Plan for the Development of Electric Vehicles" issued in 2012, China officially proposed the implementation of a phased strategy for the industrialisation of electric vehicles, dividing the process into three phases. The first phase took place from 2009 to 2012; the second phase from 2013 to 2015, and the third phase from 2016 to 2020.[5] In 2010, the State Council issued the "Decision on Accelerating the Development of Strategic Emerging Industries", which classified the electric vehicle industry, the energy efficiency industry, the environmental protection industry, and other related sectors as strategic emerging industries in China.[6] Strategic emerging industries are considered sectors with significant technological innovation potential that are in the early stages of development. It is evident that studying national-level political incentives and influences holds both theoretical and practical significance. The electric vehicle industry serves as a typical example of strategic emerging industries in China, playing a prominent role in steering China's economic and technological development over the past decade.[7] Since then, thanks to related programs and policies, the industry has made significant progress and is currently in the stage of technical and commercial demonstration.

In China's transportation sector, energy consumption has increased by nearly 10% annually, accounting for nearly 15% of total energy consumption. In 2019, the national vehicle fleet reached 348 million, representing a 6.4% increase over the previous year. Among them, the number of "new energy vehicles" (NEVs) reached 3.81 million. The total emissions of the four evaluated pollutants from national vehicles amounted to 16,038 kt; CO_2 emissions from gasoline vehicles exceeded 80% of total vehicle emissions, and HC emissions exceeded the pollution threshold by 70%, according to the Annual Report of the Chinese Transportation Source Environmental Management.[8]

In response to these challenges, the Chinese government launched two environmentally friendly NEV demonstration projects to promote the commercial utilisation of vehicles. The first phase ran from January 2009 to December 2012, covering 25 pilot cities including Beijing, Shanghai, Hangzhou, Dalian, and Shenzhen. Initially, the demonstration project focused on public areas (such as buses and special vehicles), then expanded to private areas starting from May 2010. However, the results of the first phase fell short of expectations. Consequently, the Chinese government issued a statement titled "Continued Work to Promote the Development of New Energy Vehicles", deciding to continue the demonstration

5 Wu et al. 2021.
6 The Central People's Government of the People's Republic of China 2010.
7 Zhang et al. 2017.
8 China Mobile Limited 2020.

project for the next three years, known as the second phase NEV demonstration project. The second phase project encompassed 39 cities (urban groups), totalling 88 cities.[9]

Based on the above, it becomes clear that the Chinese electric vehicle industry has been active for at least a decade and has shown significant progress. Although the increased production for export and the prioritisation of the European Union as a market have only occurred in the last few years, it could have been anticipated with proper attention to market expansion, and accordingly, a stricter regulatory environment could have been established.

The data transmission mechanisms of passenger vehicles and the preparedness of the European Union

In the past decade, the European Union has issued numerous regulations, best practices, and guidelines aimed at enhancing the security of digital devices used by consumers. In recent years, data protection has increasingly featured prominently in the listed standards, which will be elaborated upon in the following section. The most significant development in terms of regulatory environment in recent years has been the introduction of the NIS2 regulation, which member states are obliged to transpose into national legislation. Since NIS2 applies not only to governmental but also to a wide range of market players, including suppliers, it represents a significant advancement in the field of data security. However, it can be asserted that in terms of requirements, it does not present a sufficiently modern solution, as it is largely based on the NIST 800-53 r5 standard, which is a generic, organisation-focused information security standard and does not specifically consider the safety of products used by consumers, nor was it created for this purpose.

Although, the role of data security is increasingly emphasised in new regulations, it can also be observed that among the regulations, only the GDPR focuses specifically on consumer data and the transparency of data flow. The aim of this study is not to comprehensively present the problems related to the GDPR, but below, we have collected some examples to illustrate that despite the application of the GDPR, several challenges still arise, and compliance alone does not guarantee that users can be informed about the use of their data (examples 1, 2, 3, 4). It is also important to note that regulations related to various cloud services and a series of regulations concerning industrial devices are relevant to the topic of this study due to network communication; however, these are not discussed in this research due to limitations of scope.

The data processing of personal information related to connected cars is governed by data protection guidelines, which sometimes link loosely defined and/or incompatible purposes (e.g. providing requested services, credit and behaviour assessment, and operating and expanding business activities). For example, data originally collected for maintenance purposes can be used by insurance companies to enrich driver profiles, develop individual pricing, offer insurance policies based on driving behaviour, or investigate liability in car accidents. Traffic safety authorities could use this data to enforce traffic rules, such

[9] Wang et al. 2017.

as speed limit enforcement. Every piece of data related to a person's car use, such as driving routes and destinations, in-car communications, or infotainment services, can reveal sensitive information about the individual's life. People's driving habits and places of interest can not only enable their identification, but also infer sensitive information such as religious and political affiliations, sexual orientation, and relationships. Therefore, the collected data is useful for profiling and monitoring individuals, especially when it is linked to existing (private or governmental) databases. Data controllers must pay particular attention to the requirements imposed by the GDPR on the processing of special categories of data, such as the limited available legal bases. Data controllers must clearly inform users of connected cars about the purpose of processing location data. Due to the sensitive nature of location data, the thorough application of data protection principles, especially purpose limitation, data minimisation, and data storage, is necessary.

Although various standards and regulations applied in the automotive industry now also encompass supply chain protection, which often means suppliers complying with standards equivalent to those of manufacturers, information security standards generally provide a framework rather than specific instructions regarding conditions. This is necessary, because certain degrees of flexibility are crucial due to different specialised situations.

In 2007, Gunnar Peterson and Elizabeth Nichols introduced metrics to measure how changes in processes during a given lifecycle can affect security in the next phase. Accordingly, they developed various metrics and examined their applicability, also focusing on monitoring system availability, reliability, and maintainability.[10] In 2008, Dan and Julie Ryan conducted a study on security and data privacy, exploring how ineffective risk measures could be enhanced and better adapted to reality. They also developed impact analysis related to investments in information security and tracking changes in expected losses.[11] In 2010, Cunningham and Pfleeger (2010) published a report on nine "compelling reasons" explaining why measuring security is difficult.[12] Later, David Evans, Steve Bellovin, and Sal Stolfo (2011) published an article discussing the use of science-based, systematic and generalised knowledge, the development of universal principles for forecasting, and the use of methodologies for testing hypotheses as tools for anecdote-driven security decision-making.[13] In 2012, George Cybenko and Carl Landwehr (2012) prepared a study on the necessity of measuring security progress. Cybenko elaborated on the difficulty of demonstrating progress in operational cybersecurity, while Landwehr wrote about the need to improve the reliable measurement of cybersecurity status at national and international levels, advocating for measurements to be controlled by an unbiased organisation.[14] They discussed past mistakes and how the game-theoretic application of illegal usage can be misleading. The authors also wrote about the lessons learned from observing the gradual increase in risk and the fluctuating nature of these types

[10] Nichols–Peterson 2007.
[11] Ryan–Ryan 2008.
[12] Pfleeger–Cunningham 2010.
[13] Stolfo et al. 2011.
[14] Cybenko–Landwehr 2012.

of data.[15] Omoyiola's research (2020) aims to review previous research on information security measurement and testing and summarises developments in the field over the past years. According to the research, the field of information security measurement and testing is dynamically evolving, introducing numerous new methods and tools in recent decades to assess and improve security levels. The study reviews various methods of information security measurement and testing, such as signature analysis, vulnerability scanning, penetration testing, simulations, model-based testing, and hybrid methods. The study emphasises that information security measurement and testing remain crucial for improving security levels and maintaining information security, and these activities must evolve dynamically in response to security threats.[16]

The above enumeration highlights a complex, continually evolving field, of which data protection and transparency constitute only a small part. In recent years, particularly following the introduction of the GDPR, chapters addressing data protection have emerged in standards, providing practical guidance on how standard adopters should proceed concerning their clients or other individuals. A prime example of this evolution is the difference between NIST 800-53 r4 (originally released in 2014)[17] and NIST 800-53 r5 (originally released in 2020),[18] wherein, among other changes, the 2020 standard introduces a new control family specifically addressing data protection.

Passenger vehicles and data security incidents

Modern vehicles contain interconnected electronic systems that can be potential targets for various threatening actors present in cyberspace. Today's cars can interact with their environment by exchanging data with control stations that provide a wide range of services to urban populations. This connectivity extends beyond smart cities to include connections with telecommunication networks. Additionally, vehicles incorporate sophisticated controllers that manage data collected in real-time through sensor networks. As a result, they play a similar role in cyberspace as mobile phones or computers. This connectivity enables functions such as emergency calls (eCall) and accessing entertainment and other content through online connectivity while traveling. Additionally, besides over-the-air (OTA) services, it provides software updates for digital content in the vehicle.[19]

To enable the manufacturer to send over-the-air (OTA) updates to the entertainment electronics devices in the vehicle, it is necessary to ensure that software remains up-to-date without requiring the owner to visit a service centre. This functionality not only provides convenience, but also proves useful for promptly addressing security vulnerabilities. However, since vehicles communicate over simple HTTPS protocols similar to mobile phones, they are exposed to various vulnerabilities.

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15 Pfleeger 2012.
16 Omoyiola 2020.
17 See: https://csrc.nist.gov/publications/detail/sp/800-53/rev-4/archive/2014-01-15
18 See: https://csrc.nist.gov/publications/detail/sp/800-53/rev-5/final
19 Venkat 2020.

In 2016, a group of Chinese security researchers from the Keen Security Lab discovered a method to breach the Controller Area Network (CAN) bus found in Tesla models, which controls displays and brakes.[20] The researchers were able to remotely access the central control unit and adjust the mirrors, lock the doors, manipulate the dashboard, and even activate the brakes. This was reported to Tesla, and the company responded to the disclosure with a newly issued update. However, this event clearly highlighted the problem of using outdated software. Several years later, another team from the Keen Security Lab discovered 14 vulnerabilities in vehicles manufactured by BMW.[21]

The data collected and transmitted in this manner not only facilitate economic crimes but are also suitable for clandestine surveillance conducted by state entities. In a previous study from 2023, we illustrated through the development of a theoretical model that such surveillance, employing multiple vehicles, could potentially encompass an individual's entire daily activities outside of an office building.[22]

Interview-based research: the state of data security in the automotive industry according to domestic experts

The research methodology chosen for this study is in-depth interviewing, considering the sensitive nature and complexity of the topic. The distinct feature of in-depth interviewing is that the researcher engages in dialogue with the interviewees based on predefined topics rather than a set question list, aiming to gather contextual information that may not have emerged from preliminary research.[23] While in-depth interviews are not suitable for generalising findings, they provide an opportunity to gather and summarise the experiences and recommendations of experts deeply knowledgeable in the field.

For this study, a semi-structured interviewing method falling within the category of field research was selected to conduct the research, as it aligns with the subject matter.[24] The aim of the empirical research is twofold: firstly, to understand the opinions of Hungarian experts on the data security issues raised in the study, and secondly, to gather proposed solutions to the challenges identified. Since this approach requires deeper dialogue and cannot be addressed simply through, for example, a questionnaire method, the use of in-depth interviews is justified. The interviews were conducted in an open-ended manner, allowing for interactive discussions beyond the initial questions and responses, which facilitated the acquisition of additional information.[25] During the interviews, it was important to uncover new information that did not arise during the literature review but could form the basis for further investigation.

To determine the appropriate questions, three dimensions were delineated based on the topics covered in the thesis: challenges related to data security in automobiles, consumer

[20] Perrig et al. 2002.
[21] Zorz 2018.
[22] Hegyi–Erdődi 2023.
[23] Babbie 2020.
[24] Babbie 2020.
[25] Babbie 2020.

responsibility and awareness, and potential solutions. These dimensions were ordered from broader to more specific to ensure clarity regarding the general approach used by the selected experts in their work and to identify any specific issues related to automotive information security.

Since not all experts possess the same depth of experience in the automotive industry, but may still have relevant professional insights applicable to the sector, it was important that industry-specific questions were used only to gather supplementary information. These questions were asked only if the interviewee had actual experience in this area.

Narrative analysis

In order to examine the practical difficulties of implementing information security standards, it was necessary to analyse the information generated during the interviews using a technique that allows for more than just isolated facts to be determined.[26] Regarding the auditing work and standards, deeper underlying reasons for differences between theory and practice, or subjective factors influencing the results, can be identified. The interview transcripts were analysed using the Krippendorff content analysis methodology, which emphasises that context is an integral part of text analysis. This approach aligns with the complex nature of the study by allowing the researcher to draw inductive conclusions about the content.[27]

Sampling

The central subjects of the qualitative, in-depth interview-based research are information security experts, including auditors, consultants, and researchers. However, to uncover relevant information during the analysis, it was necessary to narrow down the initial group of 30 participants. During the selection of the 10 interviewees for the research, a filtering criterion was applied, requiring a minimum of 5 years of work experience in one of the information security professions (seniority), as well as expertise gained in at least 5 different industries or areas. These criteria ensure that the experts possess sufficiently broad practical knowledge regarding the researched questions. Experience in the automotive industry was not a requirement, as deep sectoral knowledge is not necessary to answer the research questions, but a wide-ranging understanding of the regulatory environment in various industries facilitates the recognition of best practices.

As a result, the sample included, for example, a professional mainly working with Hungarian small and medium-sized enterprises (SMEs), as well as one currently employed in the public sector, with previous clients and employers including financial institutions, pharmaceutical factories, and food industry companies.

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[26] Babbie 2020.
[27] Krippendorf 2018.

Results

From the responses of the interviewees, it is apparent that five respondents have worked on information security projects or tasks related to the automotive industry, while the other five individuals do not have such experience. Therefore, industry-specific questions related to automotive standards were only asked to the former group of five individuals.

Regarding the challenges, several interviewees highlighted the complexity of vehicles as end products. Two interviewees also pointed out that supporting the software environment of personal vehicles is becoming increasingly challenging. If software support expires, adequate protection is no longer guaranteed. From a cybersecurity perspective, it is considered a challenge that users do not have visibility into what exactly happens with the car's IT system and data during a service. Some interviewees suggested that this should be ensured not only through proper information but also through dedicated archival tools, essentially requiring a black box, similar to those used in aviation.

One of the interviewees pointed out that broader application of the Common Criteria standard could provide a solution for taking a product-based approach to information security in passenger vehicles.[28] However, upon reviewing the list of certified devices on the standard's official website, it becomes apparent that only a few devices worldwide have this certification. Moreover, the majority of these devices are general-purpose IT tools, such as firewalls.

When it comes to the ISO/IEC 21434 standard, we are indeed dealing with an industry-specific standard, but the examination object is not the vehicle itself; rather, it focuses on certain electronic components of the vehicle. These components could include, for example, the electronic parts controlling the brakes or the Bluetooth module of an infotainment system. From the perspective of vehicle security, it is problematic that certification is not expected for every component, which means that its impact only applies "patchily" depending on the manufacturer's requirements. This situation arises not only from a managerial perspective but also from limited resources, as compliance with strict regulations can incur high costs.

Regarding comprehensive solutions, nearly every expert agreed that there is a need for a unified European-level legislation that precisely dictates the application of controls to vehicle manufacturers and suppliers, which are currently included in standards. Associated with this is the necessity to establish an authority to enforce these rules. One interviewee also pointed out that as long as economic factors do not incentivise manufacturers for greater diligence, the situation will remain unchanged.

Finally, out of the ten interviewees, three mentioned increasing user awareness as a proposed solution. According to the general opinion of the interviewees, users are generally not interested in information security issues, unless a device malfunctions or their data is genuinely at risk of being compromised or leaked.

In connection with this, diverse solutions have been proposed, ranging from general education in primary schools (such as information security lectures during computer classes) to providing more transparent informational texts.

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[28] See: https://www.commoncriteriaportal.org/products

There was also an opinion suggesting that advanced convenience and service-oriented features and practices, such as providing seat heating as a service, should be banned concerning vehicles. The logical background of this idea is that the development of information technology has reached such proportions today that security experts and standards cannot keep pace with it in any way.

Summary

In this study, we first presented the roots and processes of the spread of Chinese electric passenger vehicles in the European market. In the following chapters, we explored the potential problems caused by the malicious use of information transmitted by passenger vehicles and discussed how vehicles can be used for covert surveillance, posing national security risks. We also showcased the steps taken by the European Union in recent years to improve and develop the regulatory environment.

Through the interview-based research conducted with the assistance of ten domestic experts, we concluded that the regulatory environment of the European Union is not prepared to handle the threat posed by the mass influx of internet-connected products, namely electric passenger vehicles, originating from third countries.

Among the proposed solutions, there was roughly equal emphasis on raising awareness among users and increasing their sense of responsibility, although there was an opinion suggesting this is unnecessary. According to this viewpoint, consumers should not be entrusted with the protection of their data, as it cannot be ruled out that they may lack the necessary knowledge and preparedness for this task. Another proposed solution was the designation of a European Union-level authority capable of providing expert advice at a higher level on contentious issues related to information security and data protection and acting as a regulatory authority against abuses and omissions.

The purpose of the study was to examine whether the regulatory environment of the European Union is adequate to combat the information security challenges posed by the large volume of electric passenger vehicles currently entering the market. Based on the literature review and interviews, it can be concluded that it is not. However, further research is advisable to examine the proposed solutions and develop additional ones.

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Project Camelot – A U.S. Army Social Science Research Project

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Project Camelot was an ambitious social science project that came into existence in late 1964. The goal of the project was to assess the causes of war and to identify the actions that the American government could take to prevent such wars. The period between the introduction of Project Camelot and its ultimate demise raises interesting questions about the relationship between the American government, the military, and social sciences.

Keywords: *anthropology, Project Camelot, Minerva, U.S. military*

To better understand the operation and purpose of Project Camelot, we need to examine the organisation of the Special Operations Research Office (SORO), which was responsible for Project Camelot and also implemented it. The Office of Special Operations Research was established in 1956 to provide reports to the United States Armed Forces on a variety of topics. During its eight years of operation, SORO produced approximately 50 book-length studies on several European, Asian, Middle Eastern, African and Latin American countries, the basic philosophy of which was operational research and systems analysis, or ORSA (operations research and systems analysis).[2]

Operations research and systems analysis – ORSA

ORSA is a philosophy of science that emerged during World War II. Operative research, unlike most sciences, can point to a well-defined combination of circumstances and events. After Hitler came to power in Germany, England sought adequate defence against possible air attacks, which resulted in the development of the key elements of an effective defence by the end of 1937: the radar and the Hawker Hurricane and Supermarine Spitfire fighter. However, these devices could not be integrated into an effective system, and were left to improvisation as the disappointing results of an aerial exercise in July 1938 showed. This new type of research, carried out in close collaboration with officers of the British Royal Air Force, appeared directly in the essential developments of England's anti-aircraft system, which was put to a successful test during the Battle of Britain between August and September 1940.

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[2] Price 2016: 211.

The success of the partnership between scientists and operational forces encouraged the spread of operational research to other United Kingdom commands and organisations. When the United States entered the war, this British example was followed by American military leaders, and by the end of 1942, it was being used by groups of American scientists in the United States Navy and Army Air Forces. However, the name was Americanised and called operations research. By the end of the war, the United Kingdom, Canada and the United States already employed 700 scientists in the operational research domain.[3]

As the U.S. Army examined its ORSA requirements, the Army-wide analytical organisation applied both traditional operations research methods and new systems methods and cost-effectiveness analysis to problems in weapon systems development, and tactical and strategic doctrine development. In fact, the number and staffing of U.S. Army organisations – contracted and in-house – using ORSA methods to solve current U.S. Army problems and plans for the future grew significantly during the McNamara years. By the end of the war, the United Kingdom, Canada, and the United States employed 700 scientists in the work loosely described in these terms. Part of the work of the scientists participating in the program was utilised only in the technical background. An important innovation was that they examined and evaluated the results of tactical operations, developed combat innovations, predicted their consequences, and actually applied the innovations by comparing the expected results with the results actually achieved. This knowledge often served as a basis for tactical planning and even provided important knowledge for strategic decisions in the later stages of the war.[4]

Before the release of SORO, it is important to note that the 1960s and early 1970s were turbulent times in world history. Resurgent political movements and profound economic and social changes have affected many regions of the world, including the United States. The rapid development of technology and changing international politics, especially the communist insurgency in Vietnam, forced major changes in the weaponry, organisation, and doctrine of the United States Armed Forces. Such fundamental and rapid changes could not been coped without operational research and systems analysis (ORSA) techniques, which greatly contributed to the effective decision-making in the army during the mentioned period.

The Office of Special Operations Research

The Office of Special Operations Research was established at the American University in Washington, D.C., to support the Army's research in *insurgency/counterinsurgency operations, unconventional warfare, and psychological operations.* SORO's research included political, economic, social and cultural studies of the given area, as well as the causes and nature of conflicts and uprisings in a given country, and the tactics for overcoming them. Their investigations emphasised the psychological vulnerability of

[3] Miser 1980: 140–141.
[4] Miser 1980: 140–141.

the foreign population and the possibilities of exploiting it, as well as the feasibility of a possible military assistance for the countries concerned.[5]

From March 1962, SORO's staff expanded with the usual supervisory, administrative and support elements, as well as with two technical divisions (Research Division and Foreign Area Studies Division), whose tasks were regulated by a separate contract. The Research Department was established with a director, two department heads and six interdisciplinary research groups. The topics were wide-ranging, with a department responsible for conducting research on psychological operations and guerrilla/insurgency warfare, among others. The activities of the Research Department were supervised by the head of research and development of the U.S. Army. The Department of Foreign Studies was organised with a head of department, two assistants and four interdisciplinary research groups, several historians and geographers, as well as an editor. The department was responsible for preparing national and regional studies, and the prepared materials touched on political, economic, sociological, and military topics. The activities of the Department of Foreign Studies were supervised by the head of psychological warfare (later the head of special operations).[6]

SORO's mission was reorganised and it was renamed as American University Center for Research in Social Systems (CRESS) in July 1966, which consisted of two component departments called the Social Science Research Institute (SSRI) and the Counterinsurgency Information Analysis Center (CINFAC). The aim of the Social Science Research Institute was to involve 'special' professional talents in specific social science research, development, and preparation of studies. SSRI conducted social science research to support United States Army military operations in unconventional warfare, psychological operations, military assistance programs, counterbalances, and foreign cultures.[7]

CINFAC was tasked with creating a system to support the operations of the United States Army and other Department of Defense (DOD) organisations by collecting, storing, retrieving, and analysing information about the peoples and cultures of the world. Controversy arose in 1965 over one of SORO's research, which came into focus in connection with a study on Chile, a larger SORO research project part of the Camelot project, which examined the causes of revolutions and uprisings in underdeveloped nations and "political instability methods of treatment". The dispute over the Camelot project resulted in the renaming of the SORO organisation, and the CRESS was born in 1966. It continued to operate until 1969 based on military contracts with the American University. The CRESS's contract was terminated after civil protests against the research organisations' role in Vietnam that showed how they tried to influence the Vietnamese government's national affairs. The CRESS was later taken over by the American Institutes for Research, an independent, non-profit research organisation established in 1946

5 Shrader 2008: 199.
6 Shrader 2008: 200.
7 Shrader 2008: 201.

and currently employing 1,100 employees worldwide. The organisation has offices in Pittsburgh, Washington DC, Palo Alto and Bangkok.[8]

The Camelot Project

Project Camelot's roots date back to World War II, where psychologists already had a significant and growing influence among high-level policymakers with generous financial support and a wealth of theoretical, methodological, and organisational experience. In World War II, military psychologists examined the mental skills of the enemy and planned several psychological operations. In the years after 1945, psychology moved rapidly along the path outlined by the experiences of World War II. During the Korean War and the Cold War,[9] psychology maintained its momentum and established its future in the military. During this period, experts in psychology promoted the scientific objectives of national security and developed unique analyses of the development and revolution of emerging Third World states. In these areas, the experts ensured the maximisation of the practical, especially military, usefulness of theoretical and research activities. Because of their experience in World War II and its aftermath, behaviourists were readily employed by individual military agencies. Project Camelot and its aftermath show how far experienced psychological experts have come since the outbreak of World War II.[10]

Plans for Camelot began in 1964 based on a report from the Defense Science Board (DSB), a powerful military science advisory group. The DSB report revealed several gaps in the Department of Defense's (DoD) behavioural science programs, particularly in the study of the world's many small conflicts and their revolutionary movements. Later, the military launched a major project called "Methods to Predict and Influence Social Change and the Potential for Internal War", which became infamous as Project Camelot.[11]

The report of the Defense Science Board was also facilitated by the report formulated by the planners of the Army Office of Research and Development, which was established in 1963. In this report, they expressed concern about the Soviet-sponsored "wars of national liberation". These wars were supported by the Soviets in countries such as Cuba, Yemen, and the Belgian Congo. Since 1945, experts have been communicating the fact that behavioural science is very important in defeating the Soviets, perhaps its most important contribution to stopping communism. Their goal was no less than to anticipate and control the social and psychological challenges of World War III. According to the inventors of the project: "the CAMELOT project is a study aimed at determining the feasibility of a general social system model that would enable the prediction and influence of politically significant aspects of social development in the developing countries of the world."[12]

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8 Shrader 2008: 202.
9 Kaló 2019.
10 See: https://publishing.cdlib.org/ucpressebooks/view?docId=ft696nb3n8&chunk.id=d0e3318&toc.depth=1&toc.id=d0e3318&brand=ucpress
11 Solovey 2012.
12 Horowitz 1967: 47.

The goals of the Camelot project were formulated by the Subcommittee on International Organizations and Movements of the United States Committee on Foreign Affairs as follows:

> "The Research Office (SORO) at American University,[13] the Army began to prepare a project, which sought to integrate many disparate research problems in pursuit of a single operational objective by attempting to develop a generalized model of a developing society. The purpose of this project was to produce a better understanding of how the processes of social change operate in the developing countries. On the one hand, Project Camelot was intended to assist in identifying the forerunners of social breakdown and the resultant opportunity for Communist penetration and possible takeover;"[14]

The Camelot project was, therefore, intended to test a general systems approach to predicting and influencing instability in several Latin American countries. However, Camelot never made it past the planning stage, as in May 1965 – less than a year after the Chilean press was outraged by the leaked plans – it triggered a backlash within the United States government that led to the project's cancellation. The project fell through when an offer targeting the details of a Chilean professor's collaboration, was leaked. Due to the unexpected public outcry, congressmen feared that such "tricky research" could endanger important foreign alliances.[15]

The great revolutions led by Fidel Castro, Che Guevara and Ho Chi Minh proved that the use of social scientists working in Camelot project is essential to understand the sources of revolutionary movements and uprisings in Latin America and to develop different strategies to analyse them. SORO referred to these researches as "insurgency prevention" research. Initially, six countries were chosen for the study, the first being Chile.[16]

In April 1965, Chilean-born University of Pittsburgh anthropologist Hugo Nutini travelled to Chile to recruit scientists for a behavioural science research project on the revolutionary process and counterinsurgency measures called Project Camelot. When the Chilean scientists discovered that the U.S. military was actually funding the research, they questioned Nutini, who denied the fact. The situation became so embittered between the Chilean social scientists, the Chilean government and Nutini that both the academy and even the Chilean government banned him from returning to his country. In the meantime, criticism of the Camelot project went far beyond Chile's borders. During the Cold War, countries with hostile relations with the United States, from Cuba to the Soviet Union, condemned this project. The negative international response also caused problems for the American government. U.S. Secretary of Defense Robert McNamara withdrew the project on July 8, 1965 to reduce the political damage caused by the program, but

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13 American University was founded by John Fletcher Hurst, a Methodist bishop who dreamt of creating a university that would train future civil servants. Established and supported by Congress in 1893, the university is a student-centred research institution located in Washington, DC. See: https://www.american.edu/about/history.cfm

14 Eggers 2014.

15 Reivich 2007.

16 Gusterson 2009.

the military continued to fund these studies under the umbrella of classified research. Public political backlash from the project, however, sparked further debate among social scientists, politicians and journalists.[17]

When the true nature of the Camelot project was revealed, it was forced to limit its public activities, so the Armed Forces of the United States secretly continued to finance the confidential research, which they expected to learn about the backgrounds of past conflicts in the country under investigation to get an explanation of the generalities of revolutionary processes to set up a model to predict conflicts. They wanted to create an analytical method that would most likely predict the extent and development of internal conflicts in a given region or country. It was hoped that such knowledge would help military leaders to anticipate social change and enable them to plan effective intervention in terms of U.S. Cold War political goals and military needs. According to economic historian Walt W. Rostow, who was national security adviser to Presidents Kennedy and Johnson, it would have provided the United States with powerful generalisations about so-called traditional societies. Before the closure of the Camelot project, he assured his supporters with the positive goal of achieving significant scientific progress that could advance American foreign policy goals, satisfy the military's changing knowledge needs, while at the same time helping to prevent the advance of the Communists. Because of its ambitious goals, Camelot was a great opportunity among several psychologists who believed that they could contribute to the development of democracy and freedom by working with the government and the military.[18]

The biggest concern of foreign countries was that the Camelot project revealed the intention of the U.S. foreign policy to intervene in the internal conflicts of any country in the world according to its interests. They referred to the project as a hidden form of espionage, in which they violated the sovereignty of the countries under investigation through scientific research.[19]

Minerva is the Camelot project of the 21st century

The attack of al-Qaeda on September 11, 2001 greatly changed the research and analysis structure of the American national security organisations and they tried to build a more accurate forecasting system, for which the increase in the number of social scientists and the establishment of closer cooperation became indispensable. The Pentagon's growing interest in anthropology has sparked a major debate between the American Anthropological Association (AAA) and the Armed Forces of the United States about exactly what tasks social scientists can perform on the side of the military. The Human Terrain System,[20] funded by the Ministry of Defense, which employed socio-cultural experts directly in the

[17] Solovey 2012.
[18] Eggers 2014.
[19] Montes 1965.
[20] Sztankai 2013.

field of operations between 2007 and 2014 to better understand foreign society, proved to be the most controversial program.

In Roman mythology, Minerva was the goddess of wisdom and war after which the program was named. Initially, Minerva received little media attention, but due to the ambitious Pentagon initiative, it increasingly became the centre of attention, especially after comparative articles appeared regarding the Camelot project and Minerva's mission. Robert Gates, former Secretary of Defense of the United States, announced the Minerva initiative on 14 April 2008 at a conference held at American University. As he said:

> "[W]e envision consortia of universities that will promote research in specific areas. These consortia could also be repositories of open-source documentary archives. The Department of Defense, perhaps in conjunction with other government agencies, could provide the funding for these projects. Let me be clear that the key principle of all components of the Minerva Consortia will be complete openness and rigid adherence to academic freedom and integrity. There will be no room for 'sensitive but unclassified', or other such restrictions in this project."[21]

In the program argument formulated by Secretary of Defense Robert Gates, the DoD sponsors research topics that deal with terrorism, religious radicalism, and understanding China's international role and military needs, among others.[22]

The Ministry of Defense and the National Science Foundation (NDF) finally launched the Minerva Initiative program in 2008, which at the beginning received $50 million in funding. According to the project's website, Minerva's goal is: "to use and group the resources of the nation's most important universities"; "It seeks to define and develop basic knowledge about the background of current and future conflicts, with a view to better understanding the world's most important regions and political processes." The call for applications mentions anthropology, economics, political science, sociology, social and cognitive psychology and computer science as relevant disciplines. Projects receiving funding include: "A New Analysis for Measuring and Countering the Social Influence and Persuasion of Extremist Groups" from the Arizona State University; "Mobilizing the Media: A Deep and Comparative Analysis of Magazines, Music, and Video in the Age of Terrorism" from Georgia; "Tracking Environmental Spread in Social Contagion" by the State University; by Cornell University research, "Motivations and Cognitive-Social Elements of Radicalization/De-Radicalization", by the University of Maryland. At least some of the Minerva projects are clearly related to the problem of predicting revolutions or radicalisation. Inevitably, there are also neuroscience projects funded by Minerva. For example, researchers at the University of Chicago received a $3.4 million grant for the "Social and Neurological Research on Martyrdom" project, which examines how ISIS propaganda videos resonate with viewers. They aim to reveal exactly what happens in the brain when an individual is encouraged to change their mind.[23]

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21 See: https://archive.defense.gov/Speeches/Speech.aspx?SpeechID=1228

22 Tirman 2008.

23 Krishnan 2017: 86.

Summary

Many articles deal with the question of how ethical it is to involve different disciplines in military tasks. Perhaps the question is not the examination of ethics, but the depth of use.

> "Armed struggle, war is one of the defining characteristics of our human existence. A form of social existence which, in the event of its formation or occurrence – due to its complexity, as well as its extension to all other areas of social existence – in a given historical period is of the first rank from the point of view of the affected or interested social groups, rejecting all other social activities, or rather, it becomes a social activity subordinating them."[24]

As such, avoiding war is vital in which the role of the national security services is outstanding. There is no choice between the chosen tools that can be used to save lives. In times of war, battle tactics and technological innovations are the result of adapting to the unique tactics of the enemy, in which the use of social sciences is unavoidable.

The war in this special century will not be tipped to the winner by the number of weapons, technical superiority and better trained soldiers, but by the backbone of military science, i.e. the integration and application of social sciences such as sociology, psychology, anthropology, political science, communication – and the ability of media science, mass media, economics and, of course, international law. The use of these sciences in military operations, from planning to execution, have become the basis of modern warfare.[25]

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[24] Szendy 2017: 9.
[25] Sztankai 2018: 254.

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Cultural Awareness in Modern Warfare

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The international events of recent years have pointed to the fact that the role of the correlation and relationship between cultural awareness and the armed forces are much more important than as previously thought, and the analysis of the cultural background of the adversary can greatly help defeat the enemy and understand their motivations in modern conflicts. Today's confrontations are not only about the use of physical force, but also about the clash of cultural narratives and identities. The better we understand the cultural aspect, the better we can provide resources to learn about the enemy's cultural background, and the faster we can find weak points and use them as leverage to develop a successful strategy. The role of cultural awareness in modern warfare should not be underestimated. The presence of cultural factors can also be discovered during the recent Russian–Ukrainian war, which can be analysed not only as a traditional clash of forces, but also as a cultural and historical clash of the two countries.

Keywords: *cultural awareness, culture war, ethnocentrism, anthropology, military*

Cultural awareness

International relations are not only about politics and decision making, but they also have a great impact on the lives of people all around the world. International relations play a major role in shaping our world today. It is a broad, dynamic, and multidisciplinary field encompassing various social, economic, and political interactions among sovereign states and non-state actors. These relationships are essential in defining the complex interactions among the many players in today's world. It involves the analysis and comprehension of the complex relationships among states in addition to the factors shaping these interactions, such as cultural differences, economic interests, geography, as well as political ideologies.[2]

In an increasingly complex global environment, the connection between cultural awareness and military force has opened up new dimensions in warfare. Political and military leaders are now facing the challenge to deal with armed conflicts from

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[2] Saaida 2023.

a new perspective that recognises the role of cultural context, values and identity in the development, as well as resolution of conflicts. In order to gain insight into the background of 21st century conflicts, it is necessary to have a precise understanding of the depth of cultural differences. We all come from a culture that programs the individual and determines how to interpret social cues, behaviour and relationships, which make a culture, a group, or a nation unique. Culture can vary throughout time and space, and the different aspects of our own culture affect us more than it affects others.[3] In order to understand cultural awareness, a key step is to realise how culture impacts us all and how it influences people's views of the world.

Cultural awareness is the ability to become a conscious observer and thus being mindful of the similarities and differences among cultural groups.[4] Therefore, such a mindset, which can be learnt, provides the possibility to analyse the decisions of another person, group, or nation in such a way that their motivations are comprehensible. This can mean a strategic advantage during the planning process of military operations. In the field of social sciences, it is cultural anthropology that deals with the potentials of cultural awareness, since the understanding of the distinctions of a foreign culture is essential for the effective study of a society. Cultural awareness is based on such a fundamental respect that is inevitable to examine a stranger's background and perspective. Without respect and humility, it is impossible to understand subtle differences, which, in some cases, are the key to comprehend the entirety of a culture in a way it is also present in wars. Without mutual respect between opponents, it is impossible to either defeat the enemy or end the war.

The importance of cultural background in military operations

Understanding cultures and societies is crucial in post-conflict stability and support operations,[5] peacekeeping and nation-building interventions, all of which require close and occasionally long-term interactions between people of other cultures and the Western militaries. In addition, the success of UN and NATO military operations requires that not only should soldiers become experts on the culture of their adversaries, but also their allies, civilian local workers, non-governmental organisations (NGOs), international organisations (IOs), etc., since effective cooperation in a multicultural environment is only attainable by the development and use of these skills on a daily basis.[6]

In modern conflicts, cultural awareness is an increasingly significant factor of military operations. The more culturally different the enemy is from the civilian population, the more important it is for the military to understand the foreign society and the cultural background of both the locals as well as the enemy to ensure operational success. Cultural awareness can reduce friction and conflicts among people from different cultures in the area of operations, and improve the military's ability to accomplish its mission by gaining

[3] Gilbert et al. 2007 12.
[4] Goode et al. 2006.
[5] Stability and support operations (SASO).
[6] Wunderle 2006: 15.

insight into the intentions of civilian groups living there, thus enabling military leaders to go beyond such limitations as ethnocentrism.

Ethnocentrism, as a reference system and a way of thinking, has a great influence on the military mindset and on the judgment of cultures during military operations. It represents a real threat in operational areas, like the one we encountered in Afghanistan, in addition to the possibility of negatively influencing subsequent cooperation. Over the course of history, several cases have been recorded when certain military leaders attempted to interpret the actions and motivations of the enemy based on their own cultural norms. However, those interpretations turned out to be false and thus claimed human lives. As one sees it, these casualties could have been prevented by providing correct information.

Ethnocentrism is the judgement of different value systems (norms, customs, world views, lifestyles) through our own lens based on our own cultural values with the direct consequence of positively or negatively discriminating everything unusual. It is common that this evaluation is based on the preconception that our own cultural values are superior to that of other ethnic groups. Ethnocentrism is a characteristic of each and every nation in some form, or the other, and to a certain extent, it is even necessary, since social cohesion is unimaginable without a healthy national consciousness. Excessive ethnocentrism, however, can be devastating.[7]

Ethnocentrism is a phenomenon we frequently encounter during military conflicts, when people, who identify with a certain culture, ethnicity, ideology or religion, organise themselves into different groups, and at a certain level of the war, it is the clash of these cultures that can be observed. Although ethnocentrism is often debatable, it plays an important role in conflicts. Therefore, it is necessary to understand its significance and effects in warfare. The respect and preservation of cultural diversity is not an easy task in a multicultural environment. The risk of cultural insults has become an integral part of our daily lives, while prejudice, intolerance and humiliation can have serious consequences for individuals, communities, and societies. When inadequate attention is paid to cultural sensitivity or understanding in a society, it poses a risk of people developing stereotypes and prejudices about other cultures, which often leads to cultural insults. Offensive comments, mockery of cultural symbols or traditional garment can cause a significant amount of tension and can break the bonds between different communities within a society.

The cultural characteristics and mindset of a nation have a great influence on the outcome of war. A culture comprises various factors including language, religion, history, values and beliefs, which influence the individuals' and a groups' perception of the world, interpretation of events and interactions with others. By understanding different cultures, nations can foster mutual acceptance and respect, reduce misunderstanding and strengthen cooperation in addressing global challenges.[8] During military operations, cooperation is even more vital, and it is a must to cooperate with not only foreigners, but also with own subordinates.

As we can see, ethnocentrism has both positive, as well as negative effects. One negative consequence, which I have already briefly written about, is the ethnocentric

[7] Kisdi 2012: 11.
[8] Khan et al. 2020.

mindset, as a result of which another culture and identity becomes a matter of indifference. Consequently, the warring parties will not understand and respect each other, despite the fact that understanding the enemy is essential to its defeat, as the development of a strategy requires consideration of the enemy's possible actions and response to the use of force. Furthermore, culture and language are the primary segments of influence, so it is absolutely necessary to hire experts who are aware of the depths of the foreign culture, or are ready to thoroughly familiarise themselves with it. Furthermore, one of the greatest dangers of ethnocentrism is prejudice, which greatly influences a soldier's actions in the operational area. Based on assumptions, prejudice distorts our thinking, thus increasing our ethnocentric judgment, which leads to negative consequences. Ethnocentrism also has a long-term result, namely the traumas resulting from injuries, which remain for generations in the injured culture long after the war is over.

Increased attention is to be paid to the development of cultural awareness throughout military training and education. In order to overcome ethnocentrism, it is important to develop cultural sensitivity with the help of cultural specialists. The discipline that is able to reveal the differences between cultures and present them with comparative methods is Cultural Anthropology. The personnel of the Hungarian Armed Forces often have to communicate with dozens of foreigners in English or French in a multicultural environment abroad where they operate. Such circumstances often cause tension, and if we miss to prepare the members of our personnel to handle these situations, it can have long-term dire consequences, especially in such sensitive and dangerous times as it is today, when conflicts are becoming increasingly international and cultures are clashing. In such conflicts, it becomes ever so important to strengthen cultural competences in order to be able to adapt to the challenges of the battlefield.

The period of the culture war

Violent conflicts increased in various parts of the world. Starting with the Russian–Ukrainian war in 2022, followed by the Hamas attack on Israel on 7 October 2023 and the Israeli counterstrike against the Gaza Strip – which raises the possibility of a wider Middle East war –, violence also increased across Syria, including armed drone attacks by U.S. troops. At the end of September in the Caucasus, Azerbaijan seized the enclave of Nagorno-Karabakh – forcing approximately 100,000 ethnic Armenians[9] to leave their historical homes in the area, and fighting flared up again with Armenia. Meanwhile, in Sudan in Africa a civil war is raging, conflicts have returned to Ethiopia, and Niger's military takeover in July was the sixth coup in the Sahel Region and West Africa since 2020. There are many conflicts in the world where culture and identity play an important role in the fighting. In many of today's cultural conflicts, it is ethnic and religious minorities as well as groups based on regional and political dimensions that fight against each other. The Israeli–Palestinian conflict is one of the most striking examples of cultural and identity clashes in which the parties fight for their own land. What makes this

[9] Hovhannisyan 2023.

situation almost unresolvable is that both sides consider the same territory as their own on a religious, historical, and cultural basis. Conflicts with similar cultural backgrounds are the Rwandan genocide, the Kashmir conflict, and the Balkan war, as these conflicts have an impact on regional and international stability, hinder international cooperation, and exacerbate instability in the affected regions.[10]

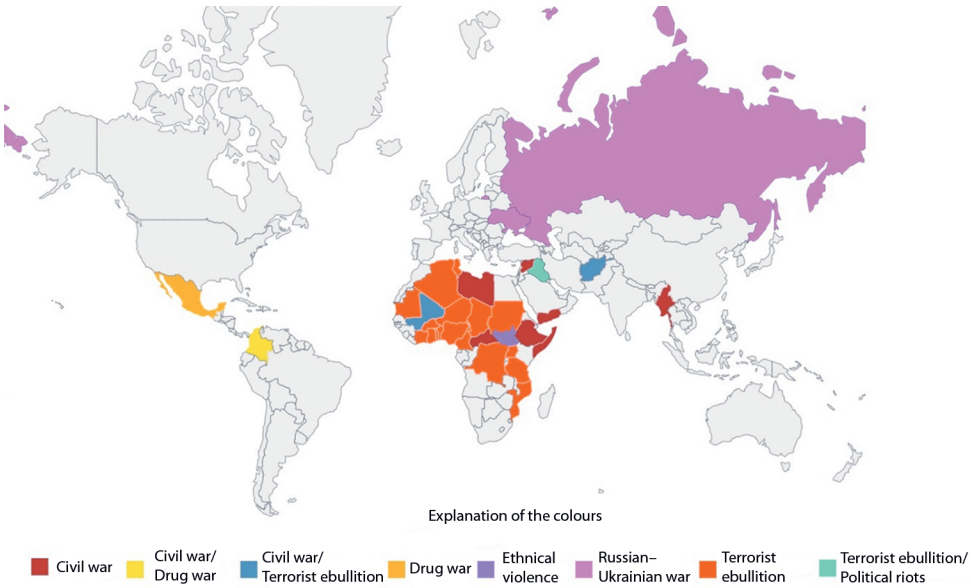

Figure 1: Map: wars fought in 2023
Source: https://worldpopulationreview.com/country-rankings/countries-currently-at-war

The culture wars of the present

The Arab–Israeli conflict is influenced by cultural differences. On the one hand, it is disputes over land ownership that caused the conflict, as both the Israelis and the Arabs consider the land sacred. However, religion also plays a major role, as differing religious narratives have led to intense cultural divisions. These cultural differences raise challenges in communication and understanding by hindering dialogue and negotiation. Cultural stereotypes and bias have also contributed to mistrust and a lack of understanding.[11]

The primary cause of the 1994 Rwandan genocide was ethnic and cultural tension between Rwanda's Tutsi and Hutu communities. The origin of the conflict can be traced back to Belgian colonial policy, which classified Rwandans into two ethnic groups, namely the Tutsis and the Hutus, based on arbitrary physical characteristics. The tension between the two communities remained even after gaining their independence from

[10] Krause–Renwick 1996: 213–217.
[11] Appel et al. 2008.

Belgium. This cultural and ethnic division was exploited by political leaders in order to incite violence and justify the mass slaughter of the Tutsis. Hutu extremists used hate propaganda to justify their actions, portraying the Tutsi as a threat to the Hutu way of life, and their massacre as a "cockroach extermination". The dehumanisation of the Tutsi was a vital element of the genocide, where cultural and ethnic differences were claimed to justify their massacre.[12]

The Kashmir conflict, rooted in the 1947 partition of India, is a long-standing territorial dispute between India and Pakistan over the Jammu and Kashmir region, which is under Indian domination despite the majority of the population being Muslim. The main factors of the Kashmir conflict are the cultural and religious differences between the two countries.[13] Due to the fact that the majority of the population in the Jammu and Kashmir region is Muslim, they consider themselves culturally and religiously closer to Pakistan than to India. The cultural dispute led to violent clashes between Indian security forces and militants in the region.[14] International efforts to resolve the Kashmir conflict have been ongoing for decades, with little success. The role of cultural debates in the Kashmir conflict highlights the importance of understanding and managing cultural and religious differences in international relations.[15]

The Balkan wars of the 1990s and the Kashmir conflict both involved such cultural disputes that led to violent confrontations. In the Balkan Wars, the conflict between Bosnian Serbs, Croats and Muslims was driven by cultural and religious differences. Similarly, the Kashmir conflict between India and Pakistan also has a profound cultural dimension, both claiming the territory as their own. The role of cultural disputes in these conflicts highlights the importance of addressing these disputes diplomatically, promoting mutual understanding between different groups. International organisations, such as the UN, play a crucial role in preventing conflicts and promoting peace in such situations.[16]

Among the important historical aspects of the Russian–Ukrainian war is the creation of culturally very different identities in different regions of Ukraine. Every region of Ukraine has its own unique history, including Transcarpathia, the only part of Ukraine that historically experienced a long-term Hungarian rule. Most of the southern territories were carved out of the Crimean Khanate, while the major part of central Ukraine once belonged to the Grand Duchy of Lithuania. The history of Ukraine was greatly influenced by the political situation in Poland and Russia (Soviet Union). All previous regimes left their marks on the region, for example, Polish and Hungarian are still widely understood and spoken in Galicia and Transcarpathia, while in the eastern and southern regions a Russian-speaking population predominates over Ukrainians. Russia under the presidency of Vladimir Putin has never treated the countries of the former Soviet Union as sovereign states. The same applies to Georgia and Moldova outside of Ukraine. In Russia's strategic thinking, these countries are viewed as states with a Russian identity and a sense of belonging, thus remaining under the influence of Russia. As for Russian politics, the primary factors

[12] Gourevitch 1999.
[13] Husain et al. 2020.
[14] Kamil Kazan 1997.
[15] Husain et al. 2020.
[16] Musaraj 2013.

leading to the conflict is the lack of international acknowledgement of Russia's power status as well as the active interest of certain countries to join Western organisations, such as the European Union or the North Atlantic Treaty Organization (NATO). The reasons for the outbreak of the war can be traced back to 1994, when Ukraine entered into partnership with the European Union by signing the Partnership and Cooperation Agreement. In 2009, Ukraine was invited to join the Eastern Partnership project within the framework of the European Neighbourhood Policy. In 2012, Poland participated in the ratification of the European Union–Ukraine Association Agreement. In June 2012, the European Parliament decided to send a delegation to Ukraine, and despite all the lies, corruption, blackmail, and Ukrainian oligarchs, the EU had a positive attitude towards this relationship. Contrary to the Ukrainian dreams of full involvement, on 21 November 2013, a week before the Eastern Partnership summit, the Ukrainian government (under the influence of Moscow) suspended preparations for signing the EU–Ukraine Association Agreement. After President Viktor Yanukovych expressed his opinion, Prime Minister Mykola Azarov announced that Ukraine would not ratify the document for reasons of national security. The following day, about 2,000 people gathered in Maidan Square, the main square of Kyiv, where the 2004 Orange Revolution had taken place, to demonstrate against their deprivation of a better future, which led to deadly clashes between the protestors and the police. Considering the tense situation that had developed on the nights of 21 and 22 February 2014, President Viktor Yanukovych left Kyiv and flew to Kharkiv. Yanukovych's flight was followed by the decision of the Ukrainian Verkhovna Rada (Supreme Council) to release Tymoshenko from prison, who made an immediate appearance on Maidan Square to encourage further protests.[17] These events initiated the cultural gap between Ukraine and President Putin, which eventually escalated to the occupation of Crimea and the "special military operation" of 2022, thus causing a deep and protracted antagonism, the end of which no one can predict.

Globalisation and war

David Brooks stated[18] that the great Cold War struggle between communism and capitalism ended in the 1990s and democracy was on the rise. Nations became more and more dependent on each other economically. It seemed that the Internet was poised to facilitate worldwide communication and a global convergence around universal values such as freedom, equality, personal dignity, pluralism, and human rights. We named this convergence process globalisation. It was above all an economic and technological process focusing on an increasing international trade and investment. Nevertheless, globalisation was also a political, social and moral process. In the 1990s, Anthony Giddens[19] a British sociologist, claimed that globalisation is "a change in our living conditions. This is how we live now." This included "the intensification of worldwide social relations". Globalisation

[17] Himka 2015.
[18] Brooks 2022.
[19] Giddens 1990: 64.

was about the integration of world views, products, ideas, and culture. The assumptions that the world's nations, admiring the success of Western democracies, would follow suit; that modernisation would bring about more consumerist and secular societies, as in Europe and the U.S., driven by the desire to make wealth rather than conquer others, turned out to be false. Our world is not like that anymore. It was an optimistic vision about the future course of history, progress, and convergence. Unfortunately, this vision does not describe the world we live in today. The globalisation process has slowed down and in some respect has even reversed. There are much more global conflicts than during the 1990s. Trade, travel, and even communication between political blocs have become more troublesome morally, politically and economically. Many Western consumers do not want to trade with China due to accusations of forced labour and genocide. Many Western CEOs are rethinking their activities in China as the regime is growing increasingly hostile to the West and supply chains are being threatened by political uncertainty. World economy seems to be gradually splitting into a Western and a Chinese zone. Naturally, globalisation as a flow of trade will continue. But globalisation as the driving force behind world affairs seems to be over. Economic rivalry has now merged with political, moral, and other aspects into one global competition for dominance.[20]

In order to end current conflicts, fostering cooperation through cultural understanding and acceptance would be vital. Cultural diversity is to be seen as such a value that can promote better communication, trust and mutual learning. Cultural differences, however, can lead to misunderstanding and conflicts. Stereotypes and biases can also hinder cooperation. Therefore, cultural sensitivity and respect are essential. It is imperative that we approach cultural acceptance with a critical mindset and recognise the importance of cultural self-determination.[21]

Conclusions

People in different cultures have different ways to express themselves and make themselves understood, which leads to misunderstanding and, as a result, conflicts. The prevention of conflicts by understanding different cultures is an important aspect in both military operations and politics. By gaining a deeper understanding of each other's cultural values, norms, and beliefs, we can build trust and reduce the chance of misunderstanding that might lead to conflicts.[22] It is, however, essential to approach this task with a critical sense to recognise the diversity within cultures and to avoid stereotypes and generalisations that can perpetuate conflicts. In addition, it is important to handle cultural differences constructively, to engage in dialogue and negotiations in order to find mutually acceptable solutions that respect the cultural values of all parties involved. By recognising and appreciating the unique cultural identities of others, we can foster peaceful relationships

[20] Brooks 2022.
[21] Nishii–Özbilgin 2007.
[22] Nishii–Özbilgin 2007.

and build bridges of understanding and respect.[23] Promoting mutual understanding and acceptance of different cultures is a crucial factor of international relations. Recognising the value of cultural diversity and the unique strengths of each and every culture can lead to greater harmony and cooperation between nations.

International experience and military force developments indicate that the development of modern military preparations and technical equipment has become more area-specific. Furthermore, Western countries, such as Norway, the United States and Great Britain, articulate the better understanding of the local civil society as a critical strategic advantage. Therefore, the shaping of this shift in knowledge and way of thinking can no longer be described as a scientific fad, but rather developing such competence is our duty. In a multicultural environment, a single soldier's mistake is enough to set back the development of trust with the locals for several years. The military challenges and experiences of the 21st century prove the vital importance of the military use of anthropology. Developing cultural awareness is essential to understand and avoid unnecessary conflicts that otherwise might accompany military tasks. We experienced the kind of tension in Kosovo, Afghanistan, the Central African Republic as well as the Western Sahara that, in addition to the war situation, intensified the antagonism between the local population and the military forces coming to their aid. Obviously, every nation faces different challenges back home, but in an operational environment, cooperation is key to survival.

The development of cultural sensitivity as a competence and the application of cultural anthropology, together enable the military force to better comprehend and more effectively manage modern conflicts. Cooperation and mutual understanding are the key factors to a successful conflict management, and the achievement of sustainable peace. With their approach and research, cultural anthropologists can promote a more effective conflict management and the achievement of long-term stability. However, competence as the conscious use of skills and abilities is absolutely necessary for every soldier who performs military service abroad or overseas. Soldiers working in the operational area aim at reducing conflicts and increasing effective cooperation with the local armed forces and civilians. The development of such competencies is a long process, though. These are to be learned over the course of years, and even then there is the risk of interpreting and using the information subjectively. However, as articulated by the International Society of Military Sciences (ISMS), which brings together the highest level of military educational institutions of small democratic countries, gaining this knowledge capacitates today's soldiers to successfully tackle the challenges of the future. After all, it is not only past experience that must be utilised, but in addition to the development of our technical equipment, our training and education must also be continuously and simultaneously improve if we want to deploy knowledgeable soldiers.

[23] Steers et al. 2010: 76.

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