
Original article

The use of constructive and virtual simulation technologies for skills training in military education

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INFORMATIONS

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ABSTRACT

The report describes how simulation technologies are embedded in military education in Vasil Levski National Military University. It is more than obvious that both NATO and EU borders are surrounded by insecurity and instability. The EU and NATO countries are facing a very wide range of security challenges and threats: from state and non-state actors; from military forces and from terrorist, cyber, or hybrid attacks. Those challenges should be included in the military education programmes, giving the cadets the opportunity to study the security treats and to be trained to react to them. Simulation systems constitute an excellent tool for the creation of a number of scenarios. Based on them, we are able to train the cadets in a virtual environment, covering a variety of different training objectives.

KEYWORDS

military education, training, security,
virtual and constructive simulation systems



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Introduction

Peace, security and society development are interlinked nowadays more than ever. The security environment is vital for the society and it links the private, national and international security aspects. Internal and external security are interdependent and the distinction between them is provisional. The internal security is influenced by financial, economic and political international processes, energy projects and the national commitments concerning the defence of global democratic values. Additionally, the Republic of Bulgaria has to answer to the incoming security threats to the defence and control of the external EU borders, as well as to face the cross-border criminal activities.

The risks and threats in their diversity and different forms of appearance could be identified as asymmetric by nature and the impact caused by them influences both national and regional security environment.

1. Security challenges (covered by military education)

As outlined in the 2010 Strategic Concept [1], as well as in subsequent documentations, crisis management is one of NATO's fundamental security tasks and capabilities. NATO's role in crisis management goes beyond military operations aimed at deterring and defending against threats to Alliance territory and the safety and security of Allied populations. It may involve military and non-military measures in order to address the full spectrum of crises – before, during and after conflicts. A crisis may be political, military or humanitarian and can also result from a natural disaster or as a consequence of technological disruptions.

Globalisation remains the leading tendency that will continue to affect the internal security environment. Globalisation factors could be identified as:

- Economical, in terms of difference in economic growth from West to East.
- The impact of different economic subjects on the local economy. On one hand, Bulgaria is part of the common EU market, on the other, there are indications that the economy depends on energy sources coming from outside EU. The energy diversity is always one of the main goals, having been declared by any government since 2007, but still all the projects for diversification are ongoing or frozen.
- The increasing impact from non-state actors, including economic and religious.
- Migration – both internal and external.
- The poverty problems and the climate change.

Asymmetric threats should also be considered very seriously. International terrorism is usually pointed as the main one. Now we are facing the trend when this term is composed of many subcomponents. It becomes more and more difficult to generalise the root causes and to identify the actors. One example could be the presence of two different actors in Islamic Republic Afghanistan – The Taliban movement (supported by Al Qaeda) and the so-called ISIS-K (Islamic State of Iraq and the Levant-Khorasan Province). The first one has been identified for many years as the global threat and there have been ongoing operations against it since 2001. Now, there are some signs indicating negotiations and reconciliation processes between official Afghan government and the Taliban movement. On the other hand, ISIS-K is recognised as the branch of ISIS/DAESH and is identified as the ENEMY and lately we have been observing the ongoing fights between the Taliban and ISIS-K. The cross-border crime activities such as weapons smuggling, drug trafficking and illegal migration are still in place and they also affect local and regional security. The proliferation of Weapons of Mass Destruction (WMD) is on the rise and the will of several state and non-state actors to acquire the materials for WMD remains unchanged.

The cyber domain now is also the main factor that impacts the local and regional security environment more deeply than we can imagine. Merriam Webster [2] defines cybercrime as "criminal activity committed using a computer especially to illegally access, transmit, or manipulate data". Extending the criminal part of this threat, the cyber domain is now being recognised as legitimate battle space. At the 2014 NATO Summit in Wales, Allies noted that the impact of cyber-attacks could be as harmful to our societies as a conventional attack. As a result, cyber defence was recognised a part of NATO's core task of collective defence. At the Warsaw Summit in 2016, Allies recognised cyberspace as a domain of operations – just like air, land and sea. At the Warsaw Summit, Allies also adopted the Cyber Defence Pledge aimed at strengthening the cyber defences of national networks and infrastructure [3].

We can identify the three main pillars of military education: theoretical education, practical training and military experience.

The security challenges theory is covered by the curriculum called “Regional and national security”. There are three specific subjects, which include the above mentioned security challenges: “Basics of national security”, “National and international security concepts and doctrines” and “Risks and threats for national and international security”. Additionally, from pure military perspective, the cadets will study military science which covers the military instruments that are applicable in order to be able to response to any kind of security challenges and threats. Practical training is the essential part of education. Military experience will begin in military university, but it is a continuous process, enriched during the military career of every military serviceman.

2. The use of constructive and virtual simulation technologies

Skills training has to be considered as an important factor in military education. It helps to overcome confusion caused by lack of competence. Military training can be classified in two main categories – individual and collective training. Individual usually provides job-specific skills and cognition to individual cadets. Collective training is aimed to teach how to accomplish the tasks, specific for squad-platoon level with appropriate C&C (command and control) and support elements in different combat and non-combat situations.

Military training could be conducted by the conventional training methods. They usually are effective from practical point of view, but involve huge cost, time and risk of life. There is also a 24 hours a day restriction concerning the use of weapons in the University training area, ecological requirements, etc.

Simulation technology is accepted as effective training tool because it covers the requirements for the individual and collective training using simulators, virtual and constructive applications. The use of simulators and simulation systems, based on simulation technologies in general is a very powerful tool for skills training, providing a huge variety of training options, especially in Military education.

There are many advantages, such as cost effectiveness, “train as you fight” approach, the use of virtual environment that is very close to the real one, etc. Depending on the system, the cadets will be charged both mentally and physically, which gives them positive development in building leadership qualities and practical habits.

In Vasil Levski National Military University (NMU) simulation tools are considered to be the important tools that can support all the pillars of education.

In order to support the theoretical studies, simulation tools are used as a supportive instrument, to create interactive examples. During practical exercises, depending on the type of simulation tools which are used, cover individual or collective training requirements are covered. Speaking of military experience in terms of planning and conducting real military operations, simulation tools will be used during the planning phases for analytical purposes such as mission analysis, war gaming etc., and during the preparation phases to train the soldiers and units for conducting specific tasks in virtual environment that is close to the real one.

2.1. Types of simulations

2.1.1. Constructive simulation (CS)

CS is a computer-based simulation. The main approach is that the users do not work with weapons or equipment, but they use mathematical models to represent the combat situations. The human portion is represented by logical statements that are identified as combat rules. The goal of their use is to train the units and HQs, in conjunction with preplanned maneuver taking into account the time and space. It also includes virtual entities that represent real soldiers, weapons and environment. Constructive simulation also offers the opportunity of visualising different events, occurring in any specific battle scenario: movement of forces, attrition calculation, logistic support and combat service support.

In NMU, constructive simulation system that is implemented is so referred to as Joint Conflict and Tactical Simulation System (JCATS). JCATS has been up and running since 2006. It is used for skills training for all categories of trainees.

JCATS is multi-sided, interactive, entity-level conflict simulation applied by governmental organisations (e.g. military and site security organisations) as a tool for training, analysis, planning and mission rehearsal. Simulation is primarily focused on command and control or unit synchronization issues. It offers an excellent opportunity for exercising tactics, techniques and procedures for units of almost any type.

The range of the tasks covered by JCTAS is represented below in Figure 1.

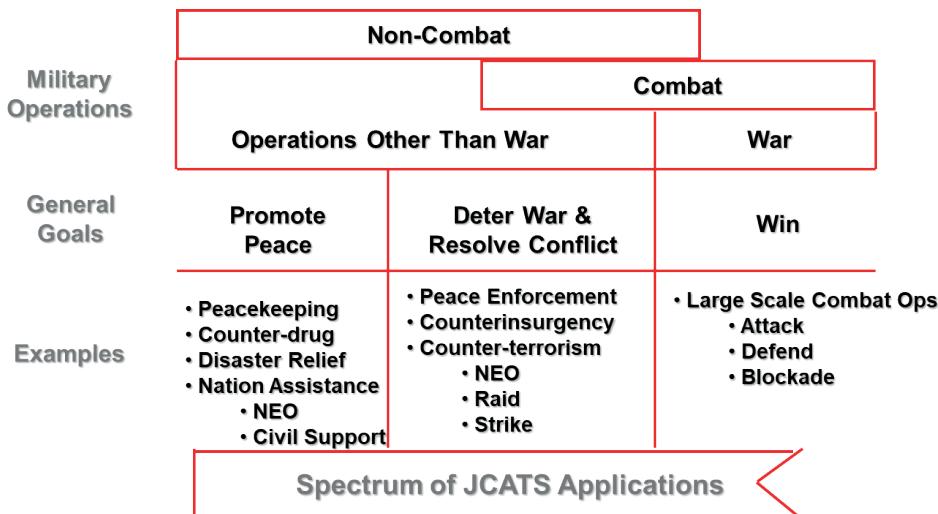


Fig.1. JCATS range of tasks

2.1.2. Virtual simulations (VS)

VS is a simulation involving real people operating simulated systems. Virtual simulations inject a Human-in-the-Loop into a central role by exercising motor control skills (e.g., flying jet or tank simulator), decision making skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a C4I team).

The main virtual simulation tool, accepted by Bulgarian Armed Forces, is called Virtual Battle Space, version 3. The product is available in National Modelling and Simulation Training Centre “Cheralliza”, but is also accessible for all institutions, including National Military University.

VBS3 provides a virtual training environment for land, air and sea training and mission rehearsal applications. It presents cognitive training in a situational context, resulting in faster assimilation of content, increased retention, and integration of key training objectives.

It provides an open platform to help the training audience to:

- learn and teach the tactical procedures,
- repeat the missions/become familiar with the operational environment,
- analyse situations (help to make the decision),
- Practice Combined Arms and Joint trainings,
- create content and add features.



Fig. 2. VBS 3

2.1.3. Live simulations (LS)

In Live simulations, real people operate real systems, such as a soldier on a field training mission.

Since 2012, the Bulgarian Armed Forces have been trained with the use of the Deployable Instrumented Training System (DITS). It provides a mechanised company sized system with 95 infantry sets and 10 BMP vehicles kits.

Additionally, National Military University has small weapons firing simulator that gives us the opportunity to practice individual training audience tasks, by using real weapons such as Assault rifles, sniper rifles, pistols and personal antitank weapons in virtual environment.

2.2. Practical use of simulation systems

The main focus in NMU lays on the skills training and building professional qualifications. As mentioned before, we follow the stepped approach and individual and collective training

are embedded in our curriculum. The main goal is to transform the theoretical knowledge into practical skills and experience. The individual skills are main target for the cadets during their first and second year of training. They are trained as soldiers and soldier-specialists. During their third year they will be trained as squad leaders, and the last level is platoon commander. Every year the University organises a complex exercise that involves all the cadets and faculties.

The exercise is usually at the squad-platoon-company-battalion level. The exercise is multi-service and the cadets are trained at all different levels. The first phase of the exercise is Computer Assisted Exercise (CAX). The exercise scenario is played in virtual environment first and then conducted on the training field. Simulation systems give us the opportunity to cover all the security threats and challenges, given to the training audience as theoretical knowledge, but also to practice and repeat additional skillset including different troop leading procedures, SOPs, various kinds of target acquisition procedures (lethal and non-lethal), close air support, medical evacuation, etc. Last but not least, simulation tools create very interesting opportunities in practicing comprehensive approach, performing tasks that are not combat by nature. Constructive and virtual simulation systems also give us the opportunity to simulate different weather conditions, day and night. The difference between the University and the regular users of the Sim Systems is that we use the first and second year cadets as operators, not specially trained professional ones. It gives them the knowledge for the future on how to embed simulation tools more effectively in order to achieve the given training objectives.

From technical point of view, simulation systems are also very applicable for experimenting, for example testing new equipment and operating models that are not available for regular use i.e. unmanned aerial vehicles.

Conclusions

The nature of the modern world is very dynamic nowadays. The end of the so-called "Cold war" somehow gave the European countries the sense that the end of dictatorship means that democracy does not have an alternative, especially in Euro-Atlantic environment. Unfortunately, we can see that instability is coming towards Europe from many different directions. It is obvious that the hybrid warfare is now conducted in all domains and unfortunately NATO, EU and all European countries are targeted very actively. The security challenges and threats are well identified in national and multinational level. The main task for military education is to create the proper set of skills in the future officers and non-commissioned officers (NCOs) that will enable them to enforce the proper actions in order to diminish the risks for our countries. The theoretical studies are very important, but without practical exercises we will not achieve the final goal for military education – the next generation of officers and NCOs. Simulation systems are important tool that can significantly influence the results of education in a positive manner. Based on the common standards, they create the framework for the NATO and EU countries to study the concepts and doctrines, following the same approach and exchanging not only theoretical views and information, but also digital models, terrain features and distributed knowledge in general.

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Conflict of interests

The author declared no conflict of interests.

Author contributions

The author contributed to the interpretation of results and writing of the paper. The author read and approved the final manuscript.

Ethical statement

The research complies with all national and international ethical requirements.

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Biographical note

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Wykorzystanie technologii symulacji konstruktywnej i wirtualnej w szkolnictwie wojskowym w celu ćwiczenia umiejętności

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| STRESZCZENIE | Raport opisuje, w jaki sposób technologie symulacyjne są wbudowane w edukację wojskową na Narodowym Uniwersytecie Wojskowym im. Wasyla Lewskiego. Jest oczywiste, że obszar nieobjęty granicami państw NATO i UE cechuje niepewność i niestabilność. Kraje UE i NATO stoją w obliczu bardzo wielu wyzwań i zagrożeń dla bezpieczeństwa: ze strony podmiotów państwowych i niepaństwowych; mogących przybrać formę działań sił wojskowych albo ataków terrorystycznych, cybernetycznych lub hybrydowych. Wyzwania te powinny zostać uwzględnione w programach edukacji wojskowej, dając słuchaczom możliwość badania zagrożeń i szkolenia w zakresie reagowania na nie. Systemy symulacyjne stanowią doskonałe narzędzie do tworzenia |
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wielu scenariuszy. Na ich podstawie jesteśmy w stanie szkolić słuchaczy w środowisku wirtualnym, realizując różnorodne cele treningowe.

SŁOWA KLUCZOWE edukacja wojskowa, szkolenie, bezpieczeństwo, systemy edukacji wirtualnej i konstruktywnej

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