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SIMULATION TOOLS IN THE ARMED FORCES INTERFACED BY THE OPERATIONAL DESIGN

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ABSTRACT

The operational design and its practical application are directly influenced by the training, experiences of the individual command levels and as well they are determined by the economic development of the country. Its quality implementation in the practice is directly addicted upon operational art, which is the real output of the cognitive approach by commanders and staff, by air traffic control instructors and inspectors. And that's what it is sustained by their experience, cognition and as well as verdict – to propose strategies and operations to set up and utilize armed forces. The usage of the simulation tool and synthetic environment is the core part to reach the aim of the high level of the efficiency and at the same time to reach the required level in the flight region safety.

KEYWORDS: operational design, armed forces, safety, simulations, synthetic environment

1. Introduction

Due to advancements in new and emerging technologies, and increasingly sophisticated disruption methods used by adversaries, the operational environment in which the developed countries (e.g. United States) operate is extremely complex. The probability that for example the U.S. and its partner nations will face a well-structured enemy in the future is very low, if any. The terrorist attacks in Washington D.C. and New York City in September of 2001 exposed the requisite to quickly attain a deep understanding of operational environment, one that extends beyond the boundaries of any one country or state. The U.S. was, and is still to a degree, facing an unknown enemy with no geographical borders and is no longer limited by reach. Defining the ends, ways, and means on how to fight was not clear, ambiguous and controversial for many (The USAF, 2016). Operation design will allow planners to understand the operational environment, including current and desired status of the system, will help to define and frame the problem to be solved, continuously validating in accordance with any emerged

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changes, and, more importantly, will provide a guidance to develop the strategy.

Operational design is a process of understanding and problem framing that helps commanders to define the operational approach. The commanders, and by extension their staffs use education, experience, and judgement to support the planning process (Joint Publication 5-0). The process allows the commander make an informed decision in the complex operational environment and gives him an operational vision, rather than discovering the complexity itself (Reilly, 2012). Understanding the operational environment is the basis for successful planning outcome.

Because ultimately there is a difference between the current and desired system, planning must commence to solve the problem. However, ill-structured complex problems are influenced by a number of factors, hence by choosing an operational approach requires deep analyzing and understanding of the consequences. Operational design is a tool to construct a campaign plan, while applying decision making. (Reilly, 2012) The goal is to gain an overall situational awareness, which will allow commanders to determine an operational approach. This should minimize the risk associated to a given operation as well as it should enlarge the expectation that the plan is able to live not only through the initial contact. For instance, after terrorist attacks in 2001, the U.S. found itself unprepared. Many questions emerged, such as:

Who the enemy is?

What lead the enemy to take action against the United States?

How did they prepare the terrorist attack?

How did they break the air defense system?

Ultimately leading to questions on how to fight against an enemy that is spread within 27 countries. Fast forward 16-years later, it is clear that understanding the operational environment, having a sense of cultural awareness was terribly difficult and became an underlining theme of the war. (The USAF, 2016)

2. The Initial Phase to Realize How the Simulation is Important

A framed problem is an outcome of the initial phase of operational design. At this point, the commanders are aware of the factors that define the operational environment. They understand where we are, where we want to get, and what the key points to attack are. In addition, it defines the sequence, expected adversaries reactions, friendly strengths and weaknesses, who the friendly, neutral, or hostile forces are, and many other planning factors. A framed problem guides planners to establish initial hypothesis of the friendly, adversarial, and other factors that define the operational environment (The US Army, 2008). Moreover, a framed problem helps the commanders at all levels to conduct a comprehensible discussion about the scenarios of the situations where they intend to use air or ground forces .

Analyzing of the elements of operational design is essential to frame a problem and to guide planners to develop the strategy during joint operational planning. Eight out of these elements participate to gain the situational awareness and frame the problem. The rest is a part of an operational art, which helps planners with the strategy development. The eight problem-framing elements are mutually interrelated. These elements are: "*end state, objectives, effects, centers of gravity, decisive points, lines of operations, arrangement of operation, and assumption*" (Reilly, 2012). The element "*end state*" defines the point, that military forces are no more needed, reached by a combination of operations of joint force mission with an effective "*arrangement of operations*".

"*Objectives*" are the goals toward which every military operation should be directed, and "*effects*", desired or undesired, describe the behavior of the state after an action. Probably the most important element is "*centers of gravity*", which identifies the source(s) of power of the state to react. To reach the "*decisive point*", which allows commander to take an advantage over enemy, needs to be fulfilled by a couple of sequential tasks called "*line of operation*". Planners need to use "*assumptions*" to eliminate the risk by identifying branches and sequence. Compliance with safety criteria in this context is directly proportional to the quality of operational design and finally affects the security system of the country. Here there is the opportunity to use the simulation tool to develop the potential crisis scenarios and to define the most efficient approach.

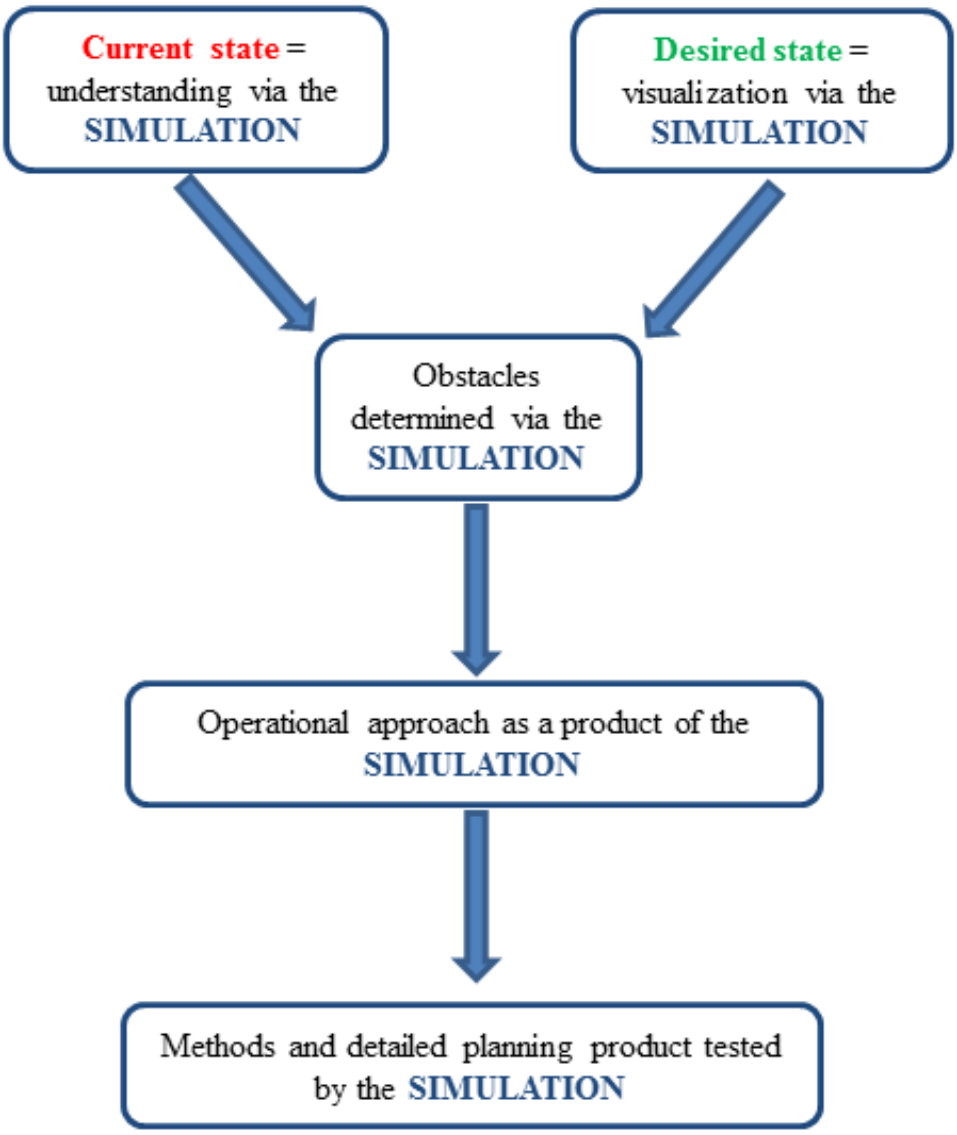

Figure no. 1: The importance of the simulation in the operational design
Source: own

While there are many connections in between these eight mentioned elements of operational design, and even there are some others with the elements participating on the strategy development, there is the closest triangle in between *lines of operations, effects and decisive points*. To reach the decisive point, which is consequently linked to a center of gravity, and eventually to an objective, a commander needs to fulfill multiple tasks. The tasks must be conducted sequentially with a goal to disable enemy forces. The line(s) of operation, which includes all pre-planned tasks, will then conclude with reaching the decisive point. However, after each of the tasks, a desired effect occurs, in other words, the commander will conduct the next task upon the reaction of the enemy. If pre-planned well, the action will cause desired enemy reaction, and the changed operational environment will allow follow on actions of the line of operation. By this way, the element of operational design "*lines of operation*" is linked to "*effect*" and then further to "*decisive points*".

Even though at the beginning of the nineteenth century the possibilities of the simulation were "primitive", French General Napoleon Bonaparte introduced his decisive and victorious strategy "*la manœuvre sur les derrières*". His fundamental idea was to cut the lines of communication within the enemy – the decisive point. First of all he needed to envelope the enemy formation to be able to separate the main body of the enemy and other forces. He managed to do it by an initial maneuver towards the rear and made the enemy move and accelerate his forces forward (Paret, 1986). This desired effect opened the enemy configuration, which allowed Napoleon's second force to make the next attack towards unprotected main body of the enemy. His forces cut the communication lines of the opened enemy and isolated the deluded rear forces and the enemy's main body. Napoleon at this point reached his decisive point, because since this moment he had an advantage over the enemy and could directly attack the center of gravity. Hence, since these three elements provide an essential guidance to reach the decisive points, they are crucial for modern planners.

18th century battles were conducted for the goal to conquer another country in the way of marching army versus opponent marching army. The operational environment in future campaigns will be much more complex. There are several reasons: new and sophisticated technologies, such as synthetic environment for training, weapons of mass destruction, cyber technology, drones; adversaries infiltrated to civilian population, without any geographical boundaries; and ultra-radical adversaries with significant cultural differences and the way of thinking (Rajda, 2016).

3. Tools in the Modern Sophisticated Synthetic Environment

The concept of the modeling and simulation (M&S) has historically been known for several thousands of years. The first one records of its usage are attributed to the ancient Egyptian and Chinese. Notwithstanding to the initial simulation, the real breakthrough with the use of the modern technologies and the expansion of the simulation occurred in the early 20th century. At the beginning of the mentioned century, M&S was performed separately. It was influenced by the fact of the possibility of representing a real environment entity for a particular purpose, which was limited by the possibility of information technology as well as communication technology, by the absence of network interconnection and the limited possibility of using the network modules. At the beginning of the 20th century, M&S was able to contain only a limited narrow part of the real environment. Many simulation tools and systems did not

have direct connection to a real tangible tree dimensional environment. However, the growth of the new technological capabilities in conjunction with M&S has enabled applications to become more and more sophisticated, and their intersection and representation of the real environment is getting closer and closer to reality (Cayirci and Marincic, 2009).

The parts of live, virtual and constructive simulations can be divided into two basic groups:

- The simulations that are determined by the technologies and science which is used in the simulation itself,
- The simulations that are mostly determined by the cultural and human attributes.

Urban environment belongs to the greatest challenges in terms of the application of technological knowledge in the synthetic environment. This is achieved primarily by the need to create and model external objects that belongs to the most important elements of the synthetic environment. Each urban environment is very complex. The creation of the urban environment is different from the creation of the natural environment and definitely requires application at least in three levels of knowledge of its own subsystems. These are the three core subsystems of the urban system:

- physical subsystem;
- functional subsystem;
- social subsystem.

The physical city subsystem is made up of a number of shapes with different angles that are distributed and arranged in the grid pattern where there are huge numbers of covers as well as regular lines with the possibility of directing the activities associated with the formation of the crisis situation. In one urban environment, all the objects can have different architectural styles. The vertical dimension in this three-dimensional urban space is of great importance. This vertical dimension allows the creation of conditions that create obstacles for the attacks but also enables defensive action in the synthetic environment such as cellars, high hedges and obstacles, underground sewerage systems and many others that are the product of human creation and human existence. Modern urban agglomerations are characterized by their own infrastructure, consisting of different types of developed subsystems, such as formal subsystems with their own centralization, urban node types and connections as well as industrial technologies. Undeveloped or primitive urban communities are made up of a number of informal eccentric components, where adaptive and overlapping low technological advances are evident, influenced by individualism or small groups of individuals. All the connections in such low developed urban areas cannot be considered to be centralized (Tolk, 2012).

Complexly, each the social subsystem could be characterized by the factors such as population demographics, religious affiliation, cultural maturity and historical aspect. This tied network of various factors is a very complex and difficult to understand. Creating of such synthetic environment that is capable of taking into account all of these mentioned aspects is crucial for the successful preparation of armed forces in order to eliminate the loss of life in a real environment.

Every urban terrain allows to increase the effectiveness of the radical terrorist activities and is able to influence the length of time for initiation of the reaction and length of time to declare the readiness of military units. It is very difficult to distinguish between own and enemy units or individuals. The numbers of the killed and wounded are high and the amount of ammunition is also limited. Also, the effective use of the weapon systems and firepower for the use in the exterior of the

city agglomeration is limited. The support for air attacks and effective coordination, transport of wounded, evacuation of the population, fire extinguishing, and many others are also intricate elements that also play a key role in conducting combat activities in the urban agglomerations. Support of the satellite systems may also be limited and the use of radio communications is limited too. Warfare in the urban agglomeration is psychologically and physically extremely exhausting, stressful and both human and material destructive.

However, even nowadays, in the case of advanced simulation technologies, it is not possible to achieve such resolution of objects that is identical with the respect to the individual's sensation in the real environment, especially when creating multi-level underground as well as above-ground buildings and objects (Nečas and Grega, 2013). Due to the fact that city fighting and combat operations are extremely grueling on all sides, it is necessary to constantly improve the synthetic environment and so to eliminate the potential losses of human power and lives, but also to increase the possibilities of preserving urban agglomerations and thus contributing positively in the economic sphere to conduct successfully all the combat activities.

4. Conclusion

Analyzing the operational environment has become arguably more crucial now, that at any point in the past. The operational design assists in framing a problem during joint operation planning by analyzing its eight elements. A well-framed problem provides the commander an essential understanding of the situational environment and is basis for visualizing possible solutions and developing the strategy. Nowadays all the parts we are able to construct virtually by using of the simulation tool and we have to realize that the modelling and simulation paradigm are secured so near at hand that the information which is being simulated could be a significant part of the real environment.

The second part of the operational design is "*What*" and it consists of the other elements. In the phase of problem framing, there are three elements creating the closest ties, and are also a fundamental triangle. Those are "*lines of operations*", "*decisive points*", and "*effects*". Consistent analyzing and executing of the line of operations with linked effects leads planners and those executing to reach the decisive point. "*What*" is the gate to successfully attack the center of gravity of the enemy, reach the objectives and finally establish the end military state. Finding the balance in between those elements and exploitation of the simulation tools is the clue for commanders to deal with today's threat successfully.

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REFERENCES

Cayirci, E. & Marincic, D. (2009). *Computer assisted exercises and training,* New Jersey, USA: Hoboken, 21-26.

Nečas, P. & Grega, M. (2013). *Simulation technologies: implications for security management and training*, available at: http://wydawnictwo.aon.edu.pl/pl/images/Security_2_2013.pdf.

Paret, P. (1986). *Makers of modern strategy*, available at: http://www.nber.org/feldstein_lecture_2015/ZOELLICK%20Makers%202015.pdf.

Rajda, Z. (2016). *Současné hodnocení terorismu z pohledu trestního práva*, available at: https://www.vsbm.sk/data/revue/revue-2-16.pdf.

Reilly, J.M. (2012). *Operational design, distilling clairty from complexity for decisive action*, available at: http://www.dtic.mil/dtic/tr/fulltext/u2/a604644.pdf.

The United States Air Force. (2016). *The planners perspective*, Maxwell AFB, USA: Air Command and Staff College.

The United States Army. (2008). *Commander's appreciation and campaign design,* available at: http://www.tradoc.army.mil/tpubs/pams/p525-5-500.pdf.