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Knowledge Database of Asymmetric Threats

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Abstract: The article deals with a possibility of creating a knowledge database of asymmetric threats on the basis of experience of previous operations. The experience of combat use in operations demonstrated the need for an improved training for the mission. Decision Support System is a tool which improves process of planning and executing mission in asymmetric warfare. The core of the system is a knowledge database, serving as a comprehensive source of historical information, and components supporting the assessment of risk for future missions. The article focuses on the fact that data in the database should be saved. The main content of the database should consist of experience from previous missions, such as information about mission environment, goals of the mission, enemy in the area of engagement etc. In performing tasks in missions the system should contribute to an overall increase of combat effectiveness and protection of human lives in particular.

Key-Words: Decision Support System, knowledge database, mission, sophisticated information system

1 Introduction

Definition of asymmetric threats or warfare has various forms as disproportion, differentiation and disharmony between two or more parties in a conflict. Asymmetry is an inherent feature of crises and wars (primarily terrorist activities). The growing importance of asymmetry in present conflicts (military, terrorist and other) led to considering asymmetric threats as a separate specific area of armed operations. Typically, this area is characterized by complications, ambiguous and uncertain situation and lack of complete and reliable information on one's own and on enemy forces. However, each country perceives the definition of asymmetric threats in a different way.

Conducting military operations in urban environments, in particular anti-terrorist operations, has become more frequent in recent years due to changing nature of modern warfare and thus, as a consequence, it appears that asymmetric threats are more likely to happen in urban areas.

According to NATO documents the asymmetric threats usually arise in relations: strong-weak or large-small. Asymmetric threats are most often posed by a party which seeking the confrontation is unable to resist the enemy in a symmetrical manner i.e. using the same or similar means of warfare. The weaker, poorer armed party of the conflict tries to choose the means of confrontation in a way which minimizes the possibility to exploit the overwhelming combat potential by opposing party. The case of asymmetric actions is having a place also when one party made a breakthrough in some technology or achieved technological revolution which increases its possibilities and the combat ability of the armed forces.

NATO must be prepared to act effectively against the use of asymmetric means by its enemies. At the same time, it is assumed that potential opponents of NATO will be increasingly using the asymmetric methods of fighting, including an unconventional strategy and tactics, and technique.

In terms of preparation for the actual operation and management of peace support operations is necessary to pay attention to the use of decision support systems. Sophisticated information has a crucial role in these systems.

2 Decision Support System in asymmetric warfare

Decision support system (DSS) is a tool which improves process of planning and executing mission in asymmetric warfare. The core of this system is a knowledge database, serving as a comprehensive source of historical information, and components supporting the assessment of risk for future missions.

Decision support system could be used to support:

- planning at the Operational level – especially in monitoring risks in the Area Of Responsibility,

managing allocation of Force Protection and pre-deployment of Force Protection,
- planning at the Tactical level in intelligence management and threat analysis – by risk assessment of the mission plan,
- mission rehearsal by mission review and simulation of potential events during the mission (short briefing based on potential risk),
- mission execution by the terrain data collection and status reporting.

Managing information in military area is not optimized. Military planning originally focused on scheduling and deployment with less emphasis on the supply of information for mission execution (leaving that for logistics).Sophisticated Information System (SIS) can offer a solution for dearth of information transfer by providing methods and tools which extend the results of planning with an information scheme for mission execution. There is a great need to gain information advantage. When dealing with asymmetric threats, the crucial factors are both the timing and the quality of information. Current systems do not guarantee the proper (optimal, needed etc.) service level in this area. By identifying the informational content required, the following gaps in current systems can be found:

- the lack of standard asymmetric threat models and information,
- the lack of tools supporting mission planning / execution for protection against asymmetric threats,
- the lack of implementation of more sophisticated methods of data processing and filtering e.g. reasoning techniques.

The core of system is a knowledge database which defines the information scope. This scope is used as a basis for structuring the knowledge which is contained in the knowledge database. The requirements which define the knowledge database are derived from analysis of user needs and analysis of example scenarios of the knowledge database use. Building the concept of a mission is an attempt to form a general description of different types of operations performed by military units. Missions are dynamic, coordinated actions of one or more military units executing their orders and plans. Each mission has its parent mission, except for missions at strategic level. At the lowest level (lower then tactical level), mission only consists of one or more tasks. For the model of the database, asymmetric threats are any threats, often using non-conventional weapons and terror to achieve its goals.

Military planning still focuses on operations scheduling and deployment of forces, mostly due to decreased appreciation of supplying adequate information required for mission execution. Sophisticated information system can offer a solution to that problem by providing methods and tools which extend the results of planning by using information schemes for mission execution. The sophisticated information system aims to develop a set of new mission supporting tools that aid force protection in an asymmetric warfare context, both in urban and non-urban environment.

3 Sophisticated Information processing system

The analysis of recent armed forces combats has proved that their goals have been achieved when strategically combining different combat aspects into single system e.g. effective weapons, dynamics and information. It shows that a crucial role in modern conflicts is played by its immaterial part i.e. the information. Military experts start to consider information as the main factor that determines victory or defeat. Therefore, a decisive aspect that influences the success of the combat, regardless of the nature of mission, will be the ability to effectively acquire, generate, transmit and manage information. The core of the system is a knowledge database (KD) which defines the information scope (Fig.1).

Fig. 1: Knowledge database - the core of the system

This scope is used as a basis for structuring the knowledge which is contained in the knowledge database. The requirements which define the knowledge database are derived from analysis of user needs and analysis of example scenarios of the knowledge database use.

The concept of a mission is defined as different types of activities performed by military units. The most important part of a mission is task to be performed in order to achieve a specific purpose. The terms used in a mission are presented below.

- Superior mission: A higher level mission, in which the current mission takes part.
- Mission Characteristics: The following characteristics of the mission represent mission concepts:
    - Order: A communication written, oral or by signal, which conveys instructions from a superior to a subordinate. There are different types of orders for planning: Fragmentary order, Operational order and Warning order.
- Description (tasks, area, units, time, objective, purpose).
- Course of Action: optional parameter which described a detailed plan how to perform a task.
- Commander Intent: a clear and concise statement of what the force must do and the conditions the force must meet to succeed with respect to the enemy, terrain and the desired end state.
- Mission Type: the type of the mission: offensive, defensive, stability, etc.,
- Rules of engagement: Directives issued by competent military authority which specify the circumstances and limitations under which forces will initiate and continue combat engagement with other forces encountered:
    - Mission procedures: Procedures of executing tasks during the mission e.g. standard operating procedures related to the mission.
- Mission Assessment: a result of analysis of data from previous missions, which include mission reports, results from reasoning techniques, applications and lessons learnt from previous missions.

The following terms are important when describing a mission, but they are not a part of the mission concept itself:

- Environment: the environment in which the mission will be executed is described in the Environment concept. The mission environment is associated with the Operational area (each operational area has a specific environment),
- Other assets: assets other than military units taking part in mission execution, involved in mission, e.g. NGOs or Humanitarian organization protected during stability mission. Assets are described as parts of mission concept,

The forces concept comprises a series of resources employed by the forces to achieve the mission goal. The different types of assets are following:

- Means of war: these are the means used for warfare. They include weapons and sensors etc.:
    - Weapon: A weapon that is chemical, biological, radiological nor nuclear is considered a conventional weapon used by military groups. Sensor: Equipment which detects and may indicate or record objects and activities.
    - Vehicle: A self-propelled, boosted, or towed conveyance for transporting a burden on land, sea or through air or space.
- Civilians: Sometimes civilians can be part of Civil-Military Operations. Host-nation support and care of displaced civilians and they represent a value for the mission.
- Construction: Some buildings that are of special value for the success of the mission.
- Humanitarian organizations: A private, voluntary organizations with no governmental established for the purpose of fulfilling a range of activities, in particular development-related projects and organized at local, national, regional or international level.
- Military unit: A military element whose structure is prescribed by a competent authority.
- Asset VIP: A person of high level of authority who is to be protected as a part of mission goals.

To describe asymmetric threats in knowledge database the following terms are used.

- Asset: Anything that has a value to the part of the conflict. Contrary to its popular meaning, in this document "Asset" means also "objects unable to perform any action by themselves".
- Threat: It is a potential cause of an incident that may result in personal accident to military organization or other assets. Threats are realized in incidents. Examples of threats are:
    - IED explosion,
    - Mortar and rocket attack,
    - Sniper fire,
    - Attack a humanitarian convoy,
    - Attack on a patrol, a base, a check point, a helicopter and other.
- Event: Anything that occurs and is recorded in the system,
    - Incident: An event that may happen to any asset. The difference between the terms "threat" and "incident" is that "threat" means a possible menace,

whereas "incident" means something which has already happened.

- Vulnerability: A weakness of an asset that can be exploited by one or more threats. Vulnerability is a characteristic of an asset.
- Force protection: All measures and means that can be used to minimize a vulnerability of any asset to any threat in any situation, or to preserve freedom of action and the operational effectiveness of the force.

The environment of the mission is usually defined as weather and terrain of an area. The concept of the environment in project is defined by the following terms:

- Area of Operations: An operational area, which is defined by a commander for land, air or maritime forces to conduct military activities. Area of operations is sufficient in size for the joint force component commander to accomplish assigned missions and protect forces. The area of operations in the project is classified according to the type of area where the military operation is conducted into:
    - Area of influence: It is a geographical area where a commander is directly capable of influencing operations by manoeuvre or fire support systems normally under his command or control,
    - Area of interest: It is the area of concern to a commander relative to the objective of current or planned operations, including his areas of influence, operations,
    - Base: It is a location from which operations are projected or supported.

Usually an area can be described by the environment that surrounds it, in project the area of operations does not cover all aspects of the environment and it is only a military term. Therefore, we introduce the concept of actual area as follows:

- Actual area: An area, which contains the Area of Operations and its surroundings where the mission is being conducted.

Other aspects describing the environment of the area are weather, sides and background.

- Weather: The weather of the area where the mission is conducted. The area includes the Area of Operations and its surroundings. The information about the weather can be stored in the database as:
    - Actual weather: Information about observed weather conditions,
    - Weather forecast: Prediction of future weather conditions,
- Background: Background information about the area where the mission takes place. e.g. its history, culture, religion, behaviour, life style, and any type of additional information on the environment,
- Sides: General information about the forces taking part in the mission. This includes Own Forces and Enemy Forces.

4 Mission planning, execution and training

In currently available information systems supporting military decisions, the main problem is more and more often not the lack of information to be used but – even quite the contrary – the easiness of generating information. This information can even be supplied in great amount but if not properly processed (filtered, explored, etc.) and coordinated in time its usefulness decreases rapidly. The lack of understanding and uncritical approach to these systems, methods and techniques, as well as results provided by them, can bring a danger to military operations. After the rough analysis of selected DSS class tools, it can be affirmed that e.g. just a minimum of computer knowledge is needed to conduct the analysis based on nonlinear regression for the data gathered. However, using its results without appropriate background could lead to serious misunderstandings which in the battlefield can bring irreversible human losses. Problems mentioned above lead to a conclusion that in the area of training there is a need for constructing tools which would illustrate the results of both proper and improper use of information – thus the human operator remains the most important link in the decision chain.

Fig. 2: SIS in planning stages

The initial planning phase has been identified as a difficult step within the entire planning process, which has also been confirmed by the literature analysis. Realization of this stage (Fig.2) in planning, will bring new quality.
It can be achieved by:

- rough idea of the verification mission terms of tactical and technical parameters,
- estimation of the risk level for various variants of the mission,
- optimization of the original idea for a mission against accepted criteria,
- various forms of visualization of the plan.

Phase zero of the planning is important because an error in the initial planning stage can propagate to other stages of planning. Therefore, it is necessary to identify and verify at the preliminary ideas stage a variety of mission plans. It should also be noted that the lifting of restrictions in constructing the plan strengthens the creativity of planners. Also the initial phase of planning is time-consuming and difficult to formalize. Removing these inconveniences of planning is absolutely justified.

The essence of mission execution issues in SIS has to rely on a permanent comparison of actual situation of the mission with the plan (Fig.3). It must be stressed that the SIS system is to remain a system of Decision Support System class and a final interpretation of the suggestions and any decision to execute is made by a human operator, not the machine. With the progress of situation, the system must be capable of generating / setting the current task. At the operational level there is the Current Operational Group.

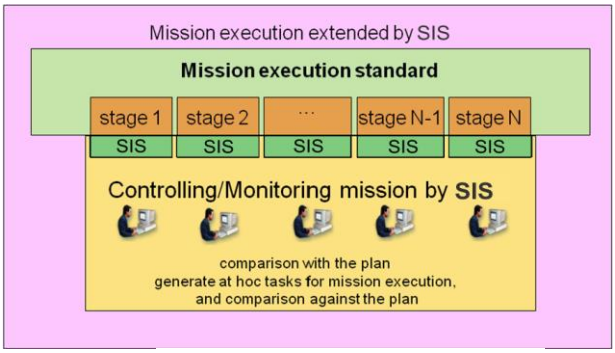

Fig. 3: SIS in mission execution process

Most of the advanced armies in the world have formal mission support concepts, command computerisation and well developed databases with algorithms for these kinds of systems. The features of these systems were defined on the basis of factual and deductive databases with generalized knowledge, expressed in the procedural layer at the operational – tactical layers (forces ratios, saturation, feasibility and needs assessment, limits, etc.).

For various reasons (usually financial constraints but sometimes also lack of developing capabilities in the country) their development is still taking place (i.e. in Slovakia). There are no doubts that even most advanced countries can cover at most several percent of the command posts' intellectual activities in the full decision making cycle. Specifically, the following processes can be computerised in traditional way:

- the inference process has strictly deductive character. The consequences are evaluated on the basis of known causes. Between conclusions and premises there is a cause-and-effect relationship, where the formal explication is logical implication,
- the inference process is defined as an algorithm.

The training will be limited to the planning process with particular emphasis on phase zero and validation process during the various stages. Acquisition and development of creative thinking skills, the desire to minimize the level of risk awareness on preventing the loss of human and other assets will be the main determinants of the training. The training process to be implemented is Convention modular based on elements of the simulation (Fig.4).

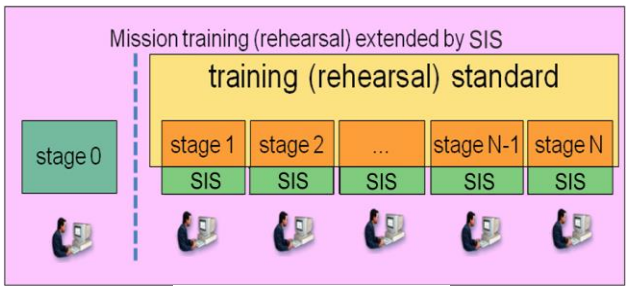

Fig. 4: SIS in mission training process

At the core of the transformation in education of highly qualified military and non-military personnel for peace missions are new paradigms based not only on information, but also building the knowledge database. These paradigms are:

- dematerialisation of information,
- real-time multimedia exchange,
- increasing efficiency of telecommunication infrastructure,
- depersonification of knowledge and processing techniques,
- information processes virtualisation and organisational structures,
- permanent monitoring of the most critical processes.

Dematerialisation of information means the ability of information to function in isolation from substantive component. From the contemporary theory of knowledge, the information is when specific data (video, audio, text, etc.) is connected with an interpreting function. In many cases, it is important that the data transfer and visualisation are both done in real-time.

More and more efficient telecommunication infrastructure offers higher bandwidths, which provides more capabilities for military IT systems.

Depersonification of knowledge and processes means the ability (better capability, efficiency) to produce and store knowledge and its use to solve problems using appropriate meta-knowledge implemented in the software. The development of IT technologies enables to automatize knowledge by gathering and generating it in a relational and algorithmic way. The reasoning machines are implementations of meta-knowledge. These machines can generate answers to questions previously solvable only by humans; they are also able to find cause-and-effect relations both in quantity and quality.

Virtualisation of information processes and organizational structures is mainly based on distributed computing. In practice this means that:

- critical assets (e.g. experts) could be physically located outside the area of interest, which leads to costs, risks and overall performances optimization,
- IT centres can be organised with the aim to provide the information to users according to their needs and permissions,
- during the mission critical actions, the necessary resources are available to provide the maximum potential.

Realisation of these theses requires constant monitoring and controlling the most vulnerable processes. Conduction of military operations in urban environment, in particular anti-terrorist ones, has become more frequent in recent years, and so as a consequence it could be assumed that asymmetric threats are more likely to happen in urban areas.

5 CONCLUSION

The SIS would be used for mission planning, training and execution by collecting, analysing and distributing information in a smart manner.

For mission planning the main SIS support is on providing a central knowledge database that can be integrated with the other systems for useful decision support. The core planning tools provide additional means for assessing and mitigating risks. Sophisticated filters and visualizations can shorten the time needed for mission planning and make plans more detailed and effective in terms of enhancing shared situational awareness and increasing force protection.

For mission execution SIS provides a shared and collaborative use of records - pictures, videos and sounds - which is a great help for troops in the field, using a PDA - Personal Digital Assistant, and mission monitoring and control at a command post.

The main potential of using SIS **for mission training** is that it enhances a mission simulation environment substantially with actual and relevant information from the operational theatre. The most of these environments focus on delivering a geo-specific or geo-typical terrain database of the operational theatre, supporting the militaries to train (at home). SIS can enrich these environments further by incorporating the knowledge database with actual and relevant information from the operational theatre, making it a flexible and adaptive training system that can be tailored to specific missions and specific training audiences with recent, relevant and up-to-date mission characteristics. To be able to accomplish this, lessons identified and learned in theatre need to be incorporated in the simulated training environment. In the SIS vision, therefore the central knowledge database used in theatre is connected to or is the same as the one used for mission training. This also requires a close cooperation among training, tactics and doctrine branches within the armed forces.

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