SOME PROBLEMS IN MODELING AND SIMULATION AREA IN THE BULGARIAN ARMED FORCES

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Introduction

A new trend in IT technology during the last 10 years has made modeling and simulations possible in the field of military training and education. Now, many countries all over the world create their own models and simulation systems for military and civil use. These systems may be used for building new types of weapons in order to design ships and airplanes, and, last but not least, for military personnel training and education.[1] As unbelievable as this may seem, simulations with the help of political systems models have even been used as a tool for predicting political crises – a domain in which Bulgarian society has known considerable tremors in recent years.[2] Modeling and simulations have also been used as a tool for analyzing country-specific economic situations.

In the armed forces, using techniques as modeling and simulations has gained popularity in the last few years mainly because of the cost-reducing effects they have on military personnel training and education. At the same time, the creation of models and the building of simulators require a solid scientific infrastructure with competent scientists and a skilled workforce able to create, develop and maintain them.

Worldwide, many scientific organizations, institutes and laboratories are involved in modeling and simulator building processes, as they each perform a task in the creation process of a common system of models. All these organizations fall under MoD control and its requirements for models and simulators. Today, as part of a new trend in the world, different non-profit and non-governmental organizations are also getting involved in building and developing different sorts of models providing effective control of military forces.

INFORMATION & SECURITY. An International Journal, Vol. 3, 1999, 140-146.

The essence of combat modeling

Without a doubt, there is an interoperability problem between the many modeling and simulation environments available today; a problem that is more pressing every year as the demand for simulations dealing with increasingly complex and heterogeneous systems grows. Military simulation in itself is significantly different from most "civilian" simulation applications and requires therefore some unique approaches.

Military simulations differ from other simulation applications in several aspects, including:

- The wide ranges possible in the scope and resolution of tactical battlefield scenarios,
- The large number of entities that can be involved in tactical battlefield scenarios,
- The hierarchical structure of many of the entities in tactical battlefield scenarios,
- The complex, dynamic relationships among entities in tactical battlefield scenarios,
- The "non-cooperative" entity interactions that characterize tactical combat, and
- The need to manage multiple levels of entity aggregation and fidelity.[3]

In its essence, a combat model is a common informative representation in electronic form on a graphical user interface, which portrays the status of army units. All this information is represented on different situation pictures – on water, on the ground and in the air, and in an electromagnetic or radioactive environment. Having all these situation pictures available allows a complete simulation. Most models created (although it depends on their purpose) represent two actors, conventionally named red and blue. Both these actors are given tasks by the people using the simulators and acting as commanders. Subsequently, these commanders analyze and evaluate the way in which these tasks are accomplished or remain unaccomplished in order to identify the weak aspects of the actors':

- Strategy and tactics;
- Interaction with other forces;
- Logistics;
- Intelligence;
- Radiolocational observation;
- Medical ensurance;

To make this analysis possible most of the models provide (not only on graphical user interface, but also in table form or on graphic charts) information the user can benefit from at the beginning and at the end of a simulation process.[4] This allows for the flexibility that the commanders need to follow the situation's changes and to react accordingly.

There is, however, too large a gap between the user's problem and the model description that the simulation program understands. In fact, commanding in the different simulation programs should resemble more the way a commander gives orders to his subordinate units in reality, that is in three steps: finding a platoon-like or battalion-like unit first, then giving them orders and following their accomplishments. In other words, the simulated environment should be a great deal closer to the real life environment.

Military simulation applications often require that experimental scenarios cover both a large scope and a fine resolution, a combination that can result in a large number of individual entities. Often these requirements can be traced back to the capabilities of modern tactical sensor systems, which can observe very large areas of the battlefield at unprecedented levels of detail.

A new trend in modeling is the representation of human factors such as the psychological training and the morale of the troops and pilots, which greatly affect the effectiveness of the armed forces in today's battles.

At the beginning models were started on separate machines and all users would be connected to these machines providing them with the modeling results. During the last 20 years distributed interactive modeling and simulation has become a widespread approach. Using this method, different kinds of models run on separate computers and exchange information between them concerning the combat situation changes on the battlefield.[5]

Models may exchange data and messages using a common database – in most cases these are ORACLE, INFORMIX or other databases which allow object-orienting representation of data.The idea of using the object–orienting approach was born at the begining of the nineties and is actual today.

Components of models, like platoons and battalions, are typically available in model libraries. Using a graphical user interface, the commander gives orders to subordinate units and these tasks are memorized in a database. When we use distributed interactive simulation, different models may request the database to allow them to read the current status of an object but only if the database logic permits this. The problem therefore is to build this logic as to make it meet the needs of interoperability

between the different kinds of participating models. Another problem concerning distributed interactive simulation (DIS) is time synchronization between all models.

In order to control the movements and other activities of so many entities, it is necessary to make good use of the hierarchical structures of military units.[3] In battlefield scenarios of this size, it would be convenient to be able to manipulate entire divisions as single entities, defining division area boundaries and setting high-level objectives. However, a division is a complex organization and does not always act as a single entity. A more practical approach requires most combat and combat support units to be controlled at the battalion level, with special units, such as reconnaissance, being handled at company level or below. A good set of tactical simulation models must include support for modeling the processes by which military units receive orders, assess the situation, decide on a course of action, and generate orders for their subordinates.[6] As we mentioned above, some models are started on one machine and can be used as models to help commanders make decisions. Here the commander gives commands to both his subordinate units and the enemy units according to his expectation of what the actions of the latter will be. After the end of a simulation he then receives the results from the model. This helps him make decisions and build different variants of decisions. In this case, the problems concerning the database logic do not exist since the database is placed on the same computer as the starting location of the model.

The new trends in information technology in the last few years have created an opportunity to build WEB-based simulations, which allow users to interact using Internet-based networks.

The current state of modeling and simulation in the BAF

The BAF have implemented two kinds of models (developed in the Military Scientific Research Institute, now IADR – Institute for Advanced Defense Research) by a small group of which the author was a member. These models are to be used for situation estimation (to assist commanders making decisions) and for officer training. Both models are for ground forces purposes only. They include some elements of the Air Force and other forces as well, but detailed models for other services in the BAF are not included in these models.

Due to a lack of money and qualified people, Bulgaria has not had the opportunity to achieve the results some other countries have.

The very schematic representation of the environment may be seen as one of the main disadvantages in the existing BAF models. Among other gaps are:

- The lack of a detailed representation of AIR and NAVY situations;

- The lack of logistics representation;
- The non-representation of the communications and information system, which is one of the basic systems in today's operations;
- The fact that the NATO countries' graphical signs are not used, a problem that is relatively easy to solve on short notice.

All the other disadvantages, however, make us think that we have to develop a new model using the original models.

Despite all the disadvantages, methods for staff preparation and education using the existing models achieve positive results, but have its critics, too. The basis for these conclusions are the highly estimated exercises, which were conducted using these models.

Frequent structural reform on the scientific research level in the BAF have not allowed us to solve all the problems and disadvantages in the existing models. At the beginning of the new millenium the BAF do not have an organization or even a team responsible for the development and maintenance of today's models. Modeling and simulation is one of the decisive factors in Bulgaria's efforts to acquire NATO membership. They are identified as areas of great importance to which not only the US but also the European countries must pay great attention. If we had invested more time and effort, our models today would have been more competitive than they are now. But at the beginning of model utilization we met with strong resistance from the commanding staff. We spent considerable time convincing commanders of the advantages of model utilization. To be honest, the commanders were not opposed to the new models, but simply to the new developments in staff preparation simply because they all looked for the disadvantages, forgetting the advantages of what was being offered. The doubts arose often because there has not been an opportunity to compare our models with those developed in other countries.

It would be a great advantage to accept the conduct of CAX (Computer Assisted Exercises) using Bulgarian models. This tool is very useful in today's difficult economic situation . The use of CAX could change an old technology in the conduct of exercises and in the decision making area. In these areas the models play a positive role as they give commanding officers a dynamic change of situation without having to use real forces. This is another purpose and advantage of CAX. If all possible situations were present in the models they would provide for a better sense of reality and confidence.

Conclusion

At the begining of the new millenium Bulgaria has great opportunities to exchange ideas in the field of military modeling and simulation. The PfP Consortium of Defense Academies and Security Studies Institutes and the PIMS program provide such a chance.

We do not prepare specialists in our universities and academies for modeling and simulation purposes as this discipline has an insignificant place in their curricula. Many countries have universities specialized in modeling and simulation. In Bulgaria only the Technical University in Varna prepares students for the challenge of the new trends in information tehnology. Most of the people identify modeling with 3D modeling, but this is actually only a small part of a larger modeling discipline.

We have not conducted research and studies with the goal of discovering what the state of affairs is in the field of modeling and simulation in Bulgaria. This makes the task of modeling development spontaneous and without a strategy or concept. A concept has not yet been developed in this area. In most cases this is a reason to think that it is an underdeveloped and unimportant aspect of the force's preparation.

I would like to point out that conclusions like these are possible only after studies and research activities as the ones mentioned above as they provide a concrete task of solving the problems in this area. The economic situation does not allow us to solve the existing problems quickly. But the economic situation is not the only problem - there is a lack of personnel as well. Modeling and simulation require very well prepared personnel, with a long-time experience in the field, which we hope to create and develop. We have to give them the chance to develop this expertise in the Bulgarian Armed Forces as is the case in many countries all over the world.

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