Simulation Environment for CAX in Joint Training

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ABSTRACT

The Computer Assisted Exercise (CAX), based on the constructive simulation is natural continuation of the staff and forces live training at all levels. Being a contemporary approach for preparation and training, CAX gives a possibility to present the staff training and readiness, to train different courses of action and choose the most appropriate one, to improve the commanders' management skills and to assemble the staffs and teams.

The paper outlines the challenges under transformation of the Bulgarian Armed Forces, a training approach of the military units and the interaction with other ministries and agencies in simulation environment. It reveals the terms of reference for the development and application of the simulation in preparation of the units through providing not only direct training capability, but also an interoperability in multinational environment, as well as a regional stability through conducting CAX with neighbouring NATO and non-NATO countries.

1.0 INTRODUCTION

During the last two years a team of the Bulgarian National Center for Modeling and Simulations (NCMS) has been established in National Military Training Complex (Figure 1). Its primary objective is to assist the training of commanders and staffs from battalion and equivalent to Joint Task Force level through the use of the Joint Conflict and Tactical Simulation (JCATS) system and NATO command and staff procedures in order to plan, organize, and conduct any type of operations, strengthen the interoperability with NATO, and to achieve General Staff and Ministry of Defense training and planning requirements.

Bulgarian Armed Forces have already the experience of battalion and brigade level exercises, simulation of crises and operations other then war with different structures. The last two CAX are – a tripartite one between Bulgaria, Romania and Serbia, which objective is to prognosticate eventual crisis as a result of the floods by using simulations, and the bilateral Bulgarian - American exercise with the Tennessee National Guard. The distributed exercises are also considered as a key element supporting the Arm Forces transformation and as an opportunity to establish a multinational federation, using network technologiesas

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well as the benefits of sharing a common toolset and approach. The main issue on the current stage is whether the NCMS should be developed as a specialized center of the MoD or as a broad spectrum center with capabilities for interaction between the MoD and other ministries, civil agencies and organizations within civil – military cooperation.

As a consequence of all Computer Assisted Exercises and simulation, which have been conducted in National Military Training Complex, important conclusions and lesson learned have been made. These experiences serve as a base for further training of the center's personnel for future activity and help us in conducting a wide spectrum of operations. The purpose is to go ahead and together with NATO simulation community to develop a modern NCMS.

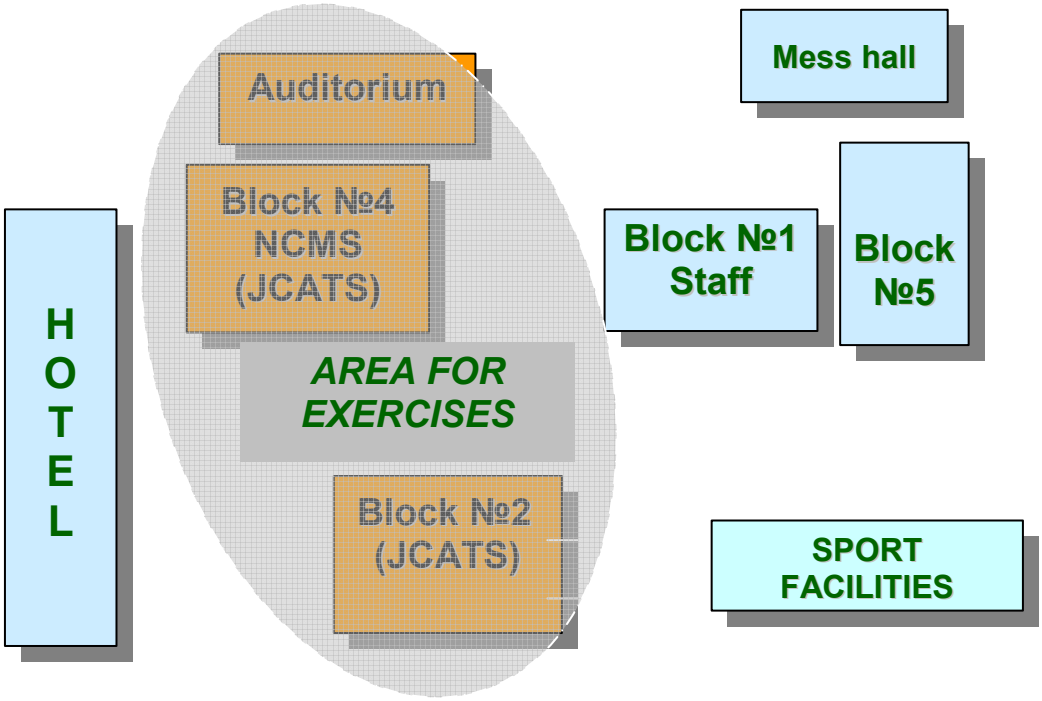

Figure 1: National Military Training Complex "Charalitza"

2.0 PREPARATION OF THE UNITS, INTERACTION AND INTEROPERABILITY

In biennial period of work in the National Center for Modeling and Simulations have been conducted the following exercises: 7 on a battalion level, 3 on a brigade level, simulations of different crises, floods, industrial disasters, 3 exercises for peacekeeping operations, simulation of terrorist attack, 2 exercises for NBC and Ecology department, 2 navy exercises, a tripartite one between Bulgaria, Romania and Serbia to prognosticate the eventual floods in case of crises by using simulations, and the bilateral Bulgarian American exercises with the Tennessee National Guard. There are 22 exercises and simulations.

Up to now, Computer Assisted Exercises based on JCATS system include planning and implementation of different combat operations, such as:

- March;
- Occupation of an area close to the area of operations;

- Occupation and development of a defensive area;
- Conduct delaying combat operations by a mechanized battalion as a forward element of a mechanized brigade;
- Conduct the operations in a security belt;
- Take part in a counterattack;
- NBC & E body activities against the use of chemical weapon;
- Operations other than war and etc.

Everything pointed above gave an opportunity not only for the training of staffs and units from different services, but also for improving the personnel of National Center for Modeling and Simulations preparation for troops management in different types of combat operations (Figure 2).

The JCATS system is an excellent tool for staff training and synchronization at battalion and brigade level, for conducting of analyses and experiments in order to optimize the decision making process, to conduct distributed computer assisted Command Post Exercises (Figure 3). In this connection one of the main features of JCATS system is to provide After Action Review (AAR) after completing the training of a given task. The AAR is conducted in a flexible way and usually is assigned by the exercise director (EXDIR). The EXDIR together with the Analyses and Control group specify events and questions on which special attention has to be drawn and events whose strong points or failures have to be discussed. There are two types of AAR conducted in NCMS:

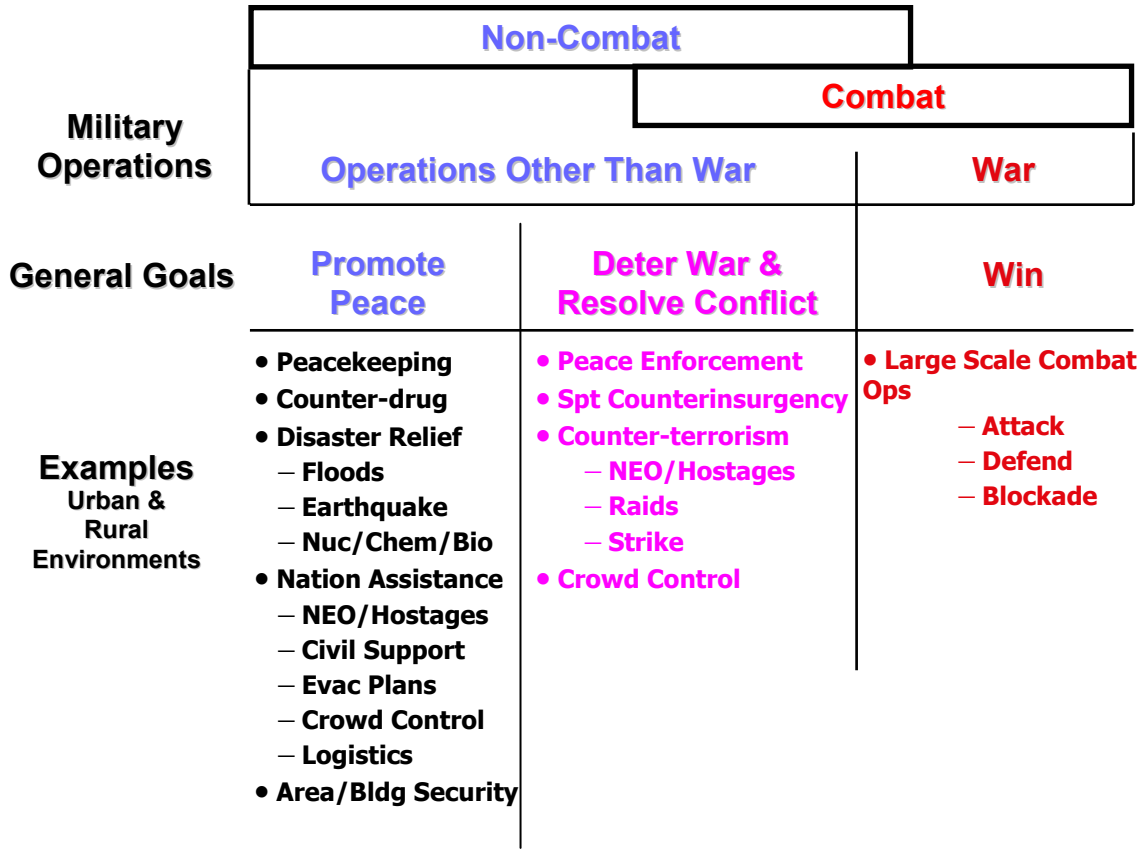

Figure 2: Spectrum of NCMS Applications

Formal After Action Review (mainly conducted in NCMS). The AAR usually takes up a long time, training devices are used, time preparation for AAR is limited and it takes place in premises where additional presentation equipment is available. The observer and controllers participate in the AAR.

Informal AAR (it is used to prepare commanders and staffs for the fields' combat conditions). It is conducted by someone who is in the unit command; it does not take so much time, materials at hand are used for the presentation, it takes place where it is possible and the focus is primarily on the training issues.

Each AAR finishes with repetition of the given combat day or task, during which once again there are, stressed both: the mistakes made, and the tasks that were performed well. The record itself of the combat day allows changing the speed of simulation, as well as to stop and increase or decrease the scale for better visualization.

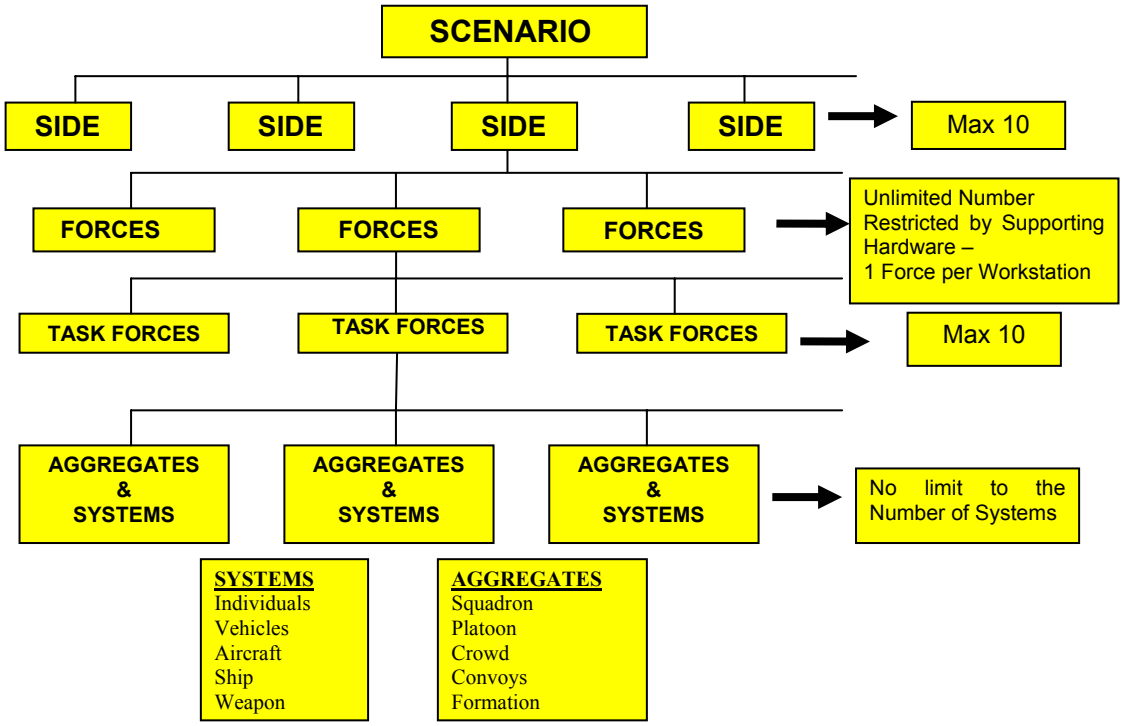

Figure 3: Simulations System JCATS

Conducting the AAR is a creative activity and there is not a strictly defined pattern for it. Each next AAR can and should be different from the previous one, especially when there are several AARs for one and the same unit. As many additional methods are used in presentation of a given situation, as better the trainees can remember it.

We must not forget that the purpose of the AAR is not to show how badly is prepared a commander or a unit. AAR focuses on improving their activities through real and honest self-evaluation. Thus the participants themselves enhance their professional level and confidence.

In a conclusion we can say that the simulation is an efficient way of training, allowing staffs and units to rehearse organizational and operational skills in order to improve the entire special training and combat readiness.

Officers, staffs and forces training should be focused on enhancing command skills, studding the models of combat and support vehicles and applying the procedures in decision-making process to a level responding NATO standards.

As a consequence of all Computer Assisted Exercises and simulations, which have been conducted in National Military Training Complex, the following important conclusions have been made.

The main stress during the first experimental exercises in July and August 2005 were on operators' preparation to work over tank battalions modeling, because the main officers and NCOs personnel had not been appointed.

The improved operator's preparation contributed for the fast creation of synthetic situation close to the real situation. It was necessary a persistent work in order to enhance operators theoretical preparation and practical skills for quick and adequate activities to manage order of battle and to submit correct reports.

The steady improvement of operators' preparation in both technical and tactical level resulted in a precise and complete execution of commands and tasks assigned by trainees, Higher Staff and Opposing Force in simulated operations.

The operators are "the bridge" between the training units and simulation system. Their training and skills to work with JCATS play the crucial role and the higher preparation can be achieved through:

- Profound and purposeful training with JCATS system capabilities, tactical and technical characteristics of different kind of weapons, ammunitions and equipment and the way and environment they can be used.
- Daily theoretical and practical trainings with JCATS;
- Test and control system for operators' skills and knowledge.

The good knowledge for the system enables officers to apply different variants, using minimal human and technical resources. It was proved the view that the system can function of full value when the level of preparation of commanders, operators and observer controllers is high.

There is an effect of using the system only in case of complete and detailed familiarization with it by the command personnel, which will be trained. In order to achieve a maximum effect in training through the system is necessary a profound exploration and knowing its capabilities.

The inventive usage of system capabilities for modeling and simulations leads to training environment maximum replicating the combat one.

For achieving a positive result in using JCATS system in conducting Computer Assisted Exercises (CPX) it is necessary:

- Good knowledge of JCATS technical capabilities;
- Good knowledge of tactical and technical characteristics of different weapons, ammunitions, vehicles and equipment;
- Good knowledge of ways and environment for combat usage of armament and vehicles;
- It is necessary for all exercise participants to be well familiarized with both: simulation system capabilities and methods of conducting computer assisted CPX.

The exercise for mechanized battalion in December 2005 showed clear that in case of incorrect database input and minimal discrepancies in tactical and technical armament characteristics result in incomplete simulation of combat operations and incomplete replication of real operations. Replicating the real staff, without being constrained of staff armament and vehicles limitations, the unit commanders' train more successfully the assigned tasks.

Through comparing the losses of the passed operation or combat day and identifying the exact reason for failure (or success) we achieve better comprehension for mistakes or wrong decisions that have been made. The trainees in different kinds of operations rarely have repeated one and the same mistake.

The analyses for every phase or for the whole exercise have to be made upon the really happened actions by the trainees in a created situation.

Part of the trainees were not so serious and accepted the simulation as a "game" not as an exercise. The system relies on the exact parameters, which can ensure a realistic outcome. And exactly with this JCATS distinguishes from funny videogames and attach a practical importance to the training process. It is often observed an ambition for achieving a success (a victory), ignoring the fixed rules for conducting combat operations in the prescriptive documents. This ambition is observed in the activities of both: the own and the opposing forces. The limitations and rules were broken in order to win at any price (gamesmanship).

Often, visual communication between the training audience and units could be observed during the exercises which violated the requirements of the computer-assisted command and staff training and a prerequisite for non-achievement of the goals at different stages of the exercise was created. Strict observation of the limitations for non-admission of a real contact between the training audience and units is needed, saves by technical assets.

In the follow-up simulation of flood disaster in April 2006, it was proved once again, that the system has unlimited capabilities for simulation of crises of any type.

During the exercises with NBC & E department, conducted May 2006 and May 2007, there has been successfully trained the real putting into operation of a command and control system, specialized for the NBC forces. It became obvious the need of a specialized command and control software, which would make easy the process of decision making. That weakness was peculiar to all types of exercises.

The following exercises in 2006, conducted with Light Infantry Brigade, Tank Brigade, mechanized and tank battalions and NAVY unit, have allowed to put into operation everything learned up to this moment. The teams have already operated in an organized manner and confidently. Also, new points were introduced to compare the real relief with the map relief through photographing the terrain. Unfortunately, many of the trainees do not pay attention to this element. That was why this new type of analysis was introduced for a more accurate AAR.

The use of the capabilities to simulate all types of fire by the artillery and the direct fire equipment helped to calculate the results from the firing through the characteristics of target impact probability and kill probability, in accordance with the lethality of the ammunition the task was performed with. In the exercise AAR's there may be shown the artillery fires, carried out by both opposing forces, as well as the destroyed armament, vehicles and personnel, and by which fire equipment they were impacted.

In June 2007 were conducted a tripartite exercise between Bulgaria, Romania and Serbia to prognosticate the eventual floods in case of crises by using simulations. It was joint exercise on the national systems for crisis management, for protection of national borders and the focus was on training of national and regional crisis management laying on the documents on the initiative for PfP.

The purpose of exercise was the fight against the terrorism, ecological incidents, nature disasters and emergency situations. For fist time JCATS was used for prognosticate the level of river Danube in case of flood. It was played the most dangerous variant in which the terrorist groups demolish the walls of dams.

The simulation of operations helps the crisis staff to take successfully the rapid decisions and reactions. They informed the population for probable overflows in every one part of the river, evacuated up to 20% of population, estimates the conditions and dangerous zones.

Joint trilateral exercise "Danube guard" is a new stage for interaction and coordination between the different ministries and departments as in the countries as well and between them. It developed practice for joint work and gain experience in crisis management for participated countries.

As a climax of our hard work were conducted in July 2007, with 40 National Guard soldiers from across middle and east Tennessee USA, from the 278th Armored Cavalry Regiment in a Training Exercise with counterparts from the Bulgarian Armed Forces. The event had been over a year in planning and coordination between the Tennessee Army National Guard, US European Command (USEUCOM) and General Staff of the Bulgarian Armed Forces. In the spirit of allied cooperation and a desire to ensure the Bulgarian and American militaries stay prepared, Exercise Marada Horseman 2007 serves to keep both countries soldiers ready to meet the challenges associated with conducting military operations in international coalitions, in a 2-week long exercise to enhance and develop inter-operable staff skills in NATO (North Atlantic Treaty Organization) coalition operations. Over the course of several planning conferences in Bulgaria, with the assistance of National Guard Bureau, USEUCOM and US Army Europe (USAREUR), the foundations and details of planning the exercise were formulated. During the course of the exercise, the Tennessee Troopers and Bulgarian soldiers were able to sharpen their staff coordination and planning skills to integrate multi-national units into their formations and planning functions.

That exercise was very helpful for Bulgarian site to see the level of preparation and readiness for conducting multinational events of that kind. For our team like a host nation and for first time conducted multinational exercise like that, was very valuable the very high praise by American site. "There is little to say that could be improved from a host country perspective. The outstanding level of support and reaction to changed conditions could not have been better. The staff at Charlitza did an excellent job of supporting and conducting the exercise."

3.0 LESSONS LEARNED

When dealing with multiple foreign participants (like fellow NATO partners), simple formats that are easily understood and implemented between coordinating staffs. Using clear, concise tasks to maneuver units within the order is definitely a sustain from this exercise. Task Organization also enabled the different participants a chance to integrate equipment and personnel to maximize the cooperation during the simulation. Recommend simplifying the operations order to be able to be used effectively by all participants. Also, additional coordinating and teaching needs to be accomplished for future battalion and higher missions prior to SIMEX.

More training and familiarization is needed prior to the start of the exercise. For example, battledrills that are common to US personnel are not so common with other NATO partners. Training or familiarization classes on standard operating procedures, battle drills and unit composition and capabilities (Tactical HUMINT Team, and Psychological Operations Teams) so that all participants can work together effectively. More advanced training on various computer systems and JCATS prior to the start of the simulation would prove helpful. Establish 2-3 days of advanced computer training and participant's standard operating procedures (SOPs) familiarization at the beginning of the exercise. Practical exercises can also help provide a check on learning of the necessary skills before starting the simulation.

Establishing a format for the rehearsals is essential. This will keep the rehearsal focused on the operation. Discuss briefly the contingencies and battle drills that will develop the common operating picture. Teach in advance the format for the rehearsal to allow commander's to brief essential elements of the operation in a way that is easily understood by all participants.

Too much traffic on one channel during the simulation places friction on the operation. Multiple networks in different languages slowed down the flow of information. A more robust communications package would enhance the flow of information and reduce friction between units. A recommendation is adding more radios and more channels to simulate actual radio networks.

Crosstalk is essential for integrating multiple languages and procedures during operations. Commanders at all levels have to conduct direct coordination between each other to ensure proper unity of effort. Staff officers also must conduct the same crosstalk to ensure the same unity of effort during the operation. Coordination between brigade and battalion needs to increase prior to next SIMEX. Time needs to be planned to allow Bulgarian battalion to have the same planning time as the US battalion regardless of location. This needs to be direct coordination and not between other staffs to allow questions and complete understanding of the mission. Multiple opportunities to coordinate face-to-face and directly via internet or phone should be utilized.

Thorough Mission Analysis is crucial to a successful operation. Staffs conducted a very intense Mission Analysis demonstrated by a successful simulation. Noteworthy during the simulation was the deception plan during the operations. One key note to pay close attention to during Mission Analysis is time-phasing of maneuver elements. Improper time analysis when planning can desynchronize the operation. Ensure that you implement controls to reduce variables in your time analysis. If you have outside units; such as civilian agencies in the operation, focus on implementing these controls to keep them within your time analysis. Timing on the assault objectives is also crucial.

The above-mentioned considerations present Lesson Learned process as very important part of each exercise. The following activities are connected with collecting the important conclusions and issues, including:

- Collection of data flow during the exercise in data base and providing access to them via web system;
- Verification of data /review for applicability, etc./;
- Data storage;
- Data analysis:
  - Automatic /generation of statistical indexes/;
  - Expert /experience based/;
- Dissemination to the users concerned;
- Transforming of Information to Knowledge;
- Knowledge storage in Lessons Learned Repository.

Resource library has been already established in the NCMS and connecting in unity net with other simulations centers will contribute for sharing and using of experience and LL from conducted CAX by each one.

4.0 FUTURE DEVELOPMENT

According to the Concept for development of the Integrated System of Modeling and Simulation and Distance Learning in the Bulgarian Army the simulation centers have been built in Rakovski Defence and Staff College, Vasil Levski National Military University as well as Vaptsarov Naval Academy. The kernel of these centers is Joint Conflict and Tactical Simulation System.

The next short term goal is to create the communication and information architecture for the CAX support and to implement distributed CAX, including National Simulation Center and other centers. The expectation is that national experience in this activity will provide the capability and environment for future participation of Bulgarian Simulation Centers in joint multinational training process.

The other important field of modeling and simulation development is to direct this technology to the military units. Through the available mobile modeling and simulation systems JCATS the military subdivisions will give the possibility to train up the ordinary activities and tasks.

Besides, the long-term objective is to provide permanent link not only between Bulgarian Army units, but also among many nongovernmental and military organizations in order to achieve interoperability and collaboration. This issue is very important in connection with the force preparation for crises control and management and participation in operations other than war.

4.1 Joint Training and Transformation objectives

A crucial new role in effort to transform training through the establishment of a Joint National Training Capability (JNTC) will significantly improve joint training by embedding joint tactical tasks in Service training events, closing gaps between Service training programs, establishing broader joint interoperability training events, and configuring exercises to improve linkages between them; all in one distributed training environment.

The first transformation of training is the establishment and improvement of Service training centers. These sites provided the Services with robust, dynamic, training in a realistic, combat environment. The JNTC will produce a second transformation in training by extending the Service centric focus to encompass joint operations. In this way will be refined realism in a joint context, opposite forces, ground truth and the assessment of the joint training events through better instrumentation and data sharing.

The expectation is that JNTC will reach beyond the essentials of training event planning and execution. JNTC will coalesce Service investments in training systems, infrastructure and CAX such that the tools of training are joint tools. JNTC will ensure that all elements of joint command and control systems, processes, and techniques are employed in Service and joint training, including the oversight and management for diverse, unique Service OPFOR tools shared across Service boundaries. Finally, JNTC will provide the resources, coordination, focus, and a testbed for the development and implementation of the advanced training technologies for the CAX.

The training of today's military must prepare the force to learn, improvise, and adapt to constantly changing threats in addition to executing doctrine to standards. Training transformation initiative is designed to provide dynamic, capabilities based training in support of national security requirements and will accomplish the following objectives in conducting CAX:

- Strengthen joint operations by preparing forces for new warfighting concepts;
- Continuously improve joint force readiness by aligning joint education and training capabilities and resources with combatant command needs;

- Develop individuals and organizations that intuitively think jointly;
- Develop individuals and organizations that improvise and adapt to emerging crises;
- Achieve unity of effort from a diversity of means.

The goal of establishing the JNTC is to improve the ability of Bulgarian forces to fight effectively as a joint and combined team by extending joint training to a much broader audience. There can be no question that joint operations are essential for future success of the Bulgarian military forces.

While the requirement for individual Services to train their units in core competencies will never go away, the need for a more extensive joint training experience with the attendant supporting infrastructure, is clearly evident. If Bulgarian Armed Forces must be ready to fight jointly, with little or no notice, and in a complex and challenging situation presented by the 21st century security environment, joint training must be institutionalized to a degree not seen before.

Such improvement requires a new set of capabilities to augment our existing training structure. These new capabilities must be built firmly upon and integrated with the already capable Service training centers and facilities, such as the simulations centers and National Military Training Complex. These facilities not only represent a considerable investment, but they have also excelled at training units in Service tactical competencies. The goal is to create a joint, world-wide network of training capabilities using the full spectrum of live, virtual and constructive simulations.

As the JNTC matures, it will be available to serve the additional purposes. The capabilities being built will prove useful for experimentation, concept development, testing and evaluation, rapid prototyping, mission rehearsal and the melding of all elements of national power. However, joint combined and interagency training essential to success in future conflicts is the primary purpose for investing in this capability.

To define, build, implement and maintain the system and technical architecture to support the operational training concepts of the JNTC, a well-structured and precise systems engineering and configuration management process should be created and managed. The JNTC system and technical architecture should be composed of models and simulations, simulators, communication infrastructure, command and control system, range instrumentation system, and emerging training technology system. The research, design, development, integration, test and operation of the technical infrastructure should be accomplished trough the technical management of various activities with Joint Forces Command, the Services, and contractor support organizations.

The conducting exercises, as a complex combination of live, virtual, and constructive simulations would significantly enhance the readiness and Joint Warfighting capabilities of the participants.

The objective is to provide a training environment that enhances our ability to improve Joint warfighting capabilities. Today we can operate jointly, but only with great effort to overcome the warfighting gaps. As the force transforms, we must achieve jointness in peacetime so that we can achieve full spectrum dominance in times of conflict. In other words, the force of the future must be born Joint – our doctrine, organizations, training, material, leaders, personnel and facilities must all be interoperable. JNTC will provide broad-based management for MoD training transformation resources.

5.0 CONCLUSONS

National Center for Modeling and Simulation achieves important progress in use of simulation for staffs and units training and education. The main future objectives are:

- To develop the necessary operational, system and technical architecture for future joint training federation;
- To conduct joint distributed exercises for military operations and operations other than war – crises management, disaster relief, peace keeping, antiterrorist operations, etc., with NATO and PfP countries, based on the modern technical infrastructure;
- To create appropriate conditions and environment for cooperation with the governmental and nongovernmental organizations in order to address humanitarian disasters, terrorist attacks and other crises;
- To use the mobile simulation system for intensive personnel training and education.

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