

Operational Analysis Support to Energy Security in South East Europe: Bulgarian Academic Community Approach

Dr. Zlatogor Minchev¹
Dr. Velizar Shalamanov²

Institute for Parallel Processing-Bulgarian Academy of Sciences, C4I Department
e-mails: shalamanov@acad.bg, zlatogor@bas.bg

1. Introduction

The new challenges related to the 21st century energy supplies have opened a vast field for searching of new alternative energy sources and technologies, for the global resilient society like: nuclear power, biofuels, fluorophore-nitroxide compounds (FNO), wind power, solar power, sea wave's power etc.

Naturally, this is strongly related to the world's fossil non-retrievable fuels reserves diminishing and the common understanding of their usage influence to CO₂ emissions augmentation. This phenomenon is closely related to the global warming effect and the climate changes in the Earth. Above all, it should be clear that the world's demand/supply ratio, regarding natural oil and gas usage, is getting strongly unstable variable by means of a constantly increasement in the global world's developed economies needs, free market prices growing and general but complex supplies limitations.

In this situation, both the North Atlantic Alliance and EU are prioritizing the energy security as an important element of their future security / defense and economic plans.

Today the New NATO Strategic Concept will be based on the development of a Comprehensive Approach with the relevant technological support. The transatlantic policy within the next 20 years will be closely related to EU/NATO dialogue on security and defense topics and priorities that exists in their both agenda.

According to the Alliance Comprehensive Approach for an integrated security (that encompasses both EU and UN) the areas of Consultation, Command & Control (C3) will support NATO and Nations. These C3 areas are gathered around the new challenges like: energy security, climate change, piracy, cyber defense - problem areas that are adding new dimensions for Operational Analysis and technology support to the already traditional areas of common defense situated around Article 5, crisis response/emergency management, fighting terrorism and maintaining the partnership and enlargement process for NATO.

The new EU agenda (ESRIA³) is also considering these problems in the next 10-15 years horizon, when the defense and security boundaries will be less distinct and the security will encompass defense in respect to the society social security and the global context for a "non-isolated world".

Here it should be noted that nowadays the transatlantic role of the Alliance is getting more and more similar to the one of UN and the EU will have to be responsible and to develop own capabilities according to ESRIA in five clusters: (1) security cycle - preventing, protecting, preparing, responding and recovering; (2) countering of different means of attack; (3) securing critical assets; (4) securing identity, access and movement of people and goods; (5) cross-cutting enablers.

¹ Dr. Zlatogor Minchev is the Director of JTSAC, C4I Department at the Institute of Parallel Processing, Bulgarian Academy of Sciences (BAS) and currently is an Executive Head of C4I Department.

² Dr. Velizar Shalamanov moved in July 2009 to NATO C3 Agency as Director Sponsor Account "NATO and Nations" after being for 5 years head of C4I Department at the Institute of Parallel Processing, BAS and in the period 1998-2001 - Deputy Minister of Defense - Bulgaria on Defense Policy, Planning and Integration.

³ European Security Research and Innovation Forum, Final Report, December, 2009.

Where is energy security within ESRIA and NATO New Strategic Concept situated?

Generally the energy security in a changing world⁴ is a challenge in itself because of the complexity, speed of change and uncertainty, i.e. a multicriteria problem which could be addressed by an effective use of the Operational Analysis (Operations Research) in a multidisciplinary environment for foresight and strategic planning.

An extremely important dimension of this approach is to be able to govern effectively the process starting from the foresight, decision making and planning as main aspects of consultations down to the technical solution development and its integration in existing command and control systems. A solution, which requires a really comprehensive C3 support to the security comprehensiveness.

But, energy security is also directly related to crisis management, critical infrastructure protection, security of economics and indirectly to the rest of ESRIA, which makes the task of energy security even more uncertain and multi-aspect.

So, even in the relatively short time horizon of 10 years the global energy security could be appointed as: C3 comprehensive, uncertain, complex and thus difficult to tackle, control and predict.

This paper will present: the authors' understanding of the problem of energy security in South East Europe (SEE) and the Wider Black Sea Area (WBSA) as a result of the region's geostrategy; the development of the relevant capabilities in Bulgarian academic community linked with administration, industry and non-governmental organizations in the area of analytical support to energy security, as well as the concept of a Center of Excellence for Military Support to Civilian Authorities as an instrument for addressing: energy security, cyber defense and other new challenges to security through the concept of an integrated security sector; and finally - the integration of national capabilities in the international network for operational analysis and foresight/strategic planning.

2. Bulgaria in SEE/WBSA context

The right and reliable security and economic environment as well as the adequate strategic context is an important topic to be studied in order to address the proper way of providing energy security and critical infrastructure protection. A model of influences and dependences relations of the Bulgarian regional and political context is presented in Fig. 1:

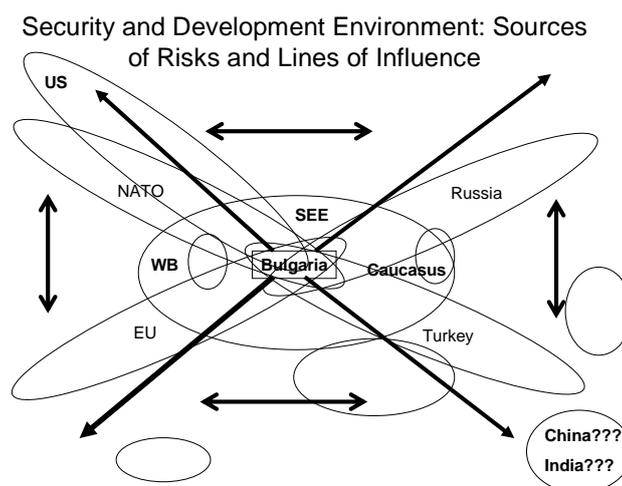


Fig.1. Bulgaria and SEE in the center of powers' influences and their interactions.

⁴ Energy security in a changing world, Romanian Journal of International and Regional Studies, Volume IV, Bucharest, 2-3/2008, EURISC Foundation – Romanian Institute of International studies, IRSI, 286 p.

As it is clear from Fig.1, Bulgaria has a unique position - both geographic and geostrategic in South Eastern Europe (to extend from Western Balkans to Caucasus with Black Sea in the middle). We are on the crossroad between EU and Turkey/Russia, between NATO and Russia, between “functioning core” and “gap of nonfunctioning good governance” and a lot of other dichotomies. The key influences are related to EU, NATO, US, Russia and Turkey, but we have to add many key bilateral relations between Bulgaria and NATO or EU countries as well as relations between these factors of influence. The country is surrounded by active conflict zones in Europe, Asia and Africa in the perimeter range of 1000-2000 km.

This environment and its dynamics is an important factor in planning for energy security and critical infrastructure protection. As a result of such an environment and dynamics of external (flows of: money, people, resources and security guarantees) and internal factors (majority in the Parliament of the Euro-Atlantic or Euro-Asian forces) Bulgaria has very interesting trajectory of transition during the last 20 years (see Fig.2). It is a unique situation in comparison to any other new member of NATO or EU for the last 20 years and very similar as model with the countries that are now in PfP in SEE and may be for other NATO partner countries outside of Europe. This internal dynamics of country “climate” is the key factor in shaping decisions on energy security and infrastructure protection.

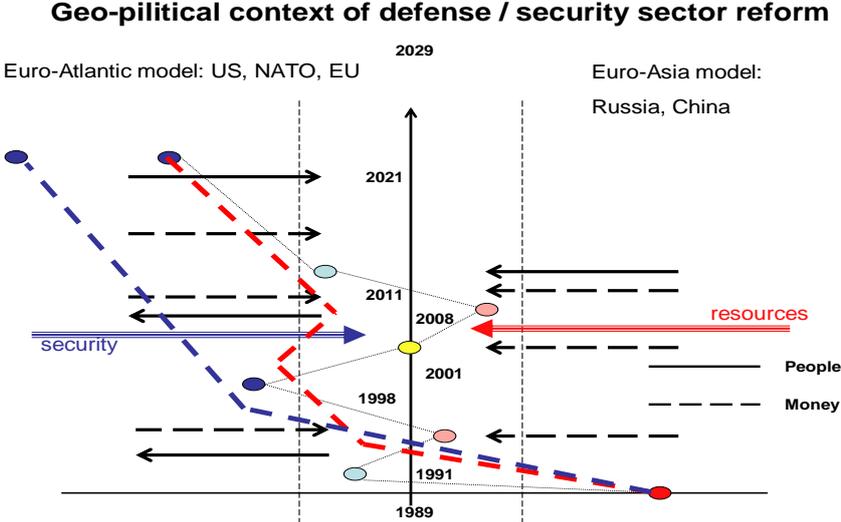


Fig.2. Trajectory of the new NATO/EU members (left line) and oscillations of Bulgarian transition (right line).

The key point for the future is that Economy will be more and more integrated in the Euro-Atlantic community and political and security sector, as well as energy/infrastructure sector have to follow or may be, after certain time, to lead this transition in order to be effective and to keep integrity of the country and even - integrity of people at high political level. So, the challenge is to achieve high level for integration⁵ - horizontal (between deferent infrastructures and security services) and vertical - from policy and governance to management and command and control. The key instrument for such integration is the combination of Operational Analysis (OA) for concept development and decision making support together with Computer Assisted eXercises (CAX) for experimentation / training and deeper / larger understanding of the situation, concepts and plans validation.

⁵ Niemeyer, K., Shalamanov, V., Tagarev, T., Tsachev, T., and Rademaker, M. NATO Operations Research Support to Force and Operations Planning in the New Security Environment - SfP 981149 Final Report, Sofia, Artgraf, 2008.

The main goal of the established in 2006 Joint Training Simulation and Analysis Center - Civil Security (JTSAC-CS)⁶ (at the Institute for Parallel Processing - Bulgarian Academy of Sciences⁷) is related to exactly this challenge - to provide tools and test environment for OA and CAX in support of the change management process of the security sector, including the improvement of energy security and critical infrastructure protection.

Bulgaria being in the middle of Adriatic - Black Sea - Caspian Sea Bridge and being a member of NATO and EU with close cooperation with US (including joint military facilities) could support regional cooperation through OA and CAX in JTSAC-CS in the transition period for the region.

Considering the disclosed context of the Bulgarian position in SEE and WBSA the role of OA/CAX implementation is inevitable by means of possible scenarios development, simulation and analysis that are related to Critical Infrastructure Protection (CIP) and Emergency/Crisis Management (EM, CM). This is based both on world known best practices for future situational analysis from one hand and from another - shows a great flexibility in the methodology. Generally, CAX nature is multidimensional and in the most extreme, best case, allows combination of live, virtual and constructive simulation of the environment (CIP) model. In the next paragraph a description of JTSAC-CS capabilities will be given.

3. Joint Training Simulation and Analysis Center - Civil Security Capabilities

The Joint Training Simulation and Analysis Center - Civil Security (JTSAC-CS) is an academic R & D center founded in 2006 with the support of NATO, EU, Bulgarian Government and Bulgarian Academy of Science (BAS) as a part of the Institute for Parallel Processing (IPP) - BAS.

The Center specializes in integrated Live, Virtual and Constructive (LVC) simulations for Computer Assisted eXercises (CAX) and Operational Analysis (OA). Generally, JTSAC studies the application of OA, CAX and Information Technologies in the new security challenges of the 21st century.

Mission of JTSAC is to be a key partner of the integrated security sector institutions planning and analysis process with the help of OA & CAX. Vision focuses on ability with high-professional team to support the complete life cycle of OA & CAX. The strategy is based on Knowledge & Technology integration for better education & training.

The main objective of JTSAC - CS is to provide scientific and educational support to the Integrated Security Sector on the bases of OA and CAX, conducted jointly by subject matter experts, scientists from BAS and leading national and international high-tech companies from the security sector.

The basic JTSAC - CS capabilities are integrated around the Basic low-cost Environment for Simulation & Training – BEST. This environment has been developing since 2005 within a series of projects and tested with the EU TACOM SEE 2006, Struma 2008 and in 2010 will be part of Phoenix 2010 exercises.

BEST is integrating CAX simulation via CAX-ENVironment (CAX-ENV) and six additional modules depicted in Fig.3:

⁶ Shalamanov, V. Computer Assisted Exercise Environment for Terrorist Attack Consequence Management, In Transforming Training and Experimentation through Modelling and Simulation - Meeting Proceedings RTO-MP-MSG-045, Rome, Italy, October 4-7, 22-1 - 22-18, 2006.

⁷ <http://www.bas.bg/clpp/en/indexen.htm>

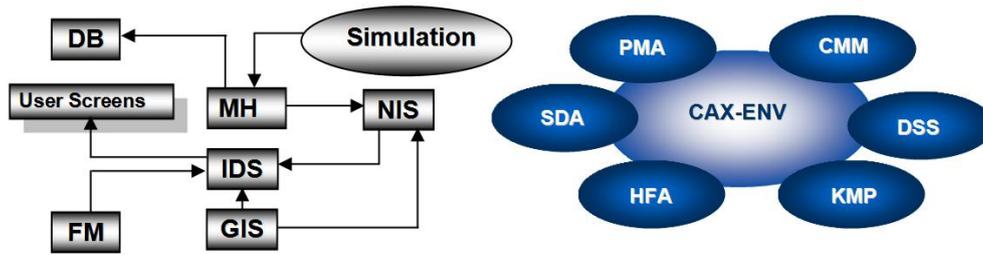


Fig.3. CAX-ENV and other BEST modules.

CAX-ENV is an element of BEST that encompasses a network system for: Message Handling and Instant Messaging chat (MHS); Integrated Display System (IDS) for displaying different fused information about simulated events⁷: geographical, seismological and meteorological information (via Geographical Information System,), exchanged messages log via a Web Information System integrated into a network information system (NIS) that allows remote Field Modules integration for mobile C2 Center construction, including WAN, LAN and satellite TCP and VoIP communications assurance and video surveillance (including night vision cameras); Finally the completed simulation is archived in to a Data Base (DB) for After Action Review and Post Mission Analysis.

A detailed implementation of BEST methodology⁸ is shown in Fig.4:

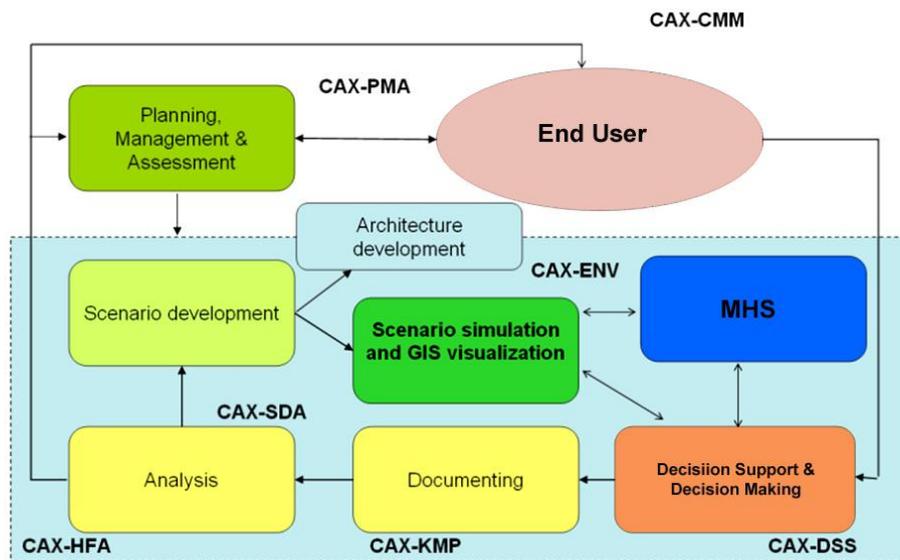


Fig.4. JTSAC-CS BEST Methodology.

Following, Fig.4 we will disclose the implemented in BEST elements⁹: The Change Management Model¹⁰ (CMM) is giving the context of the security sector transformation in the sense of security sector integration and validation of the process via the active legislation

⁸ Niemeyer, K., Shalamanov, V., Tagarev, T., Tsachev, T., and Rademaker, M. OR Support to Force and Operations Planning in the New Security Environment - NATO SFP 981149, Final Report, April, 2008.

⁹ Shalamanov, V., Penchev, G., and Nikolova, I. The Role of Center of Operational Analysis in Integration of Science, Industry, Government Capacity to Support Integrated Security Sector in Bulgaria, International Conference for Security and Defence Industrial R&D, NATO SFP 982063 "Management of Security Related R&D in Support of Defence Industrial Transformation", May 14-15, Sofia, 76-95, 2009.

¹⁰ Shalamanov, V., Minchev, Z., et al. Security Studies in Bulgaria 1999-2008, G.C. Marshall, Bulgarian Academy of Sciences, Demetra Publishing House Ltd, October, 2008.

testing through CAX. In this sense, CMM provides also the link with the end-user of CAX; The Project Management and Assessment (PMA) implements tools and methods for economical evaluation planning and control on the bases of COTS like: MS Project[®], QPR Balanced Score Card[®] and own ad-hoc developed software solutions; The Scenario Development and Assessment (SDA) implements a four step process: structural analysis, system analysis (both developed within own ad-hoc developed software I-SCIP¹¹), dynamic risk forecasting (developed with the COTS Powersim Studio[®]) and agent based simulation (developed with NC3A software for agent based simulation - GAMMA[®]); Following developed scenarios requirements a CAX ENVironment (ENV) architecture is designed via System Architect, OpNet (for communications), ARIS and NAF, DoDAF principles¹². The Decision Support Systems (DSS) package provides a set of distribution tasks solvers for emergency delivery of resources (water, food, medicines, blankets, clothes, etc.), people evacuation, rescuing and network (electrical, water or road) distribution problems; The Knowledge Management Package (KMP) is providing an integrated space for archivation of results in electronic form, from ongoing or already passed CAXs, available in a WWW environment (see: <http://www.caxbg.com/>); Finally, the Human Factor Analysis (HFA) gives a possibility via questioners fill-up, battery of psychological tests (including: alertness, attention, stress, fatigue etc.) and neurofeedback tracking for evaluation in a qualitative manner the real involvement of the trained participants in CAX and for improvement of their results/performance, i.e. an ability to learn and improve their knowledge and reactions for hypothetical, plausible scenario based hypothetical/future situations.

4. JTSAC Capabilities Application

On Fig.5 is presents the Battle lab architecture for C2 in crisis/emergency management (CM/EM) applicable to energy security scenarios. This architecture was developed under NATO RTO MSG-049 “M&S Support for Emergency Response Planning and Training” in preparation of CAX Phoenix 2010 and is part of EU FP7 MACRToolset project.

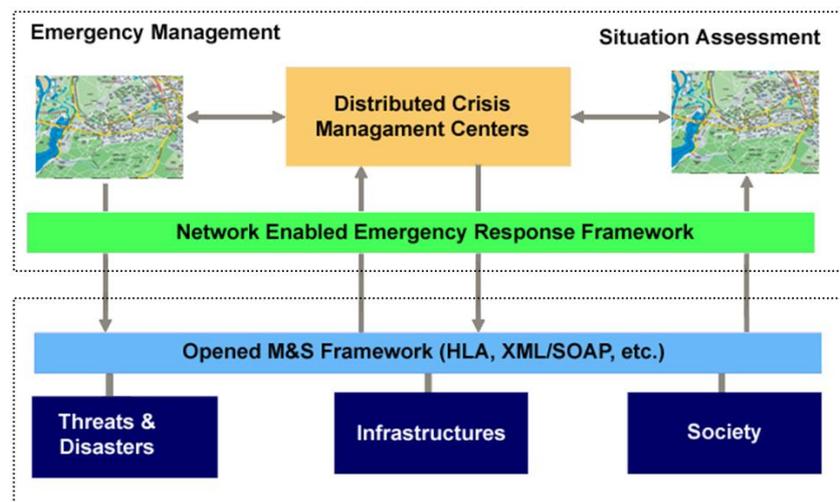


Fig. 5. Battle lab architecture for C2 in crisis/emergency management.

¹¹ Minchev, Z. Intelligent Scenario Development for CAX, NATO ARW Scientific Support for Decision Making in the Security Sector, Velingrad, Bulgaria, IOS Press, 16-24, 2006.

¹² Stoykov, M., Shalamanov, V., Kirov, G., Stoyanov, V., Ivanov, I., Tsankov, A., Integrated System for Emergency Management (Architectural Methodology), Change Management Series, Softrade, 2006 (in Bulgarian).

Using JTSAC as a base for the development of CM/EM C2 Battle lab is essential for validation of the products envisioned in MACROToolset project and at the same time will be used to consolidate cooperation between Bulgarian Academy of Sciences, industry, ministries and NGO in the area as well as an element to be connected with CFBLNet (Combined Federation of Battle laboratories)¹³.

Referring to exercises as an instrument we have to recognize that EU TACOM SEE-2006¹⁴ was the first full scale exercise to involve all the national institutions in Bulgaria (incl. media and NGO) with responsibilities to security (more than 10) together with EU, NATO, UN OCHA and 7 SEE countries with observers from 17 EU countries. After several national exercises led by MoD, MoI or Ministry of Health currently JTSAC is supporting Phoenix 2010 with the architecture following the one prepared for MACROTolls project (see Fig. 5).

Our research led to development of a framework for integration of new technologies in a creative environment for CAX that is used for education & training (E&T) and Research & Development (R&D) for the integrated security sector (considered as a complex adaptive system) change management as presented Fig. 6:

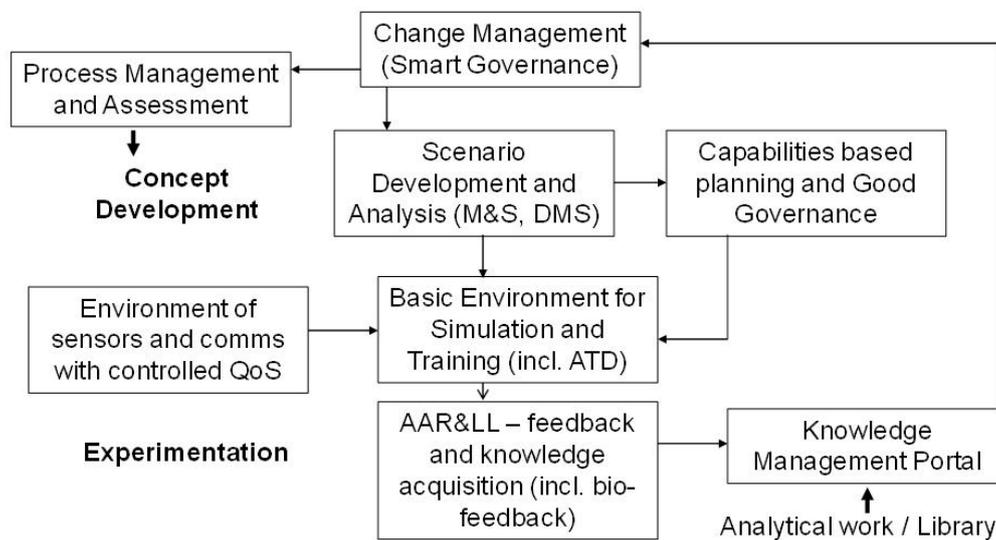


Fig. 6. Integration of new technologies in a Creative Environment E&T/R&D for the integrated security sector change management.

We currently work on the development of a framework for Regional Center for Energy Security and Network of Knowledge Centers on Energy Security for SEE and Black Sea Region, based on our experience in building JTSAC and Center for Security & Defence Management¹⁵ established within the key support of NATO SfP 981149 project.

Finally, we have to note that the institution building for the last 10 years in the area of Comprehensive Approach to security in Bulgaria, which is related to the Bulgarian Academy of Sciences (BAS) was organized in accordance with the following key events' list:

¹³ Combined Federation of Battle laboratories (CFBLNet) – www.CFBL.info with NATO and European PoP: CFBLinfo@nc3a.nato.int is secure, established, multi-national, and on the cutting edge of research, Development, Trials and assessment in the Net Centric Warfare.

¹⁴ EU TACOM SEE 2006, Technical Report, Institute for Parallel Processing, BAS, Sofia, December, 2006.

¹⁵ <http://www.caxbg.com/is/>

- 1999 – Situation Center in MoD / Government, Framework Agreement with BAS;
- 2002 – Center for National Security and Defense Research (CNSDR) in BAS;
- 2003 – Science Coord. Council to Standing Government Committee on Civil Protection (in BAS);
- 2004 – C4I Department development in IPP, BAS;
- 2005 – Center of Operational Analysis in BAS (related to NATO Sfp 981149 project);
- 2006 – Joint Training Simulation and Analysis Center in BAS (Civil Security);
- 2009 – Center for Security and Defence Management in BAS;

The next steps, the authors presume, will be focused on:

- 2010 – Allied Command for Transformation EPOW, SPP Program exercises;
- 2011 – 2013 – Center of Excellence on Military Support to Civilian Authorities (CoE MSCA).

The role of the Bulgarian Academy of Sciences as an “Advisor” to the Nation since 1869 on Science and Technologies, including security related issues could further support MoFA, MoI and MoD for larger regional role in the context of NATO / EU role in SEE/WBSA with joint Bulgarian – US projects added to the process.

This will logically result in development of a Center of Excellence (CoE) on Military Support to Civilian Authorities accredited with Allied Command for Transformation, providing planning and testing of civilian capabilities, supported by military capabilities in maritime security. A model of the general architecture of the CoE MSCA is presented on Fig. 8.

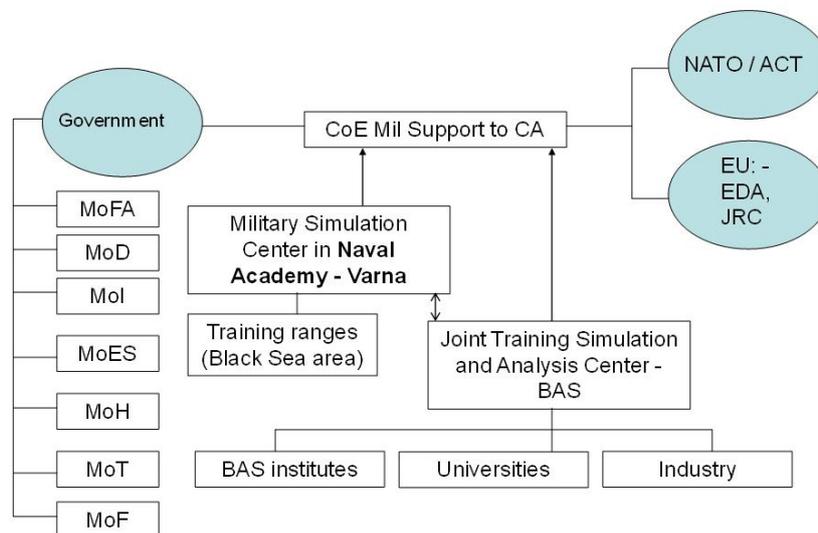


Fig. 8. Model of Center of Excellence on Military Support to Civilian Authorities.

Conclusion

In the present paper a brief overview of the Bulgarian position in SEE/WBSA was disclosed both in the geographic and strategic context. Apart of this, a methodological framework based on OA and CAX for plausible futures validation is presented via the academic JTSAC-CS. The disclosed framework addressing the energy security and CIP in the region with CAX integration and validation, allows good and explanatory view point from a scientific perspective of the problem at hand.

All above developments are sustainable only in the larger regional and NATO/EU context of further development of the integration processes in SEE and WBSA.

NC3A is a key operational analysis and C3 support, at large, agency in NATO. After very successful first Regional Chief Information Officers' Conference for SEE and accepting the proposed by the regional nations' role of technical advisor to both SEDM process and SEEBRIG, there is a possibility for improvement of the regional capabilities in the area of OA and CAX and development of a regional center in support of security studies and training. Established framework MoU with MoD of Bulgaria, negotiated currently Cooperation Agreement with Bulgarian Academy of Sciences and just signed MoU between MoD and Bulgarian Academy of Sciences are basing sound ground for trilateral cooperation – MoD-NC3A-BAS.

IIASA in Austria is a leading applied system analysis institute in support of global problem analysis, so regional cooperation in the area of OA and CAX to support energy security and environmental issues could follow this model.

EDA is the EU instrument in the area of capabilities planning for defense and security, promoting multinational projects, so could be good EU instrument to further foster regional cooperation in addition to the above developments.

JRC of the EC is a main asset for research in the civil security area for EU so, could be key player in the FP7 format to involve regional nations in EU large research effort in the area of energy security.

US – GlobalEESA (Global Energy and Environment Strategic Ecosystem)¹⁶ is another forum to exploit the developments presented in the paper for the strengthening of the energy security for the SEE and Europe as a whole.

Last, but not least series of ARW/ASI supported by NATO Science Committee, especially HSD Panel on security matters in SEE and WBSA for the last several years logically set up a base for this more focused discussion on energy security as one of the key challenges for the region. Logical next step is institutionalizing of the process through use of JTSAC.

¹⁶ The Energy and Environment Strategic Foresight laboratory – US Department of Energy: Final Report from the event 27-28 April 2009, August, 2009, <http://globaleese.org/>