

Introduction of the Network Centric Warfare concept to Czech Armed Forces

Pavel Eichelmann and Luděk Lukáš

Abstract—One of the features determining the strength of troops is command and control. The quality of command and control is determined by the quality of the command and control systems (C2S). The Czech Armed Forces are developing tactical command and control systems (TC2S) for the Ground and Air Forces. The TC2S were a little bit separately developed. Now, we want to use the benefit of shared situation awareness. The concept of Network Centric Warfare is a solution of this problem. The integration of both TC2S's is its main objective. To apply this concept, separate C2S's of different units are integrated into one logical system, into one joint C2S. Thus it is possible to create the common operation picture for all units of the task force.

Keywords—*Network Centric Warfare, command and control, tactical command and control system, situation awareness.*

1. Theoretical background of Network Centric Warfare

The Czech Armed Forces are under the process of reform; they reduce their structure to become smaller, modern and mobile. The modern armed forces have developed intensively. They change their mission, capabilities and structure according to assigned political tasks. There is a growth of their dynamic abilities, swing operation, range and number of fulfilled activities. The above-mentioned complicated problems need new manners to solve. One of the possible manners is to improve the command and control process. It is directed into improvement of situation evaluation, commander's intent formulation and task assignment to subordinated units. It is important for each element of battle formation to know its task and its contribution to fulfilment of the whole mission.

To solve this problem, the command and control system (C2S) is improved according to Network Centric Warfare (NCW) concept. The Network Centric Warfare is a concept that is based on integration of separate C2S's of different units into one logical system, into one common C2S. Thus, it is possible to create the common operation picture for all units of the task force.

NCW focuses on combat power that can be generated from effective linking or networking the engaged military troops. It is characterized by the ability of the geographically dispersed forces to create high-level shared battle space awareness that can be exploited via self-synchroniza-

tion and other network centric operations to achieve commander's intent.

NCW concerns about networking rather than networks. It concerns increased combat power that can be generated by a network centric force. The power of NCW is derived from effective linking or networking knowledgeable entities that are geographically or hierarchically dispersed. NCW recognizes the centrality of information and is potentially a source of power. Networking of entities enables them to share information and to collaborate to develop shared awareness, and also to collaborate with one another to achieve certain degree of self-synchronization. The net result is the increased combat power.

NCW provides opportunities to improve both command and control (C2) and execution at each echelon. NCW offers the opportunity to not only be able to develop and execute highly synchronized operations, but also to explore C2 approaches based upon horizontal coordination or self-synchronization of battle entities.

NCW is based on using new abilities of the information and communication technologies (ICT). There is a new view on strength of information. By sharing information we can improve our situation awareness and understanding. New ICT has the potential to improve this process.

Information is compared to glue that bonds organization into one unit stuck together to accomplish the object function. Higher dynamic and swing of operation needs new quality of the glue. Correct information flows provide activity synchronization, information sharing, situation awareness and understanding.

The commander and staff who understand to battle situation can better formulate the battle objective and direction of main effort. Like view of the chess-board is important for a chess-player, knowledge of friendly troops and enemy situation, terrain and weather conditions is important for a commander. The data collection was limited in the past. This status of uncertainty was named "fog of war".

Nowadays we have new better communication and information systems (CIS) and this restriction was reduced. We can collect position and status data in real time. The information system reduces "fog of war". It provides situation awareness that is same like real battle situation. The common shared knowledge of situation is important for success of task force. The Air Force and Ground Forces need common operation picture that is created as an intersection of their separate operation pictures. Common operation

picture improves objective formulation, task assignment, activity synchronization of the task force.

NCW is based on robust network environment. The separate C2S's are integrated into one logical system. The sensors, decision makers and action elements are interconnected together. Technological borders and bottlenecks of information exchange are reduced. Each force element has access to all needed information. Provided information creates a real situation picture. There is a common database that maintains data for all command levels. All command levels have the same situation picture.

2. NCW importance for Czech Armed Forces

The Czech Armed Forces battle capability has been improved by introduction and usage of new C2S and CIS. The Ground Forces' Tactical Command and Control System (GF-TCCS) has been developed and used by the Ground Forces. It is predetermined for the division or lower levels. The Air Forces' Tactical Command and Control System (AF-TCCS) has been developed and used by Air Forces, too. Developing these C2S's have followed the battlefield digitisation concept. However, in the development phase these TC2S were a little bit separated. To apply NCW concept, we would like to integrate GF-TCCS and AF-TCCS into one logical system (Fig. 1). Thus, our Joint Forces will have a C2S of new quality. We will create better potential for joint actions of the Ground and Air Forces.

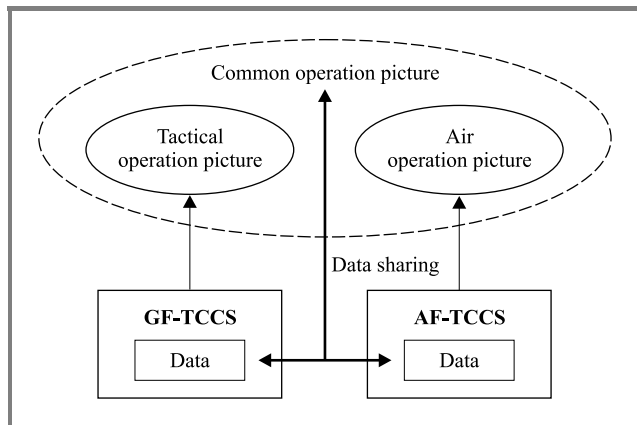


Fig. 1. Common operation picture based on integration of GF-TCCS and AF-TCCS.

It is important to improve our joint doctrine and procedures based on NCW. We have to realize new possibilities and to design new tactics and procedures. These tactics and procedures will be tested and improved to be a part of the new doctrine. We improve abilities of formulating battle objective, of synchronising activities and fulfilling tasks.

Thus NCW will have influence on mission capability package of the Czech Armed Forces.

3. NCW program description

It should be noted that the Czech Armed Forces now have no real concept detailing the NCW program. Several partial studies have been made on this subject with analyses of those topics. The Military Technical Institute of Electronics and Military Technical Institute of Air Forces, both from Prague, have been the leaders in solution of this problematic area.

There is no doubt that each military organization improving its own performance must, sooner or later, implement the NCW principles. The notions like information superiority, knowledge superiority, decision superiority, sharing information, common operation picture, etc., aren't only phrases but they must be implemented in C2S to improve C2. Last military conflicts have reflected that achievement of these funds makes the operations much more effective.

We know that NCW implementation will have expressive impact to the Czech Armed Forces. This concept causes to force a broad organizational measures and C2S system architecture changes. Each of these changes is important and crucial, however C2S system architecture and suitable ICT implementation is important for the first phase of the NCW concept.

We will study and analyse good foreign experience in this area. There is a good example of Sweden, Norway and Finland cooperation. Together they have provided an analysis of their current C2S's and their networking. They received what they have and what not. Important result was what they would have to complete to obtain the robust NCW C2S.

At the beginning, the Czech Armed Forces will necessitate carrying out a thorough analysis of NCW abilities. Thus we will locate the positive part of next effort. It isn't possible to invest an astronomical sum and purchase technology of all sorts, but rather to choose the fundamental pillar of future architecture. Thus, the system can be realized through gradual evolutionary steps. This progress has two benefits. Financial area is the first. We can accomplish correct technology acquisitions. Personnel area is the second. The NCW C2S will have new capabilities. Its using will need a change of users thinking to take advantage of NCW capabilities. Our commanders and operational personnel have to realize step by step these capabilities for C2 improvement.

Our military experts will contribute to the NATO NCW program to receive state-of-art knowledge and experience. Other cooperation will be done on commercial ICT firm level. Therefore, we prepare and constitute our solution teams that will be capable to design and develop the NCW C2S.

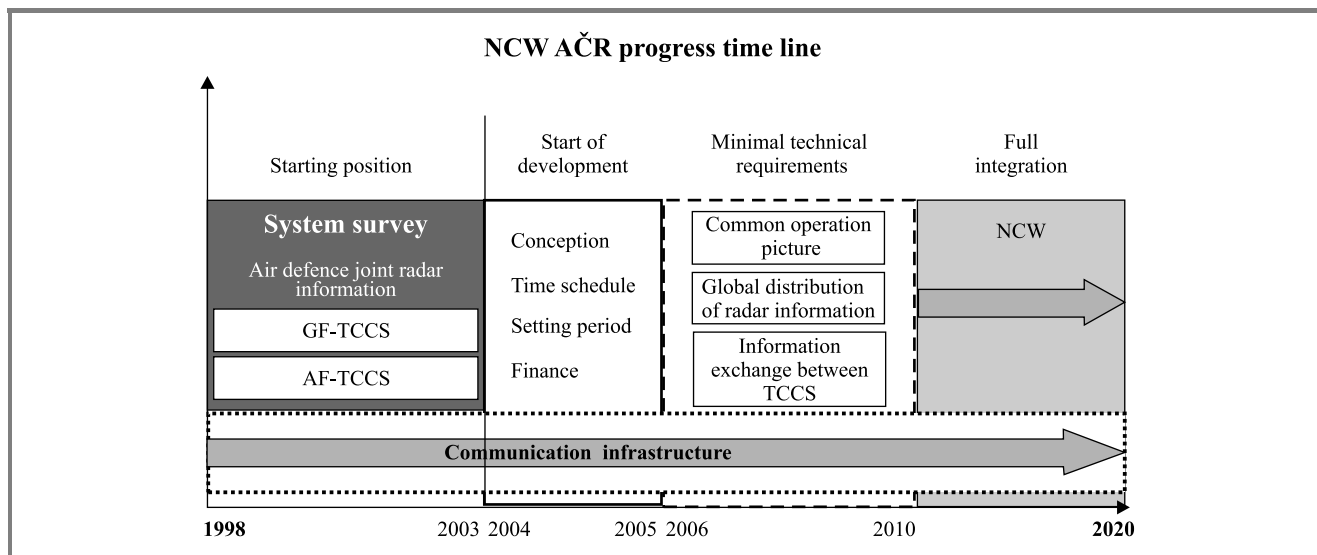


Fig. 2. The time line of the Czech Armed Forces NCW program.

To successfully solve the NCW problems, it will be necessary to make up conceptual study that would cover all the important issues of above NCW. The analyses of GF-TCCS and AF-TCCS will create one of the main parts of this conceptual study. We have to analyse all the important IT problems and find the solution for integration of AF-TCCS and GF-TCCS. The integration of TCCS and Stationary Information System will be next step. It will be done by integration of the MoD Overarching Information System and TCCS. Thus we will have military information environment for seamless information sharing and exchange. Figure 2 depicts a time line of Czech Armed Forces NCW program.

The key is in using NATO standards, MIP for example. IT standards used for development of other Czech Armed Forces Information Systems (Staff Information System for example) should also be concerned so that necessary level of information sharing is provided.

At first, GF-TCCS and AF-TCCS integration will be done on brigade level. We assume information sharing and creation of common operation picture. The fundamental set of formalized messages will be defined that will mediate information between GF-TCCS and AF-TCCS. The chosen technology will be demonstrated and verified. Thus we can pick suitable HW and SW platforms and technologies. We hope that we can exchange the basic set of formalized messages at first. This is important for information sharing. Creation of a simplified version of common operation picture will be the next step. Thus we can provide for common sharing of situation information through all command levels and authorized users.

We assume that the main integration problem will be in the area of information security. Each of the information systems has its own security rules. The National Security Agency plays an important role here because it is the certification authority in this area. We will respect NATO

security standard too. Information security is concerned as a very sensitive area and it is necessary to look for global solution suitable for all NCW C2S.

It is important to determine several crucial issues that will have the key role in our process of C2S integration. The following are some of these problems:

- NCW capability analyses and suitable selection of proper function;
- methodology assessment to provide for an information system integration;
- C2S system architecture change;
- suitable SW and HW technology selection to provide for function and data integration;
- technology implementation providing information exchange;
- common operation picture creation;
- security proposal and realization of integrated systems;
- migration of the already established and operated information systems into the final NCW shape;
- modernization of the action elements, namely to accomplish the NCW requirements;
- to design a model solution of internetworking separate C2S to optimise effectiveness of the whole NCW C2S.

The set of above mentioned problems reveals that this project won't be short-term, but it will be strategic. We can say that it is the gradual reconstruction of the modern

armies that shall enable variety of missions. We hope that the Czech Armed Forces will be among these armies.

4. NCW technological groundwork

The Czech Armed Forces have already modernized several years. Our forces are equipped with the weapon systems and CIS coming from 1970s. We have problems with our off road vehicles, light trucks, armoured vehicles, aviation and tactical CIS.

The situation seems unsatisfactory for NCW implementation. However contrary is the true. We can prepare all process of NCW implementation utilising our coalition partner experience. We can prepare the research background of NCW, choose the suitable tactic of NCW implementation, prepare appropriate projects. We have time for thinking about NCW in the Czech Armed Forces. But there is short time for thinking.

There is a good position for NCW in the area of stationary communication system. Our microwave radio relay network provides the data transmission circuits for information systems and computer networks. The data networks are made of CISCO products. It is possible to say that we have homogeneous environment for stationary data transmission. The situation was convenient in the area of mobile tactical communication too. For tactical needs we have developed and fielded new tactical communication system TAKOM, which was presented on this conference last year. It is a digital ISDN communication system that uses 2 Mbit/s channels. CISCO products like in the stationary systems provide data transmission.

But we have faced a problem to provide data transmission for mobile users by Tactical Radio System. It is composed of VHF and HF radios. This system can provide data transmission or voice traffic but not simultaneous data and voice transmission. The essential disadvantage of this solution is in preemption of data transmission by voice traffic. Situation awareness message delay may be tens of seconds or minutes.

The above-mentioned solution is based on using Czech VHF radios RF-13. However there are some considerations about using software-defined radios for Tactical Radio System. Our Military Technical Institute of Electronic, Prague tested Rohde & Schwarz M3TR and Harris Falcon. The question of TRS implementation is open. Thus we have to solve problem to provide simultaneous voice and data traffic. It is an imperative request for NCW.

To determine fitness for NCW we will have to test communication and information technology features. There are many possibilities but we have to choose perspective technologies able of providing for interoperability and simplicity of our solutions.

Computer networks fielded in the Czech Armed Forces are largely based on INTEL (WINDOWS OS) or SPARC (SOLARIS OS) technologies. There is continual exchange

of HW and SW platforms to satisfy information system requirements.

The Air Force use several computer based information systems namely BOIS and SEKTOR-VS. The basic objective of these systems is command and control support. These systems are produced by Czech firms. Similar situation is in the Ground Forces. They use Battle Vehicle Information System and Movement Control System to provide situation awareness and message transmission. The process of broad usage of informatics within military structure started seven years ago.

Evidently better is the situation in aviation because the Czech government has approved leasing of JAS 39 GRIPEN supersonic aircraft. It is equipped with state-of-art CIS technology.

For object identification we use sensors of multiple types. In the area of active radars we use old Soviet and Czechoslovak products of various age. Mainly the Soviet radars need upgrading especially for digital processing of radar information and largely implementation of IFF. The passive surveillance systems are represented by the older type (TAMARA) and the new type (VERA). For both of them it is necessary to solve the problem of data fusion to get common air picture.

5. Czech Armed Forces NCW status

Brigadier general Jiri Baloun, chief of J-6/General Staff, has presented his vision of the Czech Armed Force NCW [6]. He considered NCW was along with technology also doctrine, information superiority, new style of command and control and military thinking. The Czech Armed Forces have elaborated several fundamental studies that will present the solution of our NCW problems. We will cooperate in the appropriate NATO working group to solve these problems. The elementary problem is providing for CIS interoperability and data sharing to ensure the situation awareness. The problem is simple to define but difficult to solve. For solution we need a good vision, coalition technology experience and standards, plan and time to ensure evolution and integration of systems into one, into information age environment.

The NCW C2S is potential for better C2. We can benefit only from employing that potential. The solution is beyond signal corps responsibility taking all the Czech Armed Forces. It is an issue of new style of command and control. The change of thinking is extremely long route with many obstacles. But we have to finish this journey to have better Armed Forces.

6. Conclusion

The Czech Armed Forces are under the process of reform, reduction of structure to be smaller, modern and mobile. The key point is the growth of their dynamic abilities,

swing operation, range and number of fulfilled activities. One of possible manners to fulfil the above-mentioned requests is improvement of the command and control process. We can solve this problem to improve the command and control system according to Network Centric Warfare concept. The network centric warfare is a concept that is based on integration of separate digital C2S's of different units into one logical system, into one common C2S, exploiting the ICT benefit. NCW offers the opportunity to not only be able to develop and execute highly synchronized operations, but also to explore C2 approaches based upon horizontal coordination or self-synchronization of battle entities.

We know that NCW implementation will have an immense impact on the Czech Armed Forces. Our military experts will cooperate on NATO NCW program to receive state-of-art knowledge and experience. One of the major integration problems will be in the area of information security.

The NCW C2S is potential for better C2. We can benefit only from employing that potential. It is an issue of new style of command and control. The change of thinking is extremely long route with many obstacles. But we have to finish this journey to have better Armed Forces.

References

- [1] D. S. Alberts and J. Gartska, "Understanding Information Age Warfare", in *CCRP*, Washington, USA, 2001, p. 312.
- [2] J. V. Mc Gee and L. Prusak, *Managing Information Strategically*. Wiley, 1993.
- [3] M. Snajder and P. Zadina, "Technological support of NCW, project OPER-SÍŤ", in *VTUE*, Praha, Czech Republic, 2003, pp. 48–95.
- [4] L. Lukáš and P. Hruza, "The concept of C2 communication and information support", in *CCRTS*, San Diego, USA, 2004, p. 7.
- [5] L. Lukáš, P. Tomecek, and P. Hruza, "The synergic integrated concepts of C2S", in *ICCRTS*, Copenhagen, Denmark, 2004, p. 7.
- [6] J. Baloun, "Network enabled capabilities", in *C2 Conf.*, Brno, Czech Republic, 2004.



Pavel Eichelmann currently holds the post of research officer of TCCS department of Information Technology Development Agency Prague. In 1998 he graduated from Military Academy (MA) in Brno. After graduation from the MA he fulfilled his regimental duties in the signal brigade as the commander of signal company.

Since 2001 he works like researcher in area of Air Forces CIS. His research and publication activities are directed to the field of TCCS, Air Forces Information Systems and computer networks.

e-mail: pavel.eichelmann@army.cz
Information Technology Development Agency
Pod vodovodem st 2
158 00 Prague, Czech Republic



Luděk Lukáš currently holds the post of chief of COMSYS section of the Military Technology Faculty of University of Defence in Brno. In 1981 he graduated from Military Technical University in Liptovsky Mikulas (Slovakia). After graduation from the MTU he fulfilled his regimental duties in the signal brigade as the commander of troposcatter company and chief of staff of signal battalion and commander of Army signal center.

Since 1991 as Military Academy personal he gradually held appointments as lecturer. He is a member of national board for interoperability and the technical program committee of RCMCIS conference in Poland. His research and publication activities are directed to the field of C2 communication and information support, C4I systems and tactical communication system.

e-mail: ludek.lukas@vabo.cz
University of Defence/K-302
Kounicova st 65
612 00 Brno, Czech Republic