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# IMPLEMENTATION OF NETWORK ENABLED CAPABILITY AND INTEROPERABILITY IN THE ROMANIAN ARMED FORCES

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## 1. Examining the Progress in Romanian C4I Capabilities to Comply with the NATO NEC Environment

One of the military operations' features for the twenty-first century is the increasing complexity as strategic, operational and tactical levels merge, as operations serve a mixture of military and civil objectives, and as operations are carried out by coalitions of the willing. Military commanders are increasingly faced with the issue of reconciling traditional military operations with overall mission and national policy objectives.

At this moment, "TRANSFORMATION" is the buzzword in the military area. TRANSFORMATION is a key word in NATO and at the same time in Romania. To us, this concept basically means:

•Re-consideration of the military operations' nature, as well as the doctrines, skills and assets;

•Transformation impact onto C4I systems, where some frameworks could be met. I will mention only NATO Network Enabled Capabilities framework,

which is the base of our transformation concept, and the Critical National Infrastructure framework.

The goal of these two frameworks is to provide information superiority, one of the fundamental pillars of the NEC concept.

NEC allows a better and timely support of the entire range of operations. The key results expected are:

•Information and decision superiority (NEC's first goal)
•Provision of information coherence and interoperability for all users
•Increase of receptiveness
•Increase of flexibility

These results are only possible within a Networking and Information Infrastructure (NII) that brings together land, maritime or air sensors, command and control centres, and effectors.

In our opinion, NEC's fundamental criteria are:

•Intelligent networks
•Information management applications embedded into the network nodes
•Distribution of broad-band services
•Guaranteed end-to-end Quality of Services (QoS)
•Security solutions evenly distributed throughout the system
•User mobility

NEC concepts are based on intelligent networks, capable of effectively contributing to information management and dissemination. This implies having information management applications embedded into the network nodes, able to perform Command, Control and administrative transactions (Intranet), by widely using graphics and imagery tools.

Broad band services are needed for these applications. These services require real-time data, i.e., multimedia service with guaranteed end-to-end Quality-of-Service for streaming video, sensors management, effectors' control, etc.

This whole environment requires security solutions evenly distributed throughout the system (information security, multilevel security, user authentication and registration) to serve different users communities.

And, last but not least, the NEC concept requires supporting user mobility: specific systems and technologies that extend voice and data services to fielded units down to the soldier.

Taking into consideration the second framework mentioned, it is necessary to emphasize that this one gained in consistency after 11$^{th}$ September, and the basic criteria are the following:

•Proprietary or dedicated data flow

•Providing a redundant network (grill systems), diversification of the transmission environment (radio relay, satellite, optic fibre)

•Automatic re-establishment of the users' connections through pre-emption and multiple priority mechanisms

•Operations System Support (OSS)

•Use of certificated on-line crypto equipment

•Control systems for access to the public systems

The Romanian National Defense Network is made of the Strategic Network and Information Infrastructure; Tactical Network and Information Infrastructure; Functional Application Services, as well as users and missions.

The first implemented element and one of the most important is Permanent Telecommunication Network. This represents the basic infrastructure of our National Defense Network (NDN).

The Radio Strategic Network is a single channel network, based on high performance radios, designed to provide communication capabilities for the headquarters on the move and to be a back-up solution for Permanent Telecommunication Network.

In order to provide supplementary communication capabilities in some specific areas, some deployable elements of Permanent Telecommunication Network are installed on shelters and on trucks.

Each of the services (especially the Air Force and the Navy) has the capability to set up its own specific networks.

In order to increase the Romanian National Defense Network performance, we believe a development strategy should be adopted, based mainly on the following steps:

•Assessment of the existing systems

•Developing an Overarching Architecture

•Developing necessary Reference Architectures and Target Architectures

•Designing the roadmap of Target Architectures for National Defense Network

These steps have already started to be addressed according the operational requirements and budgetary provisions.

Today, the PTN represents the backbone infrastructure of the Romanian National Defense Network used by all the military. Over this communication system, a military INTERNET infrastructure has been built. At the strategic level, these two elements are the pillars for Networking and Information Infrastructure. The NDN concept of development will allow the evolution towards a component of the NATO confederation of networks. The present performance provides us with

operational capabilities and internetworking with some limitations. But what is most important, there is a will to improve these capabilities.

Strategic NII provides communications in support of an important number of functional applications, for example: SCCAN (including sensor connections – FPS 117, GAP FILLER, radars, and upgraded analogical vectors – air bases, SA Missiles, EW units), NBC Monitoring and Warning System, National Integrated Meteorological Information System, SCOMAR, Military INTRANET etc.

PTN is an Enhanced EUROCOM System based network with EUROCOM, STANAG and comercial (ITU-T) gateways to other networks. All of these ensure a high-level of interoperability with commercial communications networks (ITU-T) and mobile tactical networks (STANAG and/or EUROCOM). Also, there is an interconnection to NATO General Purposes Communication System (NGCS). In the future the NDN will provide services to NATO users on the national territory. The Romanian NDN is connected to the Italian National Defense Network via SICRAL satellite system. We do have the possibility to be connected to other nation's tactical network also.

The Strategic Radio Communications Network (SRCN) has been designed to provide a minimum voice, data and link capabilities for all tactical and operational units' Headquarters (HQ) in case other communications cannot be used. SRCN is used for Services' Headquarters (HQ) as well as tactical and operational level units, with priority on the units which are at NATO's disposal. All kind of provided communications are protected, using encrypted, incorporated systems and hopping frequency as main working mode. SRCN has integration capabilities with messaging services from INTRAMAN.

The main information services offered by the Military INTRANET or INTRAMAN, as well as the Information Systems for Support Infrastructure are:

•Core information services (e-mail, file and printer sharing, WEB, hierarchical activity management, hierarchical document flow management, etc.)

•Information Applications for Support Infrastructure:

- Military Operations Support IS (SISAM)
- Intelligence for Defense IS (SIA)
- Modeling and Simulation IS (SISMIM)
- Armament IS (SISARM)
- Military Training IS (SIMIL)
- Automated Integrated Logistic System (AILS)

There are Out-Of-Area extensions of the Romanian National Defense Network to support the Romanian deployed troops in overseas operations. There are also extensions for the Romanian Ministry of Defense representations to NATO, ACO and EU. These extensions provide voice, data and VTC services.

## 2. Expanding the capabilities of Romanian defense with integrated technology to ensure multipurpose capability and flexibility

The operational needs that can be defined for a defence common network are:

•To provide connectivity for all involved segments: political level, military at all levels, international coalition like NATO, EU and others

•To have access to the network to meet criteria like flexibility, simplicity and security, in country or out-of-area, in order to allow users to exploit the network:

- from fixed sites through military, governmental or commercial infrastructure;
- from fixed sites via deployable CIS/CCIS assets;
- from mobile assets/commands/units via connections set up by means of remote access services.

One of the most important technical requirements for a National Defence Network is to comply with the most relevant standards to ensure interoperability and capability. The network topology has to grant suitable flexibility, survivability and seamless services integration. The network has also to support different services / applications / functions and the relevant information flows, granting both autonomous and COMMON operations, integration and data exchange when required by specific services or applications.

No less important is the employment of the latest technologies such as Software Defined Radio, Secure Communication Interoperability Protocol, and TACOMS Post 2000, etc.

Actions should be concentrated on the implementation of the "Common Network" for the Romanian Armed Forces that has to ensure support for:

•Internetworking services

•Core services

•Functional area services for personnel, intelligence, logistics, planning, training simulation, etc.

This approach is similar to those conducted in NATO for the development of NATO Bi-Strategic Command Automated Information System, Deployable CIS, and NATO General Purpose Communications System.

By taking advantage of the recent procurements and by optimizing and integrating systems, already deployed or meant to become operational in the near future, under the assumptions on targets made, the following requirements should be addressed:

•Support of broad-band services (multimedia integrated services)

•Optimization of the available transmission bandwidth

•Upgrade/implementation of access networks

•Increase of network security through NATO approved encryption systems, and NATO security concepts (i.e., multilevel security)

•Upgrade of existing/introduction of new IT platforms to support Core Services

•Increase of integration: OOA seamless support through satellite bearers, and high-capacity connectivity to mobile assets

•Enhanced interoperability between the National Defense Network and NGCS

•Increase of automation and control functions to replace human work

These requirements will lead the process to accomplish the final goals:

•Building a secure and high survivability network

•Full integration of all the network components, both strategic and tactical

•Rationalization of the network architecture and of the technologies adopted in order to optimize efficiency and management capabilities

•Evolution of services

Starting from the present situation, a sequential plan of actions could be defined in order to realize the "Common Network" for the Romanian Armed Forces. The services provided by the network are divided into two main categories, based on the Bi-Strategic Command Automated Information System: core services and functional area services. Core services are fairly well developed among the network; the main problem that remain is to disseminate these services for all users.

In the Functional Area Services we consider the Romanian Armed Forces have just started to invest efforts and money. These activities are driven by the necessity of real time information exchange between effectors and sensors, as well as the necessity of mission specific services. The services will be provided starting from the core to specific areas for: national users, NATO users, Coalition users, and Out-Of-Area projections.

For the short term perspective, efforts will be focused on the integration of the existing systems and on introducing only integrated subsystems, or subsystems with integration capabilities into the existing network.

The Romanian Armed Forces are in the process of testing and finalization of integration activities of the new Electronic Warfare System - the AZUR program, and the Weapon System - Hawk XXI. Also, there are two main programs for the services – SCOMAR – surveillance and reconnaissance system for the Navy and SCCAN – command and control system for the Air Force.

For near future, the ambitions are high. Because of the great demand for new high-capacity information systems, efforts should be concentrated on up-

grading the existing infrastructure by introducing the high rate bearers. For some areas high capacity Fiber Optic area networks will be achieved. In order to increase the processing capabilities, multi-protocol and multi-service switches will be introduced.

At the same time, efforts have to be oriented on:

•The integration of the legacy systems through specific gateways that will not limit the performances

•The use of software defined radio extended for all services and all types of communications. The use of radios with such capabilities already started.

•Making functional a global network management system that will allow the management of such a complex system

•INFOSEC area, for information and systems protection. IP crypto has to be used as a standard solution

•Sensors' integration and the use of smart sensors.

### 3. Effective digital and mobile communications for command & control support and reconnaissance data

The Romanian Ministry of Defense has started different modernization programs, many of them at low level echelons. All this was associated with Romania's commitment to NATO at the moment they were initiated. In this moment, the commitment involves higher echelons, as a consequence of the lack of coordination, because it is very difficult to integrate them all into a brigade level system.

When analyzing the situation at the Romanian General Staff level, the Communications and Information Directorate along with the Land Forces Staff support has decided that the only way to solve all the integration aspects is to start a process of C4ISTAR system definition at brigade level, because a flexible, layered, responsive C4ISTAR system (Command and Control, Communications, Computers, Intelligence, Surveillance, Target Acquisition and Reconnaissance) is potentially the most influential force–multiplier within the overall battle space.

In order to develop a competitive C4ISTAR system, the architectural approach recommended in NATO C3 Systems Architecture Framework is the best solution. As key technology, battlefield digitization and the concept of C4ISTAR system as a key enabler were adopted. For management purposes, never less important is the coordination with all related programs.

For practical work purposes, the Romanian General Staff has established an Integrated Project Team, that unites representatives of the Ministry of Defense and representatives of experienced companies in the field of C4ISTAR systems,

tasked with developing the basic elements for a C4ISTAR system at brigade level. In addition, this team has to provide interoperability and capability gaps analyses and to suggest an implementation roadmap.

Developing and utilizing effective digital and mobile communications **to provide the soldier with command, control and reconnaissance data** are based on: operational requirements, technological, time and budgetary constraints.

When we are talking about operational requirements, there are two main groups:

•The first takes into consideration the capabilities that should be provided by the system in order to support all types of military actions.

•The second refers to interoperability requirements. Usually, one of the capability requirements is interoperability, but, considering the last experiences on operational theatres, we consider that this issue should be addressed separately.

The C4I system should provide command support for all command levels. All weapon systems have to be integrated. Mobility is a key characteristic of tactical systems. Protection is a term behind which there is security, and Electronic Counter Counter Measures, Encryption (ECCME). The communication support is to provide sufficient Transmission capacity for command support and functional services. Last but not least, the system should provide interoperability between the national and international areas.

The time when interoperability for command–control systems was ensured by communication interoperability is long gone. The new context of battlefield transformation has changed its meaning. For the time being, when we are talking about C4 systems' interoperability, we are talking about communications, but also about sharing information, common operational picture, and common applications. There is very specific information that should be shared which is very important for the troops deployed in the theatres: friendly force tracking and situational awareness.

There are some technological constraints that should be considered in developing a C4ISTAR tactical system at brigade level. Because i tis impossible to purchase a brand new system, with new vehicles, new combat support and combat service support elements, almost always some of the older systems should be used – in our situation, the Romanian Armed Forces have to use the legacy fire control system, artillery support and ISTAR capabilities.

At the tactical level, the communication support is characterized by low capacity. With all new technologies, the single channel radios with 16 / 64 kbps is still one of the most used communication support for combat troops. There are two other major issues that we consider to be technological constraints:

•The command-control systems, combat support systems and combat service support systems are using different databases, and this makes the process of integration into a C4 system very difficult. MIP program is solving the problem at HQ level and for command-control purposes. JC3IEDM will extend the area of coverage as data model, but apparently will not solve all the issues.

•No less important is the mechanism of data exchange, which also depends on communication capacity.

**4. The way ahead: key programs & projects**

The key programs that will allow the Romanian Armed Forces to implement the C4ISTAR systems at the tactical level are:

•Equipping the brigade, division, and Land Forces Command Centers with HQ C4I Systems.

•Equipping Combat Battalions with a generic and simple Command and Control System (also called BMS or Battlefield Management System). The combat battalions need to receive orders from above, to report information (e.g. position, alerts, logistics status) with a simple and fast C4I generic system, knowing that the main goal of these battalions is to fight, not to insert a lot of data into a complex software system.

•Equipping Intelligence Battalions with a specific Intelligence C4I System. Intelligence is a specific work, using a lot of different means to acquire and process information, from Electronic Warfare to Human Intelligence. The C4I system for Intelligence battalions is fully dedicated to the missions performed.

•Equipping Support battalions and brigades (e.g. Artillery) with specific C4I System. For example, the full optimization of Artillery fire effects can be achieved only with a specific C4I system, taking into account all artillery data and parameters (guns location, ammunition status, 2D, 3D security rules, doctrine, etc.). In parallel, the Artillery C4I system should have additional functions, like maneuver or logistics, fully operational.

When brigades are available and Combat brigade levels are equipped with the HQ C4I system, it is expected that the Romanian Armed Forces will integrate all this into a Divisional level C4ISTAR system, also including the Combat Support brigades (as Artillery Brigade).

Another project that is part of C4ISTAR development is the Advanced Individual Combat System (AICS). The aim of AICS is to enhance the core functions of maneuvering, finding, engaging and conducting Dismounted Close Combat. It addresses C4I, surveillance and target acquisition, and lethality and

mobility capabilities to enhance the tempo and precision of infantry operations across the spectrum of conflict.

AICS is a modular, integrated, and upgradeable fighting system which will equip the Land Forces dismounted and mounted soldiers with a range of technologically advanced features, each seamlessly interconnected into a single platform. The system will interconnect each section of soldiers into the digitized battlefield as a "weapons system" in their own right, each man-platform in this section contributing to the larger, Network Enabled Capability.