THE NATIONAL AIR COMMAND AND CONTROL SYSTEM (NACCS)

Colonel Professor Gheorghe BOARU, PhD

Introduction

Gaining air supremacy or a favourable air situation (either locally, temporarily or only on some directions) has become an important objective for military strategists. Under these circumstances, the control of the airspace of interest has become increasingly important.

Given the current vulnerabilities and threats, the Air Force will develop its combat actions in a more complex military operation space in accordance with a very short time for assessment, analysis and decision. The National Air Command and Control System (NACCS) must provide a reaction capability allowing for the synchronization of the air force actions in Romania's airspace, with the Alliance's air force operations, with the possibility of developing real-time defensive actions (i.e., surveillance, mission assignment, airspace control, etc) and ensuring surprise of the enemy by rapidly counteracting with national and NATO collective forces.

The most efficient way to ensure the unity of effort in Romania's air defence and security is achieved by the centralized control of all specific operations by one commander who exercises his authority in a well-defined and delimited framework existent even in peacetime.

The modernization and integration of the National Air Command and Control System represents a process of adaptation, especially in order to achieve appropriate flexibility of the collective defense, to meet the NATO extended air defense and crisis management needs. In this context, the Air, Land and Naval Forces integration into the National Air Command and Control System represents a viable and long-term solution.

Achieving the national air command and control system

Achieving the national air command and control system is requested by the existence of several air defense specialized means owned by all three services, led unitarily at national, regional or sectorial level in order to increase efficiency and decrease the mutual engagement risks (e.g. avoiding fratricide) during an action in common areas.

Meeting the basic requirements to achieve the forces' action integration with the specific mission of the air defense provides the air defense system with the following characteristics: organizational and structural modularity, mobility, flexibility, action complementarity, timely reaction and sustenance.

Due to the airspace characteristics (i.e., three-dimensional, with no natural lateral delimitations), in disposition of forces and means they focus, besides the air defense stratification (i.e., counteracting and destroying the air attack means in all height variety), on the necessity to ensure a target engagement area deeply echeloned on the near access routes to the air-defended objectives.

The synchronization of the air defense efforts within Romania's Air Defense System must be done by all the HQs of the services.

1. **Romania's air defence integration into NATO – NATINADS (NATO Integrated Air Defence System)**

In the current international security environment, NATO has defined and validated the concept regarding the achievement of NATO Integrated Defence System – NATINADS – which encompasses the principles and concepts to accomplish the Alliance's collective air defence mission and ensures the capabilities destined to crisis and conflict management situations.

The increase of NATO's role and missions to maintain peace and solve conflicts determines a process of adapting NATINADS, within the collective defence, to meet the extended air defence needs and increase the contribution to crisis management. In this context, the Romanian airspace integration into that of the Alliance must be accomplished by observing the Alliance's guiding principles and concepts in order to fulfill the collective air defence mission. Romania's Air Defence System must contribute to our country's military security, to the Alliance's collective defence and ensure crisis management capabilities.

3. The use of integrated command and control systems for the airspace surveillance and control

Romania's airspace radar surveillance system represents the main source of information for the national and the Alliance's air defence system in this area. The true integration into NATO air defence system – NATINADS imposed the analysis of the current airspace radar surveillance national system and its adaptation in accordance with this demand.

The airspace surveillance general purpose is to prevent an air aggression and ensure Romania's sovereignty in its own airspace, and also to send the necessary information for the early warning in Romania's and NATO integrated air defence system (NATINADS).

The space and information development of the airspace surveillance actions requires the organization and operation of all specialized forces in one system providing new valences to its actional dimension.

Actionwise, the airspace surveillance covers most part of the information and electromagnetic components of the operation's vertical dimension. The rapid increase of the importance of these components, especially for air operations, is a major characteristic of the future new types of conflict.

Spacewise, the airspace surveillance actions cover the whole operation area, both nationally and abroad in accordance with the equipment possibilities. Carrying aut successful air defence operations requires intelligence about the enemy air actions prior to its entering the defended areas; moreover, for successful air strikes in the enemy space, awareness of the air situation on the air route and in the areas with the targeted objects is necessary.

Timewise, the airspace surveillance importance is given by the character of permanence of these actions, of different intensity in peacetime and with increased length during operations.

In conclusion, all operations are preceded by, and include, the airspace surveillance, irrespective of the armed conflict character and duration.

The use of the airspace must be optimized and the risk regarding losing own air means can be reduced by restricting the aircraft freedom of action. All the airspace users must know the measures and means to ensure the reduction to the minimum of risks regarding counteracting own air means by increasing to the maximum their freedom of action. These measures and means are called *airspace control.*

4. Implementation of National Air Command and Control System – NACCS. Compatibility and interoperability with the future NATO air command and control system – ACCS

In peacetime, crisis or wartime, the Air Force must participate in the integrated air defence operations under NATINADS command in order to maintain control over the national airspace as an integral part of NATO airspace and to expand it to the military strategic space. In addition, it must ensure the preparation and deployment in theatre of the air forces "under NATO command" and participate in fulfilling national responsibilities regarding own forces' logistical generation and sustenance and also defending Romania's territory, population and forces. Consequently, the National Air Command and Control System must be in total accordance with the Air Force's role and missions, both nationally and within NATO.

As part of Romania's Army Command and Control System, NACCS provides the command and control capabilities specific to airspace actions in order to accomplish the collective defence objectives within NATO, the national security and to solve airspace crisis. NACCS represents a combination of organizational structures, specialized personnel, specific procedures and equipment destined for th planning, conducting, controlling and coordinating military air actions.

In order to ensure the unity of forces specialized in carrying aut airspace military operations, NACCS must allow for the integration of Land and Naval Forces air surveillance and defence elements and means.

The NACCS development is based on the following operational requirements:
- real-time reaction ability to reject an air aggression;
- response for offensive and support needs;
- interoperability with other command systems;
- processing a large amount of dynamic information;
- data electronic and simultaneous distribution;
- computer assistance in the decision-making process

NACCS has the following functions:
- surveillance and reconnaissance (S&R) which will ensure the ability to produce and send the unique air picture known to users, sensor management, sensor data processing and display, data exchange with other systems of the services;
- airspace management through the airspace control and planning capability;

- air traffic control, which provides services of air intelligence, directing, coming and going from the airfield, emergency and warning, search and rescue services; it should also include the coordination and control capability of military and civilian flights;
- air force management through the ability to plan, distribute missions and coordinate forces and resources at operational and tactical level;
- offensive, defensive and support air mission control, at tactical level;
- command and control resource management, providing the ability to plan, use, deploy and control air command and control resources.

The National Air Command and Control System encompasses the following elements:
- the Air Operations Centre corroborated with Basic Control and Reporting Centre (CRCBz) under NATO command, destined for the airspace surveillance, performing recognized air picture and weapon control;
- the Reserve Control and Reporting Centre – destined to take over, in real time, the air surveillance and weapon control functions and, in time, all of BCRC functions;
- Air base operations centres;
- Surface-to-air missile operations centres and surface-to-air missile battalion command points which ensure the decentralized execution to counteract air targets with surface-to-air missiles;
- Electronic warfare operations centre which ensures the decentralized execution for electronic protection.

The airspace surveillance is automatized by processing the data provided by the Air Forces digital radars. The connection diagram of these radars will be direct at Sensor Fusion Posts and independent ones. The Recognized Air Picture is materialized into the airspace integrated display and produced in CRC. The operational requirements regarding air surveillance, defined for the initial Air Sovereignty Operations Center, are valid for NACCS as well. These corroborate with the following operational requirements:
- the recognized air picture (RAP) is achieved independently at CRCBz and CRCRz and is based on the following data:
  - military and civilian digital radars, directly connected to CRCBz and CRCRz;
  - identification friend or foe systems (IFF), NATO and national secures modules;
  - flight plans;

- other sources including information sent by analogue digitized radars or fed in by operators;
- long-range three dimensional radars (FPS-117) and short- and medium-range three dimensional radars (GAP FILLER), directly connected to PFS/CRC Bz and PFS/CRC Rz;

- the recognized air picture (RAP) is formed of plot data sources provided by FPS-117 and GAP FILLER radars with digital format;

- the RAP multitracking characteristic permits to follow the plots/trajectories and eliminate the parallel plots/trajectories; also, the following actions are possible:

- PFS minimum capacity: 48 plot sources/trajectories;
- integration of data from early warning aircraft;
- ensuring the plots/trajectories reception and identification at PFS/CRC Bz and PFS/CRC Rz levels.

NACCS permits RAP distribution at the PFS/CRC Bz PFS/CRC Rz level. RAP distribution is done integrally or filtered by other users and NACCS components.

NACCS ensures the airspace and actions operational command and control except the civilian air traffic control. The system supports wartime, crisis and peacetime operations. This system also supports the air operations activities in view of real-time control of air defence missions starting with setting the objectives for air operations and the real-time control of the executed missions and assessment of mission results.

The NACCS structure includes a CRC Bz located in the Air Operations Center in Balotesti under NATO command and one CRC Rz, under national command located within 71 Air Operations Center in Campia Turzii. In peacetime, CRC Bz produces the Recognized Air Picture (RAP). RAP is also distributed to Larissa Combined Air Operations Centre to the two neighboring CRC (Hungary and Bulgaria) through Link 1 and also to all the NACCS components (i.e., air bases, jamming centre, missile brigade command point and the surface-to-air missile battalion command points). CRC Bz also ensures a Link 11 with an early warning aircraft in order to improve the ability to discover and warn about the air actions, especially at low and very low range. A filtered air picture (FAP) is then sent to the Romanian nodes through the Romanian Wide Area Network. FAP represents RAP generated by CRC Bz filtered in accordance with its content and geographical area.

RAP includes data from the following sources:
- FPS-117 radars;
- GAP FILLER radars;

- low range radio locators for landing;
- civilian air surveillance radars;
- civilian and military data regarding the flight plans obtained through FDEx system;
- data from two neighboring NATO ASOC transferred through Link 1;
- data from a AEW NATO transferred through Link 11.

The national nodes with the ability to receive FAP through WAN include the following:

- Wing Operations Centre (WOC);
- Surface-to-air missile operations centres;
- Surface-to-air missile fight units (SAMFU);
- Electronic warfare operations centers (EWOC)

When CRC Bz is not available, CRC Rz will generate the local air picture (LAP) for all the Romanian nodes connected to WAN. In peacetime, CRC Rz will be a reserve training facility, ready to generate LAP. The transfer from CRC Bz to CRC Rz will be done manually.

The NACCS acquisition necessitated an integrated approach, on all the component subsystems: information, communication, infrastructure and security:

1. The Communications and Information subsystem is a component of the integrated command and control; it processes and displays data, ensures support by providing connections between C2 centres and also between them and the execution points. The software program gathers all the resources and data into a unique integrated system.

The services provided by the communications and information system are network services (RTP/RMNC) and also user services, and they are operational, administrative and information ones.

The information flow is ensured both vertically – in the command and control hierarchic structure, and horizontally – within the cooperation relations – throughout the Air Force organizational structure. All the command hierarchic levels are able to immediately extract all the information they need.

The communications and information system (CIS) for the National Command and Control System (NCCS) is structured as follows:

A. Communications and information network COM-NCCS
B. Data processing services (information applications)
C. Voice Communication Switching VCSS COM-NCSS together with VCSS-NCSS and the command and control information systems represent the command and control integrated system (CIS-NCSS) for the air forces command and control.

The communications and information infrastructure is based on:
a) achieving the system technical project
b) achieving, based on the system technical project approved by the neficiary, of the installation, testing, running and maintenance works;
c) training the SMFA technical staff in exploiting and maintaining the equipment.

For the specific communications and information network, there are certain demands:
- reliability, viability and operability;
- easy links and communication between the sources and information users;
- the parallel and simultaneous use of two different sending environments;
- redundancy at the level of equipment in the essential nodes;
- allocating and/or rapid resource configuration policies;
- high maintenance;
- compatibility with NATO telecommunications systems;
- integrated network management

Communication technologies used for COM-NSSC implementation:
- TDM (Time Division Multiplex);
- TDMoIP (Time Division Multiplex over IP);
- VoIP (Voice over IP);
- ISDN (Integrated Services Digital Network);
- ATM (Asynchronous Transfer Mode)

The network access system is organized in modules ensuring the following three basic functions:
1. Interfaces between users, network and transport services levels;
2. Network services;
3. Interface and network services management.

The HF radio networks organized with HARRIS stations are destined to initiate and develop a command network for operational needs, used as backup for RTP/RMNC network.

The long-range communications tactical subnetwork is a subsystem of RTP/RMNC as follows: BALOTESTI, OTOPENI, FETESTI, BOBOC, BACAU, CAMPIA TURZII and CHITILA. Access of terminal connections of the FPS, GAP FILLER sensor-location and Air Police radio-locations type is done by the access nodes.

The technical communications and information support ensures the achievement of NCCS functions through the following defined applications:

- applications generating radar data, processing, producing and distributing the recognized air picture – RAP including the compatibility with the NATO system – AEW (Airborne Early Warning);
- applications ensuring vocal communications for air directions;
- applications ensuring equipment management;
- applications ensuring the civilian-military flights planning;
- SAM command and control applications

2. The infrastructure and security subsystem has the following basic elements:
- MAOC-ASOC (Main Air Operation Centre) with NATO CONFIDENTIAL level of classification;
- Remote ODC, with NATO CONFIDENTIAL NAOC-ASOC (National Operation Centre) level of classification;
- SAMFU-IU, without a level of classification yet (it will be accredited with NATO CONFIDENTIAL level);
- 3D, 2D radars with CLASSIFIED level of classification;
- FDEx (Flight Data Exchange) with CLASSIFIED level of classification (is not part of NCCS).

In its final configuration, NCCS must ensure:
- the integration of data provided by digital, military and civilian radars and data from other sensors, locally, nationally and collectively (Alliance);
- production of the nationally recognized air picture (RAP) and also its distribution, in a differentiated and filtered way to authorized users;
- digital radar command and control;
- assessment of air threats, by establishing and sending warning and alarming levels;
- tactical control of defensive, offensive and support missions;
- centralized command and decentralized execution depending on the air operation complexity, but also decentralized leadership in certain situations.

NCCS represents the extension of the current programs and the implementation of the NATO system in order to plan and conduct air operations ICC (Integrated Command and Control) and NAMIS (NATO Automated Meteorological Information System); it must also ensure the computer assistance / automation of the military air operations by integrating command, control, communications, computers, information and interoperability, surveillance and reconnaissance. Moreover, it must ensure data and information exchange, quickly and securely, and be interoperable with the current NATINADS and the future ACCS (Air Command and Control System), currently developed by NATO. It must be adaptable and open enough to support evolutional operational concepts

depending on the transformation of the Alliance's and Romania's military structures or on the changes in the operational environment.

By using NATO ICC software program, NCCS will coordinate the airspace use with the civilian aviation and the creation of special air routes necessary to support the defensive and offensive actions and also to coordinate the airspace use with other military actions (Land Forces air defence and artillery fire in the firing ranges).

5. NATO Air Command and Control Integrated System (ACCS)

In the early 90s, NATINADS was characterized by a large diversity of technical platforms used in the command and control centres. The systems developed or acquired by each NATO member state through own funding were at different technological levels, with different capabilities and could not ensure the required interoperability at the Alliance's level.

It was then decided to achieve of a unique integrated system operating on a unique hardware and software platform to be later developed based on a unitary concept.

Thus, the ACCS (Air Command and Control System) Program emerged, representing one of the Alliance's major projects.

From the operational point of view, ACCS will ensure the integration of the command and control static and deployable elements of NATO European states, combining the planning and execution functions of the offensive and defensive air operations. At the same time, ACCS is a key element for the implementation of the new generations of NATO command, control and communications equipment and also for the inclusion of anti-ballistic missiles capabilities.

ACCS will exchange data with the air defense capabilities, air traffic control systems, manned or unmanned aircraft, military navy ships, space systems and other systems. The basic missions of the system are: air traffic control, air surveillance, air mission control, airspace management, force management and C2 resources management. Nowadays studies are under way on the equipping of mobile command and control centres with the same capabilities as the fixed ones.

The ACCS system is designed to automatically solve the following functions of the air command and control:

- force management FM – the activity to plan, execute and conduct the actions of manned or unmanned aircraft and the surface-to-air weapons;
- air mission control AMC – monitoring the missions in progress, directing the fighters and allocating air targets to subordinated units;

- airspace management ASM – developing and maintaining the airspace structure. In wartime, the importance of airspace management increases through the maximum use of space at the same time with diminishing to the minimum fratricide risk;
- air traffic control ATC – coordination with mission control, radar control area, the refuel-leave service, coordination of the civilian/military traffic, alarming the Search and Rescue (S&R) Service;
- surveillance – RAP management – producing and distributing, receiving and distributing the land and naval forces and submarine trajectories;
- command and control resource management (C2RM) – management of sensors, ACCS modules and air operation communications, includes allocation, development, configuration, execution and monitoring.

In April 2004, when Romania joined NATO, the ACCS program was in full progress.

The system's operational requirements and architecture had already been defined and were in the phase of approval by the Alliance.

Romania interceded at different levels of representation in order to be included on the replication list and the Steering Committee's recent decisions have created the premises to reconsider the current system configuration. These efforts must continue with a real political and military offensive within the Alliance, at all levels of representation, in order for Romania to be included as an ARS entity in the ACCS program.

6. Achieving compatibility and interoperability between NACCS and ACCS

The Air Force analysis for 2015 must take into consideration the context in which both systems, the national and NATO one, will be operational in Romania.

As a NATO member state and an integral part of NATINADS, Romania must meet the Alliance's airspace collective defence requirements. This is an implicit commitment assumed once we joined NATO and will remain an obligation for our country whether or not it will be included on the list of ACCS entities. At the same time, Romania's geostrategic status, at the eastern border of the Alliance, its operational potential and important investments in upgrading and purchasing new sensors and command and control equipment entitle our country to be in ACCS architecture with an ARS element. Once demonstrated the importance of the two systems for Romania, we must take into account the requirements of their simultaneous operation, as follows:
- complementarity, by avoiding overlapping and useless resources;

- compatibility, by ensuring interoperability and "communication" ability between the two systems.

The first requirement has been fulfilled ever since NCCS architecture was designed; it took into consideration the ACCS configuration and its functions.

The second requirement, interoperability, must be assessed through technical, training and procedural compatibilities.

The technical compatibility is ensured by meeting these requirements:

- NACCS development in accordance with NATO standards - the ACCS development is also based on these NATO standards;
- ensuring, through ICC equipment provided by NATO specialized agency, the air operation planning in NACCS;
- connection of the national sensors both to CRC Bz and then to ARS in order to support NATO requirements and the CRC Bz national ones.

Thus, through the functions offered by finalizing NACCS, Romania will have an operational system which will meet all the ACCS requirements.

The future compatibility will be ensured by adopting a personnel training system and assessment standards similar to those of the Alliance's.

The procedural compatibility will be ensured by implementing NATO standard procedures and harmonizing the national regulations with the Alliance's ones.

7. Implications of NACCS implementation on the transformation and modernization process of Romania's air security system

In its efforts to strengthen the capabilities to respond to new threats, Romania, as a NATO member, a US ally and an EU member, will have to reshape its air forces allowing participation in the new types of peacetime, crisis and wartime operations and response to the future regional and global challenges.

Romania's integrated air defence concept pffers solutions to Romania's effective air defence through a new and unitary conceptual approach focusing on organizational and structural measures to achieve modular and complementary entities of forces specialized in airspace actions, from all the services integrated into the National Air Command and Control System (NACCS).

The National Air Command and Control System (NACCS) must include subsystems of air surveillance, identification and air control connected to all the weapon systems in order to benefit real, timely and identified data regarding the air situation dynamics. Such a National Air Command and Control System permits setting and observing the weapon system rules of engagement to avoid fratricide.

We consider that in the NATO collective security dynamics, Romania's integrated air defence concept offers solutions, opportunities, responsibilities and actions to integrate Romania's air defence within NATO Integrated Air Defence System which, in the new geostrategic context, has an extended definition, both conceptually and organizationally.

Starting from the two dimensions of Romania's air defence integration, it is necessary to improve the force use through timely and nationally coordinated actions; this could also give the incentives for solving the issue of Romania's air defence integration in NATINADS.

Given the air security as part of the national security, the future evolution of the regional and global security environment, the air forces' important role on the modern battlefield and also Romania's Military and the Air Force transformation and modernization process, it is necessary to improve the air security system (NACCS) and to reassess the objectives, strategies, concepts, plans and programs in order to adapt them to the new realities of the 21st century.