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SOME ASPECTS REGARDING THE ARHITECTURE AND BASIC REQUESTS FOR AN AIR DEFENCE BATTALION COMMAND POST

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Abstract: *The operational heart of an air defence battalion, or for a Ground Based Air Defence (GBAD) system, is represented by the Command Post (CP) structure. In order to assure the surveillance function, a CP must integrate and control also a sensor subsystem. The paper presents some relevant aspects regarding the architecture and the main characteristics of such command and control structure.*

Keywords: *air defence, Battalion Command Post (BCP), command and control, GBAD, SHORAD, weapon system.*

1. INTRODUCTION

An mobile Air Defence Battalion is equipped with a self-propelled system–of–systems, comprised of: a Battalion Command Post, a few (4÷6) Battery Command Posts and the Weapon subsystem (guns and missiles) with/without dedicated sensors.

The Battalion Command Post (BCP) is the command and control (C2) structure of an air defence battalion and integrates weapons (with/without dedicated sensors) and sensors.

The BCP site consists of a Radar, a Command and Control Shelter and a Vehicle. The BCP control a number of BtCP's (Battery Command Posts) which are connected in a Battalion radio net. The BtCP site consists of a Command and Control Shelter and a Vehicle.

State-of-the-art military advanced sensors have unprecedented requirements regarding the vast amount of environmental data to be measured and processed. Therefore, a basic functional element which must be assured at the level of a *Ground Based Air Defence* (GBAD) system is the *surveillance*, which consists of two main aspects:

- air picture production;
- asset management.

A BCP can control multiple sensors; it will provide air space data exchange with Higher Echelon Unit (HEU) through Tactical Data Links (TDLs). Also, a BCP interfaces with subordinate and/or adjacent Air Defence units. It will have the capability to combine RAP (Recognized Air Picture) and LAP (Local Air Picture) in a Single Integrated Air Picture (SIAP).

All relevant information from the RAP will be filtered at the battalion level and forwarded to the battery level as required, similarly all GBAD information unique to the LAP should be extracted at the battalion level and made available for use by other systems (e.g. for subsequent incorporation into the

RAP). A generic Command and Control architecture is shown in the diagram below (***Figure 1***).

The BtCP controls a number of WTs (weapon terminals) which are connected in Radio net. The WT receives commands and target information from the Battery radio net and integrates the weapons and sensors on the weapon platforms.

The system described in the diagram performs the following functions:

- Command and Control Posts (CN1) above the netted Battalion Fire Units should serve to support the Battalion by: improving the tactical battlefield situational awareness, improving the information basis for engagement decisions, improving the engagement scheduling through coordination, optimizing friend protection, optimizing the general use of sensor and weapon resources;

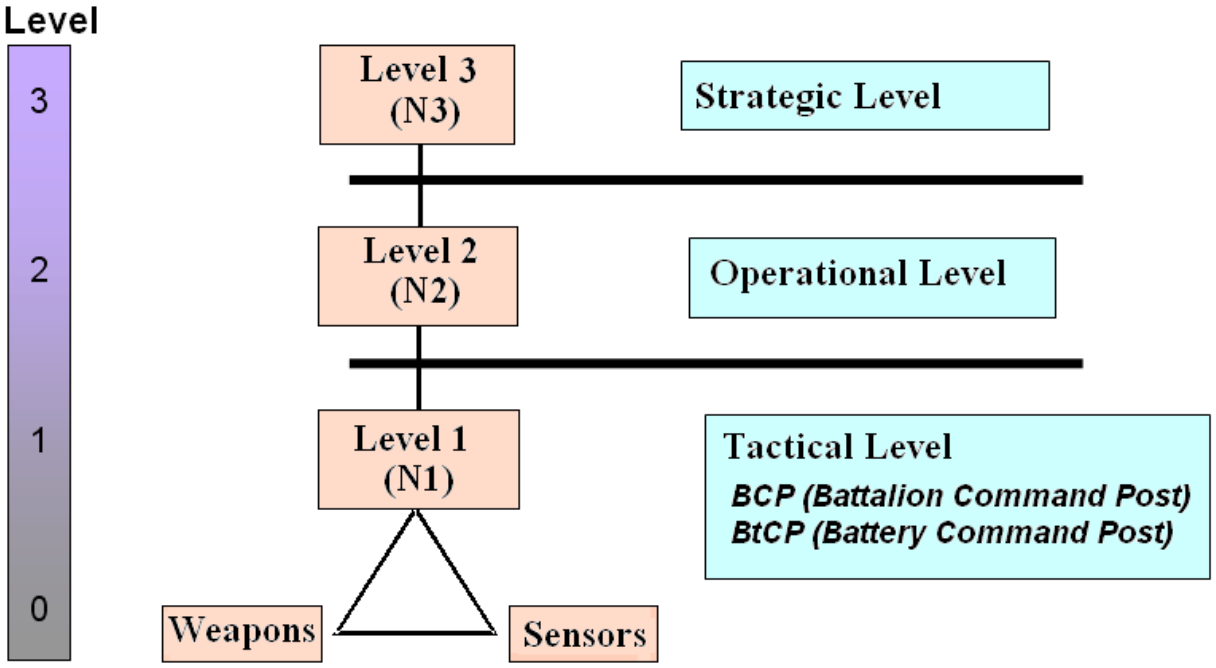

Figure 1: -A generic weapon system C2 arhitecture

- At the same time these CNs should continue too have the capability to manually intervene or directly control the Battalion engagements;
- The main CN functions are:

- establish a Local Air Picture (LAP) including ID and classification (All-sensor integration);
- transform received orders and information into a form directly useful for the Battalion Fire Units;
- generate formatted information showing own and enemy capacities and limitations;
- perform high level engage ability assessments for all subordinate weapon systems and allocate weapon systems to targets (engagement coordination).

The main tasks which are performed by a Battalion Command Post (BCP) are: data link management, sensor control, air picture production, track identification and classification, friendly protection, threat ordering, weapon system allocation.

2. AIR PICTURE PRODUCTION AND MANAGEMENT. REAL TIME AWARENESS PICTURE

The LAP (Local Air Picture) is generated on the base of information which is extracted from dedicated sensor, such as: radar and/or EO (Electro Optical sensor). The BtCP (Battery Command Post) collects a Local Air Picture based on input from Radars (or/and EO) on the weapons.

In the same time, BCP receive RAP from Higher Echelon Unit (HEU) through Tactical Data Links (TDLs).

Air Picture Management is a basic function in the Command Post and makes shared awareness throughout the GBAD force possible.

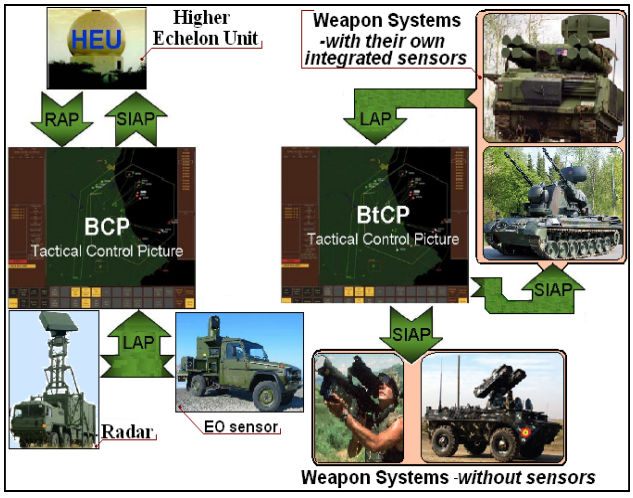

Figure 2: -Single Integrated Air Picture (SIAP) based on multiple correlated inputs

The air picture management subsidiary functions are: Track Correlation, Identification handling, Friendly Protection and Airspace Control Orders visualization. The geographical area which is in full colour displays lots of information such as: target data, Airspace Control Order, position of Defended Assets, position of Air Defence systems.

The quantity and quality of the information which represents the aerial situation is strongly influenced by the main characteristics of the sensors.

Thus, image quality which reveals the airborne threats depends on the following sensor characteristics: range and elevation coverage, accuracy (in azimuth, in range and elevation), data renewal rate, resolution, detection capability against future threats (UAVs, stealthy targets, cruise missiles), radar track capacity, the signal processing, dedicated to reject the noise and, to eliminate the effect of ECM measures.

A Battalion Command Post will have the capability to combine the RAP and LAP.

2.1. The Cueing Systems

An innovative system, named Cueing Systems (CS), has the role to improve the capabilities and mission profiles of the weapon systems. This system (CS), which is supposed to close the capability gap of connecting weapon teams to a real time situational awareness picture, comprises a Cueing Device, the Communication/ Cueing Processor Unit (CCPU) and a Weapon Terminal (WT).

The computer is configured to display and handle real time surveillance data as well as airspace control means. Within the Weapon Terminal all required orders and commands like fire control and target data can be transmitted. Pursuant to the reports and information about status and position of weapon teams, the Weapon Terminal (WT) provides cueing information to the gunner.
This information is displayed by the Cueing Device that visually guides the gunner to cue the weapon system to the assigned target.

Therefore, the basic function of the WT is to assure the *engagement management*, which consists of three phases: *target designation and search* (WT displays in real time the target designation data from BtCP), *target identification*, and *firing and kill assessment* (Weapon Terminal informs the operator when the target is inside the firing range).

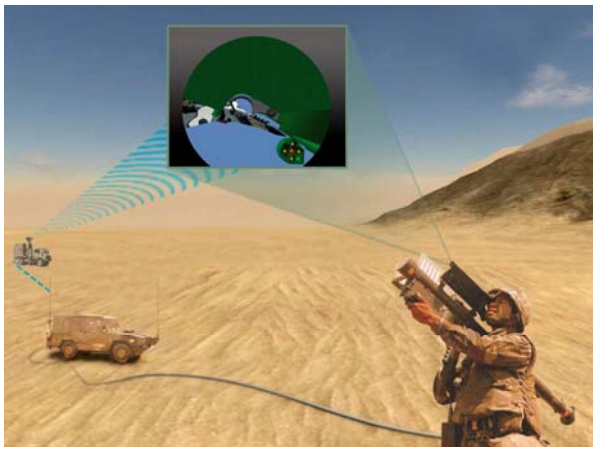

Figure 3: -A "MANPAD" cueing system example

3. A BCP TYPICAL ARHITECTURE. BASIC REQUESTS

The BCP site consists of a sensor subsystem, a command and control shelter and a vehicle.

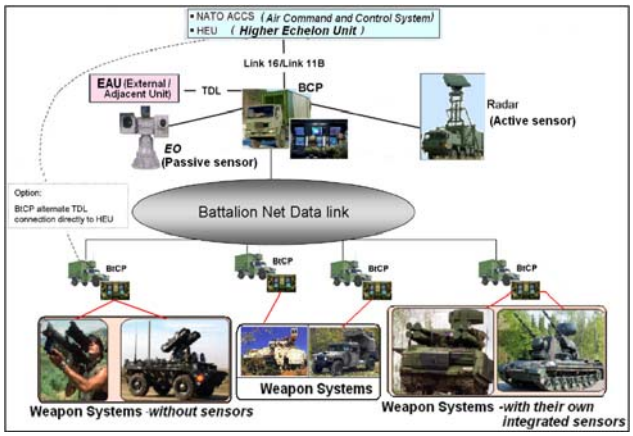

Fig.4 - A typical configuration for an air defence battalion

The BCP controls a number of Battery Command Posts (BtCP's) which are connected in a Battalion radio net. A Battery Command Post, whose site consists of a command and control shelter and a vehicle, controls a number of weapon terminals (WTs) which are connected in Radio net.

Therefore, the Battalion Command Posts represent the command and control (C2) structure of that battalion.

This structure integrates weapons (with/without dedicated sensors) and the sensor subsystem.

The basic requests for a Battalion Command Post are the following:

- BCP comprises 3 main subsystems: the BMC4I (Command and Control) subsystem, the sensor subsystem and the vehicle subsystem;
- the system has an open physical, functional and data architecture;
- is able to command and control more than 4 BtCPs;
- the Command and Control structure provides the following functions: system and network management, LAP generation, Threat Evaluation and Weapon Assignment (the TEWA function), Force planning and operations:
- the sensor subsystem (SS) includes active and passive sensor, which can acquire the following air threats: fixed and rotary wing air vehicles (aircrafts and helicopters), UAVs, missiles, Large caliber rockets, artillery and mortar ammunition;
- The sensor subsystem is capable of operate in a countermeasure environment (ECM/IRCM) without significant reduction in effectiveness;
- The vehicle subsystem assure IED (improvised explosive devices) protection and has fording capability;
- All subsystems are integrated and interoperable with NATO ACCS and C4I systems.

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