# THE USE OF UAV'S DURING ACTIONS OF INTEGRATED AIR DEFENSE SYSTEMS

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***Abstract:*** *The missions that Unmanned Aerial Systems can run represent the main goal for which they were designed, if in case the missile's mission is clear, meaning that their missions are outlined, when we speak of unmanned aircraft, the range of missions in which they are involved is wide, being extremely flexible regarding their use. There are a multitude of aircraft destinations they can run both in peacetime and crisis or war times. Areas of their use are diverse, and there are concerns for the development of unmanned aerial vehicles and for their integration into the airspace.*
***Keywords:*** *Integrated Air Defence system; support making ; tactical mobility*

## 1. INTRODUCTION

Considering that the UAV systems cover a very wide range of missions with high efficiency, we have found that they can bring visible improvements in the Surface Based Air Defense (SBAD) missions.

On the base of the sensors or weights that can be incorporated or transported by the aerial platform, next to the ground station, I found a solve to some problems (confinements) related to the artillery and ground-air missiles' missions.

Surface- to -Air Missiles next to the defense systems create the nucleus of the air defense with the base on the ground. SBAD plays a decisive role that is in a continued growth due to the threatens that covers, as: TBM (Tactical Ballistic Missile), battle

The advantages that SBAD structures have in this moment are the following:

- TBM engaging;
- the ability to engage two or more targets at the same time;
- the ability to engage aerial targets, that fly currently with very high speed and at different altitudes;
- quick reaction time;
- the ability to engage aerial targets in all weather conditions, both day time and night one;
- low vulnerability.

The creation of combined cannon-missile structures is determined by the fact that, under the aspect of destruction possibility, there is a complementarity report, because the cannons are effective at very short ranges (0-1000m), and the missiles above 1000m. Combining two systems, one of them SHORAD type and another VSHORAD type, in an integrated entity under tactical and operational aspect, represent one of the noticeable trends that characterize the evolve of these defense systems. The components are actionably and functional integrated through a fire guidance center (FDC), in a shooting entity that disposes of connection capabilities with command-aerial control systems [10].

## 2. UAS SUPPORT MAKING FOR AIR DEFENCE INTEGRATED SYSTEMS

All the same the usage of Air Defense systems that can be used for covering the *empty spaces* from the staffing zone of ground-air missile systems with a medium or long range is imposed.

These empty spaces exist due to the fact that there are distances between 200-1000m where the missile can't operate, due to the necessary time to get in the supervision stage.

The effective action ray of the systems is about 4-5 km, and approximate 10-15 km for short range Air Defense systems, presented in [3].

Aerial defense with CLUSTER surface base, means the usage of more types of missiles/ artillery systems with a different action range, so that the destruction areas overlap for creating a simultaneous disproof of the uncovered targets on different directions and in the same time, for the reciprocal assistance of them, presented in [3]

The disposal of the dislocation areas of Air Defense systems within CLUSTER may be circular (balance defense) ore one of the waiting direction of the threaten (weight defense) [2].

The performances of the percussion with or without a pilot (airplanes, helicopters, voyage

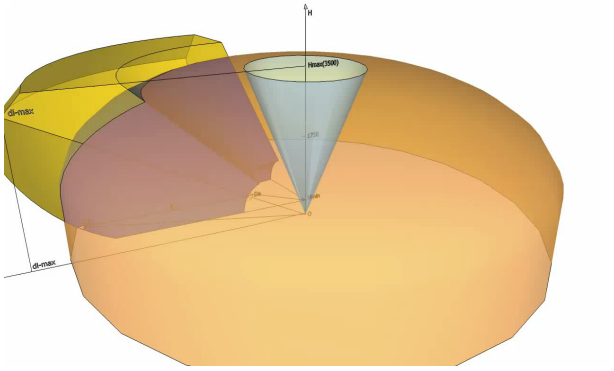

Fig. 1 Action areas of integrated systems used in the CLUSTER configuration 3D

For this, I propose creating a conceit related to the architecture of a multiagent systems which is compounded by an integrated ground-air missile system, SHORAD-VSHORAD, with a mixt cannon-missile group, beside a UAV system able to defense an aerial object.

So, a commander is placed in the highest point of the hierarchy.

The architecture is generically and flexible to facilitate the fusion between different types of technologies.

In the network, the autonomous UAVs can be centralized controlled; this thing needs each UAV to communicate all the data's from sensors and receives control signals.

This structure offers an environment in which the agents coordinate themselves, cooperate and negotiate in order to take the needed measures and right decisions in order to achieve the objectives.

With a view to the coordinated control between aerial vehicles, each person from the team is considered an agent with particular capacities involved in the execution of a part of the mission.

The UAS has the ability of correcting the artillery fire, not only by the simple view of the projectile orbit, by the appliance of the corrections remembered above, in case in which the intended effect of destruction of the target is not created. In this way it is obtained a high efficacy, a high destruction probability with reduced ammo consumption in a short period of time.

The spectators monitories the battlefield from a distance and with an aerial perspective that allows the ground station to see $360^0$ around the target and to deliver the data's at users in real time.

In case a shooting session is executed simultaneous with more cannons, an UAV is capable of engaging more targets in the same time and offers split information for each cannon. In the planning of the mission, we have to consider the following requests:

- the existence of a qualified
- spectator - FO (Forward Observer) available to execute the mission, to monitories the video space and deliver the information to the Fire Sharing Center (FSC), to determinate the disproof method, and after this at the battle subunits

- GCS (Ground Control Station) is located in the tactical center of operations in order to simplify the commands and the control, to ensure the engagement of more targets in the same time
- to assure the video take-overs from a longer distance and maintain the communications with the GCS
- to exist communications with the battle subunits

The targets are video monitored, and when fire is executed over them, in the moment of the impact image captures are realized in order to appreciate the shooting and the adjustments execution.

The locating of the target is realized with the help of Cartesian coordinates.

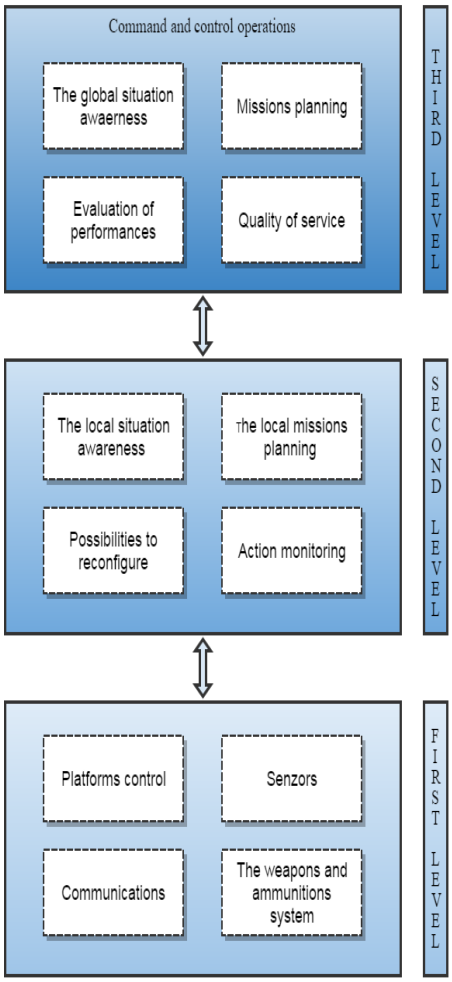


Fig. 2 Hierarchical Architecture of a multiagent system

The UAS (Unmanned Aerial System) order of actions to support the artillery firing is presented in figure 3.

Using the UAV in artillery support, that explores and carefully oversee the allocated space and transmits the information in real time or almost real, the subunit can place the cannons in hidden places, behind some obstacles, ground unevenness, they can guide them for a reduced visibility of the enemy, so he doesn't know where to attack, but where he is attacked from either.

All the operations are centralized in FDC, which could be also in a hidden location.

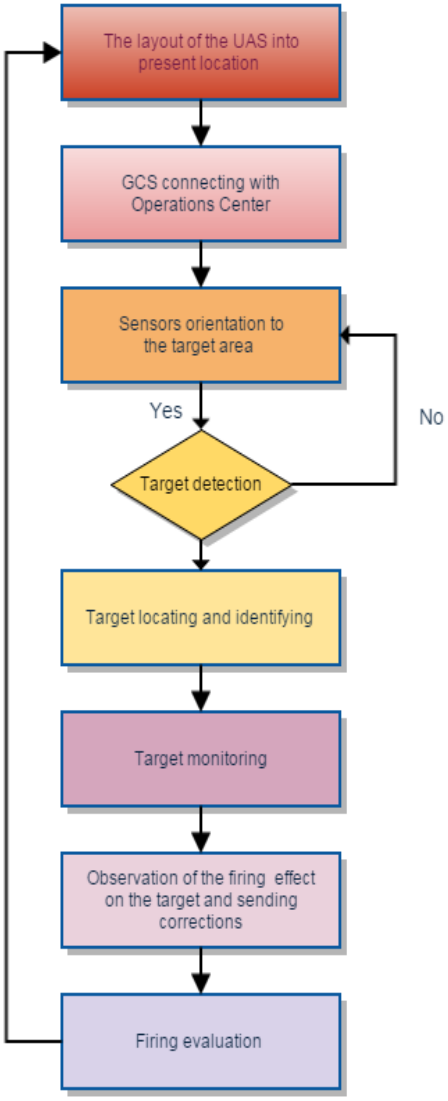


Fig. 3. Chronological order of actions

With the help of the UAV sensors, the commander can see the whole situation behind the obstacles because the aerial vehicle has the appellation of "commander eyes" because it is located above the area, being in the same time located very hard.

In FDC all the operations take place and from here are given all the orders.

An UAV equipped with a lot of sensors can accomplish a few missions of the reconnaissance group, in a long or shorter time, with lower resources consumption and with a limited number of personnel.

Taking into account that it has in its compound TV cameras during the day, and also during the night or infrared video cameras, photo cameras, exploring systems through and of radiolocation and auto control termichal systems it can offer the commander a whole series of features.

In such situations, the usage of the UAV is necessary because it can offer the commander a overview image of the examined terrain, but one actualized that can present in a detailed way the elements or the information needed to start the march.

This can offer information related to the road length, possible march itineraries, and also choose the most suitable route for displacement with capturing the interested areas (perimeters).

The captured images are processed on the ground, so the displacement itineraries are established considering them to have the following characteristics: short distance and maximum safety.

Missile systems have in their compound radars that they use in the purpose of detecting the targets, aerial overview and offering the data's about the aerial situation needed to the recognized air picture (Recognized Air Picture - RAP), but also for directing the missiles to the target.

These radars have a series of advantages that are implemented during the technological and scientific progress, but they also have some confinements related to the coverage of the whole threaten eidolon.

In case of a diversified relief (the presence of the mountains, of the hills and of the plateau) some rules are imposed in order to place the action formations.

The own explore radars, for data's achievement, for illumination have to be placed on the highest point in order to use their whole exploring capacity.

Aerial threatens of the aerial objects that should be under defense and of the means and missile systems forces are represented by the enemy's aerial means and the lethal/unlethal actions that they can use.

The most spreader aerial threatens, with improvement tendencies in the future are: airplanes of all types, helicopters, airships without a human pilot and missiles [5].

In this moment, the main threatens related to the radars from the missile systems compound are represented by helicopters and by UAV because they evolved at low heights and can't be seen on the radar because are hard to find and disprove because of their reduced dimensions and of their termichal and small radiolocation prints, characteristics that assure them great possibilities of detection.

These two types of threatens have the advantage that they can execute the wonder attack, choosing a flying direction on valleys, where the radar detection abilities are almost null.

The targets detected by the radar can be disproved by the missiles, but the others will succeed into accomplishing the mission.

This situation is illustrated in the figure 4.

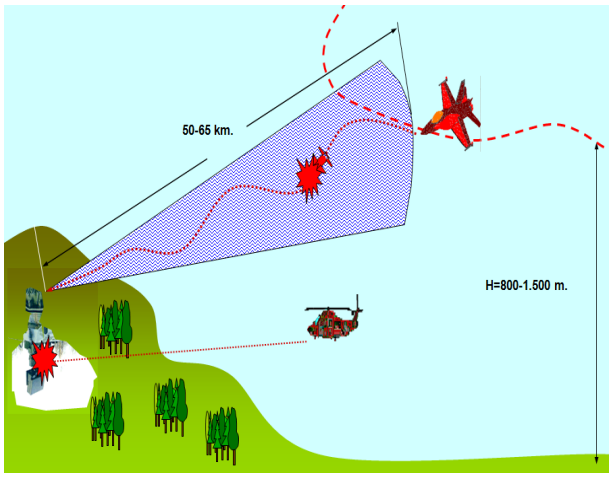


Fig. 4 The radar uncovered area

The radar maximum range (unambiguous) is given by pulse repetition period $T_R$; ambiguities arise over this distance.

The formula for calculating the maximum distance is :

$$D_{max} = \frac{c \cdot (T_R - \tau)}{2} \quad (1)$$

$$D_{max} \approx \frac{(T_R - \tau)\ [\mu s]}{6.66\ \mu s} \quad [km] \quad (2)$$

where:

$c$ is the speed of light $3 \cdot 10^8$ m/s ,

$\tau$ is the pulse duration of the survey.

If the pulse width is small compared with the repetition period, it can be ignored in the formula. It should however be considered if large radar pulse duration, pulse compression using the reception.

It follows that the pulse repetition period is a very important factor in determining the maximum range by the radar as targets whose time delays occur at distances exceeding the wrong $T_R$ indicator.

These targets are called echoes (second - sweep or second - time - around).

## CONCLUSIONS

In this study we have emphasized the continuous knowing of the aerial evolution by the omnidirectional view ($360^0$) it is imposed a short reaction time. Also, the tactical mobility is effective created by the help of an UAV.

One of the solutions related to a counteraction method of a wonder attack from some airships that evolve through the valleys, consist of placing an UAV in the area that has a high risk and where the helicopters and enemies can action against objects under defense.

Considering that the UAV delivers through GCS the information in real or almost real time, by detecting the targets located outside the action area of the radar, can warn about a wonder attack.

Having the information provided by the UAV sensors at hand, the launch ramps of the missiles are directed to the attack direction and are waiting for their disproof.

The authors take full responsibility for the contents and scientific correctness of the paper.

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