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DEVELOPMENT OF THE APPROACH TO THE ORGANIZATION OF AIR DEFENSE AGAINST DRONES ON THE BATTLEFIELD

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Abstract

The basic rules for organizing the defense of one's positions against attacks by enemy drones on and near the front line is described. Prospective directions for the organization of complex, hierarchical, and echeloned air defense against drones have been identified.

Keywords: attacking drone, hunter drone, air defense, organization, development.

Introduction

Drones have become a powerful platform for use as offensive weapons. They can be both reusable and disposable. Very inexpensive drones are capable of inflicting economic losses on the enemy in the rear, which are several orders of magnitude higher than their cost. This situation is on the battlefield. In addition to direct losses of military equipment, obtaining information about the enemy provides an indirect benefit. Also, the need for the enemy to carry out special measures for camouflage, movement in small groups (and for the technician even alone), and difficulty in concentrating forces and means for attacks leads to significant changes in the picture of the battle. The platforms used today to shoot down drones were developed, as a rule, to destroy expensive manned platforms (planes, helicopters), and therefore have a high cost.

The use of drones as an element of air defense is ideal. However, there are several specific problems that still need to be solved. These problems fall into two directions. The first is the development of a new approach to the organization of air defense (different for the rear, for the front line, and for the battlefield). The second is the development of new types of drones or the modification of existing ones that will be able to perform air defense tasks.

The purpose of the report is to develop the approach to the organization of air defense against and identify promising platforms for its implementation.

Methodology for the development of air defense against drones

The air defense system should be complex and hierarchically organized. It should consist of automated systems for drone identification, decision-making, and destruction of enemy drones.

Drone identification systems. They should be both ground and air, both stationary and mobile. They should be both autonomous/automatic and include a human (for example, for drone controlling, decision making, etc.). They should be based on different principles: radars, acoustic systems for recognizing the sound signatures of various drones, and optical identification systems in different spectrum ranges (both automatic and with the use of human operators). For this, it is optimal to use the universal mobile platforms (wheeled, tracked, flying) on which universal removable blocks for identification can be mounted.

At the same time, flying platforms are more promising, as they allow 1) to cover a wider area (and therefore a smaller number of them will be needed), 2) reduce the time for rebasing and spatial reformation of defense, 3) better identification of flying objects against the background of the ground objects, 4) the possibility of echeloning in height, 5) the possibility of using identification blocks that work on different physical principles, 6) the possibility of organizing air defense consisting of universal platforms of different sizes (which increases the air defense resistance against enemy aircraft and missiles).

Decision-making systems. They can be both stationary and on a moving platform. They can both include human operators and be automatic (for example, using Artificial Intelligence). They can be organized according to the example of coordinator drones described in [1], which allows one to use prepared sets of scenarios and carry out training with the use of computer simulation. When using flying platforms for retransmission (re-transmitters can be part of the complete set of centers), such centers can be in constant motion, which

increases their resistance to enemy attacks.

Systems for enemy drones destroying. They can be formed as both stationary and mobile platforms (moving on land, water surfaces, underwater, and in the air). These platforms can be both autonomous (drones) and manned. At the same time, people can be controlled both from the platform itself (plane, helicopter, pickup truck with a machine gun, etc.) and remotely (FPV, etc.).

An example of the organization of the air defense system at the front line

The task of air defense on the front line is to prevent the enemy from using drones for reconnaissance and destruction. The peculiarity is that hunter drones must be used, including over enemy territory. It is also an important fact that an effective air defense system must also include the destruction of the enemy's infrastructure, the task of which is the identification of drones and decision-making centers. The time factor is also important, because decisions on the battlefield must be made in a very short period of time.

Over its own territory, the air defense organization can use the technologies described in [2]. In addition, it will be necessary to actively use the camouflage of ground air defense facilities (decision-making points, landing pads for hunter drones and their ground bases, etc.). It is also necessary to take into account the need to counteract radio interference and the possibility of electronic failure.

The main method of enemy drones combating is to intercept them over enemy territory. Here, the identification methods of enemy drones, as well as the rapid delivery of small hunter drones over enemy territory for interception, are of critical importance.

Medium and large hunter drones can be used as carriers of small hunter drones, which will create local curtains in the paths of enemy drones. It is also promising to develop the delivery of cassettes over enemy territory with small hunter drones using rocket and jet platforms. Armored mobile wheeled and tracked platforms can also be used to deliver cassettes of hunter drones directly to the battlefield.

Discussion and conclusion

The design of the air defense organization on the front line described in the article makes it possible to develop an effective short-term program for forming an order for the modernization of existing drones and training personnel for their maintenance and use. The result can be used to determine strategic directions for ordering the development of a system of new types of drones, auxiliary platforms, and software products, which are necessary for the formation of air defense in future wars. The development of distributed hierarchical control for autonomous drone swarms [1] can determine the future development of air defense systems.

The use of drones for air defense on the front line requires an analysis of both the specifics of the battle area and the combat situation of one's own and the enemy, as well as the currently available drones and their maintenance and use systems. This circumstance requires the development of new computer systems to analyze the situation, assist in choosing the optimal solution, and train at the level of artificial intelligence systems to assist human commanders. The emergence of hierarchically organized autonomous swarms of drones [1] for both attack and defense can bring the organization of the battle to a new level and significantly increase its effectiveness.

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