

**REMINDER**  
**to protect and counter enemy**  
**UAVs**

**Moscow**  
**2023**

One of the serious problems faced by battalion, company, and platoon level units during a special military operation was the massive use of UAVs by the enemy, primarily commercial small-sized quadcopters (drones).

This memo contains practical recommendations for commanders (military

personnel) of combined arms units performing combat missions (tasks) during a special military operation to protect and counter Enemy UAVs.



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**REMINDER**  
**to protect and counter small-sized enemy UAVs Threats of small UAVs**  
**(copters)**

Small UAVs are characterized by small geometric dimensions, low thermal contrast and flight speed, as well as a small effective dispersion area, which does not allow them to be sufficiently effective in defeating air defense systems (MANPADS).

These factors are decisive in organizing protection and counteraction in units equipped with small arms, using service, improvised means and advanced developments and combat against UAVs.



BpLA A1-C «Fury» Kamikaze FPV drone with warhead  
based on a shot from an RPG-7

Rice. 1 Typical samples of small UAVs and drones made in Ukraine

**With the help of small-sized UAVs, the enemy solves the following problems:** 1. Conducting reconnaissance. Drones with an infrared night vision camera or the so-called IR forward-looking system pose a particular threat. They can see a person not only at night, but also through the crowns of trees, mask nets, etc.

2. Guiding and adjusting fire. When promising targets are detected, the drones transmit a video signal to the operator's smartphone or tablet and target artillery (tanks) according to the coordinates.

3. Fire damage to personnel and military equipment, incl. using kamikaze drones such as FPV drones.

In addition to kamikaze UAVs, a relatively new, widely used method of destroying military equipment has become the release of modified or specially manufactured unguided munitions from hovering quadrocopter (octacopter/hexacopter) UAVs.

The most common commercial drones are: **Dji Mavic 3** capable of carrying a load weighing no more than 400-500 grams.

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Rice. 2 Typical samples of ammunition and IEDs used for dropping from UAVs.

**Ammunition and IED base used for drops from drones: RGD-5 (RGN) hand grenades.**

handmade converted VOG-17 (30 mm), VOG-25 (40 mm);  
NATO rounds for 40x53 mm grenade launchers;  
handicraft devices based on TNT blocks.

F-1 grenades are also used, either on Mavic 3s in calm weather, or on larger UAVs capable of lifting their weight. The greatest demand in the special operation zone is the modification of the VOG-17M ammunition, in which the fuse is equipped with a self-destruct device with a delay of 25 seconds. These are the types of shots that are installed on UAVs by both Russian fighters and the enemy.

## **Protection against small UAVs**

The organization and implementation of measures to ensure the protection of unit personnel and military equipment from the danger that arises when the enemy uses small-sized UAVs and kamikaze drones involves the following main activities:

- notification and dispersal of personnel and equipment;
- camouflage and shelter for personnel and equipment.

### **"Stay Unnoticed"**

The best way to avoid problems with enemy drones is to remain undetected. That is, be able to deceive the drone operator.

The main thing in this matter is **this is dispersal, camouflage, shelter of personnel and military equipment.**

**What does dispersal mean?** - this is the choice of distances between objects (areas of deployment of units), which exclude their joint destruction during the operation of small-sized unmanned weapons. During dispersal, the following requirements must be adhered to: it should not negatively affect the accomplishment of assigned tasks and complicate management and interaction. Given these requirements, as a rule,

the optimal distance between objects and units is selected, in

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depending on the expected radius of destruction of an enemy UAV carrying maximum power ammunition.

**Hence the conclusion: do not place equipment in an open space and close to each other!** In addition to accumulations of equipment, this also applies to personnel – don't crowd together. Especially in open spaces where you can be spotted by a UAV.

## **Camouflage and shelter from UAVs**

**What does camouflage and cover mean?** This is a set of measures aimed at reducing the visibility of personnel and equipment, as well as protecting them from the effects of enemy forces, incl. from small-sized unmanned weapons. The main methods of performing tactical camouflage tasks in order to counter enemy UAVs are **hiding, imitation and demonstrative actions.**

**If positions are located in a populated area** – it is necessary to hide more in houses, garages, on verandas, under awnings. Move less through open spaces unless absolutely necessary. At night, do not turn on hand-held or tactical flashlights or car headlights, which can be easily seen by UAV equipment.

**Remember that** in hot weather at an air temperature of about 40°C, the UAV's infrared camera practically does not detect a person, and in bad weather, UAVs cannot operate in strong winds, in smoke or during a thunderstorm.

Use available tools and auxiliary materials. Thus, pieces of glass or other mirror materials placed on the roofs of buildings and equipment will create obstacles for the UAV camera.

**If the positions are obvious (large fortified area, trench lines, in the absence of cover by trees):**

do not give the enemy an understanding of how many people are defending, where exactly the people, equipment, firing and observation points, dugouts, and ammunition depots are located;

do not burn fires or dry things in open areas;

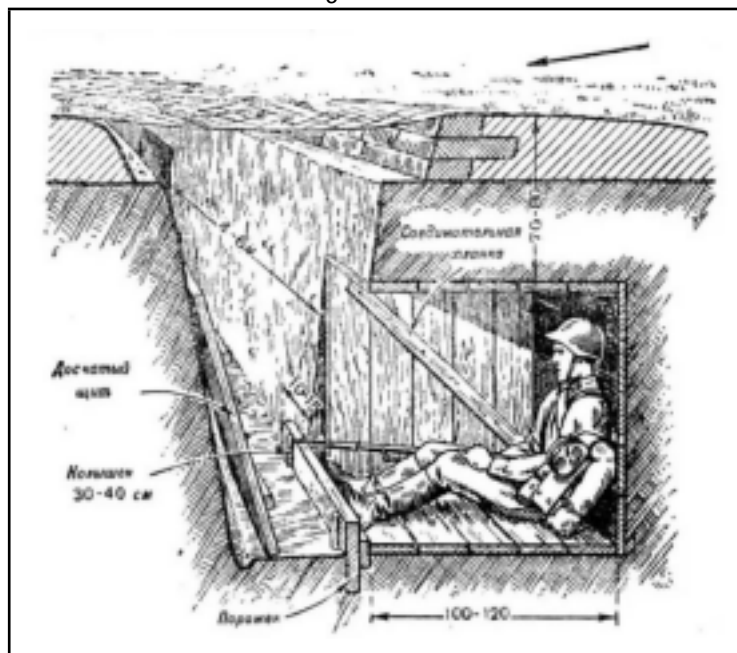
do not scatter garbage (boxes from army dry rations and other waste) around your positions, move less unless absolutely necessary. if you use potbelly stoves in dugouts, then create an extensive system of chimneys outward. So that the smoke does not pour out in a column, unmasking the fortification, but spreads through 4-7 thin channels;

if possible, dig “fox holes” at observation posts so that they at least partially hide you from observation from above;

arrange canopies over you from a camouflage net or a heat-insulating mat. Additionally, camouflage the points with branches, and when vehicles approach, also cover it with camouflage nets;

The simplest option for camouflaging the fighters in positions is to make dense coverings of branches over some sections of the trenches. Under these places, dig fox holes, or small dugouts in the walls of the trenches, under the parapet;

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Rice. 3. Equipment of the “Fox Hole” type shelter

cover observation posts with the same floorings from above, from where they look towards the enemy and the flanks;



Rice. 4. The car is in positions under the mask network.

trample, drive down false paths past your positions. A suddenly broken road is a sure sign of a fortified area or OP;

periodically fly a drone over your positions to assess the quality of camouflage;

try to make less noise, don't get carried away by loud chatter with your friends. Some drones are equipped with powerful microphones. They can freeze and listen to sounds. Maintaining silence (within reasonable limits) will allow you not only to avoid burning yourself out, but also to hear the enemy drone yourself. When the "bird" drops to 100-150 meters or less, it can be heard quite well.

Each commander (chief) is obliged to constantly monitor the compliance of subordinates with the requirements of camouflage discipline.

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**Imitation** consists in reproducing the unmasking signs of units (units), weapons and military equipment, engineering equipment of the area and other objects. During the simulation, false objects are equipped (positions, areas, sections, boundaries, routes, bridges, etc.), and demonstrations of vital activity in them are organized using models and simulators of the physical fields of weapons and military equipment.

**Your task is to "blur" the number of real goals!**

Depending on the terrain conditions, the amount of equipment shown should also be different. So, in wooded areas it should be shown about a third, and in open areas up to half of the standard amount of military equipment. In open areas in false areas, it is necessary to display up to 80% of military and transport equipment.

To form unmasking signs of simulated objects in the radar wavelength range, standard radar reflectors can be used: metal corner reflector OMU, "Pyramid", "Angle", "Sfera-PR", radar simulator of moving equipment IDT; in the infrared range - catalytic wick furnace KFP-1-180.

#### Radar simulators of physical fields

Designation	Purpose	Mass, kg	Time assembly, min.	Calculation installations, people
Radar metal corner reflector	Simulation of ground targets and radar landmarks or individual industrial facilities	272	6	3



"Angle"				
Radar metal OMU corner reflector	Radar simulation of weapons and military equipment and creation radar interference field	3,25	6	2
Radar metal corner reflector "Pyramid"	Radar simulation of land and surface objects	262	—	3
Radar reflector "Sfera-PR"	Radar simulation of floating bridges	76	—	2

To show life activity in the false area, the movement of units and individual vehicles is reproduced, the relative position of the models is partially changed, the number of shelters and traces of vehicles is increased, radio stations are operating (for transmission), fires are lit and light signs visible from the air are installed.

### Thermal simulators of physical fields

Designation	Purpose	Operating wavelength range, microns	Temperature radiating surfaces
Catalytic wick furnace KFP-1-180	Creation of thermal unmasking signs	3–5 8–14	250–300

**“How to protect yourself from enemy air strikes and artillery.” If you, your position, and equipment have been examined by the drone operator, then the following options are possible:**

If it is just a reconnaissance aircraft (wing or quadcopter), it will direct artillery, a mortar, another (attack) drone, or will adjust the actions of assault groups if a direct attack is planned.

If the quadcopter is equipped with a drop system, then after detecting your position or equipment, the operator will drop grenades, homemade “bombs” from VOGs or other explosive devices. In this case, they will fly from above, vertically.

If it is a kamikaze drone: FPV, or a “flying wing” (like the “Lancet”), then the strike will be delivered at a certain angle, not vertically, but even closer to the horizontal trajectory at the end.

**Based on this, you need to do everything in advance to minimize risks. Firstly, this is the depth of burial.**

**Knee-deep trenches and Jacuzzi-style trenches are not serious.** We need to dig and dig and dig deeper. Build dugouts and other engineering structures with labyrinthine entrances. If the soil is very bright and contrasting (sand, clay, black soil against the background of greenery or foliage of the litter), then resort to masking the parapets. That is, cover them, bombard them with elements of the surrounding area. Then it will be more difficult to detect positions.

It is advisable to place entrances to dugouts and ammunition depots towards the trees. Then it will be impossible for the operator of the “wing” or FPV drone to enter to strike the entrance from a convenient angle. He will either hit poorly, not hitting anyone, or he will crash into trees.

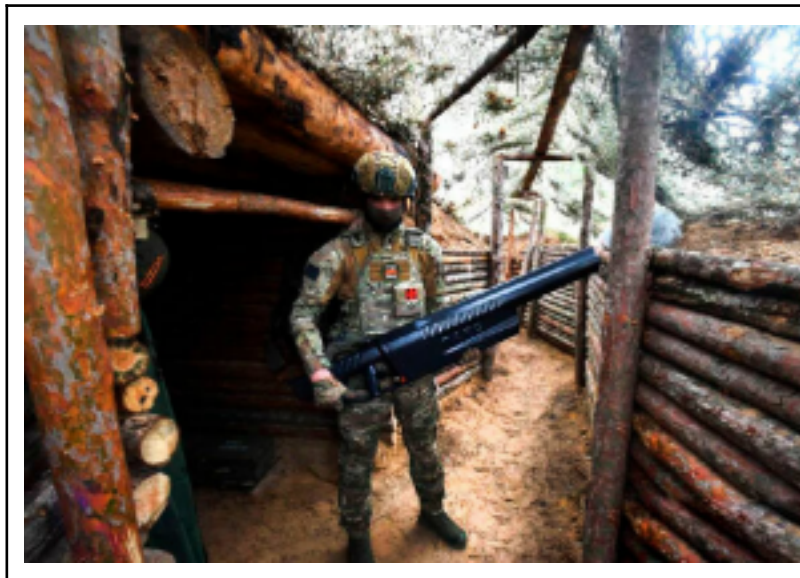
The mask net and/or mat used on top, above the position, observation point, is important not only in terms of camouflage, but also as a kind of reflector for dropped grenades and IEDs. The use of anti-grenade nets.

Try to make canopies in the places where the trenches bend, use fox holes so that the fall of ammunition on the sides, inside the trenches, does not lead to shrapnel hitting the soldier hiding in the niche. **In general, model the situation where faults can fall, and how to properly protect yourself from them by placing masses of soil under the fragments.**

In any case, an explosion above a trench, somewhere in the air or behind a parapet is much safer than in a trench, right under your feet. From such an improvised “roof” the ammunition can simply ricochet and explode somewhere to the side

**If you are covered and hit with drops tightly and regularly, change positions, create new observation points, away from the old ones.**

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Rice. 5. An operator with an anti-drone gun in position, covered with chain-link mesh and mask netting over the trenches

In a similar way, it is necessary to organize the protection of individual trenches and observation points moved forward from the main defensive line. Try to position yourself under spreading trees. Cover the top with some kind of fabric, an awning, or in dry weather you can simply use a scout scarf. Mask the cape on top with elements of the environment.





Rice. 6. Individual trench with a cape on top, camouflaged coniferous branches from the surrounding forest

**Secondly, these are measures for the passive protection of military equipment.** In order to reduce losses and damage to military equipment that can be caused by the use of UAVs by the enemy, the following elements of passive protection can be effective:

#### **Protective grilles (screens).**

After the start of the special military operation (SVO), when it was revealed problem with the Javelin ATGM hitting the upper projection of Russian tanks, they began to install so-called “visors” - lattice

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screens over the tower. Similar screens are used for passive protection tanks, infantry fighting vehicles, self-propelled guns from attacks by kamikaze drones (Kamikaze FPV drone). **Rmesh screens, welded from a powerful steel profile, - This the simplest solution, often allowing to save the life of a combatant car or at least its crew.**

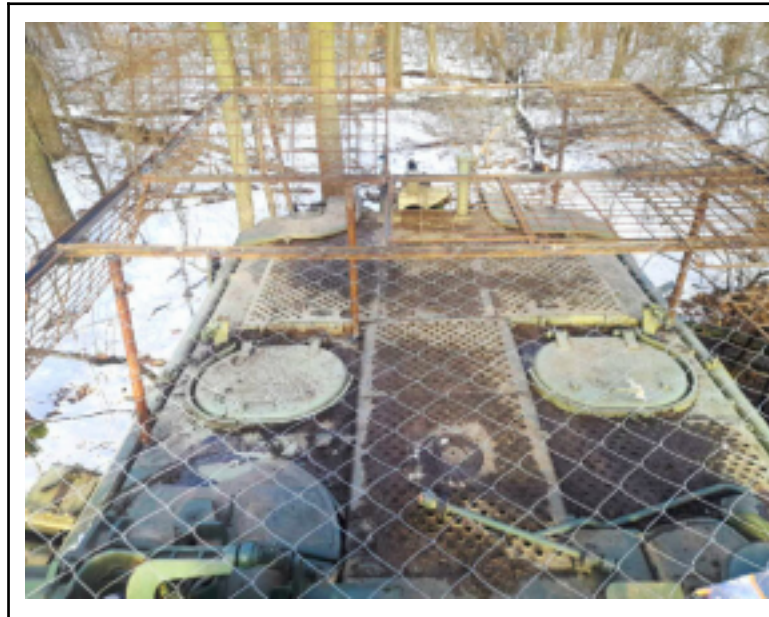


Rice. 7. Tank with a protective steel visor

**Safety nets.**

Metal mesh that poses almost no threat to ATGMs or RPG shots, can become a serious obstacle for kamikaze UAVs, in features for FPV drones.

Mesh-grid anti-drone screen kits could potentially be installed on virtually any ground combat and auxiliary equipment that may be subject to attacks from FPV drones.



Rice. 8. Protection of armored vehicles from chain-link mesh from discharges and protozoa  
Kamikaze FPV drones

### **Anti-drone screen mesh-lattice (PDESR).**

**Kits mesh-grid anti-drone screens** there may be installed on almost any ground combat and auxiliary equipment that may be subject to attacks from FPV drones.

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PDESR is conditionally divided into its component elements:

- base part;
- hiking kit;
- combat kit.

**Base part** - this is a set of fasteners, brackets, rigidly fixed on a combat vehicle, for example, by welding - it can simply be welded to the body, a piece of pipe with a hole for an oblique transverse pin or some more complex embedded structure.

**Hiking kit** – a set of protective elements that should be used when transporting military equipment, they can partially limit the operation of combat vehicles. In this case, the camping kit should provide maximum protection area against kamikaze UAVs.

**Combat Kit** – a set of protective elements that should not limit the operation of combat vehicles, but the area and effectiveness of protection, provided by a combat kit may be worse than that of a marching kit the set.

For example, a travel kit can prevent the turret from turning tank 360 degrees, but cover its entire upper projection, and the combat the kit will not interfere with combat work, but will only cover the turret and some area next to it.

### **What other requirements may be imposed on PDESR?**

Quick installation and dismantling – no more than 5–10 minutes. Safely destructible design - for example, if the tank in the travel kit was subjected to attack and is forced to engage in battle, then turning the tower should safely demolish interfering with PDESR, without damaging tank elements. Elements of PDESR are not

must prevent the evacuation of the crew.



Rice. 9. 122-mm self-propelled gun 2S1 "Gvozdika", covered with mesh screens

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### Countering small-sized UAVs in the platoon-company-battalion link

To directly cover units of a motorized rifle battalion from reconnaissance by small-sized UAVs and prevent them from using ammunition, in the platoon-company-battalion link, the following are involved:

**for monitoring, tracking and targeting UAVs:** in a motorized rifle squad (platoon) - observer;

in a motorized rifle company (at the MSB command post) - an air observation post; **for fire destruction of UAVs:**

in a motorized rifle squad - a machine gunner on duty (machine gunner); in a motorized rifle platoon - an infantry fighting vehicle crew on duty;

in a motorized rifle battalion - a motorized rifle platoon trained to fire at non-airborne vehicles (UAVs), as well as equipment (jammers). The composition of forces and assets deployed to combat UAVs in a motorized rifle battalion on the defensive is shown in the table.

#### Composition of forces and assets involved in the fight against UAVs in a motorized rifle battalion (in defense)

*Option*

Strengths and means	Total quantity		
	msv	msr	SME
Observer	3	9	27
Air surveillance post	—	1	4
Machine gunner (machine gunner)	3	9	27
Operator - anti-drone gun	1	3	9

BMP calculation	1	3	12
Sapper (for clearing downed and grounded copters, as well as neutralizing unexploded IEDs)	—	—	1

For direct cover from the actions of small-sized UAVs of the most important objects, such as the command post of a combined arms formation, a divisional artillery group, RAV warehouses and material support at the regiment-brigade-division level, **it is necessary to form combined groups using combined arms units of the second echelon, combined arms and anti-landing reserves**. It is also advisable to allocate forces and means of air defense and electronic suppression to their composition.

### Air surveillance, detection Enemy UAVs

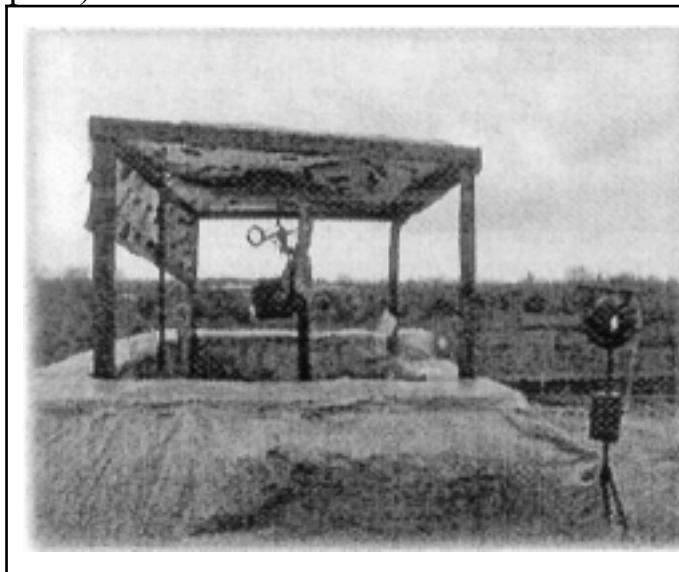
For the timely detection of enemy UAVs, notification of the command of units and duty services about them, fire destruction (electronic suppression) of enemy UAVs, a system of air observation posts (APP), as well as forces and means of directly covering the area of deployment or combat mission, must be created

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connections (divisions).

Airspace observation posts, like regular observation posts, should be installed in hidden places, and it is also necessary to have the ability to monitor airspace all around.

Based on the experience of combat operations, posts are set up at a distance of up to 400 m from the front line of defense, as well as in close proximity to important infrastructure facilities and are in interaction with the forces and means of their direct cover (personnel of fire groups, small arms, electronic suppression equipment, anti-aircraft fire weapons).



Rice. 10 General view of the aerial observation post “on the ground”

As a rule, observation towers are built for their equipment, on which both electronic warfare equipment can be installed to suppress control signals, as well as anti-aircraft and small arms weapons to destroy UAVs. They must have alternate safe



escape routes in case of detection by the enemy.

**Two or three intelligence officers are appointed to the post, one of whom is senior.**

The personnel of the observation post must have personal weapons, means of night and day surveillance (optical, optoelectronic devices, thermal imagers), means of communication and warning, food supplies, water and other means necessary for conducting long-term covert surveillance of airspace. In addition, posts can be equipped with spotlights and powerful laser pointers.

One of the most trained military personnel is appointed senior airspace observation post. The senior post officer is responsible for organizing 24/7 visual surveillance of the airspace in the assigned sector.

**Algorithm of actions of a personal observation post:**

1. Having detected an air target, the observer determines its identity, position in space (by azimuth, landmarks, cardinal directions) and flight direction, immediately reports to the head of the covered object (commander of the combined fire group), to the nearest

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Air defense command post (PU), at the platoon or battery command post, to which the anti-aircraft squad is subordinate. Gives the established signal, while notification of the flights of its aircraft is carried out in existing warning networks or through other communication channels.



Rice. 11. Procedure (algorithm) of actions of a military personnel observer upon detection of an air target

**Typical reports from a post could be:**

*"At 12.30 it's clear»;*

*"Bespilotnik. Nfrom the 3rd (landmark number or azimuth in protractor divisions). NA us";*

*"UAV, at 10 o'clock (direction according to the clock face), mhere we are, on enemy."*

2. **To select an option for countering UAVs, it is necessary to identify the aircraft.** In this case, commands are given in the format: "DRONE/direction/vertical angle to the object in degrees/approximate distance to the object in meters", for example: "DRON/12/45/70", which means at 12 o'clock, at an angle to the observer of 45°, a distance of approximately 70 m.

Or, depending on the direction of flight of the strike UAV, give the command *"DRON-ZENIT"* or *"DRONE-TOP"* in case of a drone attack from above. 3. If an observer detects a UAV, based on the current warning signal, he independently makes a decision to open fire, in the presence of fire weapons, and notifies a specially designated fire group, as well as crews of electronic warfare equipment and anti-aircraft fire weapons. **Airspace surveillance is also organized during the movement of troops (forces) as part of a motor convoy or by rail.** During the convoy, observers are placed at the head and tail of the convoy in open vehicles.

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**In his instructions for control during movement, the battalion (company) commander also determines:**

- the location of an airspace observation post in marching order;
- the procedure for protecting and covering the column from an enemy UAV strike;
- organization of communications and operating modes of radio equipment, the procedure for transmitting signals and commands in the event of an air raid by small-sized UAVs.

### **Suppression of UAVs by means of electronic warfare (jammer transmitters) and fire damage by fire means**

The technical measures to suppress UAVs are based on interfering with the control and navigation system, intercepting intelligence information, and countering surveillance and recognition equipment installed on the aircraft.

#### **Suppression of UAVs by means of electronic warfare (jammer transmitters).**

The electronic warfare company of a combined arms formation is armed with jamming stations R-330Zh "Zhitel" - 1 unit, R-934BMW or "Palantin-U" - 2 units, RP-377UVM1L "Lesochek" (portable version) - 15 units.

#### **Option 1. Composition of forces and means of electronic suppression acting in the interests of the covered formation:**

1–2 sets each **RP-377UVM1L "Little Forest"** assigned to combined groups for combating UAVs, covering the command post of a division (brigade, regiment) from reconnaissance and destruction by the enemy using UAVs;

1–2 sets each **RP-377UVM1L "Little Forest"** assigned to combined anti-UAV groups covering position areas of artillery directly subordinate to the regiment commander (artillery directly subordinate to the brigade commander), divisional artillery group and army artillery group (when operating in the division zone);

group of reconnaissance, direction finding and electronic suppression of control and data transmission channels of enemy UAVs as part of the command post of an electronic warfare company of a division (brigade) **R-330KPK and two jamming stations R-934BMW "Palantin-U and jamming stations for SRNS UAV channels R-330ZH.**

#### **Features of the use of these electronic warfare systems.**

**Jamming station RP-377UVM1L "Lesochek"**, assigned to combined tactical groups to combat UAVs, are placed on a vehicle (infantry fighting vehicle, armored personnel carrier) of a MANPADS squad and (or) a motorized rifle platoon. The stations operate in automatic mode, powered by a battery or from the vehicle's on-board network.

Before starting work, in order to ensure EMC between the jamming stations and



the electronic zones of the covered unit, bans on radiation are introduced at the jamming stations in the frequency ranges of operation of our electronic zones.

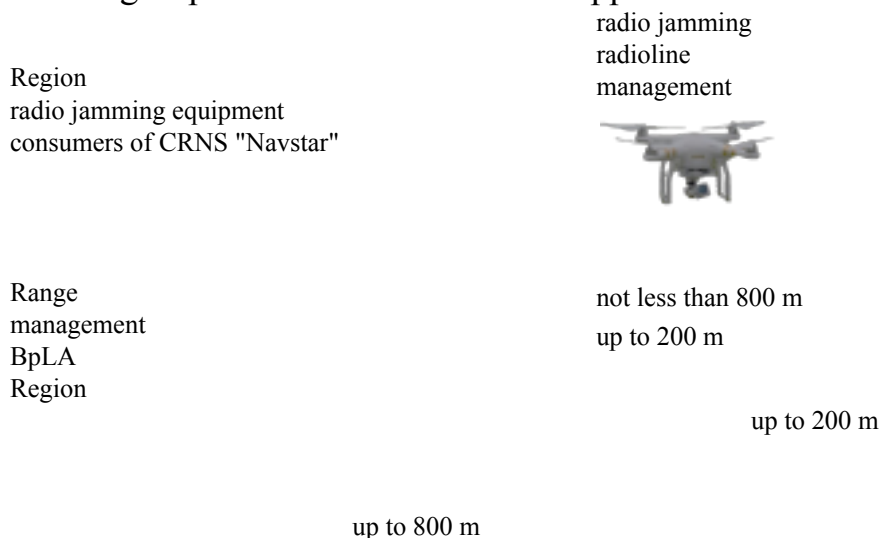
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Rice. 12. Placement of the “Lesochek” jamming station on the hood of a car

Range of electronic jamming using small-sized jamming stations **RP-377UVM1L “Little Forest” is about 500 m, Therefore, to protect extended objects from enemy UAVs, it is necessary to use several jammers.** When covering area objects to increase the effectiveness of countering UAVs, jamming transmitters must be placed on elevated surfaces (buildings, structures), and several RP-377UVM1L “Lesochek” transmitters must be used simultaneously.

Taking into account the range to the UAV, as well as the capabilities of the jamming station and the effective range of small arms fire, the commander of the combined group determines the order of application of methods to combat the UAV.



Rice. 13. Option for using the RP-377UVM1L “Lesochek” jamming station, with  
REP of radio control lines and consumer equipment of CRNS UAV

**Jamming stations R-934BMW (“Palantin-U”)** carry out radio suppression of control and data transmission channels from UAVs by setting frequency targeting and directional barriers **(in the sector 90–120 degrees)** interference in the main and side lobes of the antenna patterns of UAVs and ground control posts, as well as ground terminals of information consumers of the ROVER type (SIR). Main

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The direction of operation of the station is radio suppression of the reverse channel of data transmission and telemetry from UAVs.

**The distance from the front edge should be 3–5 km, the distance along the front between stations should be up to 10 km**, in this case, the greater the distance between stations, the further and more accurately the direction finding is carried out. When conducting RTR, information is exchanged between stations via a radio relay channel. Based on the bearings determined by calculations, the coordinates of the UAV NPU are determined.

Upon receipt of a suppression signal from the control point or in automatic mode, targeted jamming in frequency and barrage in direction is set up (in a sector of up to 120 degrees), while the control channel is broken, thereby eliminating the possibility of manual control of the UAV and obtaining objective data about its condition and position in space.

The duration of jamming is determined by the flight time of the UAV in the area of the covered object. During jamming, periodic monitoring and additional exploration of new radio sources is carried out.

When creating interference, the UAV may lose control, return along the opposite route, or begin to patrol over the area of application while waiting for communication to be restored.



Rice. 14. R-934BMV EW complex ("Palantin-U")

### **Option 2. Composition of forces and means of electronic suppression acting in the interests of the covered formation:**

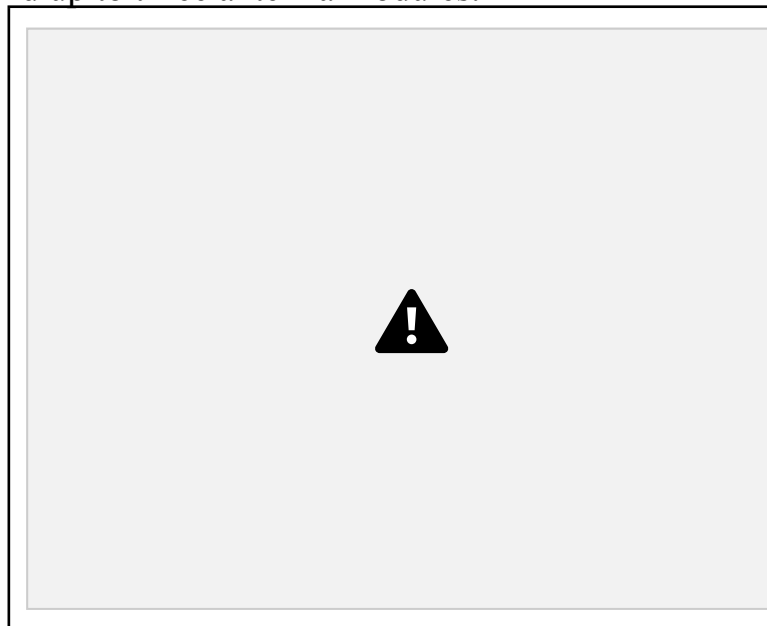
2–6 interference modules **complex "Pole-21" (Pole-21 M)**, placed to cover the most important objects: positional areas of artillery, tanks, ammunition depots, etc.;

1 set each **RUAM "Silok-01" (Silok-02)**, placed to cover the most important objects – KP (NP) connections.

### **Features of the use of these electronic warfare systems.**

**Complex "Pole-21"** It is built on a modular basis, simplifying its production and deployment. The unified module "Polya-21" is a radio station R-340RP, including

instrumentation and antenna modules. Each post of the complex includes one container with equipment and up to three antenna modules.



Rice. 15. Equipment of the "Pole-21" complex: rack with equipment (left), antenna modules (top right) and control panel

Each antenna jamming module is capable of suppressing radio signals from satellite radio navigation systems and control channels in various ranges at ranges of at least 25 km. The standard method of deploying and using the Pole-21 complex involves installing a large number of modules over a large area - taking into account the shape and size of the working sectors.

With optimal placement **one complex with 100 antenna posts allows covering an area of 150 x 150 km**. A reliable “dome” of interference is created over such an area, eliminating the use of satellite navigation.

**The procedure for covering objects with Pole-21 jamming modules from**

**UAVs:** 1. Use at least two interference modules:

one for open source GPS jamming mode;

the second is for closed-code GPS suppression mode.

2. Interference modules must be installed behind the object at a distance of 3-4 km with the orientation:

horizontal (azimuthal) - in the direction of the probable attack;

vertical (angular) - 20, 45 and 70 degrees.

3. Suppression (radiation) work is continuous.

In addition to UAVs, the complex is capable of combating cruise missiles and aerial bombs, incl. with MLRS "HIMARS".

**Operation of the Silok-01 complex** is aimed at automatically detecting drones and determining their coordinates. The Silok-02 complex is capable of automatically tracking the coordinates of a drone using a wide range of frequencies. After detecting an enemy drone, the complex goes into target suppression mode.



Rice. 16. Deployment of the Silok-01 complex.

*UAV "Fury" under the influence  
interference – disoriented c  
space, exhausted flight  
resource and made an emergency  
landing.*

Rice. 17. Scheme of actions of electronic warfare units of the RF Armed Forces in the area of the Northern Military District on June 11, 2023 to suppress the Fury UAV, using the Silok-01 complex and interference modules "Pole-21"

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**After influencing the enemy, electronic warfare systems must quickly change position in order to avoid being hit by the enemy.** Even if the station itself is not discovered, the enemy may try to launch area artillery strikes (including using shells with radio fuses) in the supposed square of its location.

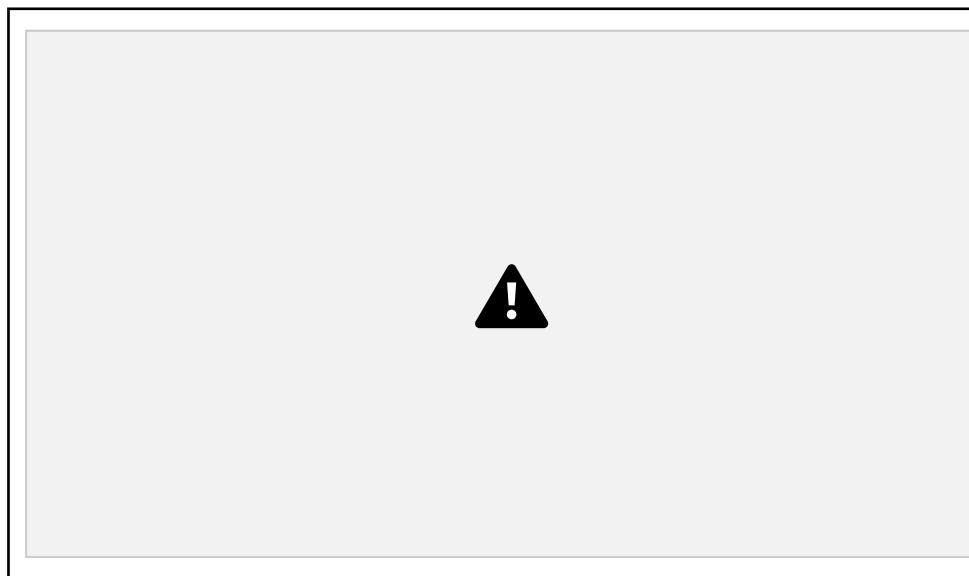
#### **Anti-drone guns.**

During the SVO, the development and active use of anti-drone guns began to suppress small-sized UAVs by creating noise interference. Among those that showed

good results during testing on the front line is the domestically developed LPD-801 anti-drone gun.

The complex is designed in the form of a machine gun with a silencer. Product length – no more than 970 mm, weight without battery – 3.5 kg. For ease of use, the battery is given the appearance of a machine magazine. **On one charge the complex can work up to 60 minutes. LPD-801 is capable of jamming control channels and navigation signals of drones at a range of up to 1,500 meters.**

The LPD-801 has been replaced by a new modification of the anti-drone gun - LPD-802.



Rice. 18. Anti-drone gun LPD-802

### **Fire damage to small UAVs.**

To protect personnel and military equipment from destruction by small-sized enemy unmanned vehicles, commanders of military units (units) need to assign fire groups. The group, as a rule, includes a sniper (group commander), 1-2 shooters to support his actions, an observer shooter with observation equipment (binoculars) and communications equipment.

The unit for combating small-sized UAVs is located in predetermined places, in the probable directions of their flight, so as to ensure round-the-clock surveillance of the airspace, timely detection and destruction of UAVs with available fire weapons.

### **Algorithm of actions of a fire group upon detection of a UAV.**

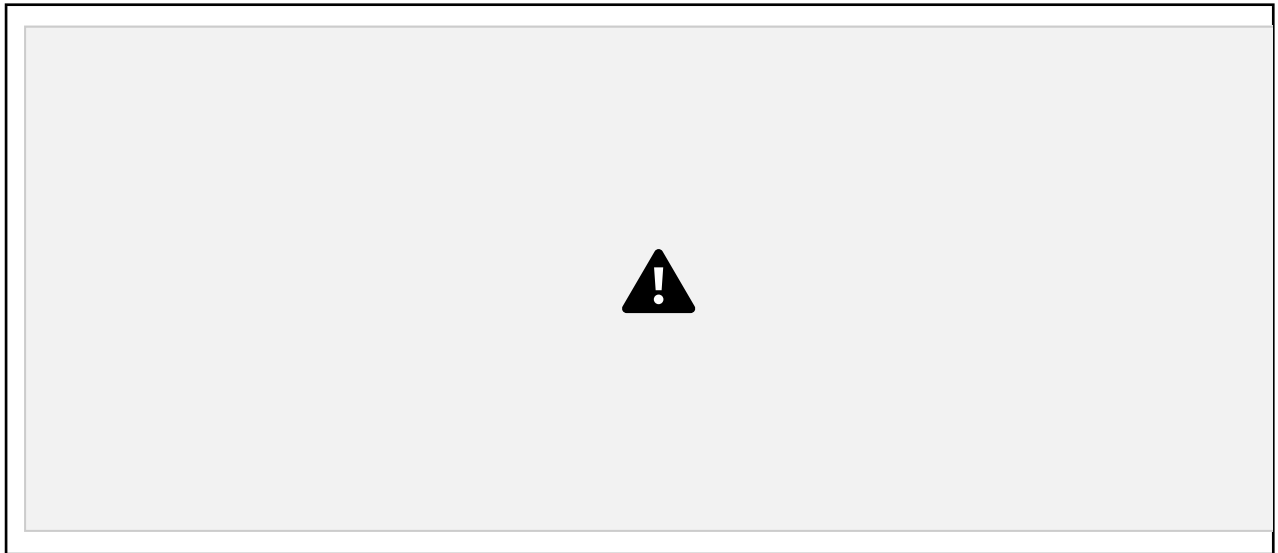
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The commander of the fire group, based on a valid warning signal, in the absence of his UAVs in the air, gives the command to use available forces and means to destroy the air target. The unit fires concentrated accompanying (barrage) fire at the enemy UAV, taking lead along the target's course and adjusting the fire along the routes.

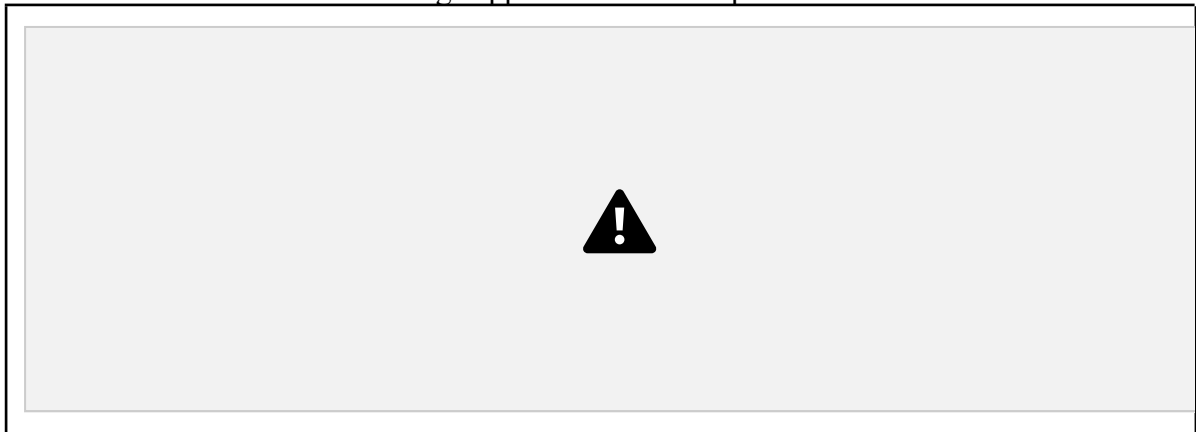
**The rules for shooting from small arms provide for firing from machine guns (machine guns) at small air targets at a distance of up to 500 m with the installation of a 4 or “P” sight.**

In this case, one of the methods of target designation of the direction of flight and location of a detected UAV will be target designation with tracer bullets (firing tracer bullets in the direction of flight or location of a detected UAV). A small UAV flying towards a motorized rifle unit is subject to continuous fire in the direction of its movement. In this case, fire is opened from a range of 700–900 m. At a UAV flying to

the side or above a motorized rifle unit, fire is carried out in a barrage or accompanying manner.

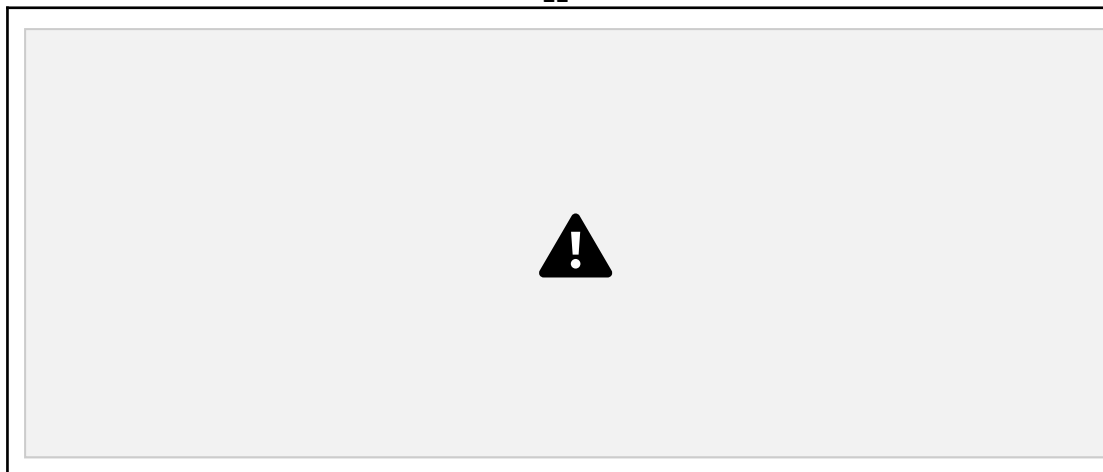


Rice. 19 - Firing from a trench (communication course) at air targets  
(with the forearm of the left hand and magazine resting on the front steepness of the trench, with the back and left leg supported on the steepness of the trench)



Rice. 20. Firing of a fire group at air targets  
from a lying position

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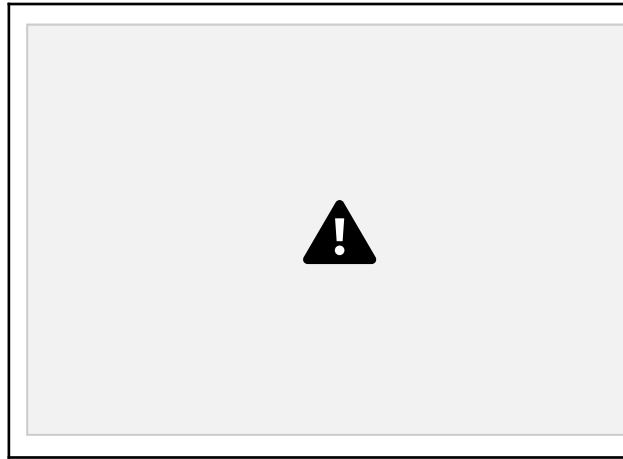


Rice. 21. Shooting at air targets using  
local items

To increase the likelihood of enemy UAVs being hit by fire, it is advisable to use



frames (tripods) under small arms.



Rice. 22. Stand for small arms

### Basic rules for shooting at UAVs:

**1. At a UAV flying at a speed of up to 45 m/s to the side or above a firing position (above its own unit), fire is carried out in an accompanying manner.**

When shooting in an accompanying manner at a UAV flying at a speed of 15-30 m/s at a distance of 100, 300, 500, 700 and 900 m, **the lead is taken to be, respectively, 1, 3, 5, 8 and 12 target corps.**



a) b) c)

Rice. 23 Scheme of aiming at an air target flying at a speed of 15-30 m/s at ranges a) 100 m, b) 300 m, c) 500 m

23

**Team "Fire" is supplied at the moment when the UAV is at a distance of 500 m from the fire weapon and is conducted for 20-25 seconds. in short bursts with fire adjustments.**

To adjust the fire along the routes, it is necessary that the shooting be carried out with cartridges with conventional and tracer bullets (in the ratio of one cartridge with a tracer bullet per three conventional ones). Firing cartridges with only tracer bullets leads to increased wear on the bore.

In all cases of shooting at UAVs, you need to remember that it takes 3-4 seconds to issue a command and prepare to fire. During this time, the UAV flies about 150-200 m.

**2. Firing in a defensive manner means that a stationary zone of fire concentration is placed ahead of the UAV along the course of the UAV.** in such a way as to ensure that the sheaf of tracks intersects with the target trajectory. The choice of direction for setting up a fire concentration zone is determined by the course and speed of the target. The fire group can fire 200-250 bullets during the

establishment of the barrage zone. This gives a bullet density that allows you to realistically expect to hit the target.

To ensure timely task setting and determination of the direction and moment of opening fire, ground references must be used. Having discovered the target, it is necessary to determine the direction to set the fire concentration zone. To do this, mentally plot the course of the target on the ground and determine the landmark closest to the course parameter, or indicate the direction of fire with a long burst of tracer bullets.

**To fire, a command is given (for example):** *"Over the bridge, with aggressive fire"*. Team *"Fire"* is given at the moment when the UAV is removed from the specified landmark by approximately 150-200 m. At this command, submachine gunners and machine gunners are prepared to fire, give the weapon the required elevation angle if the target flies in the direction of the unit's position, and at the command *"Fire"* fire for 2-3 seconds, holding the weapon in the indicated direction.

**In general, the effectiveness of fire against UAVs using the accompanying method is higher than that of the barrage method. Therefore, when the opportunity presents itself, accompanying fire is preferable to barrage fire.**

**When firing from a 23 mm anti-aircraft gun (ZU-2E), firing at a UAV on a horizontal course** is carried out with the installation of input data on an anti-aircraft artillery sight (ZAP-23). The range to an air target is set visually (linked to the range to landmarks on the ground) by eye. The degree value of diving and pitching is set to 0.

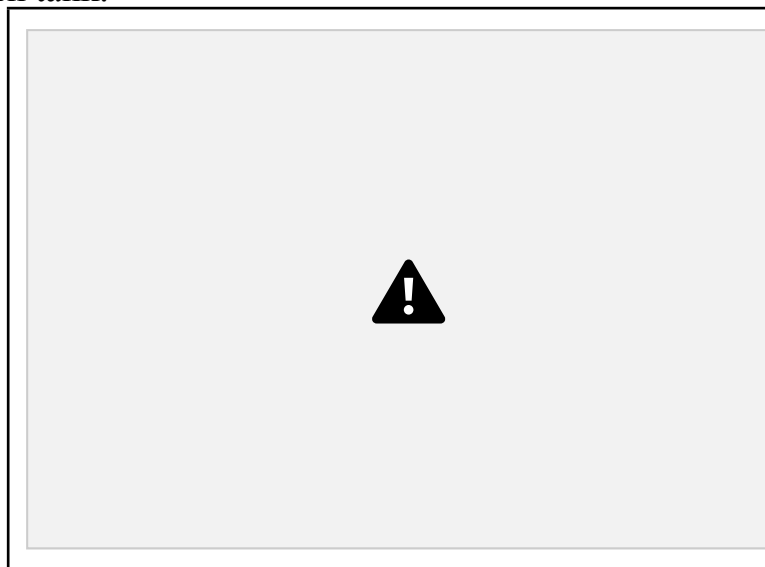
The speed is set according to the UAV type (20-40 m/s).

To engage small-sized enemy UAVs with fire from 30-mm AP BMP-2 (BMP-3) and 12.7-mm ZP mounted on tanks, it is advisable to use concentrated fire at the actual fire range, which is up to 2000 m and up to 1000 m, respectively.

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### **Recommendations for countering certain types of enemy attack UAVs.**

Positive experience in combating R-18 octocopters was gained by units during the SVO. Compared to quadcopters, devices with six (hexacopter) and eight (octocopter) propellers are more capable of lifting loads. These include Ukrainian-made R18 octocopters, the standard load of which is two RKG-1600 anti-tank cumulative bombs, created by converting RKG-3EM hand-held anti-tank grenades. This cumulative ammunition is capable of penetrating the relatively thin top armor of a modern tank.



**Recommended:**

In order to illuminate the camera of the R-18 octocopter, aerial observation posts must contain high-power flashlights with the ability to focus the light beam. To crucify the image of weapons and military equipment or the location of personnel when a drone approaches, it is necessary to use smoke bombs (RDG, DM-11, UDSH);

To engage a drone by fire, it is advisable to prepare stores equipped with tracer ammunition in advance and assign up to 8 of the most trained military personnel for fire impact. At night, it is advisable to assign sniper pairs to each company, additionally armed with thermal imagers. It is advisable to unite the personnel involved in the above activities into groups to combat UAVs.

**The order of the group's actions during the defeat of the R-18 octocopter.**

When detected by an air surveillance post octocopter R18 give a signal to the anti-UAV team. When a drone enters the group's coverage area, illuminate the camera with flashlights, and destroy nearby areas where weapons, military equipment and personnel are located using smoke bombs, creating a continuous smoke screen. When the octocopter is illuminated, the group opens fire on it with tracer ammunition, and the sniper pair hits the central control elements of the octocopter.

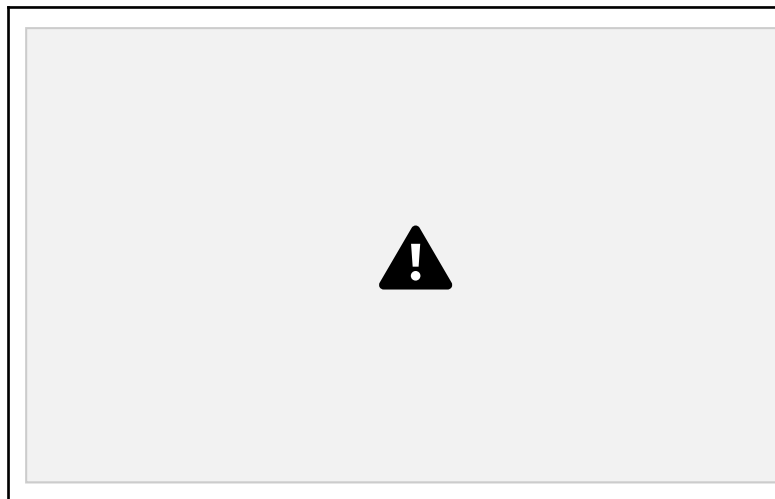
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It is advisable to fire from small arms from different positions, possibly while moving, in order to avoid opening the group's position. A feature of this method of control is the complexity of the use of various types of influence.

Practice shows that before releasing ammunition, the drone must stop in the air in one place to carry out guidance. During the complex impact of anti-UAV teams, the R-18 will not be able to stay in one place and the operator will be forced to remove the device from the affected area. The experience of such a fight shows that it is enough to hit 2 drones for the enemy to stop flying in a given zone.

**To combat small-class quadcopter-type UAVs, it is also recommended to use your own UAVs.**

If there are proactive and experienced UAV operators in the unit, when detecting the approach of an enemy UAV, the operator is asked to raise his UAV, with a piece of camouflage net (fishing net) measuring 50 by 50 cm pre-attached to the drop device, then the operator's main task is to rise above the enemy's vehicle and drop the camouflage net onto its blades, which will result in the entanglement of the propellers and the fall of the UAV.



The practice of training shooters to fire at small-class UAVs, which previously took place in the Air Defense Forces units, where a throwing machine for clay pigeon shooting was used during practical training, can also be very instructive.

**REMEMBER:** countering enemy UAVs is one of the most important tasks solved in order to ensure the security of military facilities and groupings of troops (forces), requiring creativity and initiative from commanders (chiefs). This task must be solved through the implementation of the entire specified set of measures and, first of all, –creating an effective system to counter their use, based on military weapons and fire groups interacting with them.

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## For notes

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