

## GUIDELINES

# "COMBINED ARMS UNITS TO COMBAT IRANIAN-MADE STRIKE UAVS "SHAHED-136" ("GERAN-2") AND THE RUSSIAN FEDERATION "LANCET-2"

(according to the experience of the  
Russian-Ukrainian war of 2022-2023)



**MARCH 2023**

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**This military publication is the first edition.**

**CENTER FOR OPERATIONAL STANDARDS AND  
METHODS OF TRAINING OF THE ARMED FORCES OF  
UKRAINE TOGETHER WITH THE MAIN DIRECTORATE  
OF DOCTRINES AND TRAINING OF THE GENERAL  
STAFF OF THE ARMED FORCES OF UKRAINE**



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# **"COMBINED ARMS UNITS TO COMBAT IRANIAN-MADE STRIKE UAVS "SHAHED-136" ("GERAN-2") AND THE RUSSIAN FEDERATION "LANCET-2"**

**(according to the experience of the Russian-  
 Ukrainian war of 2022-2023)**

**Military educational  
 and methodical  
 publication for  
 commanders  
 (chiefs) to use during  
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## PREFACE

This military educational and methodical publication "Methodical recommendations for "Combined Arms units to combat strike UAVs of Iranian production "SHAHED-136" ("GERAN-2") and the Russian Federation "LANCET-2" (according to the experience of the Russian-Ukrainian war of 2022-2023)" (hereinafter - the Methodological Recommendations) was developed by a working group of officers of the Center for Operational Standards and Methods training of the Armed Forces of Ukraine together with the Main Directorate of Doctrines and Training of the General Staff of the Armed Forces of Ukraine.

The composition of the working group of the author's team: Major General **Oleksiy TARAN** (development manager), Colonel **Yaroslav KOTLYARENKO**, Colonel **Valentyn HRYSHCHUK**, Colonel **Serhiy KORNIYCHUK**, Colonel Gennady **KIT**, Colonel **Oleg Chernov**, Colonel **Dmytro NIKOLUS**, Colonel **Vladyslav YASENCHUK**, Colonel **Yevhenii PETROV**, Colonel **Mykhailo BOHDANEVYCH**, Lieutenant Colonel Oleksandr **PIDHORNYI**, Lieutenant Colonel **Oleksandr Chernyshov**, Lieutenant Colonel **Ihor GURSKY**.

These Methodological Recommendations are developed taking into account the practical experience of conducting combat operations by combined arms units (units) of the Armed Forces of Ukraine in conditions of limited time during the Russian-Ukrainian war of 2022-2023.

Methodical recommendations are provided for use by military organizational structures and the tactical level (battalion, military unit and their levels) of the Armed Forces of Ukraine.

All questions related to these Guidelines should be sent to the following addresses:

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04119, m. Kyiv, st. Degtyarevskaya 19, Command of the Land Forces of the Armed Forces of Ukraine or telecommunication network "SEDO-M" – index 116 (contact phone number of developers for comments and suggestions – (62) 26-240);

10014, m. Zhytomyr, vul. Velyka Berdychivska, 17a, Center for Operational Standards and Methods of Training of the Armed Forces of Ukraine or "SEDO M" – index 360 (contact phone number of developers for comments and suggestions – (68) 44-781; (68) 32-066) in terms relating to the registration and provision of the relevant registration number.

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## ENTRY

One of the means of the latest weapons, which began to be used in military conflicts of the late XX - early XXI centuries, was unmanned aerial vehicles, which proved their ability to conduct air reconnaissance much more efficiently than manned aircraft, and perform other combat support tasks, striking the enemy. The modern army cannot be imagined without unmanned lethal vehicles, because they indicate. Artillery is pointed at the target, fire is adjusted, intelligence is transferred directly to the headquarters of the military time of the unit or unit to which the combat mission is performed, and most importantly - they save the lives of fighters.

In the conditions of conducting fleeting hostilities and a sharp change in the situation, the use of unmanned aerial vehicles is one of the factors for providing reconnaissance and information to the relevant commanders (chiefs) on a real-time scale and the ability to exert a fire impact on enemy personnel and objects. The use by the enemy of highly maneuverable units that due to the provided intelligence information (coordinates of objects, etc.), they have the opportunity in a short period of time to inflict fire damage on units that are in the first and second echelon, in areas of firing positions, as well as on reserves, warehouses with material and technical means, etc. Based on this, the fight against unmanned aerial vehicles is one of the priorities of countering the enemy's intelligence, control and combat use systems.

To date, no state is able to fully resist the planned actions of unmanned aerial vehicles.

These methodological recommendations have been worked out in order to provide commanders (chiefs) with specific recommendations on the organization of the fight against unmanned aerial vehicles, formulating existing and promising methods of combating them.

# 1. MAIN TACTICAL AND TECHNICAL CHARACTERISTICS AND EXPERIENCE IN THE USE OF UAV "SHAHED-136" ("GERANIUM-2") AND "LANCET - 1" AND "LANCET - 3"

## 1.1. General information

Since the beginning of September 2022, units of the Defense Forces of Ukraine have encountered the facts of destruction of military and other equipment with unknown ammunition. At the same time, a few weeks earlier, it was reported that the Russian army received Iranian Shahed-136 UAVs and began to actively use them in the war against Ukraine.

Repeated cases of damage to weapons and military equipment with characteristic signs of the use of kamikaze-type drones have been reported.

Due to its small size and relatively high speed, the devices are quite difficult to detect and knock down.

On September 13, 2022, Ukraine for the first time managed to destroy the Iranian Shahed-136 UAV near Kupyansk in the Kharkiv region. The marking applied to them indicates that the Russian army issues them as shock UAVs of its own design type "Geran-2" and uses them under this name.



**Figure 1.1** – Destroyed by the Armed Forces of Ukraine kamikaze drone- "Shahed-136" of the Russian army on September 13, 2022 near Kupyansk in the Kharkiv region

At the same time, there have been reports of repeated cases of damage to weapons and military equipment with characteristic signs of the use of kamikaze-type drones.



**Figure 1.2** – The defeat of a car, probably a kamikaze drone "Shahed-136"

The accuracy of the defeat indicates a rather high training of operators UAVs

Eyewitnesses note that the enemy used to hit targets "Shahed-136" is mostly in pairs with a difference of a few seconds. At the same time, priority was given to single objects (tanks, armored combat vehicles, artillery systems, cars). Hitting previously explored targets occurred with an almost 100 percent probability.

In order to exert information and psychological pressure on the servicemen of the Armed Forces of Ukraine, the enemy also actively distributes videos of the successful destruction of weapons, military equipment and personnel on the Internet.

Before deciding how best and cheaper to destroy a UAV, it must first be identified and identified. Like any material object, the UAV carries unmasking signs that emit it in the surrounding space, making it noticeable for observation. The degree of visibility is determined by its magnitude signatures in the radio frequency, infrared and visible ranges, as well as acoustic signatures. Modern light drones have signatures of small size: UAVs are made of composite materials, plastic with special painting and with a special combination of layers, their small gasoline and even more so electric engines emit little heat and work almost silently.

Kamikaze UAV "Shahed-136" is designed to destroy ground fixed objects by pointing and contact explosion of warheads and UAVs. Manufacturer – Shahed Aviation Industries Research Center.

To launch the "Shahed-136" used ground platform.

Photos and videos from open sources show a mobile launcher disguised as a conventional civilian truck with a tented top, which can simultaneously launch up to five kamikaze drones (Figure 1.3).



**Figure 1.3** – Puskova installation UAV "Shahed 136", disguised as a dump truck

Containers with such drones can be easily put not only on trucks, but also on the cars of railway trains, various ships and other mobile vehicles.

## **1.2. The main tactical and technical characteristics of the shock UAV type "Shahed-136"**

The main tactical and technical characteristics of UBpla "Shahed-136" are shown in Table 1.

**Table 1**

**The main tactical and technical characteristics of UBPLA "Shahed-136"**

Characteristic	Magnitude
Flight range	up to 1 500 km
Guidance system	Inertial
Flight altitude	from 60 to 4000 m
Flight speed	approx. 180 km/h
Length	3,3 m
Wingspan	3 m
UAV mass	200 kg
Mass of high-explosive fragmentation warhead	40 kg
Engine	MD 550

### **1.2.1. Strengths of UAV "Shahed-136":**

the long range of kamikaze drones "Shahed-136" allows it to be used to hit fixed targets in the depths of the territory of Ukraine;

the possibility of preparing for launch in the field by loading the flight task using a laptop computer (laptop, tablet).

### 1.2.2. Weaknesses of UAV "Shahed-136":

Tactics of use does not imply the defeat of moving targets. In order to reduce the likelihood of defeat, it is necessary to intensify the movement of military equipment, which is a high-priority target for the Russian Federation (MLRS HIMARS, air defense systems, EW, artillery systems, etc.);

low accuracy of hitting targets due to the "accumulation of errors" in determining the location of the device during the flight with an increase in its range and wind speed (an inertial navigation system is used);

design limitations of UAV type inkamikaze "Shahed-136" are not equipped with means of communication, which makes it impossible to control them in real time, change the flight mission, etc.;

warheads are less powerful than Russian precision weapons. To hit one target, it is usually necessary to toss several Iranian kamikaze-type UAVs.

The UAV in terms of its effective dispersion surface, large size and noisy engine operation is a sufficiently visible object to detect (visually and acoustically), accompany and destroy it by fire means.

### 1.3. The main tactical and technical characteristics of shock UAVs such as "Lancet - 1" and "Lancet - 3"

Today it is known about the existence of two versions of the strike UAV (barrage ammunition) – "Lancet - 1" and "Lancet - 3" (hereinafter - UBpla type "Lan tset"). Both have the same glider with dual X-shaped wings and similar internal systems. The main difference is the size and payload. The maximum take-off weight of "Lancet - 3" reaches 12 kg, "Lancet - 1" - 5 kg, with warheads 3 kg and 1 kg, respectively (Figure 1.4).



**Figure 1.4** – Characteristics of shock UAVs "Lancet - 1" and "Lancet - 3"

Complexes can fly autonomously, in accordance with the flight task on a predetermined route, with the possibility of adjusting it, independently find a given target and hit it. The effective flight range of the UBPLA type "Lancet" is from 40 to 60 kilometers. The flight is performed at an altitude of 60 to 3000 meters in the speed range from 80 to 110 km / h. The duration of the flight of UBPLA "Lancet" is from 30 to 40 minutes, respectively. During a dive, they can reach speeds of up to 300 km / h (Table 2).

**Table 2 The main tactical and technical characteristics of the UBPLA type "Lancet"**

№ s/n	Parameter name	"Lancet-3(1)"
1.	Speed range, km/h	80-110
2.	Flight duration , min	40 (30)
3.	Flight range, km	48-66 (40-55)
4.	Flight altitude , m	3000
5.	Frequency range, MHz (control channel)	863-873 or 902-928
6.	Strip width , kHz	100-30000
7.	Target load mass, kg	3 (1)
8.	Engine type	Electric
9.	Startup type	Catapult
10.	Gross weight, kg	12 (5)
11.	Type of blaster	non-contact/contact
12.	Type of warhead	high-explosive fragmentation

The nose contains a warhead, as well as optoelectronic means necessary for a controlled attack (Figure 1.5).



**Figure 1.5 – Equipped with several types of guidance systems and a combined television communication channel**

The electric motor is located at the rear of the fuselage. The above-mentioned UBPLA are intended for the destruction of vehicles in motion, firing positions of artillery and mortars, starting (firing) positions of air defense systems. They are equipped with several types of systems for guidance (coordinate, using optoelectronic means and combined) and a combined television communication channel that transmits images in real time and allows you to confirm the defeat of the target.

#### 1.3.1. Strengths of UBpla type "Lancet":

it is possible to hit objects in a tactical depth of up to 60 km;

Their small size and speed reduce the effectiveness of their detection using radar means.

#### 1.3.2. Weaknesses of UBpla type "Lancet":

relatively low flight speed (observed) - up to 100 km / h;

the biggest problem of both systems remains the payload; minimum payload size and its current application question the destructive power of both systems, especially against armored vehicles; during the stay in the air from 30 to 40 minutes and the range is close to 40 kilometers the enemy can use these systems to support maneuvers and offensive operations, similar to the use of artillery;

Strikes are applied to predetermined, mostly stationary (fixed) targets.

#### 1.3.4. Problematic issues on effective counteraction to UBPLA type "Lancet":

detection with the help of radars of UBpla type "Lancet" due to their size and composite construction;

visual detection is difficult due to its small size, fast dive when the target is captured;

the enemy conducts reconnaissance with the help of an Orlan-10 type UAV and the provision of targeting of the UBPLA;

silent in flight of the UBpla type "Lancet";

these UBPLAS are used during the day, but the most common and most effective is their use in the dark in the period from 23:00 to 06:00 in order to complicate their visual detection, determine their number and reduce the effectiveness of the use of direct cover facilities.

### **1.4. Tactics of application, indicating the routes, flight altitude, time of day of their application and analysis of the fight against them**

1.4.1. The tactics of using kamikaze drones "Shahed-136" of the RF Armed Forces provides for the possibility of their massive use to destroy military and civilian infrastructure (mainly buildings) in the depths of Ukraine.

In turn, the tactics of using kamikaze drones "Shahed-136" in the Iranian Armed Forces provides for the possibility of their use to expose the positions of enemy air defense units in order to further defeat them.

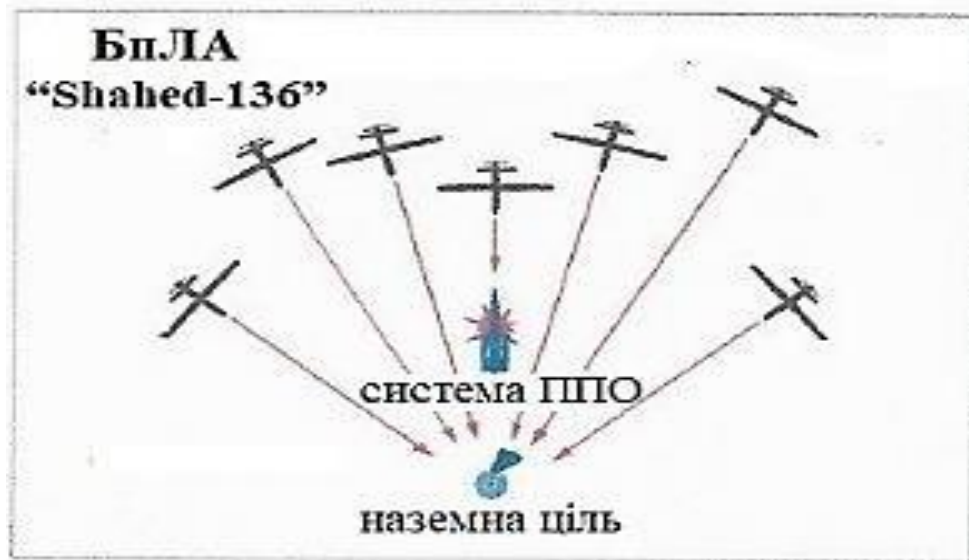
The launch of the devices is carried out from a mobile PU disguised in the back of a civilian truck. The PU can launch up to five Shahed-136 kamikaze drones with a volley.

1.4.2. The main uses of UAVs (Figure 1.6):

circumvention of kamikaze-type UAVs of zones with a developed air defense system (real-time reconnaissance and strike UAV control (target detection, strike, evaluation of the results of the defeat to determine the need for a second strike); striking a large number of kamikaze-type UAVs.



a)



b)

*Symbols:*

- a – bypassing the zone of action of air defense systems;
- b – striking a large number of UAVs

**Figure 1.6** – Variants of the use of reconnaissance and strike UAVs

1.4.3. From the analysis of the time of use of kamikaze drones "Shahed-136" of the RF Armed Forces, it was established that since the beginning of armed aggression, these UAVs have been used during the day, but the most frequently and most effective is their use in the dark in the period from 23:00 to 06:00 for the purpose of complication of their visual detection, determination of their number and reduction of the effectiveness of the use of means of direct cover of objects.

On the marching section, the flight path is rectilinear. The average speed of kamikaze drones "Shahed-136", which was observed during their combat use, is 140-150 km / h (also observed movement at speeds in km / h - 80, 70, 130, 150, 190, 200, 230, 400, respectively), and the flight altitude on the marching section - from 700 m to 2000 m, in the area of the target - decreases to 200 m. The average flight time to the affected object is 15-30 minutes. Most of the routes of their flight are carried out from the south, along highways, riverbeds and estuaries in order to mask the sound of UAV engines and the ability to fly at the lowest possible height (from 20 m) without obstacles of a natural and urban nature (power lines, high-rise buildings, etc.).

To counter these UAVs, the Defense Forces of Ukraine actively use mobile fire groups that carry out early detection, warning and destruction of targets using small arms and direct cover means.

Thus, on November 4, 2022, the forces of the MVG from the 19th pogp of the NSU in the amount of 3 servicemen armed with a 7.62-mm paired PKT, who performed a combat mission near the settlement of Trikhatki with the help of a thermal imager Therm Tec Cyclops 325 (detection range up to 1500 m, optical zoom up to 6<sup>x</sup>, automatic operation up to 12 hours, Wi-Fi and GPS) detected UAV "Shahed-136". Tracking of the target along the route was carried out by a mobile headlight "Owl" (range up to 600 m) using dense fire exposure. The object of destruction after the hit sparkled and about 2000 m north-west from the settlement of Trihatky exploded when it fell.

*Reference. The range to the target is 300 m, the approximate speed of the UAV is from 120 to 140 km / h, the take-out of the target is 5-6 figures, the tracer ammunition is every fourth. Ammunition consumption – 7.62 mm rounds – 120 pcs.*

Also, the specialists of the EW 28 ombre for greater efficiency against the means of UAVs (guidance operators) work in cooperation with MLRS "Grad". The mobile EW group calculates the place of take-off of the UAV, the location of the operator and transmits the coordinates to the artillerymen who are constantly on alert, and then everything according to a well-known scheme: urgent departure to the position, the fastest possible deployment, working out on the target and only 40 seconds to leave the position.

This analysis shows that Ukraine's air defense forces and means shoot down up to 88% of Iranian kamikaze drones. In addition, almost everyone is able to shoot down the Shahed-136, ranging from automatic small arms, small-caliber anti-aircraft guns, certain types of MANPADS, as well as short- and medium-range air defense systems.

## 1.5. The procedure for detecting UAVs such as a kamikaze drone

The organization of early detection of approaching UAVs to select an adequate means of struggle in accordance with the scale of the threat includes (Figure 1.7):

- deployment of a system of visual observation posts;
- providing visual observation posts with the main and backup means of communication for the timely transmission of information about the flight of a kamikaze UAV;
- to detect kamikaze-type UAVs in the dark, at each visual observation post, have night vision devices, searchlights (powerful lights), thermal imagers;
- placement in the area of the target of EW complexes in order to disrupt the control channel between the aircraft and the NSU;
- creation of an echeloned air defense system to defeat UAVs that were not suppressed by means of EW. Depending on the circumstances, it may include short-range anti-aircraft and short-range missile systems, short and medium-range and tactical aircraft.

1.5.1. It should be noted that after the use of Iranian UAVs in the Middle East, the American side does not consider kamikaze-type aircraft to be high-tech and high-precision weapons. Such UAVs have a number of weaknesses that can be used to organize effective counteraction:

Tactics of use does not imply the defeat of moving targets. In order to reduce the likelihood of defeat, it is necessary to intensify the movement of military equipment, which is a high priority target for the Russian Federation (MLRS HIMARS, from their defense system, EW, artillery systems, etc.);

design limitations. Kamikaze UAVs "Shahed-136" are not equipped with means of communication, which makes it impossible to control them in real time, change the flight mission, etc.;

warheads are less powerful than Russian precision weapons. To hit one target, it is usually necessary to use several Iranian kamikaze-type UAVs.

It is also noted the high vulnerability of Iranian UAVs to EW means. Satellite and radio communication channels of reconnaissance and strike vehicles have an insufficient level of electronic protection.

The most effective option for the destruction of the Shahed-136 UAV are STINGER, MISTRAL, GROM, PIORUN anti-aircraft missiles, where the aiming point should be the engine (the hottest place), which is located in the center behind, but if it is impossible to use this type of weapon, it is possible to use small arms, with advance and direction of movement (Figure 1.8).

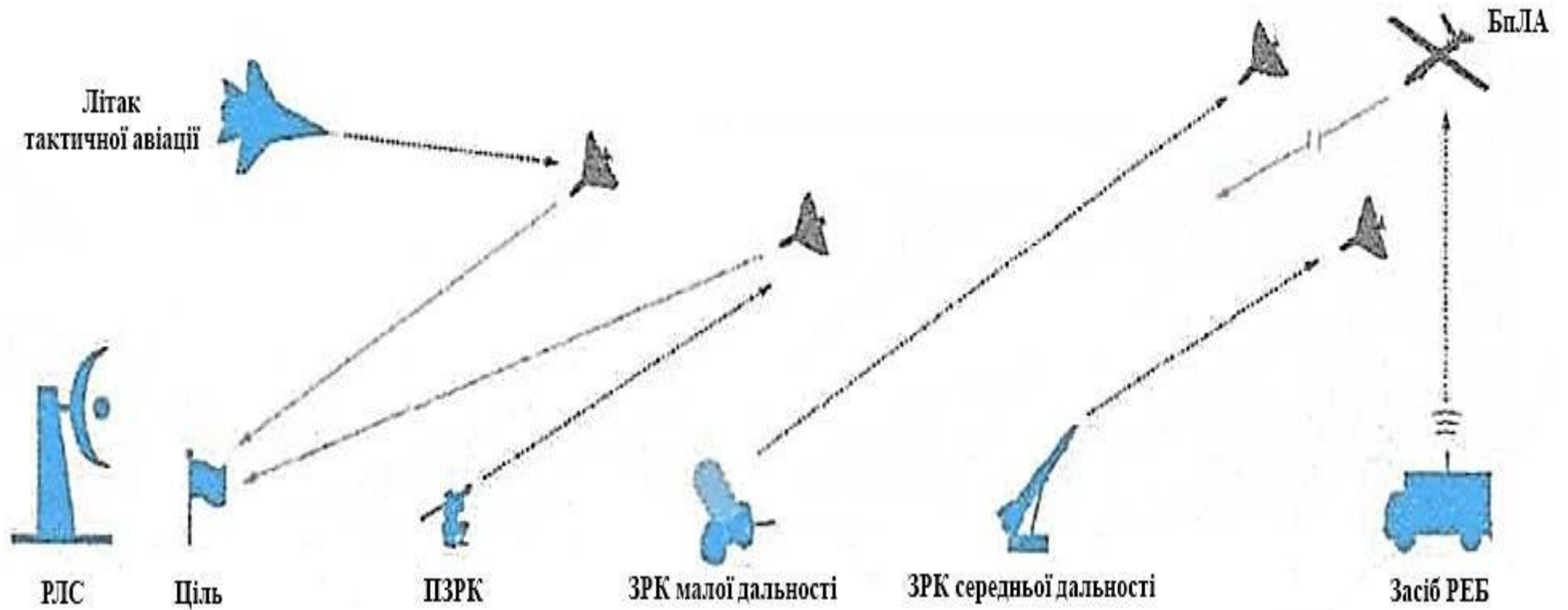
1.5.2. The procedure for actions of servicemen in case of visual detection or obtaining information about the detection of UAVs in the air on the approaches to a military facility

Officials of the guard, daily narand all military personnel, in case of visual detection or receipt of information on the detection of unmanned aerial vehicles in the air on the approaches to a military facility, must act according to the algorithm given in Table 3.

**Table 3**

**Algorithm of actions when detecting UAVs**

Source of information	Actions of personnel	Actions of unit commanders , duty officers, chiefs of the guard
UAV is visually interspersed	Remember the flight time, approximate height, type of apparatus (if possible). Flight direction (required). Provide a report to the immediate commander (chief) – immediately.	During the work – the next military facility for any means of communication immediately. During the single movement of personnel – the next military facility (upon arrival at the unit or available means of communication).
In the absence of visual UAV observation (in the presence of a characteristic sound)	Report to the immediate commander (chief) – immediately, increase surveillance.	The duty officer of the military facility - the head of the military facility and the operational duty headquarters of the highest level for subordination.
Upon receipt of information about spans with a military facility	Strengthen surveillance	The duty officer of the military facility - the head of the military facility, the personnel of the units, air defense posts, the operational duty headquarters of the highest level for subordination – immediately



**Figure 1.7** – System for combating UAVs such as kamikaze drones



**Figure 1.8** – The most effective option for the destruction of UAV "Shahed-136"

## **1.6. Experience in combating kamikaze strike drones "Shahed-136" ("Geranium-2") and "Lancet - 1" and "Lancet - 3"**

During the combat use of the Armed Forces of Ukraine, kamikaze drones "Shahed-136" ("Geran-2") and "Lancet-1" and "Lancet-3" were destroyed both by the crews of fighter aircraft and by the combat services of the air defense system S-125M1, "Buk-M1", S-300P, ZSAU "Gepard-1A2". Also, according to available information, there is a high probability of hitting kamikaze drones "Shahed-136" with the help of onboard armament of ships, armored vehicles, as well as with the use of barrage fire from small arms.

According to the results of attacks on the objects of the Defense Forces using kamikaze drones "Shahed-136" ("Geran-2") and "Lancet - 1" and "Lancet - 3", it is possible to draw the following conclusions:

- kamikaze drones "Shahed-136" – a classic wing with dimensions of about 3x4 m, which allows you to visually detect it with the naked eye at low altitudes;

- thermal insulation materials were used in the design of the engine compartment airframe ;

- the existing radar field and a high effective reflective surface make it possible to detect "Shahed-136" kamikaze drones from a distance of more than 50 km;

- in quiet weather, noise from a running engine at a distance of more than 20 km; blows are applied to predetermined, mostly stationary (immovable) Goals;

- UAVs operate at least in pairs: one or two kamikaze drones "Shahed-136", one - an indefinite type of UAV, probably operating in the mode of a scout or repeater.

More details on the organization of a comprehensive fight against kamikaze strike drones "Shahed-136" ("Geran-2") and "Lancet - 1" and "Lancet - 3" are given in Appendix 2 and 3 to these Guidelines.

## **2. FIGHTING UAVs**

### **2.1. General provisions**

The easiest and most logical way to get rid of an enemy UAV is to destroy it. Any flying equipment can be shot down. The main problem in this matter is to identify the target and conduct its successful attack. At the same time, various weapons can be used for destruction. Thus, small light UAVs can be shot down with small arms, and to defeat heavy UAVs, anti-aircraft missile systems must be involved.

In some cases, light-class UAVs are a difficult target for existing radars. These apparatuses have a small effective scattering area, which is why their detection becomes quite a difficult task. In particular, the maximum detection range is reduced.

Medium and large UAVs with large geometric dimensions, significant thermal contrasts due to the use of powerful engines

internal combustion, carrying cannon and missile-bomb weapons, parabolic satellite dishes, which have a large effective scattering area, represent a target for air defense systems.

Small-sized UAVs are characterized by small geometric dimensions, low thermal contrast, and flight speed, as well as a small effective scattering plane, which does not allow to ensure sufficient efficiency of their destruction of air defense systems, MANPADS.

**ATTENTION!** *The problem of neutralizing this class of UAVs is solved by means of electronic warfare.*

Low values of indicators of the effectiveness of the defeat of small-sized UAVs with active anti-aircraft weapons necessitate the development and implementation of a set of special measures to organize their defeat by active means, as well as to carry out a number of measures to counter the reconnaissance and fire suppression systems available on board the UAV.

#### 2.1.1. The list of activities may include:

creation of special groups of anti-aircraft formations, including various types of air defense systems, CJSC, ZGRK, MANPADS, which have relatively high reconnaissance and fire meters when detecting and firing at small targets and are intended exclusively for the destruction of UAVs;

improvement (modernization) of existing models of anti-aircraft weapons in the interests of increasing the effectiveness of the fight against small targets;

development of promising samples of anti-aircraft weapons in relation to the solution of specific tasks of detecting and hitting small air targets, including UAVs;

development of specialized complexes and means of combating small-sized targets based on the use of non-traditional weapons;

application of a set of "military" measures to counter the intelligence, control and combat use of UAVs.

A drone can be "almost killed" if during the flight it disrupts the operation of its on-board sensors, "clogs" communication channels, data and control systems, drowns out the signals of the GPS system, from which the UAV becomes "blind and helpless". It can truly be destroyed only physically, with a rocket, a projectile from an ordinary gun, or a laser gun beam. Information suppression with help u systems of electronic warfare in standard, well-developed ways, as well as with the help of the latest electronic technologies will be used for any drones without exception.

#### 2.1.2. Using direct anti-aircraft missile and artillery cover of missile and artillery weapons depots and other objects of storage of material and technical means, commanders (chiefs) should take into account:

From the personnel of the guards, "combat and three-five" are created to conduct barrage fire from small arms. In this case, it is carried out

their distribution by number. The fire is conducted in long lines in sequence by numbering;

destruction of the UAV is carried out by combining the simultaneous use of the ZU-23-2, the Strela-10 air defense system, MANPADS, "combat fives" and a searchlight;

for the organization of barragenude used regular VKK, NSVT "Utes" on the basis of armored vehicles. To illuminate targets at night, it is advisable to use the headlights "Pattern" and "Luna". In order to comply with safety measures, marks of the firing sector are applied to the turrets of machine guns;

mortars are used to illuminate the UAV, which will provide fire on them with means of destruction. During the use of mortars, the implementation of safety measures to prevent fires in the technical area is taken into account;

constant defection of faulty PPRU and determining the possibility of restoring some at the expense of others;

repair crews are created according to samples of air defense weapons with the tasks of repair, adjustment of weapons and training of personnel in proper operation. To restore the illumination of collimatorsights ZU-23-2 consider the use of conventional flashlights with a semi-discharged battery;

preparation for each air defense system of 3-4 spare firing (starting) positions and 1-2 false positions is carried out.

## **2.2. Subsystem of anti-aircraft operation**

2.2.1. In order to provide air cover for military facilities, anti-aircraft artillery platoons armed with 23-mm anti-aircraft gun installations ZU-23-2 or 14.5-mm anti-aircraft machine-gun installations ZPU-1 are being conducted to their states.

2.2.2. To counter and destroy UAVs that are attacking from the air, it is necessary to involve fire means and weapons of an anti-aircraft artillery platoon, guard personnel and the duty unit, blind optical devices of UAVs with searchlights, laser pointers and apply other measures countermeasures that can have a positive effect or force the enemy to abandon their intentions.

2.2.3. Firing positions of air defense systems should be equipped in places that provide the most complete overview of the airspace and unhindered firing (on hills, artificial embankments, roundups, roofs of storage facilities, buildings, etc.). To increase the maneuverability of air defense systems and quickly increase ix fire in threatening directions, it is possible to install the ZU-23-2 (ZPU-1) in car bodies, on MT-LB or other BM.

2.2.3.1. Firing positions of air defense systems must meet the following requirements:

provide a circular view (inspection in the responsible sector) from the point of standing of the fire agent with closing angles of not more than 00-10 (36');

inclination of the installation site of the fire means – no more than 10°;

have visible objects at a distance of at least 1, 000 m for the alignment of automatic anti-aircraft guns (machine guns).

2.2.3.2. When assigning firing sectors for each air defense fire, the location of potentially dangerous objects, settlements, and military and civilian infrastructure is taken into account. Prohibited firing sectors are indicated to personnel of air defense services, guards and duty units. In order to prevent firing of the ZU-23-2 (ZPU-1) in prohibited sectors, the firing positions of these means can be additionally equipped with limiters for pointing automatic anti-aircraft guns (machine guns) at the elevation angle and azimuth.

2.3.4. Calculations of the ZU-23-2 (ZPU-1) in case of detection of UAVs in the air of the no-fly zone of a military facility should act according to the algorithm given in Table 2.

**Table 2**

**Algorithm of actions for calculating ZU-23-2 (ZPU-1) in the detection of UAVs**

Source of information	Actions of service numbers and ZU-23-2 (ZPU-1)	Commander's actions anti-aircraft artillery platoon, duty unit
UAVs observed visually	Provide a report to the immediate commander (chief) – immediately. Calculation numbers take places according to the combat calculation, fire is opened at the command of the platoon commander, at the entrance of the UAV to affected area.	Prove the signal "AIR". They give a command, from the doses of the will of the head of a military facility to open fire on the UAV in the no-fly zone, they control the actions of the anti-aircraft artillery platoon according to the combat calculation. Report
In the absence of a visual observation of the UAV (in the presence of a characteristic sound)	Provide a report to the immediate commander (chief) – immediately. Calculation numbers take places according to the combat calculation, fire is opened when a UAV appears in the affected area, at the command of the commander of an anti-aircraft artillery platoon	for subordination: to the commander of the anti-aircraft artillery platoon to the duty military facility, the duty officer of the military facility - the head of the military facility and the operational duty headquarters of the highest level in subordination.

### 2.3. Air defense control subsystem

2.3.1. The air defense control subsystem of a military facility consists of: commander of an anti-aircraft artillery platoon (duty military facility);

air defense control point (a specially equipped place where designated officials control the fire and actions of subordinate forces and means during the repulse of enemy air strikes);

control tools (communication tools, signaling means, pointers, etc.).

2.3.2. When controlling air defense systems, it is necessary to provide an unambiguous understanding of the fire tasks assigned to the forces and provide air cover for objects.

Fire control and setting fire tasks for each ZU-23-2 (ZPU-1) is carried out with reference directions that are oriented towards the cardinal points and installed around each installation.

*For example:*

**"Shield-1", target over 12th search, or "Shield-1", target over 32nd destroy".**

The duty unit (reinforcement unit, guards) setting fire tasks for the destruction of air targets is carried out in objects and directions.

*For example:*

**"Target over vault 105 destroy, or '30th', target towards fire depot, search."**

After completing the task, destroying, or firing the air target, the services of air defense systems and other means engaged in air defense of a military facility report on the results.

*For example:*

**"I am Shield-1", target over 12 destroyed, 50 (ammunition in pieces)", or: "I am the 20th", the target over storage no. 10 has not been destroyed, has left the affected area, is moving towards the fire depot."**

2.3.2. To combat UAVs, it is possible to use the following methods and techniques by parts and subdivisions of air defense of the SV:

concentration of fire of air defense systems, ZGRK on unmanned aerial vehicles for their reliable destruction;

dispersal of fire for applying maximum wattat to the UAV group;

independent firing by anti-aircraft artillery (rocket-artillery) unit.

2.3.4. When building an anti-aircraft missile and artillery cover system for troops, it is necessary to ensure:

mutual targeting between the air defense units of the SV on the UAV, which suddenly appear at low and extremely low altitudes;

creation of two or three firing lines for guaranteed destruction of UAVs.

2.3.5. The greatest effectiveness of firing on UAVs is achieved by using a platoon ZU-23-2, both day and night, from ambushes on the routes of the UAV span.

### 2.3.6. Shooting ZU-23-2 on UAVs has its own characteristics:

the use of the ZU-23-2 unit using the intensive concentration of fire ZU-23-2 encourages the enemy to complete the task of the UAV without fulfilling the task;

setting different output data for firing for each installation makes it possible to quickly reconfigure all installations;

the use of the ZU-23-2 as a separate fire agent, separated from the fire unit, is extremely ineffective.

## 2.4. Obstruction of UAV operation

The destruction of the UAV is associated with a number of difficulties during the detection and destruction of the target. Therefore, in the discussions of methods of counteracting the equipment, an alternative to destruction is often proposed – the suppression of electronic systems. Some modern UAVs have the ability to autonomously perform tasks, but almost all such equipment is controlled by the operator, and commands are transmitted via the radio channel. Thus, the suppression of the control channel of electronic warfare means can, at a minimum, interfere with the task.

Many armies are armed with a large number of various EW systems. To successfully suppress the operation of the UAV, it is necessary to set the frequencies at which it is controlled, and then "score" them with obstacles. Not all modern UAVs are equipped with automation capable of taking control in case of loss of a signal from the operator. In addition, the loss of communication with the operator will lead to the impossibility of transmitting intelligence information, such as a video signal from the UAV camera. The further fate of the UAV, what is left without control depends on the party carrying out the interception. First of all, it can be destroyed, and destroying such a goal should not be a difficult task.

In case of loss of the communication channel with the operator, some UAVs have an appropriate mode of operation. In case of loss of a signal from the operator's remote control, the automation returns the UAV to the specified area where it can land. In this case, the control system ignores all signals, and moves to the specified zone. The zone is carried out using satellite navigation. Using a GPS or GLONASS system, the aircraft can determine its own position in space, direction and range to the operator or aerodrome and return to it. In order to prevent the "evacuation" of the UAV, EW means must suppress not only the control channel, but also the signals of the navigation system. As a result of the successful jamming of all these signals, the enemy with a high number of people will lose equipment, caught in the zone of action of EW.

2.4.1. Electronic suppression of detected enemy control radio networks, unmanned aerial vehicle control radio lines in order to disorganize the control of tactical groups and their units during operations

2.4.1.1. Electronic suppression of enemy electronic means can begin both immediately after the start of electronic reconnaissance, and simultaneously with its beginning.

2.4.1.2. Under any conditions of the situation, the process of conducting electronic counteraction includes:

- definition of REP goals;
- distribution of REP goals;
- targeting means of REP;
- radiation management of REP tools; REP effectiveness control.

2.4.2. In order to exclude cases of harm to the communication lines of their troops, prohibited frequencies for REP are brought to the units and means of EW. Radiation of radio interference at the specified frequencies is prohibited.

2.4.2.1. During the REP, EW units unmask their positions by radio emission and are the first objects of fire damage. During the battle, the positions of the EW unit should be outside the zone of destruction by direct fire, since the time of folding the obstacle stations is up to 50 minutes. At the same time, the positions of the VHF-wave interference stations should be located at a distance of 3-4 km, and the KH-wave range - 5-6 km from the line of combat.

2.4.2.2. The implementation by the EW units of the assigned tasks for radio reconnaissance and REP is carried out with the receipt of conditions that make it difficult for the enemy to detect them by means of electronic intelligence.

2.4.3. Electronic suppression of the air and ground component of the UAV is carried out in the direction of providing guaranteed REP communication lines, control and navigation systems of the UAV, available on board self-guided radiation or radio subversive weapons, as well as reconnaissance means of UAVs in the range of radio waves, taking into account possible countermeasures and various ways to protect against interference.

2.4.3.1. In order to effectively counteract UAV means and EW, it is necessary to ensure timely detection and recognition of signals emitted by onboard transmitters of UAVs, as well as simultaneous and comprehensive impact by radio interference on RECs, which ensure the direct use of UAVs (receivers of signals with user navigation, command channel, manual control channel, telemetry, target information).

### **3. THE PROCEDURE FOR THE DESTRUCTION OF KAMIKAZE TYPE UAVS**

To combat kamikaze-type UAVs at each platoon stronghold, block post, and at the locations of personnel, assign firing groups to counter unmanned aerial vehicles consisting of: a machine gunner, 3-4 riflemen, armed with AK-74. In the case of a sniper's ayasti, include him in the firing group.

To defeat a kamikaze-type UAV, prescribe regular fire means:

at altitudes up to 400 m – concentrated small arms fire ;

at altitudes up to 1,500 m – the use of DShK machine guns (Browning, twin Maxim machine guns, ZU-23-2 anti-aircraft guns (ZPU-1, 20 mm anti-aircraft guns "Oerlikon" and M-75) (Fig.3.1);

on the explored and probable routes of the flight of enemy strike UAVs to organize ambushes with DShK services (ZU-23-2, Browning, paired Maxim machine guns ).



a)



b)



c)

*Symbols:*

a – "Maxim"; b – "Browning"; c – 20 mm anti-aircraft gun "Ehrlikon".

**Figure 3.1**– Examples of the use of different types of machine guns installed on the bodies of pickups (cars)

### 3.1. The procedure for the use of small arms on unmanned aerial vehicles in the no-fly zone of a military facility

The procedure for the use of small arms for UAVs is shown in Table 4.

**Table 4**

#### The procedure for the use of weapons on enemy unmanned aerial vehicles

Source of information	Actions of service numbers ZU-23-2 (ZPU-1)	The actions of the commander of the anti-aircraft artillery platoon, the duty officer Part
UAVs observed visually	Provide a report to the immediate commander (chief) - immediately. Military personnel without weapons act according to the fire brigade. Armed military personnel occupy positions for firing, fire is opened at the command of the immediate commander (chief)	Bring to the military signal "AIR". They give a command to open fire on the UAV, manage the actions of personnel according to the calculation. They report on subordination: the duty officer of the military facility - the head of the military facility and the operational staff of the highest level of subordination.

### 3.2. Shooting techniques for air targets

3.2.1. To fire a machine gun at an air target, use, if possible, local objects as an emphasis and take a position for firing, as it is more convenient (standing, half bent, from the knee).

If the local object has an area (window sill, board, etc.), the machine gun is mounted with a support on the square. If there is no such area, put the machine gun on a local object, as an emphasis.

3.2.2. Firing from a trench (course of communication) at air targets is carried out standing with the installation of a machine gun prop on the beam (berm) of the trench (Fig. 3.2). The machine gun, mounted with a support on the bar (berm) of the trench, with the right hand to hold the pistol handle, with the left hand – by the butt below. To give the machine gun the necessary angle of elevation, the machine gunner must sit down or rise. Changing the direction of the machine gun during firing is achieved by moving the machine gunner's body in the right direction.

When shooting at air targets such as UAVs, it is advisable to be guided by the recommendations given in Appendix 1 to these Guidelines.



**Figure 3.2** – Position for firing at air targets from a trench

3.2.3. Features of the methods of firing from the machine gun  
KKS (KKMS)

(link d)

Movement with a machine gun on the machine gun is carried out by the gunner and his assistant. In this case, the machine gun can be carried on the hands (in the assembled or disassembled venom) or by the wire by the strap.

To carry the machine gun assembled, the gunner turns the machine gun with the barrel to the left all the way, secures it and takes up the hind legs of the machine near the plowshares; the gunner's assistant with his left hand takes up the front leg, and in the right hand he carries boxes with cartridge tapes (Fig. 3.3). During the transfer of the machine gun to Stepanov's machine, the boxes with cartridge tapes should be transferred fixed to the machine bracket.

To carry the machine gun disassembled, the gunner disconnects the machine gun from the machine gun and transfers it, the assistant directs the machine to the "marching" position and transfers it (Fig. 3.4).

To carry the machine gun by the strap with a fiber, the gunner gives the machine gun a horizontal position, fixes the guidance mechanisms and takes up the strap with his right hand; The assistant gunner with his hand takes up the strap, and in his right hand carries boxes with cartridge tapes.



**Figure 3.3** – Carrying a machine gun assembled



a)

b)

*Symbols:*

a – gunner with the body of a machine gun;

b – assistant gunner with a machine in the "marching" position.

**Figure 3.4** – Transfer of the KKMS machine gun disassembled

When disconnecting the machine gun from the machine, squeeze the frame latch lever with the thumb of the left hand, and with your right hand raise the machine gun by the butt upwards, holding the machine gun with your left hand by the barrel handle, and with your right hand by the butt, moving forward and upwards, bring the trunnions of the receiver out of the engagement with semicircular frame cutouts.

To transfer the machine of the Samozhenkov design to the "marching" position, it is necessary:

with the left hand, unfasten the vertical guidance clamp, and with the right hand raise the frame up to the stop;

fix the clamp;

unfasten the clamps of the hind legs;

put the machine on the ground so that the front leg is approximately vertical, and with a sharp movement turn the hind legs down all the way (until the dashes are combined); fix the clamps of the hind legs and take the machine on the shoulders.

To transfer the machine to the "marching" position after firing at air targets, it is necessary to press the swivel latch and fasten the frame with the riser to a horizontal position; fasten the riser with the frame latch and perform the steps above.

Preparation for firing from the KKS machine gun (KKMS) includes the installation of a machine gun in a firing position, the adoption of a position for firing and for the row of a machine gun. To install a machine gun, choose, if possible, a flat area with dense (soddy) soil, set the front leg in the main direction of firing, and deepen the guides of the skids of the machine into the ground.

If the machine gun was transferred in a disassembled form, then transfer the machine to the required position for firing (lying down, sitting, from the knee, at air targets) and attach a machine gun to it.

To transfer the machine of the Samozhenkov design from the "marching" position to the prone shooting position (Fig. 3.5), the gunner's assistant must unfasten the clamps of the hind legs, take the machine by the hind legs near the plowshares, put the machine on the front leg, resting his foot on the plowshare, with a sharp movement on the hind legs, install the machine in the ground, trying to match the dashes, and secure the clamps of the legs.



**Figure 3.5** – Position for shooting lying down

When shooting at air targets (Fig. 3.6), transfer the machine to a sitting firing position, then fold the frame to an upright position, and then the riser.



**Figure 3.6** – Position for shooting at air targets

When installing the machine gun on the machine in the position for firing at air targets, it is necessary to move the prop of the machine gun forward and secure its legs with a clip; tie the trunnions of the receiver into the semicircular cutouts of the riser bracket so that the protrusions of the grooves of the bracket are between the trunnions and the guide tides of the receiver.

To aim the machine gun at the target, the gunner must install a sight and a rear sight with his right hand; holding the machine gun with the right hand by the pistol grip, with the left hand, unfasten first the GN clamp, then hold the VN duck and, directing the machine gun to the target, achieve that the flat front sight coincides with the selected aiming point; fix the mechanisms and clarify the guidance, then report to the commander of the **"Ready"** section.

During the execution of the task, depending on the method of firing, the following should be fixed:

for firing to the point – horizontal and vertical guidance clamps ;

for firing with scattering along the front – VN clamp; for firing with scattering in depth – GN clamp;

for firing with simultaneous scattering along the front and in depth – the VN clamp.

At tense moments of the battle, shooting can be carried out with detached mechanisms.

To fire at the point, give a command.

*For example:*

**"Target over vault 105 destroy, or '30th', target towards fire depot, search."**

The gunner, pointing the machine gun at the target, must fix the guidance mechanisms and open fire. To open fire, it is necessary to put the fuse in the "Fire (Fire)" position, stubborn the machine gun on the shoulder so as to feel a tight fit to the shoulder of the entire backside of the butt; hold the machine gun with your left hand by the butt from the bottom in the gap, skipping the thumb of the left hand into the notch of the butt; right hand to cover pistol grip, skip and index finger into the trigger bracket; press the trigger and, without losing sight of the target, hold it until the required number of shots occurs. Then, if necessary, correct the guidance and press the trigger again, making the next turn. So act before the consumption of the designated number of rounds or to the team **"Stop the fire."** The gunner regulates the length of the queue by ear.

### 3.2.2. Features of the methods of firing from machine guns KKB (KKMB) and KKT

(link d)

3.2.2.1. The KKB machine gun (KKMB) in the "marching" position should be transported with an armored personnel carrier in a special laying of the machine.

Preparation for firing from a machine gun includes the installation of a machine gun with an armored personnel carrier on the bracket of the vehicle, the adoption of a solution for firing and loading a machine gun.

To install a machine gun on the bracket of the machine, you must:

separate the machine gun with an armored personnel carrier from the mount in the styling;

insert the pin of the installation swivel into the machine bracket, first fix the swivel lock, and then the locking strap of the bracket;

turn the box holder perpendicular to the machine gun and secure it with a pin;

install a box with cartridge tape in the holder, open the lid and prepare the cartridge tape for loading the machine gun.

If the armored personnel carrier installation is fixed on the bracket of the machine, and the machine gun is removed, then it must be placed on an armored personnel carrier; to do this, bring the trunnions of the barrel box into semicircular frame cutouts in an armored personnel carrier and lower the machine gun by butt down to sunset constipation for the protrusion of the trigger box.

Firing from the KKB machine gun (KKMB) is usually carried out from a standing position. For the convenience of loading the machine gun, the installation should provide the greatest elevation angle and fix the guidance mechanisms.

On some machines, an unpaired KKT machine gun is transported in a special styling.

To install the machine gun on the installation of the machine, it is necessary to put the ku lemet on the sliders, secure it with a check on the rear slider, and then push the machine gun forward with an energetic movement and, holding it in this position, fix it with a check on the front slider.

Guidance of the machine gun is carried out using guidance mechanisms or a control knob on the scale of the standard sight of the machine until the desired division of the sight scale is combined with the aiming point.

To lower the bolt frame of the KKT machine gun, you need to press the machine gun electricstart button and hold it until the required number of shots is fired. In the event of a malfunction of the electric trigger, put forward the fuse of the trigger lever and press the trigger lever downwards.

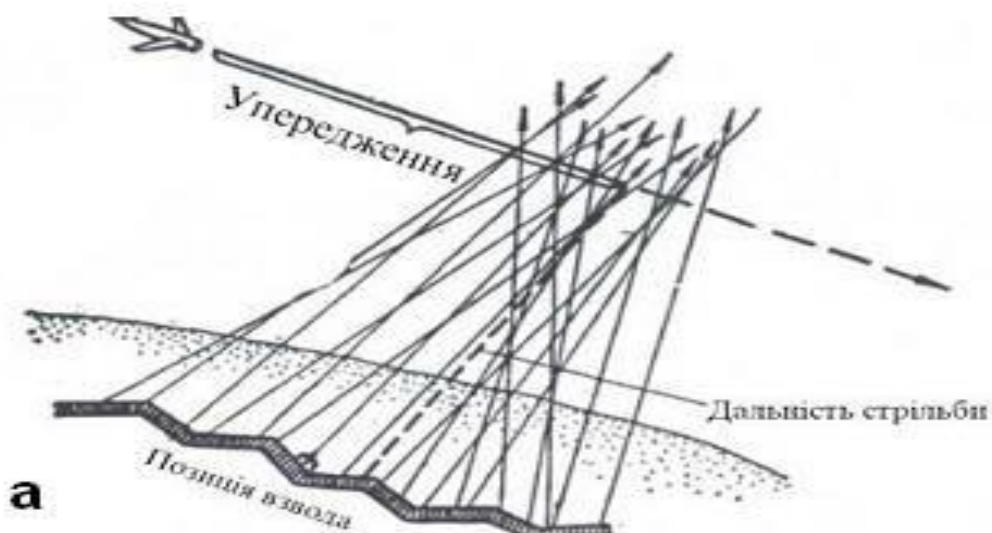
3.2.2.2. Machine gun fire on airplanes, helicopters, UAVs and paratroopers is carried out, as a rule, as part of a compartment or platoon at a range of up to 1000 m with the installation of the sight "5" at a range of up to 700 m and the installation of a sight on the mark "7" – at long ranges.

Fire on aircraft is opened only at the command of the commander, and on parachutists - on command or independently.

On an aircraft diving in the direction of a machine gunner, fire continuous fire with an "4" or "P" sight, pointing a machine gun at the head of the target or behind the barrel of a machine gun. Fire was opened from a distance of 900 m to it – 1,100 m.

On the flying apart, flying aside or above the machine gunner, fire in a barrage or accompanying way.

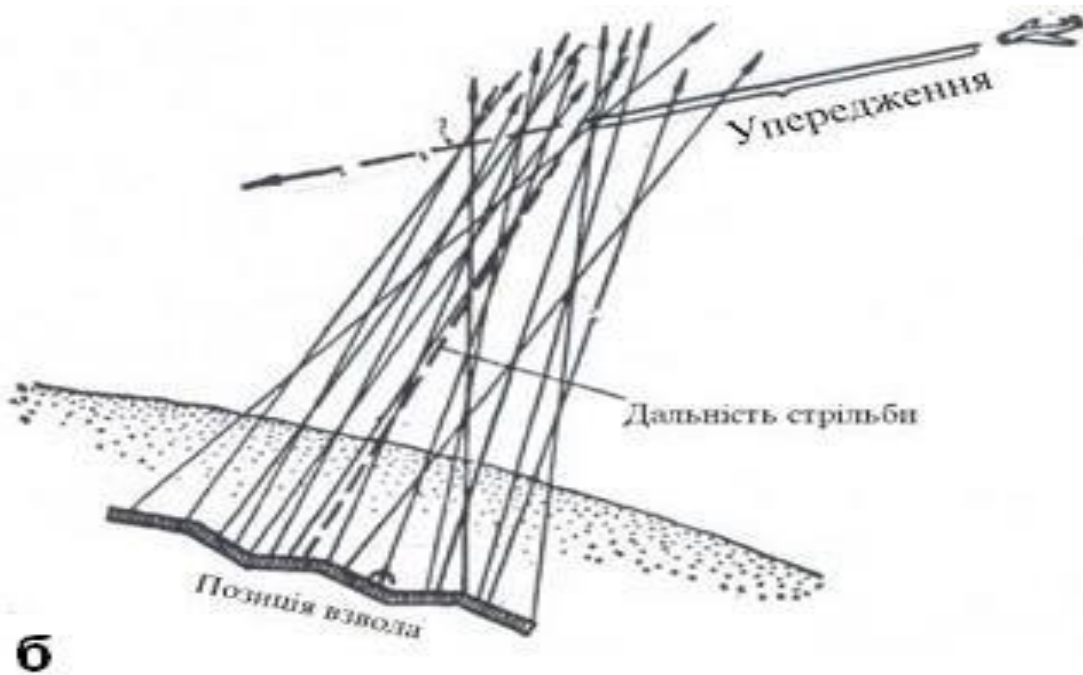
Fire in a barrage way on aircraft flying low and having an aircraft flight speed of more than 150 m / s (540-600 k / h). During firing in a barrage method, the fire of the department or platoon should be concentrated at the command of the commander in the direction of flight of the approaching aircraft (Fig. 3.7). In the direction indicated in the command of the commander, the machine gunner must provide the machine gun the elevation angle is approximately  $45^\circ$  and open fire by holding the machine gun in a given direction. Fire continuous fire until the aircraft leaves the firing zone. If the machine gunner clearly sees the direction of the tracks of his machine gun near the target, then he is allowed, without ceasing firing, to slightly move the machine gun towards the target, seeking to combine the tracks with the target.



*Symbols:*

- a – the course of the aircraft moving along (with the parameter) of the platoon position ; b – the course of the aircraft moving at an angle to the platoon position.

**Figure 3.7** – firing on the aircraft by a barrage method



*Symbols:*

a – the course of the aircraft moving along (with the parameter) of the platoon position ; b – the course of the aircraft moving at an angle to the platoon position.

**Continuation of Figure 3.7 – firing on the aircraft by a barrage method**

For low-speed air targets (helicopters, UAVs, transport aircraft), fire in an accompanying way. Prejudice to define and count targets in apparent dimensions (in figures), and fire in long bursts according to the same rules as when shooting at ground moving targets.

When adjusting the fire on the tracks, it should be borne in mind that the tracks directed to the plane seem to the machine gunner to be those that go above the plane and a little ahead of it.

To determine the bias when shooting at air targets, follow the data shown in Table 4 in the accompanying way.

**Table 4**  
**Table for determining bias when shooting at air targets by an accompanying method**

	Firing range, m											
	100		300		500		700		900		1100	
	Bias											
	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures
Glider 25 m/s;	3		11	1	20	2	31	4	46	6	62	8

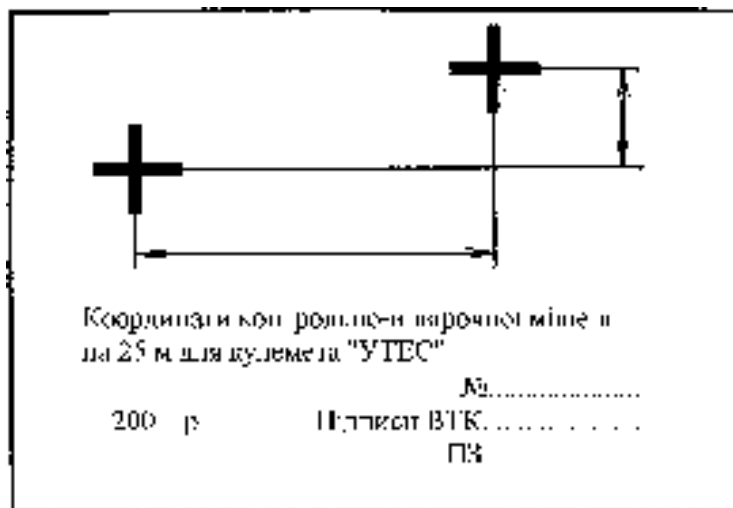
	Firing range, m											
	100		300		500		700		900		1100	
	Bias											
	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures
Helicopter (UAV) 50 m/s;	6	1	21	3	39	5	63	8	92	12	125	16
Transp.aircraft 100 m/s	13	1	43	3	79	5	126	8	183	12	250	16

**Note.** The length of the hull of the aircraft is equal to 15 m, helicopter and airframe - 8 m, UAV - 4 m.

### 3.2.3. Firing from the 12.7-mm machine gun "Utes" on air targets (link e)

Before each shooting, check the ZCU for a control and reconciliation target built in accordance with the control and verification coordinate card (Fig. 3.8), which is located in the machine form.

The main type of shooting is shooting in short bursts (4 – 6 shots in line). The maximum permissible intensity of shooting is 100 shots in continuously short bursts, one long queue – no more than 50 shots.



**Figure 3.8** – coordinates of the control and reconciliation target for the machine gun "Utes"

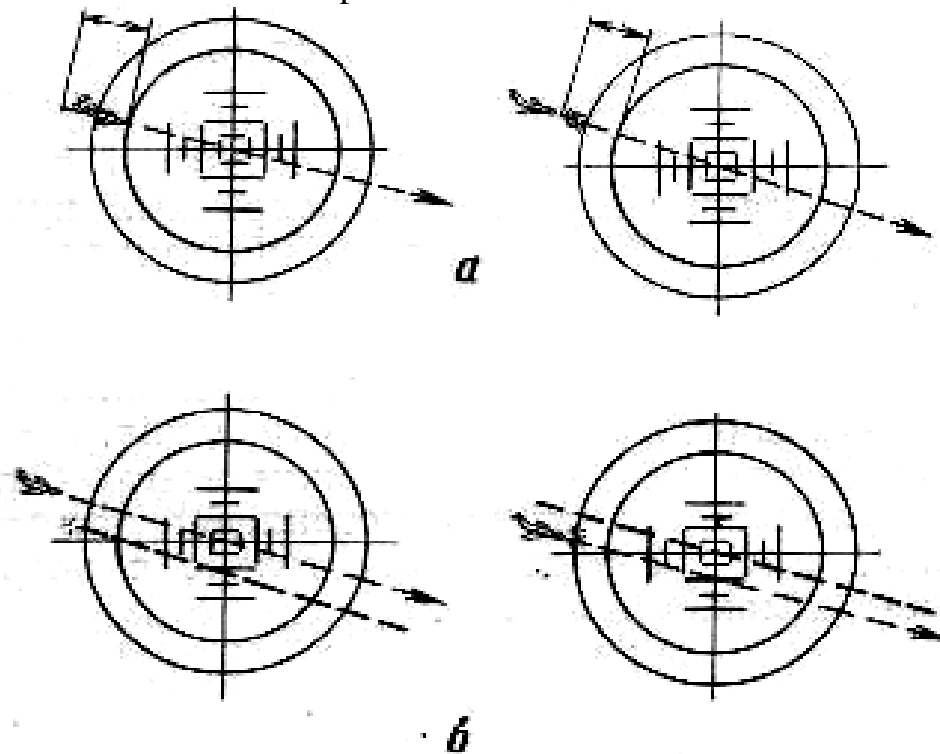
To shoot at airtargets, the one who shoots using guidance devices must connect one of the angle rings

(which corresponds to the speed of the target) with the goal so that the direction of movement of the target is to the center of the intersection of the grid (Figure 3.8).

When firing at air targets with intermediate speeds or with other angles, guidance adjustments should be made.

An angle is the ratio of the visible length of the fuselage of an aircraft (helicopter) to its length of its length. The angle is determined by the eye method (Fig. 3.9).

Angle speed is determined by multiplying the path speed of the target by the angle and the result is rounded up to 50 km / h.



*Symbols:*

a – adjustment of the deviation of routes to the direction;

b – adjustment in case of deviation of tracks in height.

**Figure 3.9** – adjustment of shooting at air targets with the removal of the aiming point.

The road speed is determined in kilometers per hour according to the type of aircraft, the nature of the task, as well as the experience of previous shooting. The aiming point on the ring of the sight grid is chosen so that the continuation of the fuselage axis passes through the intersection of the sight grid.

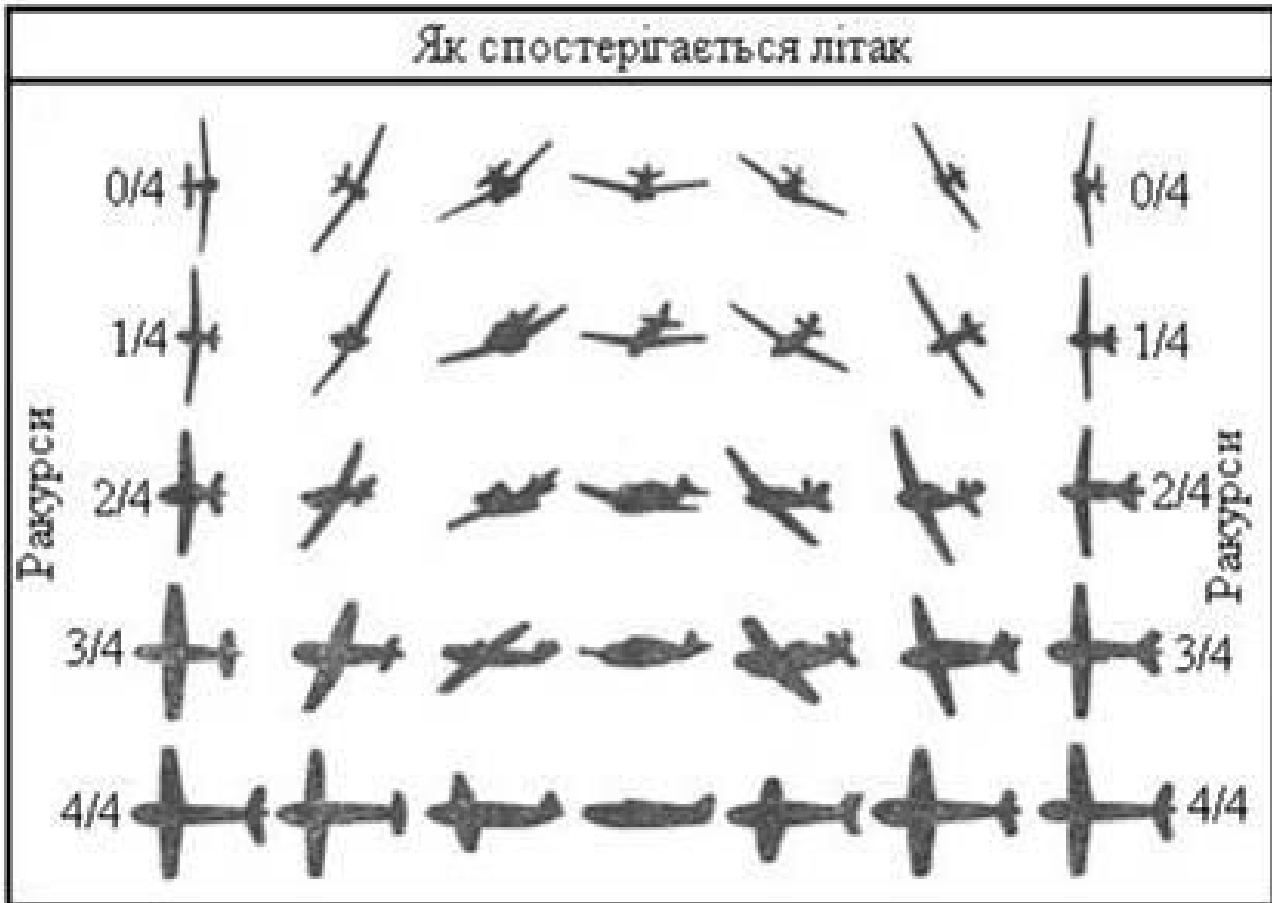
With an angle of 0/4, the aiming point is the intersection of the sight grid.

When firing at helicopters that are declining (rising), the bias to descend (ascent) is taken equal to 0-20, for parachutists – 0-10.

When firing at helicopters in the position of freezing and on lighting bombs, they do not take prejudice, they point the intersection of the sight grid to the center of the target (to the illuminated point).

Adjustments to the shooting in height and direction carry out the removal of the aiming point in the direction opposite to the tracks, by the value of the deviation of the center of the grouping of tracks (Fig. 3.10). Fire on the tracks is used when not

time to determine the magnitude of the bias on the movement of the target and to aim at the target using a sight. The shooter opens fire, directing the barrel of the machine gun slightly forward in the direction of movement of the target, observes the position of the bullet tracks relative to the target and, without stopping firing, turns the machine gun so that the tracks pass through the target.



**Figure 3.10** – Aircraft angles

*For example:*

If the target moves at a speed of 100 m/s with an angle of 2/4, then the speed on the grid is equal to two speeds of the target, that is, 200 m/s, and the shooter must point the second ring at the target, corresponding to the speed of 200 m/s at an angle of 1/4.

The most effective is shooting at ground targets at ranges up to 1,000 m and at air beamsflying at altitudes up to 500 m and ranges up to 2,000 m at speeds up to 250 m/s.

3.2.4. Firing from a 14.5-mm large-caliber machine gun Vladimirov tank (KPVT) at air targets (**link is**)

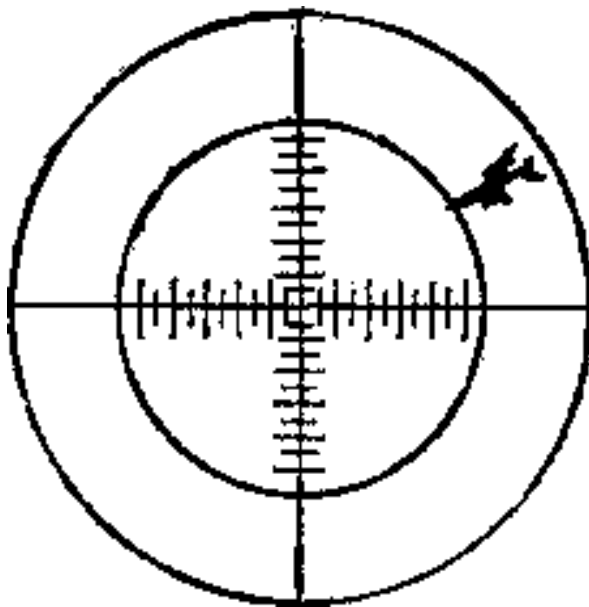
Before firing at air targets, it is necessary to determine the speed of their flight and angle at the time of opening fire. Speed and angle are determined by eye depending on the type of aircraft, altitude and range of opening fire. At the same time, on the sight VK-4, set the sitku: "400", if the speed of the aircraft is 350 km / h –

500 km/h, "700" if the speed is 550 km/h – 750 km/h and "1000" if the target speed is more than 750 km/h.

The target angle is rounded at  $1/4$ , which corresponds to the rings (applied and imaginary) on the sipof the sight. The first real ring on each grid (Fig. 3.11) corresponds to a  $2/4$  angle (the fuselage of the aircraft is visible in half of its true length, and the directional angle of the target in the inclined plane is  $30^\circ$ ), and the second – the angle of  $3/4$ .

*For example:*

*When opening fire on an aircraft at a range of 200 m and a flight altitude of 500 m, the point to choose must be chosen on an imaginary ring located between the center and the first real ring, because the target angle at this moment will be equal. When firing with a VK-4M sight, aiming at this In the case you need to do on the first ring.*



**Figure 3.11** – Pointing a machine gun at an aircraft at an angle of  $2/4$  (sight VK-4)

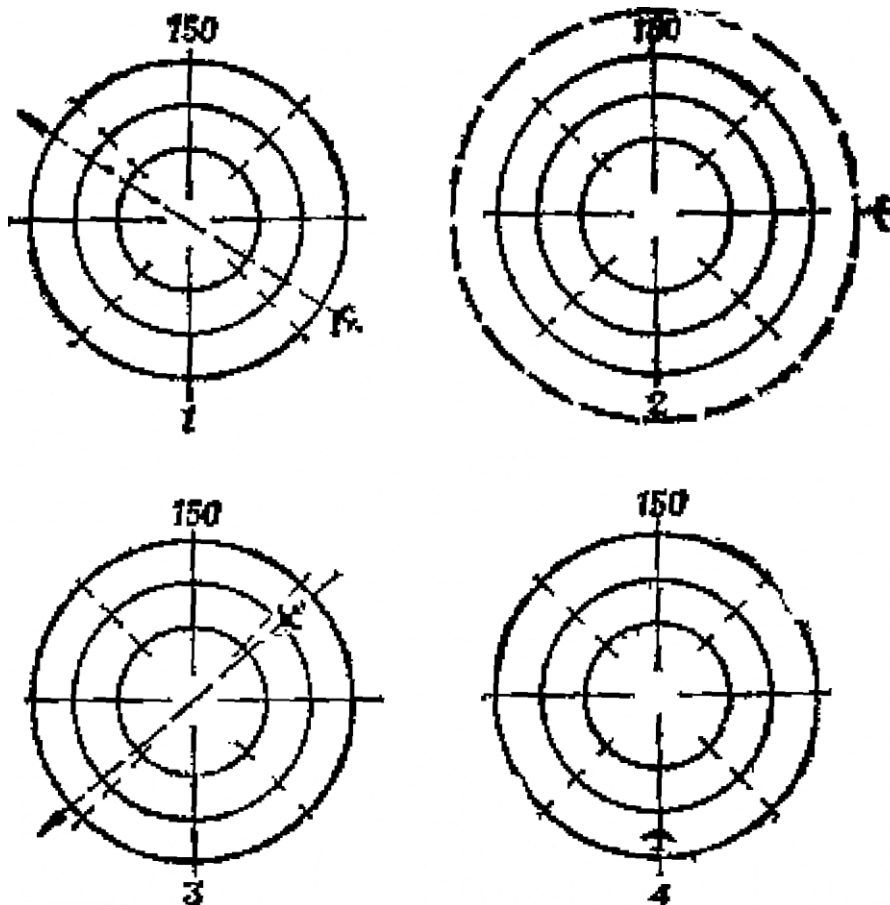
If the target speed is less than 400 km/h and more than 1000 km/h, then the ring on the grid must be chosen according to the angle speed, that is, the actual speed of the target is multiplied by the angle.

*For example:*

*The angle speed of the helicopter at an angle of  $3/4$  and a flight speed of 250 km / h will be 200 km / h, which corresponds to the first ring of the grid "400", on which you should choose the point of sighting (vision).*

The values of the speeds that correspond to the rings of each sight grid, the gunner must know by heart. Set the selected grid in sight by rotating the flywheel of the sight drum.

When it is necessary to fire with accompanying fire, then the point of sighting (b achennya) on the target (the main part of the aircraft) should be selected on the marked ring of the grid (valid or imagined) so that the path of the aircraft extended from the point of sight (vision) passes through the center of the sight (Figure 3.12).



**Figure 3.12** – Selection of the sighting point (vision) during the accompanying fire

The accompanying fire should be opened from limited distances and led first in short bursts, after reaching the normal grouping of routes into a target – in long bursts, and on small lags (less than 500 m) – with continuous fire.

Pointing at the target before opening fire and at the time of turn to carry out continuously, keeping the main part of the aircraft at the selected point of sighting (vision).

Change the ring during the change of angle to  $1/4$  or when the tracks are slightly deviated from the target. As the target approaches, the angle increases, on the course parameter it is equal to  $4/4$ , and after that the target angle begins to subside, then you need to shoot at the incoming aircraft.

When flying an aircraft on a horizontal station at a speed of 700 km/h, the grid ring number should be changed after 1-2 queues are made, and at a lower speed - 3 or more queues.

For targets that periodically disappear behind the clouds during the firing period, shooting with accompanying fire is carried out in open areas. When the target disappears behind the clouds, make one long turn and shift the machine gun to the opposite side of the cloud. After the target comes out from behind the clouds, the shooting continues.

On aircraft diving at the ZKU, firing is carried out with continuous fire, and guidance is carried out through the center of the rings of the sight grid. Fire on targets diving at a nearby object should be carried out in long lines in an accompanying way, taking into account the change in the target angle.

If during firing the gunner observes only tracks that lag behind the target or are ahead of it, no less than in two stages, then the point must be changed in the right direction by half the distance between adjacent rings.

On airplanes that appear suddenly due to clouds, natural shelters (forest, mountains, etc.) and move at low altitudes, fire "on the highways". Shooting is carried out with continuous fire and, without using the sight, change the position of the machine gun by personal observation of the tracks, to achieve the connection of the tracks with the target.

The barrage fire should be conducted, if possible, from several installations at the same time. At the command of the senior commander, with a bullet et in the direction of waiting for the air target, provide an angle of elevation of  $45^\circ$  and in 1-2 seconds of approaching the target to a certain landmark to open the barrage fire in long bursts.

If the gunner clearly observes the tracks of his machine gun, then arbitrary movement of guidance mechanisms is allowed to connect the tracks with the target.

The commander of the combat vehicle (department) during the firing at air targets monitors the position of the tracks relative to the target and corrects the fire.

### 3.2.5. Shooting at air targets from the AK-74 (RPK-74) **(link f)**

Fire from machine guns (light machine guns) on UAVs, airplanes, helicopters and parachutists is carried out as part of a department or platoon at a range of up to 500 m with the installation of a sight 4 or – P.

3.2.5.1. On a dive target in the direction of firing something, firing incessant fire with sight 4 or —P, aiming at the main part of the target or pointing an assault rifle (light machine gun) on the barrel. Fire to open from a range of 700 – 900 m.

3.2.5.2. On an aircraft flying aside or over a machine gunner (machine gunner), fire is carried out in a barrage or accompanying way.

Fire in a barrage way is carried out at targets that fly low. When firing in a barrage way, the fire of a compartment or platoon is concentrated at the command of the commander in the direction of movement of the approaching aircraft. In the direction indicated in the command, the machine gunner (machine gunner) adds an angle of elevation of about  $45^\circ$  to the machine gun (light machine gun) and opens fire, holding the machine gun (light machine gun) in the dowry direction.

Shooting is underway incessant fire to the exit of the air target from the fire zone.

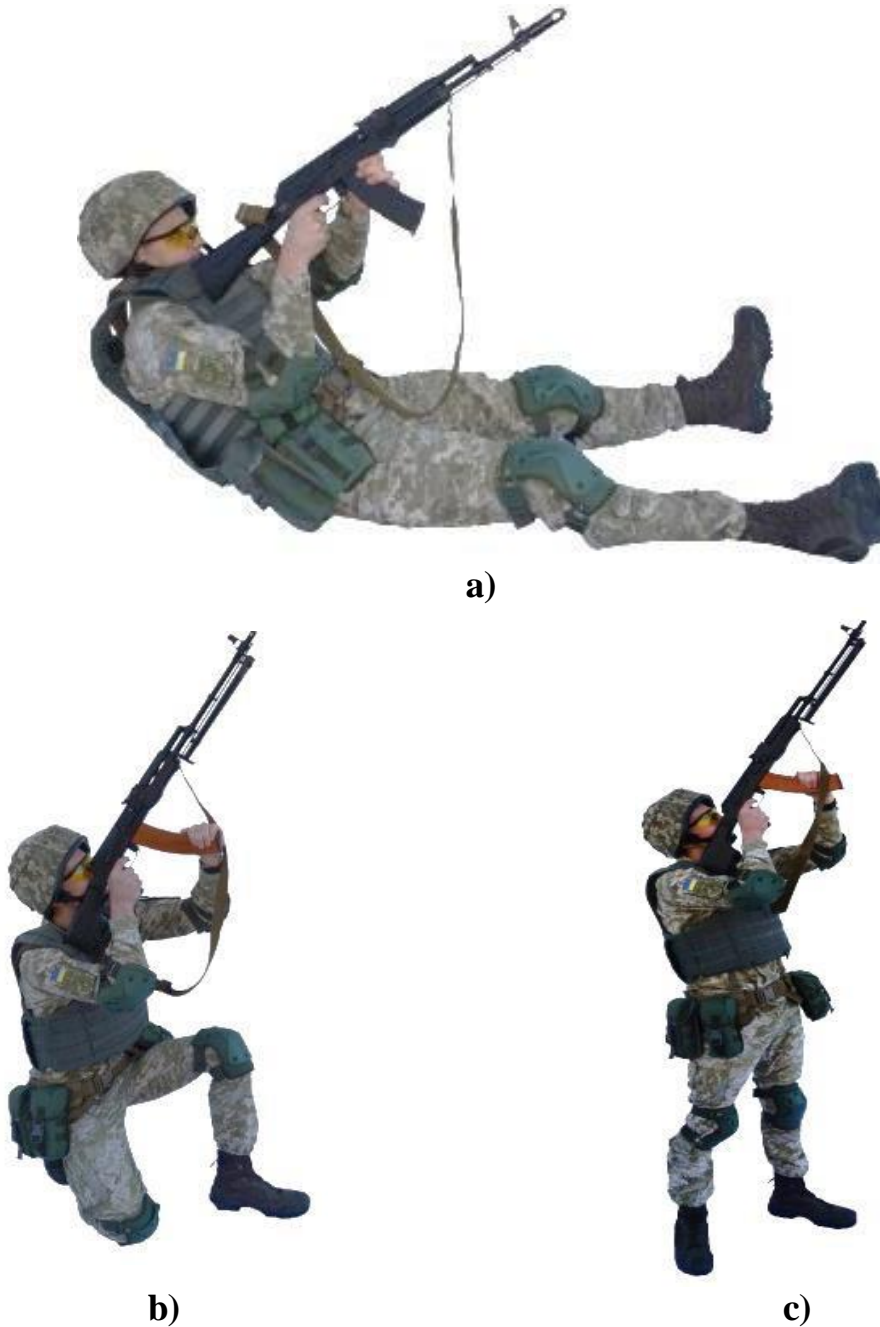
If the machine gunner (machine gunner) clearly sees near the target the direction of the tracks from his weapon, then he is allowed, without ceasing firing, to move it slightly towards the target, to achieve the connection of routes with the target.

When adjusting the fire on the tracks, it should be borne in mind that the tracks directed at the plane seem to the shooter as going above the plane and a little ahead of it.

3.2.5.3. On low-speed air targets (UAVs, helicopters), fire is conducted in an accompanying way. The lead is determined and counted in the visible dimensions of the target (in figures). When firing in the accompanying way, the machine gunner (machine gunner) whims the aiming line, in front of the target by the amount of the desired lead and makes a long queue.

Shooting from a machine gun (machine gun) at air targets is carried out from lying positions, from the knee and standing (Fig. 3.13).

For firing, if possible, use local objects as an emphasis (spire, turret fence, leer, etc.) and take a position for firing, as if it was stronger(standing, half-bent, from the knee).



*Symbols:*

a – lying down; b – from the knee; in – standing

**Figure 3.13** – Position when shooting at air targets

#### 3.2.5.4. Shooting at air targets is carried out:

with the emphasis of the forearm of the left hand and the magazine in **the object** located on the brustver (with the installation of the machine gun bipod on the spire, the turret fence, leer, etc.); if the angle under it is insufficient, then sit down (Figure 3.14 a, b);

with a support back and left foot in the predmeta located on the upper deck: raise the left leg as the highest and rest her foot on the object, and lean her back against the opposite wall and sit down slightly. Hold the machine gun (machine gun) in the same way as during shooting while standing, but rest the elbow of the left hand on the thigh of the left leg or put it slightly forward behind the knee (Figure 3.14v).



*Symbols:*  
 a – with the emphasis of the machine gun magazine in front steepness; b – from a machine gun from a bipod; c – from a machine gun from the hand.

**Figure 3.14** – Position when firing at an air target from a trench

Fire from machine guns (light machine guns) on air targets is carried out as part of a group, team, department, combat crew, platoon at a range of up to 500 m with the installation of a sight 4 or P.

According to the UAV, flying aside or above the machine gunner (machine gunner), fire is carried out in a barrage or accompanying way.

3.2.5.6. When firing by a barrage method (in accordance with the methodology given in subparagraph 3.2.2.2 of Figure 3.7 of these Guidelines), the fire of the department or platoon is concentrated at the command of the commander in the direction of movement of the approaching UAV. In the direction indicated in the command, the machine gunner (machine gunner) adds an angle of increase of about  $45^{\circ}$ – $60^{\circ}$  to the machine gun (light machine gun) and opens fire by holding the machine gun (light machine gun) in this nap. Firing is carried out with continuous fire until the UAV leaves the fire zone, or its defeat.

If the machine gunner (machine gunner) clearly sees near the target the direction of the tracks of his machine gun (machine gun), then he must, without stopping firing, slightly move the machine gun (light machine gun) in the direction of the target flight, seeking to connect the tracks with the target.

When adjusting the fire on the tracks, it should be borne in mind that the tracks directed at the UAV seem to the shooter, that they are going above the UAV and a little ahead of them.

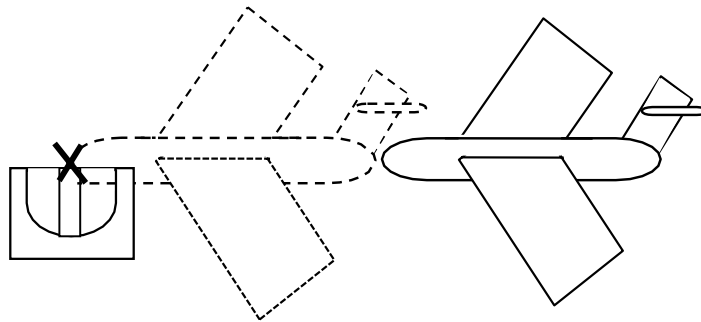
3.2.5.6. For low-speed air targets, fire is conducted in an accompanying way. The removal of the aiming point is calculated in the visible dimensions of the target (in shapes). During firing in an accompanying way, the machine gunner (machine gunner) keeps the line aiming in front of the UAV for the amount of the desired bias and makes a long queue.

3.2.5.7. To determine the removal of the aiming point when firing at a UAV, it is necessary:

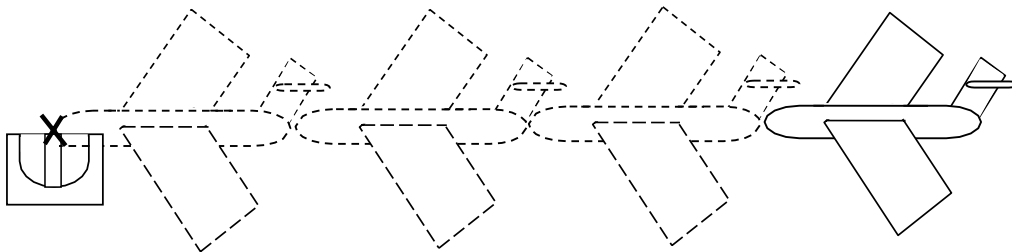
at a distance of 100 m (Figure 3.14) – 4 m (1 target body);

at a distance of 300 m (Figure 3.15) – 12 m (3 target housings);

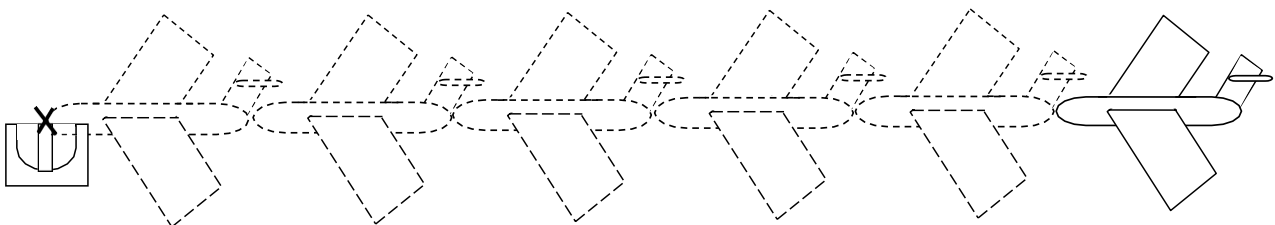
at a distance of 500 m (Figure 3.16) – 21 m (5 target buildings).



**Figure 3.15** – removal of the aiming point when shooting at a 100 m UAV



**Figure 3.16** – removal of the aiming point when firing at UAVs at a distance of 300 m



**Figure 3.17** – removal of the aiming point when firing at UAVs at a distance of 500 m

3.2.5.8. Options for submitting commands:

1. "Machine gunner,submachine gunners....., UAV landmark (azimuth)..., sight Constant, left one figure, long – FIRE".
2. "Machine gunner and machine gunners, landmark (azimuth)..., unmanned aerial vehicle, three figures to the right, long – FIRE."
3. "Department, landmark (azimuth)..., UAV, 4, five figures to the right , long – FIRE".
4. "Team( combat calculation), landmark (azimuth)..., UAV, bias of five figures, barrage – FIRE".
5. "Group (team), landmark (azimuth)..., UAV, three figures to the right , long – FIRE".

3.2.5.9. The **command "FIRE"** is given at the moment when the UAV is 500m away from the fire vehicle, and is conducted for 20-25 seconds with continuous fire.

3.2.5.10. To adjust the fire on the tracks, it is necessary that the firing be carried out with cartridges with conventional and tracer bullets in the ratio: for three rounds with ordinary bullets, one cartridge with a tracer bullet, the first should be a cartridge with a tracer bullet. Firing cartridges only with tracer bullets leads to increased wear of the barrel channel.

The road speed is determined in kilometers per hour according to the type of air target, the nature of the task, as well as the experience of previous shooting.

With an angle of 0/4, the sight point is the combination of the front sight in the aiming bar.

When shooting at the AFP, which are reduced (raised), the bias on the descent (ascent) is taken equal to 0 – 20.

When firing at the BBP in the position of hanging, they do not take a bias, they point the front sight through the aiming bar to the center of the target.

3.2.5.11. Adjustments to the shooting in height and direction are carried out by taking the aiming point in the direction opposite to the tracks by the magnitude of the deviation of the center of the grouping of tracks. Fire on the tracks is used when there is no time to determine the magnitude of the bias on the movement of the target and to aim at the target using a sight. The shooter opens fire, directing the barrel of the machine gun (machine gun) slightly forward in the direction of movement of the target, observes the position of the bullet routes relative to the target and, without stopping firing, turns the machine gun so that the tracks pass through the target.

3.2.5.12. The effectiveness of UAV fire depending on the caliber of the weapon and the range to the target is shown in Table 4.

**Table 4****Small arms firing**

Target speed	Ahead of schedule	Caliber up to 5.6 mm/ max. distance 300m	Caliber 12,7 mm / maximum distance 1200 m	Caliber 23 mm/ distance up to 1800 m
50 m/s Shahed-136	5x ahead of target corps	Ineffective up to 300 m	Good efficiency up to 600 m; small efficiency up to 600–1200 m	Good performance up to 1000 m
Flies right at you	Unproactive, Need aim at the nose of the target	Ineffective up to 300 m	Good efficiency up to 600 m; small efficiency from 600 to 1200 m	Good performance up to 1000 m

3.2.5.13. To determine the advance when shooting at air targets, follow Table 5 in the accompanying way.

**Table 5****Order****Determination of advance when shooting at air targets**

Type of air target and its speed	Firing range, m											
	100		300		500		700		900		1100	
	Ahead of schedule											
	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures	in meters	in enclosures
Glider, 25 m/s	3	–	11	1	20	2	31	4	46	6	62	8
Helicopter, 50 m/s	6	1	21	3	39	5	63	8	92	12	125	16

**Note.** The length of the body of the helicopter and the airframe is equal to 8 m.

**Table D1**

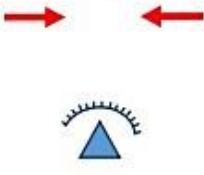

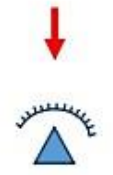
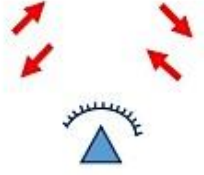

**РЕКОМЕНДАЦІЇ**  
щодо вибору точки прицілювання при стрільбі по БПЛА – камікадзе типу Shahed-136  
(дальність до БПЛА – 300÷400м)

№ з/п	Калібр кулі (пострілу), мм	Швидкість кулі (пострілу), м/с	Кількість фігур БПЛА, які брати на упередження					Примітка
			Курс (напрямок) горизонтального руху БПЛА Shahed-136 ( $V \approx 45$ м/с; $H \approx 200$ м)				при пікіруванні ( $V \approx 60$ м/с) (БПЛА заходить на ураження цілі)	
			БПЛА рухається перпендикулярно позиції	БПЛА рухається від позиції	БПЛА рухається на позицію	БПЛА рухається повз позиції		
1	5,45	900	6	7	5	6	8	
2	7,62	730	7	8	6	7	10	
3	12,7	800	7	8	6	7	9	
4	14,5	850	6	7	5	6	8	
5	23	980	6	7	5	6	7	
6	30	960	6	7	5	6	8	
7	57	1000	5	6	4	5	7	

The calculations were carried out under the following conditions:

1. The speed of the UAV in horizontal flight is 150-170 km / h;
2. The height of the horizontal flight of the UAV is 200 m;
3. The speed of the UAV when diving to the target is 200-230 km / h;
4. The range to the projection of UAVs on the ground is 300 m.

**РЕКОМЕНДАЦІЇ**  
щодо вибору точки прицілювання при стрільбі по БПЛА – камікадзе типу Shahed-136  
(дальність до БПЛА – 750м)

№ з/п	Калібр кулі (пострілу), мм	Швидкість кулі (пострілу), м/с	Кількість фігур БПЛА, які брати на упередження				при пікіруванні ( $V \approx 60$ м/с) (БПЛА заходить на ураження цілі)	Примітка
			Курс (напрямок) горизонтального руху БПЛА Shahed-136 ( $V \approx 45$ м/с; $H \approx 200$ м)					
			БПЛА рухається перпендикулярно позиції	БПЛА рухається від позиції	БПЛА рухається на позицію	БПЛА рухається повз позиції		
								
1	5,45	900	12	13	11	12	16	
2	7,62	730	15	16	14	15	20	
3	12,7	800	14	15	13	14	18	
4	14,5	850	13	14	12	13	17	
5	23	980	11	12	10	11	15	
6	30	960	11	12	10	11	15	
7	57	1000	11	12	10	11	15	

The calculations were carried out under the following conditions:

1. The speed of the UAV in horizontal flight is 150-170 km / h;
2. The height of the horizontal flight of the UAV is 200 m;
3. The speed of the UAV when diving to the target is 200-230 km / h;
4. The range to the projection of UAVs on the ground is 750 m.

## RECOMMENDATIONS

for commanders of combined arms units (units) regarding the use by the armed forces of the Russian Federation of strike UAVs "kamikaze drones" "Shahed-136" ("Geran-2"):

How dangerous they are and how to counteract them

### 1. Description

For several months in a row, Ukraine has been suffering from attacks by Iranian "kamikaze drones" "Shahed-136", which are used by the Russian Armed Forces in the course of hostilities.

There are confirmed facts of the use of these drones both on the front line and against large cities in order to destroy the critical infrastructure of Ukraine.

The enemy continues in its tactics psychological and fire influence in particular on the rear regions, where the population did not feel the "boot of the occupier", and try to keep under pressure so that there is no impression that they are retreating, losing ground and not being able to implement the plan that was stated at the beginning – to seize Mykolaiv and Odessa and cut off from the sea. Thus, in the south of Ukraine, quite powerful strikes are inflicted with missile means and "kamikaze drones". The destructive power of iron suicide birds takes the lives of civilians, destroys homes and infrastructure facilities of Ukrainian cities. Recall that in October, Russia carried out a massive attack with missiles and drones on the city of Kyiv and other regions of Ukraine (Figure 2.1).



**Figure 2.1** – Historical building in the center of Kiev, which became a target for the Russian attack

At present, the tactics of using the Armed Forces of the Russian Federation "kamikaze drones" "Shahid-136" provides for the possibility of their massive use (*resort to "swarm tactics" - 6-8 such kamikazes are launched at once in order to overcome the air defense systems of the Armed Forces of Ukraine*) to destroy military and civilian infrastructure in the depths of the territory of Ukraine. In addition to the togo, the Armed Forces of the Russian Federation most often use them in the dark in order to complicate their visual

identification, determination of their number and reduction of the effectiveness of the use of means of direct cover of objects.

Since the beginning of Russia's large-scale war against Ukraine, the Defense Forces of Ukraine have been constantly fighting drones launched by the Russian Federation.

Taking into account the fact that the enemy launches these drones en masse, at the rate of "clogging the channel" of anti-aircraft missile systems (hereinafter - air defense systems), because the old Soviet air defense systems have an extremely limited parameter relative to the number of targets that can simultaneously fire, intercept and destroy more than dozens of "Shahed-136" this is more than a high result.

## 2. Contents

The "Shahed-136" unit costs from 20,000 to 50,000 euros, so the Russian Armed Forces use them as a substitute for missile strikes due to their low cost. In total, over the past Ukrainian month, 161 Shahed-136 drones have shot down 161 Shahed-136 drones, one larger Shahed-129 and four even larger unmanned attack aircraft, known as the Mohager-6.

According to The Guardian, the Ukrainian Defense Forces have eliminated Iranian kamikade drones worth about the last month \$11.66 million - \$17.9 million.

To counter these UAVs, the Defense Forces of Ukraine actively use mobile fire groups (hereinafter - MVG), which carry out early detection, warning and destruction of targets using small arms and direct cover means.

Thus, on October 31, in the Kharkiv region, with the help of an anti-drone gun, there was an interception and forced landing of the Orlan-10 UAV.

In addition, on November 4, by the forces of the MVG 12th Sr. 19 popg of the NSU in the amount of 3 servicemen (armed with 7.62 paired PKT), performing a combat mission in the area of the settlement of Trihatky with the help of The Therm Tec Cyclops 325 thermal imager (detection range up to 1500 m, optical zoom up to 6x, automatic operation up to 12 hours, Wi-Fi and GPS) was detected by the Shahed-136 UAV. Tracking of the target along the route was carried out by a mobile headlight "Owl" (far from 600 m) using a dense fire impact. The object of damage after the hit sparkled and about 2000 after 2000 m in a northwesterly direction from the settlement of Trihatki exploded when falling.

**Reference.** *The range to the target is 300 m, the approximate speed of the UAV is from 120 to 140 km / h, the removal of the target is 5-6 figures, the tracer ammunition is every fourth. Ammunition consumption 7.62 mm – 120 pcs.*

Also, the specialists of the EW of the 28th separate mechanized brigade for greater efficiency of the weapons of UAV (guidance operators) work in cooperation with the MLRS "Grad". Mobile EW group calculates the place of take-off of the UAV, location

operator and transmits coordinates to artillerymen who are constantly on alert, and then everything according to a well-known scheme: urgent departure to the position, the fastest possible deployment, working on the target and only 40 seconds to leave the position.

This analysis shows that Ukraine's air defense forces and means shoot down up to 88% of Iranian kamikaze drones. In addition, almost everyone can shoot down the "Shahed - 136", ranging from automatic small arms, small-caliber anti-aircraft guns, certain types of MANPADS, as well as short and medium-range air defense systems.

### **Conclusion.**

As a result of the armed forces of the Russian Federation of drones in the terrorist country, namely Iran, it is possible to conclude that the military-industrial complex of the Russian Federation has embarked on the path of its final degradation.

Using "Shahed - 136" is much cheaper than a missile, which costs several million dollars, but with a probability of 0.8-0.9 it can be destroyed by the Defense Forces of Ukraine. Today, it is quite unprofitable for Russians to use missile weapons as Kalibr, Onyx, Kh-22 and Kh-59 cruise missiles. But, they use once several types of missiles in order to break through the air defense of Ukraine and actually spend tens of millions on one such breakthrough and do not always have one hundred percent guarantee that they will be successful. The use of "kamikaze drones" by the Russian Armed Forces may indicate that Russia has almost exhausted its stockpile of missiles, and is now trying to get at least something to reach targets in Ukraine.

Based on this, the fight against UAVs is one of the priority tasks and obliges to carefully study and analyze the experience of combat use, to search for new ways of using air defense systems.

### **3. Recommendations to the commanders of military units (units) on countering (detecting and destroying) UAVs "kamikaze drones" "Shahed-136"**

3.1. Regarding counteraction (detection and destruction) of UAVs "kamikaze drones" "Shahed-136":

equip visual observation posts in the positional areas in advance (hereinafter – PWS);

*Reference.* Equip them with wide-panoramic optoelectronic means of round-the-clock surveillance (thermal imagers) capable of detecting small-sized ones. small opaque targets, radio reconnaissance systems, direction finding, scanning receivers and searchlights.

to ensure operational work on establishing interaction between air defense units, mobile fire groups, brigade command post and aviation checkpoint in order to prevent "friendly fire" during joint work on the destruction of air attack (UAVs);

to equip the firing positions of air defense systems for inspecting the airspace and unhindered firing;

*Reference.* Firing positions were set up on hills, artificial embankments, landslides, roofs of storage facilities and other buildings. The most effective option for destruction is MANPADS, such as "Mistral", "Stinger", "Perun", "Thunder".

in order to disrupt the control of the UAV group, first of all, to choose to destroy the UAV with a higher flight altitude;

create and use mobile groups of PWS (2-4 servicemen) on off-road vehicles that will be able to carry out notification and detection of targets (reconnaissance RLI) with the help of SPMZ "Virage-tablet" in order to quickly detect them and transmit information to the PU with the subsequent issuance of target designations.

**Reference.** *The groups include MANPADS calculations (several types of MANPADS "Mistral", "Stinger", etc., which will increase fire capabilities). Provide Microsoft tablet computers with "Virage-tablet" SPMZ and a program for making phone calls (IP-telephony) that are connected via LTE modems to the automated control system "Dnipro". This will provide an opportunity to receive and enter information in the SPMZ "Virage-tablet", issue and receive CV, make phone calls in the network of CATS (Farlep).*

to carry out advance selection and assessment of the positions of units within the positional area, taking into account the forecast of the likely use by the enemy of various types of UAVs (their possible number in strikes and the most likely directions of attack), as well as the capabilities of air defense systems to combat with them;

to allocate (assign) fire means in advance from among anti-aircraft installations, and large-caliber machine guns capable of effectively detecting and firing small air targets for anti-aircraft fire on UAVs

**Reference.** *Optimal is the use of various modifications of the PC installed on an anti-aircraft machine in the body of a pickup truck (fast extension for interception, instant deployment). Also PKK, AKM with the corresponding BC (armor-piercing incendiary, tracer)*

*These groups should act both in the most likely (non-emergency) directions of UAV flights from ambushes and in stationary positions (buildings, warehouses, etc.). This achieves the suddenness of the use of damage to small UAVs.*

*The most effective way is barrage fire. The calculation takes a lead with a facemargin (2 times) and fires 1-2 seconds into a fixed imaginary point in the path of the UAV without conducting (without moving the weapon) – the UAV itself to fly into a cloud of bullets.*

combine (if any) the simultaneous use of anti-aircraft missile and anti-aircraft artillery complexes: "Strela-10", MANPADS with ZU-23, AZP-57, Armed Forces 23-4 "Shilka", "Gepard 1A2";

develop instructions for firing and interaction with detection and electronic suppression means when organizing the fight against small-sized UAVs in advance.

**Reference.** *The instructions should determine the procedure for conducting reconnaissance and shelling of UAVs, the exchange of information between means on the coordinates of the UAV flight, the results of combat work, methods of concentration and dispersal of fire, the purpose of the consumption of missiles (ammunition), as well as other issues regarding the specifics of combat work on small targets.*

deploy at a military facility the available means of active detection of aircraft;

**For reference:** *Active detection tools include all-round radars such as mobile coherent-pulse all-round radar "Delta", mobile three-coordinate*

*ALL-VIEW RADAR 80K6M, RADAR AN/TPQ-49A, AESA5.*

use pyrotechnics to illuminate the place of probable appearance of the target (lighting mines and signal missiles, provided that the height of the UAV does not exceed 250 meters for the subsurface of the silhouette);

use thermal imaging sights, anti-aircraft spotlights, powerful lights, etc.

3.1. Regarding the protection of personnel and equipment from "Shahed 136":  
to carry out engineering equipment of positions, using  
protective

terrain properties, infrastructure elements to protect against air impacts;

in case of detection of UAVs in the air, immediately disperse personnel,  
occupy shelters, sub-blasting niches or protective elements of the area;

disperse weapons and military equipment on the  
ground to reduce the likelihood  
of its defeat;

perform the collapse of stationary objects, taking into account the angle of  
attack "Shahed-136" (60 degrees) (Figure 2.2);



**Figure 2.2** – An example of using radar screens 19Zh6

use pre-equipped screens (stretched camouflage nets, etc.) or natural elements (bushes, trees, walls, etc.) to create obstacles at the angles of attack of the "kamikaze drone".

The use of the Armed Forces of the Russian Federation UAV "kamikaze drones" "Shahed-136" to destroy civilian infrastructure, including in the rear areas, which at a considerable distance from the front line obliges to carefully study and analyze the experience of combat use of aviation, in particular UAVs, to use the most effective methods countering them, searching for and introducing new ways of fighting. The above-mentioned should ensure the safety of personnel, guaranteed cover from the destruction of military facilities and objects of civilian and critical infrastructure of Ukraine.

## RECOMMENDATIONS

for commanders of combined arms units (units) regarding the use by the armed forces of the Russian Federation of attack kamikaze drones "Lancet-1, 3": how dangerous they are and how to counteract this threat

### 1. Description

The Defense Forces of Ukraine continue to conduct active actions, forcing the enemy to give up their positions and equip new lines of defense. Without success and prospects, the enemy resorts to fire, moral and psychological pressure, man-made blackmail in the areas in order to keep the civilian population at bay due to constant shelling using available artillery, MLRS and kamikaze drones (barrage ammunition), using Hitler's tactics in World War II, when the Nazis destroyed cities and attacked civilian targets during the Battle of Britain in order to strain the air defense forces.

Due to the deteriorating weather conditions in the autumn-winter period, the enemy refused to use the Iranian-made Shahed-136 kamikaze drones, probably due to the possibility of icing, but now it mainly uses its development, these are "Lancets", which may indicate an increase in their production at Russian factories.

These UAVs should not be compared, because they perform radically different tasks. If the Iranian drone is used to destroy large infrastructure facilities in the depths of the enemy's territory, then the "Lancet" is a drone of the battlefield, operating on the edge of the radar or air defense system, a cluster of personnel, artillery systems, directly near the front line.

Currently, the tactics of the Russian command are to concentrate groups of reconnaissance and strike drones to detect and destroy in the tactical zone. air defense systems of our troops. In some areas, the enemy began to search to a depth of 30-40 km by groups of drones, including the Lancet kamikaze strike drones, to detect air defense systems, artillery either on the move or in positions that have not yet had time to alter.

*Reference. On November 12, 2022, the Lancet kamikaze drone damaged the Buk-M1 air defense system, 16 in November 2022, the M777 trailed howitzer was destroyed (Figure 3.1).*



## 2. Contents

For the first time, the Lancet barrage ammunition was demonstrated three years ago at the Army-2019 military-technical forum. Its development and production is carried out by the Izhevsk company ZALA AERO GROUP, which is part of the Kalashnikov group of companies.

In fact, "Lancet" is a modified version of another kamikaze drone of this company – "Kub-BLA", which, by the way, has been repeatedly used by the occupiers in Ukraine.

Today it is known about the existence of two versions of the strike drone - "Lancet-1" and "Lancet-3". Both have however and glider with dual X-shaped wings and similar internal systems. The main difference is the size and payload. The maximum take-off weight of "Lancet-3" up to 12 kg, "Lancet-1" - 5 kg, with warheads (high-explosive fragmentation) up to 5 kg and up to 3 kg, respectively.

*Reference. The Russians are equipping the Lancet-3 with a 5 kg warhead with a high-explosive projectile that explodes during a collision with a target. The electric motor and the hull, resembling a rocket with two X-shaped, provide high maneuverability, but a fairly low flight speed. It has navigation and communication systems that are located in the nose. Thanks to the built-in video camera, it is possible to use a drone for reconnaissance. The torus opera has three guidance systems at its disposal : optoelectronic, coordinate and combined, so operators manually send a "kamikaze" or set the coordinates of the target for autonomous destruction.*

*In addition, the Russian Ministry of Defense in its reports focuses on the "successful use" of this device and calls it "the most effective Russian UAV."*

"Lancet-1(3)" are equipped with electric power plants, which provides them with relative acoustic invisibility with a maximum flight duration of up to 40 minutes. Run the specified non-UAV using a special ground catapult.

According to the developers, "Lancets" develop a speed of 80-110 km/h. However, when diving to the target from a height of several hundred meters, barrage ammunition is able to accelerate to 300 km / h. The range of use of drones from the ground control point is up to 40 kilometers.

It is also known that "Lancets" is equipped with several types of guidance systems: coordinate, using optoelectronic means and combined. For example, using a television communication channel, an operator can observe an online picture from a drone until the target is destroyed. It is also claimed that the Lancets do not need satellite navigation. The onboard intelligence, navigation and communication module allows you to "determine the coordinates of various objects".

As a rule, these drones are used by the USN (mobile reconnaissance groups) of the Russian Federation and try to strike at the locations of the air defense system, forces and means of artillery and where, in their opinion, there are accumulations of ammunition, for example, on green boxes from shells, etc.

In addition, these kamikaze drones are used in coordination of activities with the multipurpose unmanned aerial system "Orlan-10(30)" or "Mohajer 4(6)", which hangs at a height determined by the operator in the rear of the Armed Forces of Ukraine and acts as a kind of repeater, gives exact coordinates for their guidance. He defines the target, and the "Lancet" strikes them.

**Reference.** *It has been repeatedly noted that the use of the "Orlan-10(30)" or "Mohajer 4(6)" complex was as a distracting force (means) for the withdrawal of air defense systems of the Armed Forces of Ukraine from areas of concentration to destroy these types of UAVs and were damaged by kamikaze drones of the "Lancet" type.*

From the above-mentioned, it is possible to conclude that the tactics used by the Russian command are to force the Ukrainian air defense to act constantly, to manifest itself, to turn on radars, to disperse forces, to carry out maneuvers, etc.

And although the Ministry of Defense of the Russian Federation claims that it is "almost impossible" to intercept or destroy these drones thanks to anti-laser protection, nevertheless, practice shows that it is still possible to shoot them down.

Thus, the Defense Forces of Ukraine have repeatedly reported on the downing of the Lancets. For example, in July, Ukrainian defenders shot down a Lancet-type drone that was trying to attack a radar station in the Mykolaiv region. In addition, the Armed Forces of Ukraine shot down the Lancets in other regions of Ukraine. In October (November), the Air Force of the Armed Forces of Ukraine reported on the downing of two Lancets by fighters during a massive strike on Ukraine.

### **Conclusion.**

The nature of the war is changing, and kamikaze drones (barrage munitions) come to the fore in the modern arsenal.

Kamikaze drones, also known as barrage munitions, gained widespread popularity during the Nagorno-Karabakh war in 2020, but their potential is still poorly understood.

The use of kamikaze drones challenges outdated ideas about the possibilities of delivering long-range strikes, the survivability of armored vehicles and logistics at the operational level.

**Reference.** *Armor-piercing kamikaze drones can repeat the success of anti-tank Javelins and similar weapons in Ukraine. In addition, they are capable of operating far beyond line of sight and can destroy tanks in defensive positions, not just those that become vulnerable during maneuvers.*

Barrage ammunition is not a novelty for the Russian army. While in the air, barrage ammunition can look for a target under the control of a person, fly autonomously, striking certain targets, or use a combination of these methods with the ability to quietly overcome the air defense system. The mobility of most kamikaze drones allows small units to quietly place weapons on the battlefield.

**Reference.** *If a small group of infantrymen essentially duplicates the gunners, it is a danger to enemy forces in protected or safe areas of the battlefield. Long-range strikes can be inflicted from anywhere and disrupt operations throughout the theater of operations, detecting and destroying objects such as fuel depots, supply columns and headquarters.*

The use of kamikaze drones of the "Lancet" type on the battlefield certainly gives certain advantages to the enemy, but the use of such weapons cannot radically change the course and nature of the war.

All of the above obliges to carefully study and analyze the experience of combat use of aviation, in particular UAVs, to search for new forms and methods of using air defense systems for the timely destruction of UAVs of various classes, kamikaze drones (barrage of ammunition).

### **3. Recommendations to commanders of military units (units) on countering (detecting and destroying) BB ("kamikaze drones")**

3.1. On countering (detecting and destroying) BB ("kamikaze drones"): to ensure operational work to establish a system of interaction between air defense units, mobile fire groups and aviation in order to prevent cases of "friendly fire";

use radar means (mainly SM- and MM-range) for early detection and provision of target designations to air defense systems;

*Reference. According to the acquired experience, it was determined that the Shahed-136 UAV can be detected by radar from a distance of more than 50 km. According to acoustic signs (noise from a running engine, resembling the "sound of a moped"), in quiet weather, the UAV can be detected from a distance of more than 20 km. UAV glider (classic The wing measuring about 3×4 m) at low altitudes visually appears to the naked eye at a distance of several kilometers.*

equip visual observation posts in areas of concentration and crossing and equip them with wide-panoramic optoelectronic ones with round-the-clock surveillance asobs (thermal imagers) capable of detecting small-sized ones. low-contrast targets, radio reconnaissance systems, direction finding, scanning receivers and search searchlights;

deploy at a military facility the available means of active and passive detection of UAVs (if any);

*Reference. Active detection tools include all-round radars such as mobile coherent-pulse all-round radar "Delta", mobile three-coordinate all-round radar 80K6M, radar AN/TPQ-49A, AESA50, provided by the Armed Forces of Ukraine within the framework of military assistance from the United States.*

*Passive means of detection include complexes of detection and direction finding of electronic means (RES), mobile direction finders.*

allocate (assign) fire means in advance from among anti-aircraft installations and large-caliber machine guns, small arms that are capable of effectively detecting and firing small air targets;

*Reference. Use machine guns with thermal imaging sights, which came as international aid from partner countries and equipped independently (with the help of volunteers).*

to equip the firing positions of air defense systems for inspecting the airspace and unhindered firing;

*Reference. Firing positions are set up on hills, artificial embankments, landslides, roofs of storage facilities and other buildings. In addition, in order to increase the maneuverability of air defense systems and quickly increase its fire in threatening directions, it is possible to install a ZU-23-2 (ZPU-1) in the car body, or on MT-LB.*

assign firing sectors for each air defense fire, taking into account the location of potentially dangerous objects, settlements, military and civilian infrastructure facilities. Prohibited sectors of shooting indicate to personnel of air defense services;

**For reference:** *In order to prevent the firing of the ZU-23-2 (ZPU-1) in prohibited sectors, the firing positions of these means can be additionally equipped with limiters of guidance of automatic anti-aircraft guns (machine guns) at the elevation angle and azimuth.*

use (if available) guided 70-mm APKWS surface-to-air missiles from BAE Systems.

**Reference.** *According to the US assistance package dated August 24 of this year.*

*The missiles showed their flexibility in various combat situations, and demonstrated their effectiveness in the destruction of "2nd class" UAVs - that is, drones with a flight weight of up to 25 kg, and a flight speed of up to 200 km / h.*

*These missiles can be launched from a variety of platforms - combat aircraft and helicopters, car chassis and small boats.*

use modernized anti-aircraft artillery complexes (CBC) C-60, which are placed on heavy trucks;

**Reference.** *Recently, the updated C-60 complex has been tested in 128 ombres. It can hit air (fighter bombers, helicopters and UAVs) and ground targets (lightly armored vehicles and field fortifications). UAVs and other air targets that move at speeds of up to 300 m / s at an altitude of up to 5000 m and a range of up to 6000 m (maximum firing range - up to 12000 m) are affected. The use of these complexes in the Zaporozhye direction caused concern among the enemy, who opened a hunt for them. Based on the positive experience of using CBC C-60, the volume of their modernization and implementation can be increased, after all, such complexes in Ukraine are in storage, and can also be provided to a partner from Eastern Europe.*

shooting of the Strela-10M air defense missile system is carried out during the day, in pursuit when using a photocontrast channel. At the same time, the maximum range of destruction of the UAV when firing in advance can be – 4.5 km, when shooting towards – 3.2 km. The probability of hitting a target when shooting in advance can be on average – 0.3, when shooting towards – 0.15;

air surveillance is organized in advance. It is carried out by visual (optical) means in each unit i at each firing position. To monitor the airspace, air surveillance posts are equipped. The location of the PPS should provide an overview of the airspace in all directions and, if possible, be remote from sources of extraneous noise;

observers are appointed to conduct aerial surveillance. They conduct observations by sequential inspection by sectors and lanes and are obliged to detect air targets in time, especially those operating at extremely low (up to 400 m) and small (up to 1000m) altitudes;

combination(if any) simultaneous use of ZU-23-2, "Strela-10", MANPADS, small arms;

for firing on UBpLA, it is necessary to allocate (assign ) fire groups of 4-5 people in advance, consisting of : 1 - machine gunner and 3-4 shooters from the AK-74, as well as from among the accounts of anti-aircraft installations or large-caliber machine guns

(hereinafter referred to as the VKK), which are capable of effectively detecting and firing small air targets. These funds can be combined into temporary specialized groups for the destruction of UBpLA. In such specialized groups can use air defense systems, MANPADS (to destroy large unmanned aerial vehicles), ZU-23-2, large-caliber machine guns such as DShK, KKM, etc., as well as groups of shooters with standard weapons;

assign mobile firing groups in advance, which are equipped with high-traffic vehicles. Mobile firing groups should be placed on the most likely routes of the UBpLA flight. At the same time, for each calculation, fix a straight segment of the path (field or asphalt road) perpendicular to the likely flight routes of the UBpLA;

*Reference.* The composition and armament of these groups may vary depending on the expected threats, the capabilities of the Air Commands and their subordinate units and units. In general, they may contain mobile reconnaissance equipment, short-range air defense systems, MANPADS, machine-gun sniper calculations, as well as be reinforced by portable means of EW.

use headlights "Pattern" and "Luna" to illuminate targets at night, as well as (if available) searchlight stations, which will provide firing on them MANPADS, HCBT "UTES", 3U-23-2;

use mortars to illuminate the aircraft, which will ensure firing on them MANPADS, NSVT "Utes", ZU-23-2;

to restore the illumination of collimator sights ZU-23-2 consider the possibility of using conventional flashlights with a semi-discharged battery;

fire from the guns exclusively from the landings, the clearings of the forest, to make it difficult to directly hit the gun;

after each firing, carry out the intra-positional maneuver; carry out secretive delivery of ammunition and movement of units; in case of detection of UBpLA – leave the combat vehicle (do not try to escape

by car), running away from it for a certain distance (50... 100 m), to make attempts to defeat it with the help of rifleman weapons.

### 3.2. Regarding the electronic counteraction of UAVs:

detection of reconnaissance and strike UAVs by direction finding of radiation signals of their onboard systems by scanning receivers PR-100 (from the radio control departments of individual EW units) with complectures of directional antennas and tactical portable direction finding systems TCI 903S-8, TRC6200DF (from companies of radio interference of individual EW battalions), TCI 903-2-4 or similar;

*Reference.* TCI 903S-8 is designed to search for radio communication lines, determine direction finders at the radio stations that organize them, automatically analyze and classify radio signals in the range of 0.02–8000 MHz. Radio interference units on EW can create two direction finder pairs within the positions of the battalions of the first echelon at the distance from the contact line of 4–6 km.

deployment of elements of the UAV detection system should be carried out covertly at the prevailing heights, high-rise buildings, along the coast of reservoirs, taking into account terrain conditions and threatening directions.

to provide for the possibility of combining (exchanging) information from:

means (complexes) of reconnaissance and electronic warfare ("Bukovel-AD R4", "Prometey-MF5", "NOTE");

tactical direction finding systems such as TRC6200DF, TCI 903S and TCI 903-2-4 (from EW units);

means (complexes) of radio reconnaissance (RTR), which can be additionally involved in the detection of air targets of this class;

small-sized tactical systems of radio reconnaissance type "Plastun RP-3000" and similar;

**Reference.** *The "Plastun RP-3000" system is designed for direction finding of enemy communication councils in the range of 25–3000 MHz, automated high-speed radio monitoring, processing and recording of radio interception data. It can be used in the tactical zone by RTR units and mobile EW groups to detect enemy electronic means for various purposes, in particular to detect UAV control radio lines. Advantages of the system: the ability to detect VHF radio networks with FHSS, in particular digital control channels and the transfer of information to UAVs, determining their place of occurrence; determination of the coordinates of EW stations (VHF band), suppression of GPS signals, cellular communication, stations of active interference of UAVs.*

location of complexes "Bukovel-AD R4", "Prometey-MF5" it is advisable to carry out:

with the zonal method of cover - in the combat orders of its troops along the line of contact with a focus on potential objects of destruction (the object of cover should be in the sector of reconnaissance and suppression of the complex at a distance of its effective range, which in the group use of UAVs is 3.5-4 km);

with the object method of cover in case of covering objects that are at a considerable distance from the line of contact of the troops - in the area of their location, taking into account the need to cover from all directions the enemy's UAVs may be in full force.

**Reference.** *Provide for an operational change in the positions of the complex in order to exclude the possibility of the enemy exposing the system of covering troops and objects.*

Product "NOTA" to apply in the following modes:

mode of monitoring and analysis of the electromagnetic spectrum of the situation;

**Reference.** *It should be borne in mind that according to the experience of combat use of the product, the practical detection range of UAVs is: one UAV – up to 4.5 km, two UAVs – up to 5.5 km. The suppression range of the vigilance radio channel and the UAV control channel is 3.5 km. Given the considerable deployment time of the product (up to 30 minutes), it is necessary to provide for its advance placement in the combat orders of units (around the undercover facility, along the contact line or coast) from the hideouts by installing appropriate antenna monitoring and direction finding modules in threatening directions.*

transmitter of radio interference CEC-N1/N2 "Cloud" to install (stationary or on vehicles) within the positions of the units and change the configuration of the coverage depending on the current situation. When using several antenna modules, it is possible to create a continuous coverage area with a radius of 8 km.

**Reference.** *The transmitters are in service with the nodes of the integrated technical control of the Air Force of the Armed Forces of Ukraine and are designed to suppress GPS signals (1575–1610 MHz, 1220–1260 MHz) with the ability to counteract the "Anti-spoofing" modes. The antenna system allows you to form a suppression zone both in a separate sector and in all directions.*

to use the intelligent detection and blocking system of UAV "Banshei RB-UAV" (developer of SPC "Infoprotection"), which is designed to suppress UAV systems in the range of 25-6000 MHz at a distance of up to 3000 m.

**Reference.** *The system is not adopted, there is no data on landfill and military tests. Advantages of the system: extended reconnaissance range, which covers the range of operation of all onboard UAV systems; the ability to detect, track and suppress UAVs in real time; signature identification of signals (according to a set of typical characteristics).*

to provide for the possibility of additional use of mobile (portable) means of EW type Skywiper (EDM4S), "Antidron-Base" and "Antidron M" (LLC "Kvertus") or similar, which will ensure the failure of the control of the UAV at a distance of up to 1500-3000 m.

**Reference.** *Portable electronic system for countering unmanned aircraft systems Skywiper (EDM4S) ("NT-Servise", Lithuania) is the most common means of electronic warfare, which is provided in the Armed Forces of Ukraine by partner countries. Designed for suppression of telemetry signals and data transmission, control and navigation (in the range of 1.5 GHz (GPS), 1.5 GHz (GLONASS), 2.4 GHz, 5.8 GHz). Range – up to 3 km. Disadvantages: it takes several minutes to neutralize the UAV, during which it can transfer intelligence.*

*Mobile-stationary countermeasures complex UAV "Antidron-Base" (LLC "Kvertus") can be placed on a permanent basis at the prevailing heights (buildings). Advantages: small dimensions, coverage angle – 360°; range up to 3000 m; the ability to suppress equipment in the range of 5.8 GHz, 2.4–2.5 GHz WiFi, GPS L1 and GLONASS L1; operating time 24/7.*

*Portable complex countermeasures UAV "Antidron M" (LLC "Kvertus"). Advantages: counteraction to most types of UAVs; portability, compactness and low weight, speed of deployment, long battery life (up to 60 minutes). Range 600–1200 m. Disadvantages: lack of a UAV detection device (direction finding device).*

to try to create a continuous zone of reconnaissance and radio suppression of the onboard systems of UAVs in the area of responsibility. If it is impossible to provide such a continuous zone, it is necessary to use a set of directional antennas with the location of their centers in the directions of the likely direction of action of the enemy UAV in the means of RTR and EW (where it is provided);

in the conditions of urbanized areas, take into account that the practical use of EW means in urban environments may be limited to their small number, as well as limited radio visibility and certain legal norms (restrictions) for the installation of military equipment within settlements.

**Reference.** *Means or their individual components in the reconnaissance mode (monitoring of the electromagnetic spectrum, direction finding) should be used from the roofs of residential and industrial buildings (similar to the system of detection and notification of flights of enemy UAVs). Thus, the capabilities of the detection system can be significantly expanded (mainly in range), and the passive reconnaissance mode will not turn the buildings used into a potential target for the enemy.*

*The most appropriate standard means of EW, which can be placed on the roofs of buildings in terms of their mass-dimensional parameters, is a portable version of the complex*

*"Enclave", as well as the product "Note". The latter is more functional, because it provides both a monitoring mode and a mode of suppression of onboard navigation and control means in a wide frequency range. Also in the product "Note" there is a rotary system of emitters and joint work with a thermal imaging camera, which will increase the efficiency of reaction and the ability to work in the dark. In order to strengthen the detection and suppression zones, it is necessary to involve you are such means as a mobile-stationary complex for countering UAVs "Antidron-Base", as well as portable knapsack systems, shotguns such as Skywiper or similar.*

placement of reconnaissance and electronic warfare in the most important areas of settlements or the most responsible directions, it is advisable to carry out according to the hexagonal plan (the principle of building cellular networks) to create a continuous reconnaissance and radio suppression zone (onboard navigation receivers of UAVs, receivers of control signals and telemetry), or to use a set of directional antennas in the directions of probable actions Enemy.

deploy detection systems (direction finding) outside the perimeter of settlements.

*Dvidkovo. Use means of radio reconnaissance and means of electronic warfare (in reconnaissance mode), which by their mass-dimensional parameters can not be placed on the roofs of buildings (for example, "Bukovel-AD", "Khortytsia-M", etc.).*

to use the means of EW GNSS "Fog", within the framework of the created system in Ukraine "Joint military-civil system for monitoring the electromagnetic spectrum and EW with cruise missiles".

**Reference.** *The created system is spatially distributed. The area of cover lies in the available number of means (posts) of EW. The effectiveness of the means of EW GNSS "Fog" is confirmed by the leadership of the Ministry of Defense of Ukraine, according to which some positive results have now been "achieved" in the fight against the KR through the use of distance controlled EW posts (transmitters radio interference) type EWP N2060 and EWP N2060L (LLC "Proximus"), designed to suppress receivers of satellite radio navigation systems (SRNS), as well as radar altimeters VTZ and other aircraft (ZOKrema UAV). The effectiveness of the use of these EW posts "critically depends on their integration with the network of radios deployed by the UCRF and the state's air defense system." According to the evaluation data of specialists of the KSP of the Armed Forces of Ukraine, the means of EW GNSS "Fog" allow to introduce an error in the receivers of the SRNS KR, which leads "to an increase in the circular probability of deviation of missiles to 100-200 m from the target."*

### 3.3. Regarding the protection of personnel and weapons and military equipment of units:

in case of detection of a kamikaze drone in the air, immediately disperse personnel, occupy shelters, undermining niches or protective elements of the area;

to ensure the disguise of military facilities with standard and improvised means of visual detection by means of reconnaissance;

**Reference.** *Protection of troops (objects, etc.) can be ensured through regular camouflage nets, the use of local vegetation (trees, bushes), etc.*

to disguise the weapons and military equipment in the trenches (storages), masks are arranged - overlapping of personnel camouflage kits, stretched over the trenches (storages) and fixed along the contour with stakes into the ground. Camouflage

The coatings below are supported by racks to a height, which ensures the free movement of fire means under the mask formed. Before firing, a seam is activated, which quickly opens. Similarly, the VST is masked, which is located outside the trench. Thus, it is possible to use improvised materials (dry branches, mesh, etc.) instead of standard camouflage means. In all cases of disguise, it is necessary to hide traces of the movement of equipment to the trenches. This is achieved by powdering traces with soil and snow, carpeting cut vegetation on them, clearing the soil;

the main way to use the camouflage properties of the area in order to ensure the secrecy of the movement of troops is to prepare routes of movement, taking into account natural masks and invisibility fields formed by terrain folds or local objects;

create a system of false positions;

**Reference.** *equip false IP at a distance of 1-3 km from real IP. On the ground of false VP, periodically carry out fire activities, conduct radio exchange using various means of communication, leave traces of vital activity, periodically move models of guns.*

perform the collapse of stationary objects, taking into account the angle of attack (60 degrees) of the kamikaze drone (Fig. 3.4);

**Reference.** *The experience of military conflicts testifies to the expediency and sufficiently high efficiency of additional protection of electronic equipment from chips by using protective screens made of various materials.*

*For example, around the perimeter of the cabins, containers filled with sand (bags, boxes) or tree trunks, car tires, etc. are installed. An example of the use of such screens is shown in Fig. 2.*

*Such protection has proven its effect in mortar shelling, when the explosion of the BB occurs upon contact with the ground. The explosion of the warhead in order to ensure the greatest effectiveness of the defeat occurs, on the contrary, at a height of several meters above the target, so that the direction of dispersal of the fragments of the warehouse is about 70 degrees.*

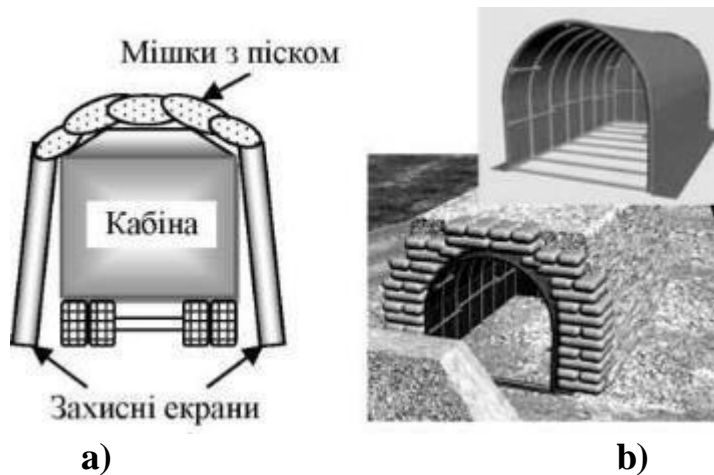


**Figure 3.4** – An example of using radar screens 19Zh6

use pre-equipped screens (stretched metal (camouflage) nets, etc.) or natural elements (bushes, trees, walls, etc.) to create obstacles at the angles of attack of the "kamikaze drone" (Fig. 3.6) (link **M**);

**Reference.** *The experience gained is reflected in NATO military standards (FM 5-103 standard). A deep cover with an overlap (covered deep-cut position) of this standard is shown in Figure 3.5. The basis of the structure is an arched frame with*

aluminum two-inch pipes. The arches are interconnected by means of transverse and longitudinal stringers using clamping couplings.



**Figure 3.5** – An example of the use of additional protective screens (a) and protective shelter (b) of the FM 5-103 standard

The frame is assembled at the location of the building. Awnings made of high strong nylon fabric with a neoprene layer are stretched on the frame. One of the end walls is also tightened with an awning made of this fabric. A protective soil thickness is poured over the assembled structure so that it is at least 45 cm on all sides. To protect the inbound direction of the ore from shedding of the soil, lining with bags of soil is used. The shelter protects against shock waves and shrapnel from ruptures of 120 mm mortar rounds and caliber artillery shells 122 mm at a distance not closer than 3 meters and from shelling from rifleweapons with a caliber of up to 7.62 mm.

Of course, such shelters, although they are quickly erected, are classified as advance. However, they, as a rule, are erected much later, after the placement of equipment (according to the availability of time and opportunity). Due to the sufficiently large amount of construction work, they require the involvement of a significant amount of manual labor, a large expenditure of resources of engineering earthmoving equipment. **It is advisable to build shelters of this type in places of permanent deployment or base camps.**



**Figure 3.6** – An example of the use of metal nets as protective screens by artillery units (a) and tank units (b)

when moving equipment, use mostly inconspicuous dirt roads with the use of camouflage smokes and aerosols;

periodically media to nominate the locations (positions) of military and other equipment, places of deployment of personnel within a certain positional area;

trenches for self-propelled guns, BM, trailed guns should be located in positions using camouflage properties of the terrain;

shielding (boiling) of OIWT samples with metal mesh (for dispersing the cumulative jet);

actively apply personnel aerosol masking (if available).

## LINKS TO MILITARY PUBLICATIONS

Military mark Publication	Full name of the military publication
1	2
	<b>a.</b> The Law of Ukraine "On the Legal Regime of Martial Law", enacted by the resolution of the Verkhovna Rada of Ukraine from 12.05.2015 No389-VIII (as amended in 2022 )
	<b>b.</b> Law of Ukraine "On the Legal Regime of the Emergency" state", enacted by the Resolution of the Verkhovna Rada of Ukraine dated 16.03.2000 No1550-III (as amended in 2022)
VKDP 5(3)-00(01).02	<b>c.</b> Temporary procedure "Execution of operational (combat) documents", approved and put into effect by the order of the Commander-in-Chief of the Armed Forces of Ukraine No 140 dated 11.09.2020
SBP 3-00(08).58(59)	<b>d.</b> Combat Charter of the Land Forces "Air Defense Forces of the Land Forces of the Armed Forces of Ukraine" Part III (platoon, division, service), enacted by the order of the Commander of the Land Forces of the Armed Forces of Ukraine dated 26.05.2016 No. 248
SBP 3-00(08).56(57)	<b>e.</b> Combat Charter of the Land Forces "Air Defense Forces of the Land Forces of the Armed Forces of Ukraine" Part II (division, battery, group), enacted by the order of the Commander of the Land Forces of the Armed Forces of Ukraine dated 27.12.2016 No. 596
VKDP 7-00(01).01	<b>e.</b> Guide to shooting. 7.62-mm machine guns Kalashnikov KK, KKM, KKS, KKMS, KKK, KKB, KKT, approved by the Commander of the Land Forces of the Armed Forces of Ukraine on 17.03.2020
VKDP 7-00(01).01	<b>e.</b> Rifle Guide. 12.7 mm machine gun "Utes", approved by the Commander of the Land Forces of the Armed Forces of Ukraine 06.08.2019
VKDP 7-00(01).01	<b>g.</b> Rifle Guide. 14.5 mm large-caliber machine gun Vladimirov tank (VKVT), approved by the Commander of the Land Forces of the Armed Forces of Ukraine 07.02.2020
VKDP 7-00(01).01	<b>g.</b> Guide to shooting. 5.45-mm Kalashnikov assault rifles (AK-74, AKS-74, AK-74N , AKS-74N ) and 5.45-mm Kalashnikov light machine guns (RPK-74, RPKS-74, RPK-74N, RPKS-74N), approved by the Commander of the Land Forces of the Armed Forces of Ukraine 02.12.2019
VP 7-00(116)03.01	<b>i.</b> Methodical manual " Safety of battle for commanders of units (servicemen)" (according to the experience of participation in Joint Forces Operation (formerly ATO), approved by the head

1	2
	General Staff - Commander-in-Chief of the Armed Forces of Ukraine 09.04.2016
VP 7-00(03).01	<b>k.</b> Methodical recommendations "Fight against unmanned aerial vehicles" (based on the experience of conducting JFO (formerly ATO), approved by the Head of the Main Department of Training of the Armed Forces of Ukraine – Deputy Head of the General Staff of the Armed Forces of Ukraine 13.04.2019
VP 7-46(12).01	<b>l.</b> Methodical recommendations "To the commander of the unit for the use of tactical UAV" (according to the experience of conducting the Joint Forces Operation (formerly the ATO), approved Commander of the Air Force of the Armed Forces of Ukraine 29.09.2018
FM 5-103	<b>m.</b> Field Manual "Survivability", Headquarters Department of the Army Washington, DC, 10 June 1985 (Field Guideline, "Ability to Survive," Department of Staff of the Army, Washington, D.C., June 10, 1985)

**Note.** If a military publication (legal act, national or military standard, a governing document and standard of NATO and NATO member states, etc.) referenced is replaced with a new one or amended, then a new military publication should be applied, covering all changes made to it.

## LIST OF ABBREVIATIONS AND SYMBOLS

Abbreviations and conditionals denomination	Full phrases and abbreviated concepts
1	2
ATO	Anti-terrorist operation
UAVs	Unmanned aerial vehicle
BPP	Barrage ammunition
HQC	Heavy machine gun
VN	Vertical guidance
GLONASS	Global Navigation Satellite System
GN	Horizontal guidance
ZAC	Anti-aircraft artillery complex
ZGRK	Anti-aircraft gun missile system
ZRK	Anti-aircraft missile system
SUN	Armed forces
ZSAU	Anti-aircraft self-propelled artillery installation
KH	Short waves
POWER LINES	Power line
LA	Aircraft
MVG	Mobile Fire Group
NSU	National Guard of Ukraine
MANPADS	Portable anti-aircraft missile system
pogp	Public Order Protection Regiment
Air Defense	Air defense
RPRU	Moving point of reconnaissance and control
PU	Launcher
REB	Electronic warfare
REFS	Radio electronic protection
RAP	Electronic counteraction
RADAR	Radar station
MLRS	Multiple launch rocket system
ST	Ground Forces
JFO	Joint Forces Operation
VHF	Ultra-short waves
GPS	Global position system( global position system) positioning objects)
NATO (NATO)	North Atlantic Treaty Organization (North Atlantic Treaty Organization)

## BASIC TERMS AND DEFINITIONS

**An unmanned aerial vehicle** is an aircraft designed to perform a flight without a pilot on board, the control of which and control over which is carried out by the appropriate program or with the help of a special control station located outside the aircraft. Depending on the principle of the control system, the following types of unmanned aerial vehicles are distinguished. systems: unmanned uncontrollable, unmanned automatic, unmanned remote-manned aircraft.

**No-fly zone (NFZ) is the territory over which the flight of aircraft is prohibited. This is a territory or zone created by a military state** over which certain aircraft are prohibited from flying. Such zones are usually introduced in the territory of a hostile state during a conflict; similar in concept to the air demilitarized zone, and primarily aimed at prohibiting the military aviation of this country from operating in the region. Such hostilities are used by the state, which provides this mode and, depending on the conditions of the NFZ, may pre-emptive attacks to prevent potential violations, or retaliatory force directed at the offending aircraft, or surveillance without the use of force.

**Air defense** is a set of organizational measures and hostilities that are aimed at repelling an enemy strike from the air, covering groups of their own ground forces or important objects in the rear. Military air defense contributes to the conquest and maintenance of dominance in the air. It is created at all stages and in all types of combat, during the movement of troops and during their permanent location.

**A quotation** (citation, from *Latin cito – I shift, I evoke*) is a relatively short excerpt from a literary, scientific or any other published work that is used, with the obligatory reference to its author and sources of citation, by another person in his work in order to make his statements clearer or to refer to the views of another author in an authentic formulation [1].

Other terms used in these Guidelines are used in the meanings, in the Methodological Recommendations "Combating unmanned aerial vehicles" (according to the experience of conducting the Joint Forces Operation (formerly the ATO) (link [k](#)) and other regulatory legal acts of Ukraine, the Ministry of Defense of Ukraine and the General Staff of the Armed Forces Ukraine (link [g – s, l](#)).

**LIST OF REFERENCES (SOURCES)**

1. The Law of Ukraine "On Copyright and Related Rights" as amended by the Law of Ukraine of 11.07.2001 No 227-III.
2. The procedure for registration of military publications in the Armed Forces of Ukraine , DDP 1-0(189), approved by the order of the Commander-in-Chief of the Armed Forces of Ukraine on February 19, 2022 No. 60.
3. A block of newsletters developed by the Main Directorate of Doctrines and Training of the General Staff of the Armed Forces of Ukraine based on the experience of the Russian-Ukrainian war of 2022-2024.





















