

DIRECTORY

**Tactics of use by the enemy
FPV drones (in diagrams)
and ways to counteract it**



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I. Introduction

An analysis of the large-scale use of FPV drones by the Ukrainian Armed Forces indicates a significant increase in their role in combat operations as **an effective means of fire destruction**. With their low weight, they are capable of lifting a load several times greater than their own weight and carrying it to a target at a speed of 100 km/h and a range of up to 10 km. In percentage terms, kamikaze drones have gradually taken a leading place **(up to 70%)** in causing

losses to manpower and equipment in tactical depth. At the same time, these indicators are typical **for all parties to the armed conflict**.

Technological development of FPV drones and related components for their combat use (increasing the range and flight time, portable payload, increasing resistance to electronic warfare, the ability to use in conditions of limited visibility, expanding the range and types of ammunition, introducing intelligent target acquisition and tracking systems, creating specialized UAV testing centers and training operators) have led to **an expansion of tactical techniques and the range of tasks they solve**.

The presented material briefly and clearly reveals general information about FPV drones, and examines the main tactical techniques for their use in the course of counteraction to Russian troops. At the same time, similar methods of combat use are actively being introduced by our "drone operators" on the battlefield. A separate block presents brief recommendations and advice on how to combat kamikaze drones on the combat line.



II. General information about FPV drones

FPV (First Person View) drones are UAVs equipped with a video camera and transmitting real-time images to the pilot's glasses or helmet (controlled from the first person).

Advantages over quadcopters:

- first-person drone control;
- instant response and maximum control over the drone;
- high maneuverability and flight speed (up to 120 km/h);
- resistance to the impact of electronic warfare (due to the modularity of the device, which allows for quick changes to the configuration and settings);
- the ability to change the drone design to suit the task;
- low cost of the product (on average 40-50 thousand rubles).

The disadvantages include:

- average flight duration 7-10 minutes;
- flight range (without repeater) – up to 10 km;
- the need for selection and high-quality training of the pilot (operational training) Torah – not less than a month).

1. Equipment



FPV drone



Video glasses

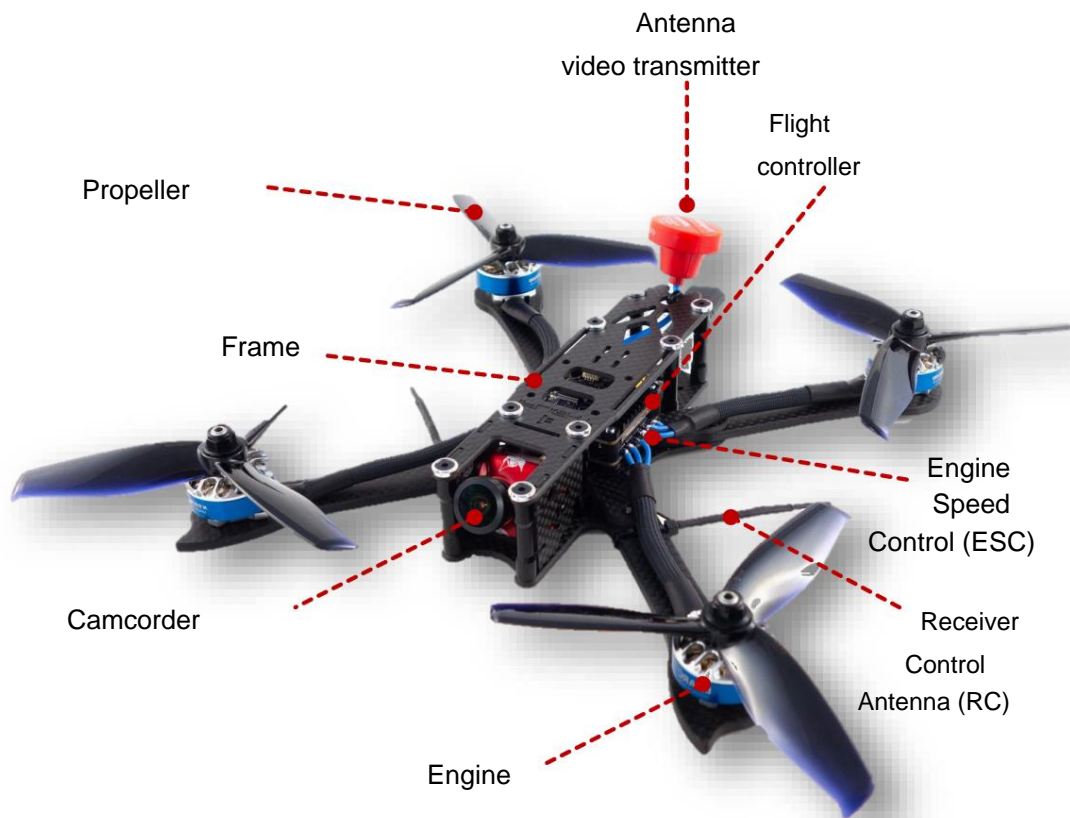


Battery



Remote control

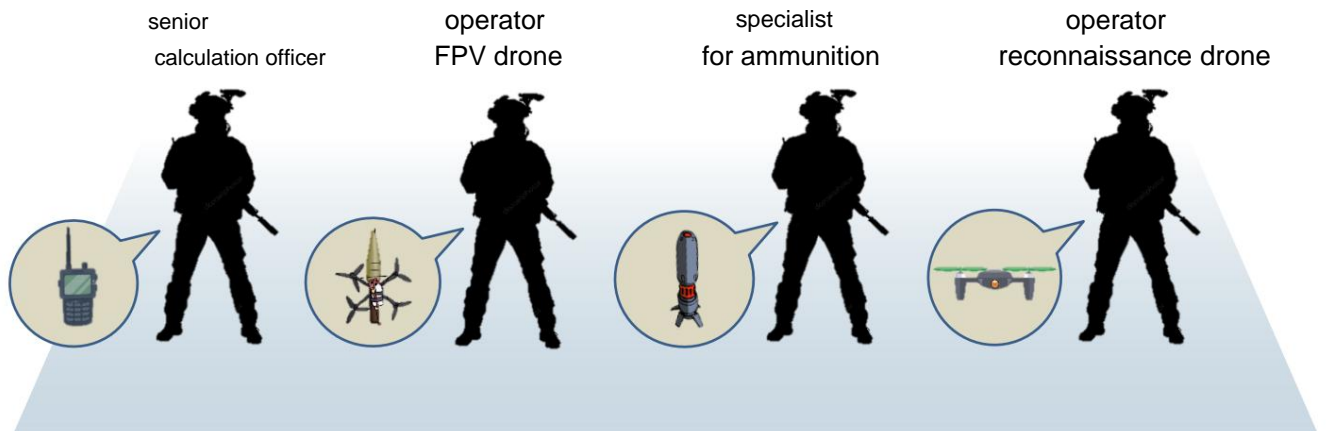
2. General structure of FPV drone



3. General performance characteristics of a typical FPV drone

- drone size – 7 inches;
- load capacity – up to 2.5 kg;
- maximum speed (with load) – up to 120 km/h;
- flight time with load – up to 10 min;
- flight range with load (without repeater) – 10-12 km;
- time to prepare for launch – 2 min.

Calculation of UAVs (option)

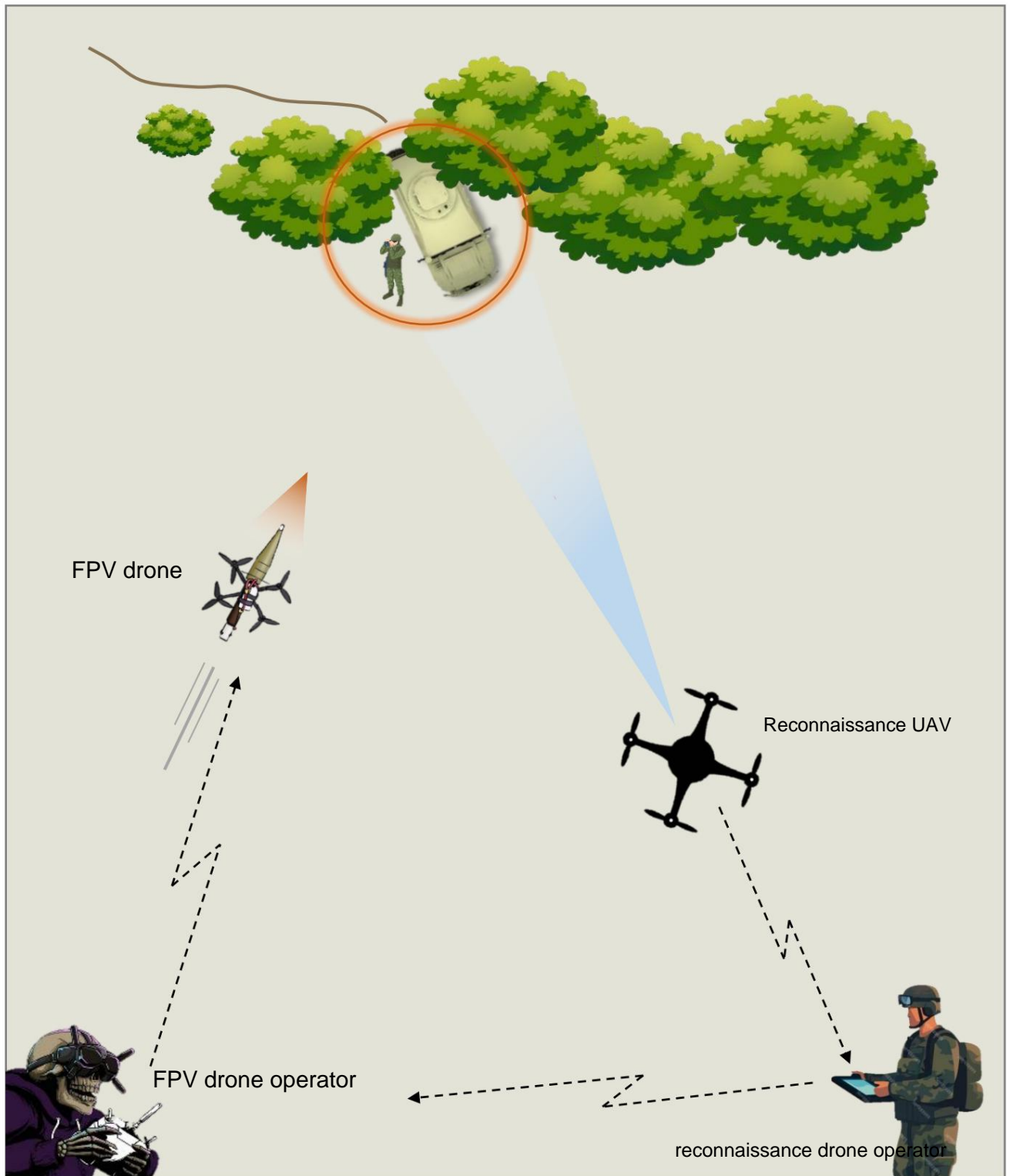


III. Tactical techniques for using FPV drones

1. "Classic"

(identification of the target by a reconnaissance UAV - launching a drone and destroying it)

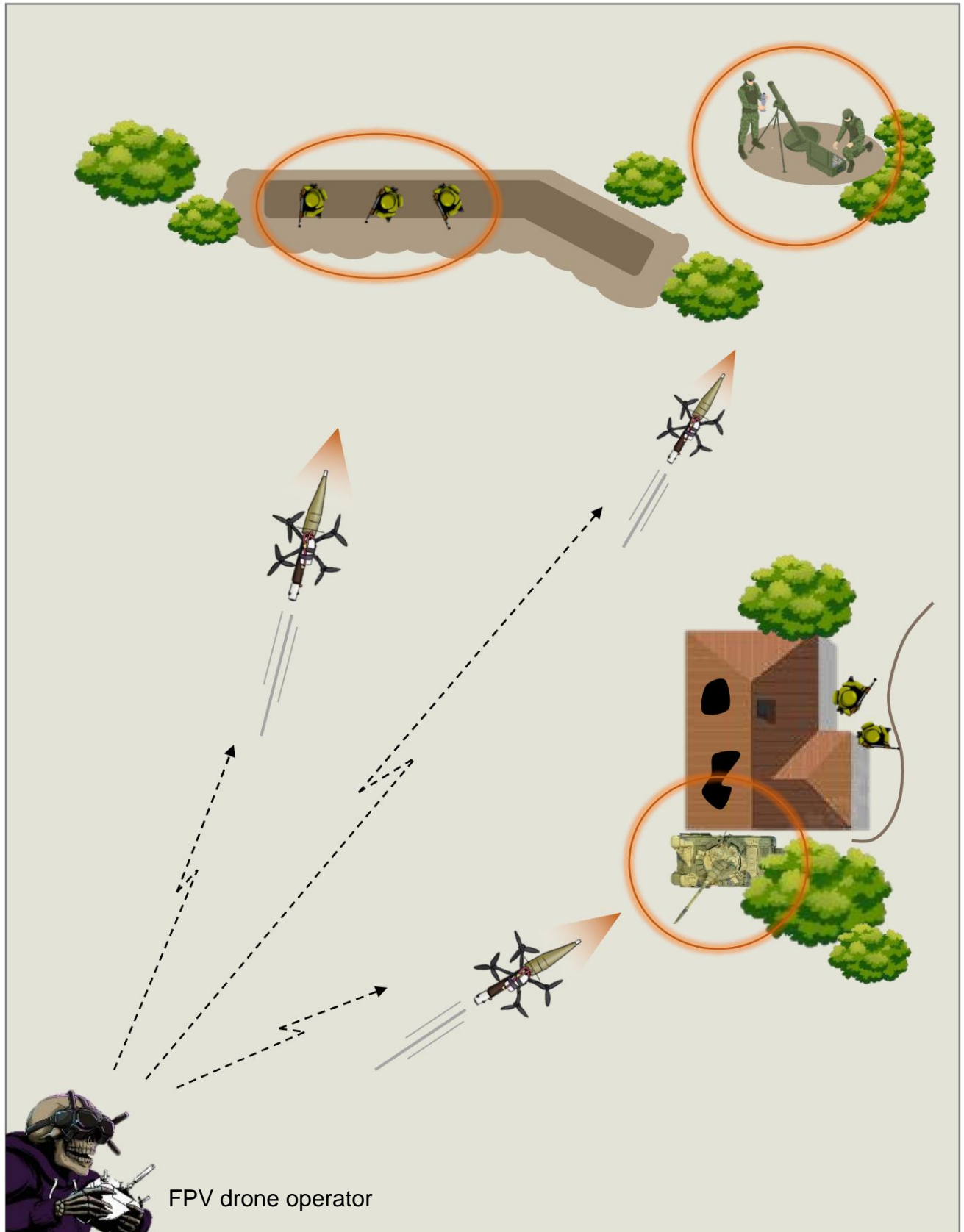
The most common method of combat use. It consists of detecting a target with a reconnaissance drone and transmitting the coordinates to the FPV operator for its destruction. Video recording of the destruction of the object is carried out by the reconnaissance UAV.



2. "Free Hunting"

(FPV strike on pre-detected objects and positions)

The essence of this method is to strike independently FPV drones on previously revealed objects and enemy positions.



3. "FPV swarm"

(FPV group strike on selected targets, objects)

The method is based on the discovery of targets (objects) by a reconnaissance UAV and the mass impact of kamikaze drones in order to destroy them. As a rule, the total consumption is 5-12 devices. Video recording of the destruction of the object is carried out by a reconnaissance drone. It is possible to combine FPV drone strikes with artillery fire and mortars.

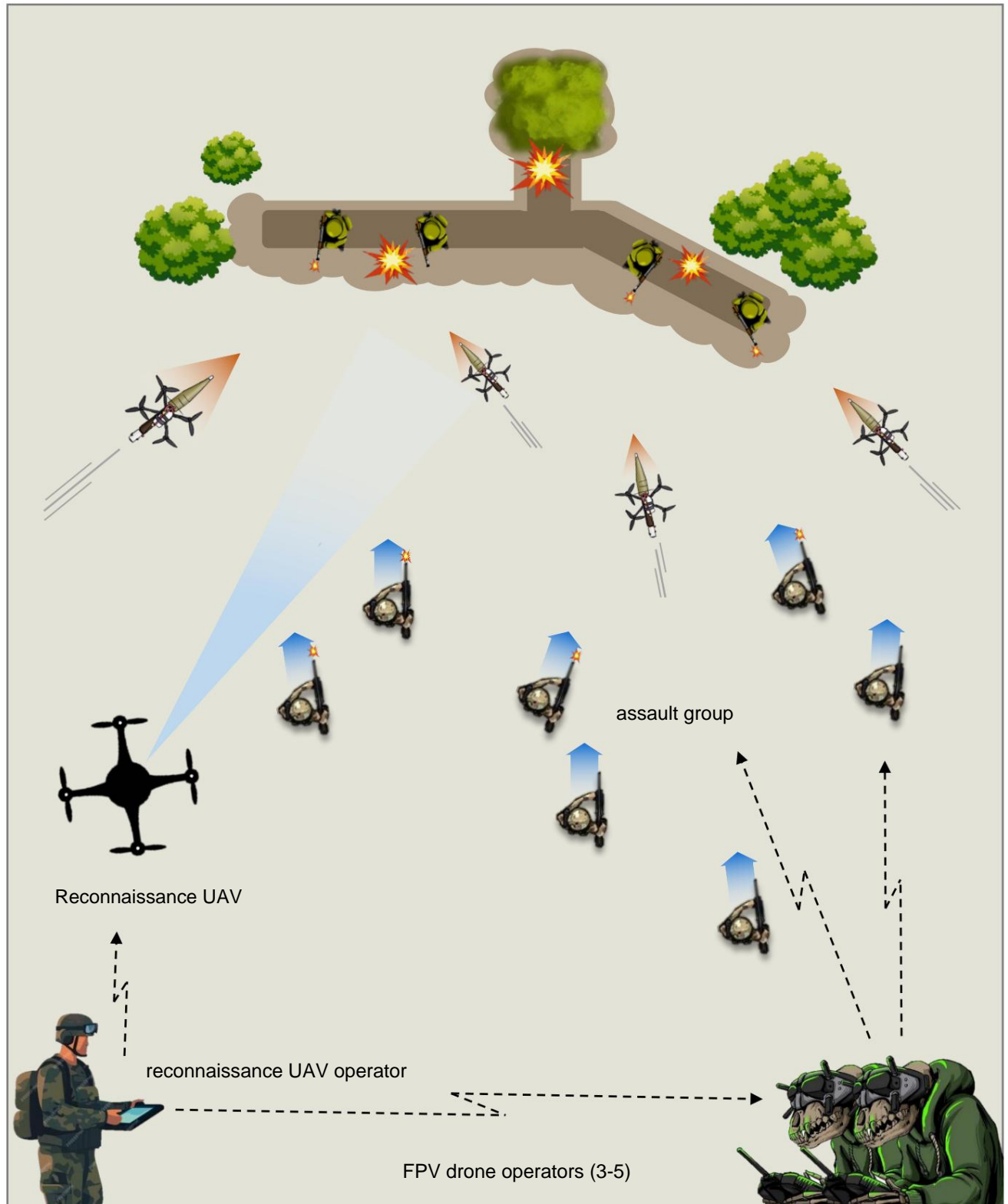


4. "Escorting the attack of the assault group with FPV drones"

(fire support for the actions of advancing units)

This method involves sequentially attacking positions with FPV drones during the advance and offensive actions of the assault group. Control and coordination of the actions of units and operators is carried out through a reconnaissance UAV. It is possible to combine FPV drone strikes with artillery and mortar fire.

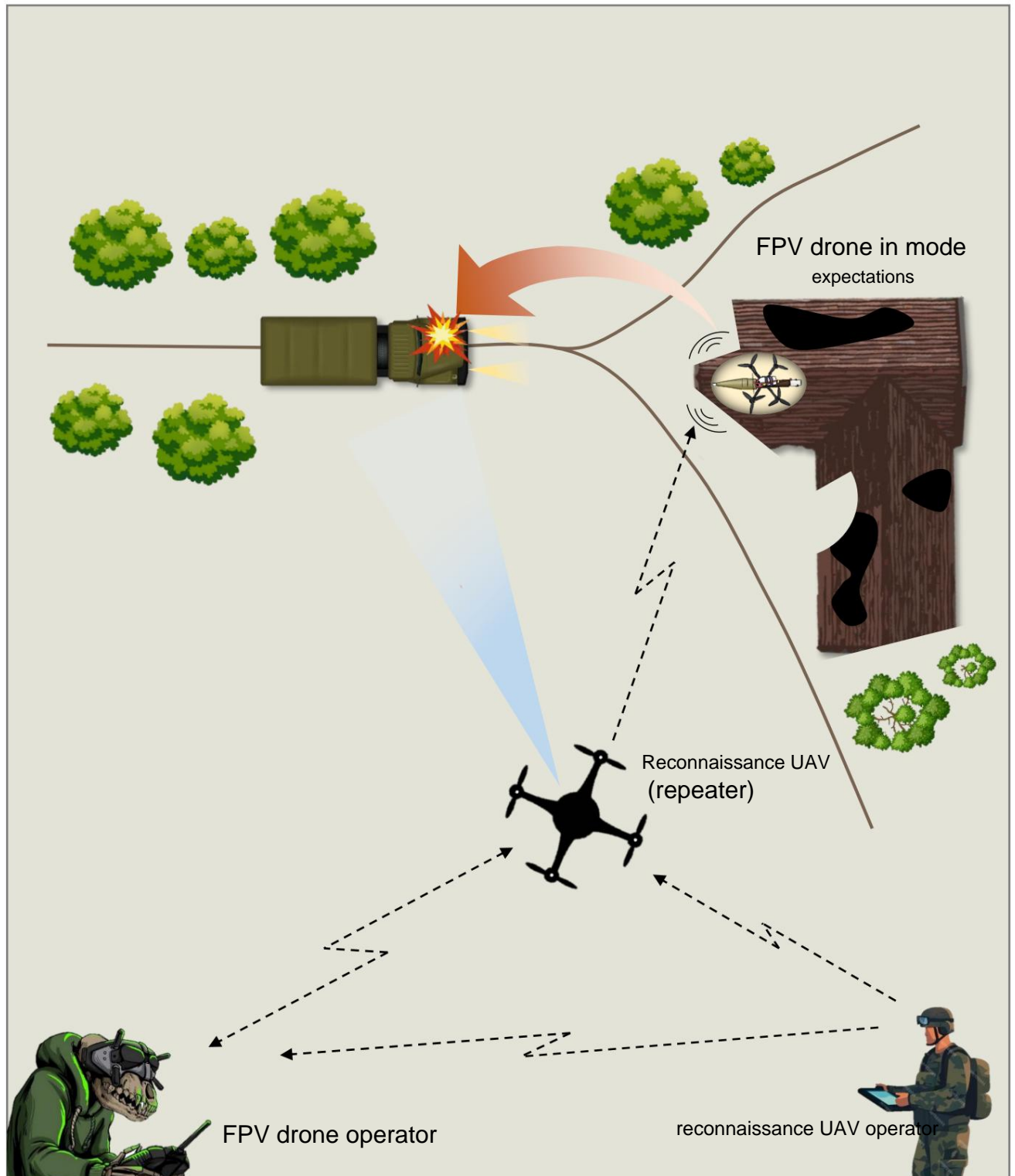
Comrade



5. «FPV-drone in ambush»

(landing and waiting - observation - surprise attack on target)

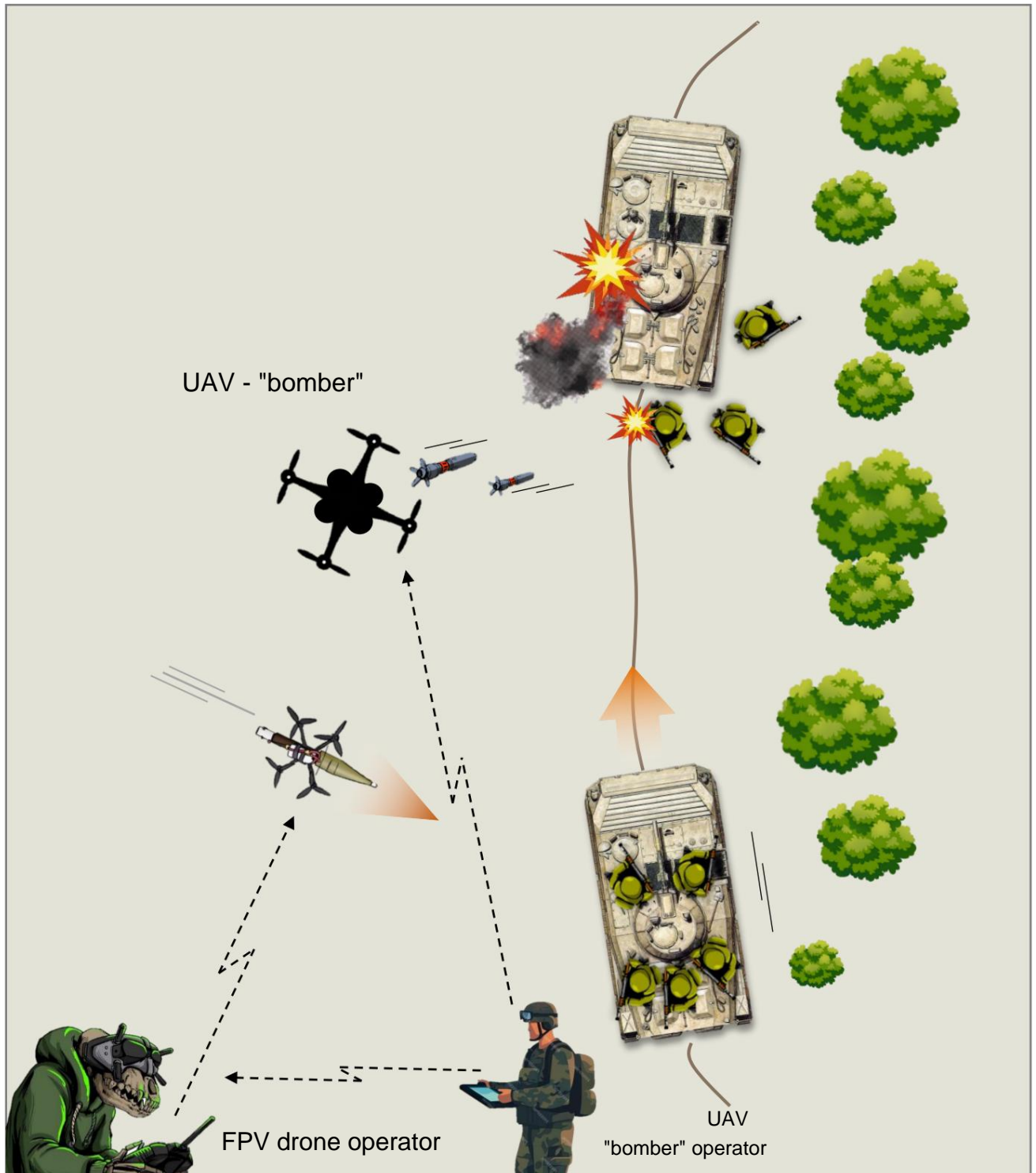
The tactical method is based on landing and taking a hidden position by the FPV drone near busy roads, intersections, places where equipment and personnel may be concentrated, followed by a sudden attack on the target. When working in tandem with a UAV repeater (reconnaissance): depth – more than 5 km, waiting time – up to 6 hours (only the control channel receiver is on). At night, attacks are possible using the headlights of moving vehicles, or using an FPV drone with a thermal imager.



6. "Combination Strike"

(FPV strike on target - dropping ammunition from a "bomber" drone)

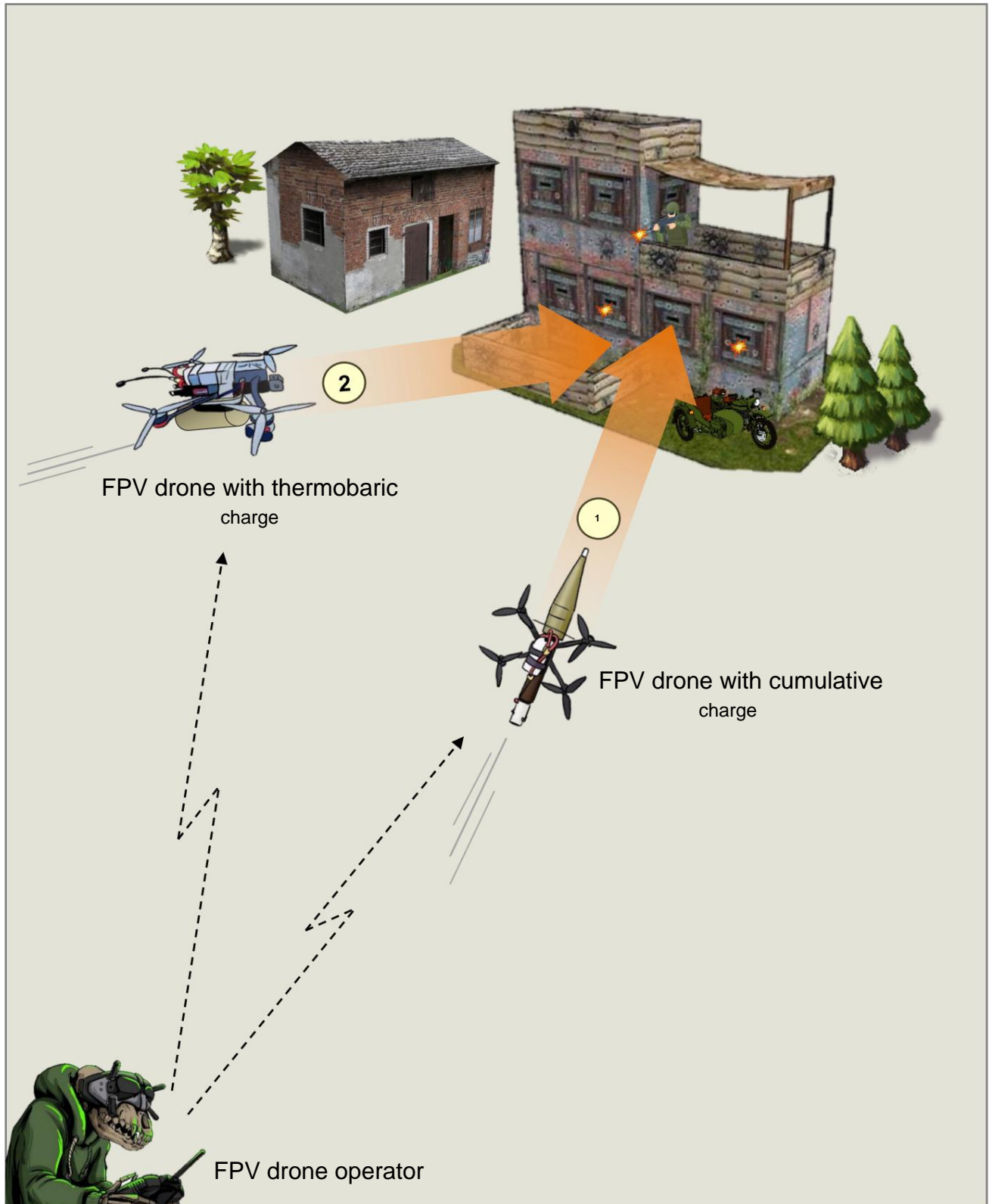
This method consists of solving the joint problem of FPV drones and UAVs. "bomber" for inflicting complex fire damage on identified targets. After the destruction (disabling) of armored vehicles (object) by an FPV strike, the drone-"bomber" drops ammunition on personnel during the evacuation. Another option: inflicting fire damage on personnel (unarmored vehicles) by dropping them in order to immobilize them, followed by the use of FPV drones.



7. "Double Impact"

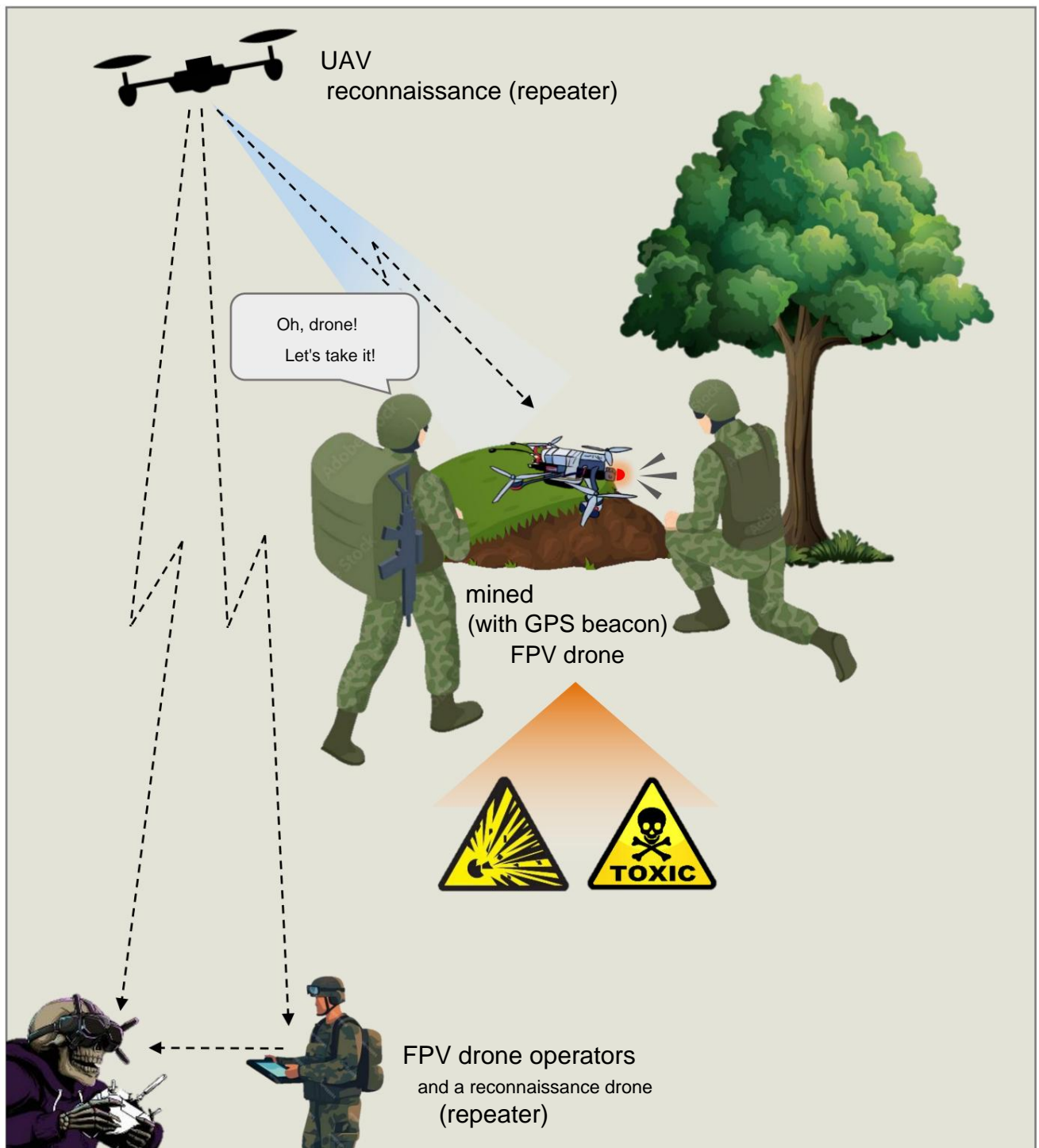
(use of two or more FPV drones with different charges to breach a shelter and destroy personnel)

In order to destroy manpower in protected shelters, several FPVs are used in sequence: the first with a cumulative charge - to penetrate the barrier, the second, as a rule, with a thermobaric action to inflict fire damage on personnel in internal premises.



8. "FPV trap" (variants)

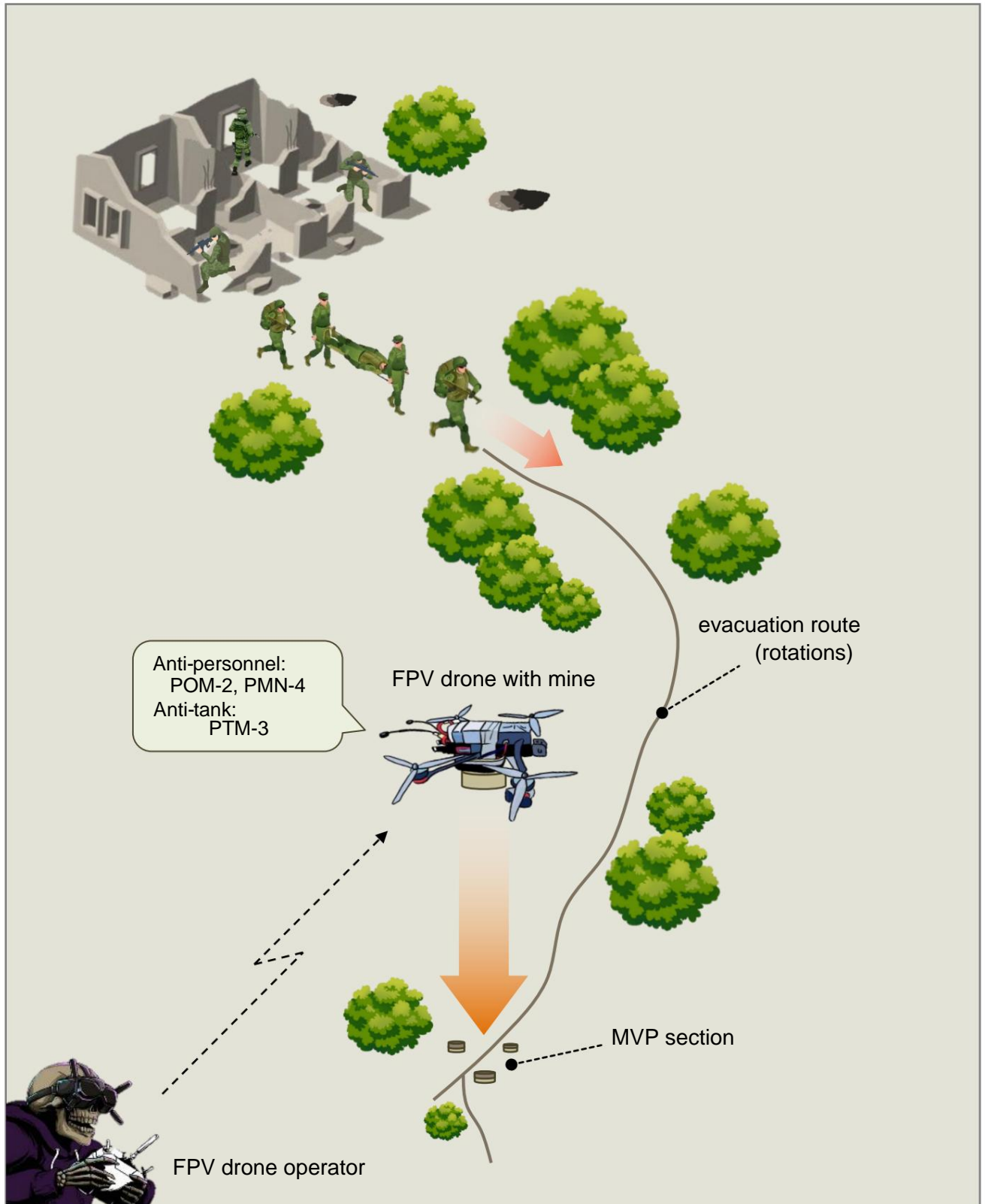
- drone landing and sound signal – when approaching (captured) the FPV operator carries out a controlled detonation via a reconnaissance UAV (repeater);
- when its position changes (due to a “jonik” type device) – self-detonation (in addition, it is possible to install a magnetic target sensor on metal);
- loading a 20-50 g charge into the drone’s structure, which is activated when it dismantling;
- built-in GPS beacon, its tracking and “arrival” to the signal location;
- treatment of the FPV drone body with potent toxic substances with skin-blistering action



9. "FPV-miner"

(delivery and installation of anti-personnel (anti-tank) mines, camouflaged IEDs on rotation and evacuation routes)

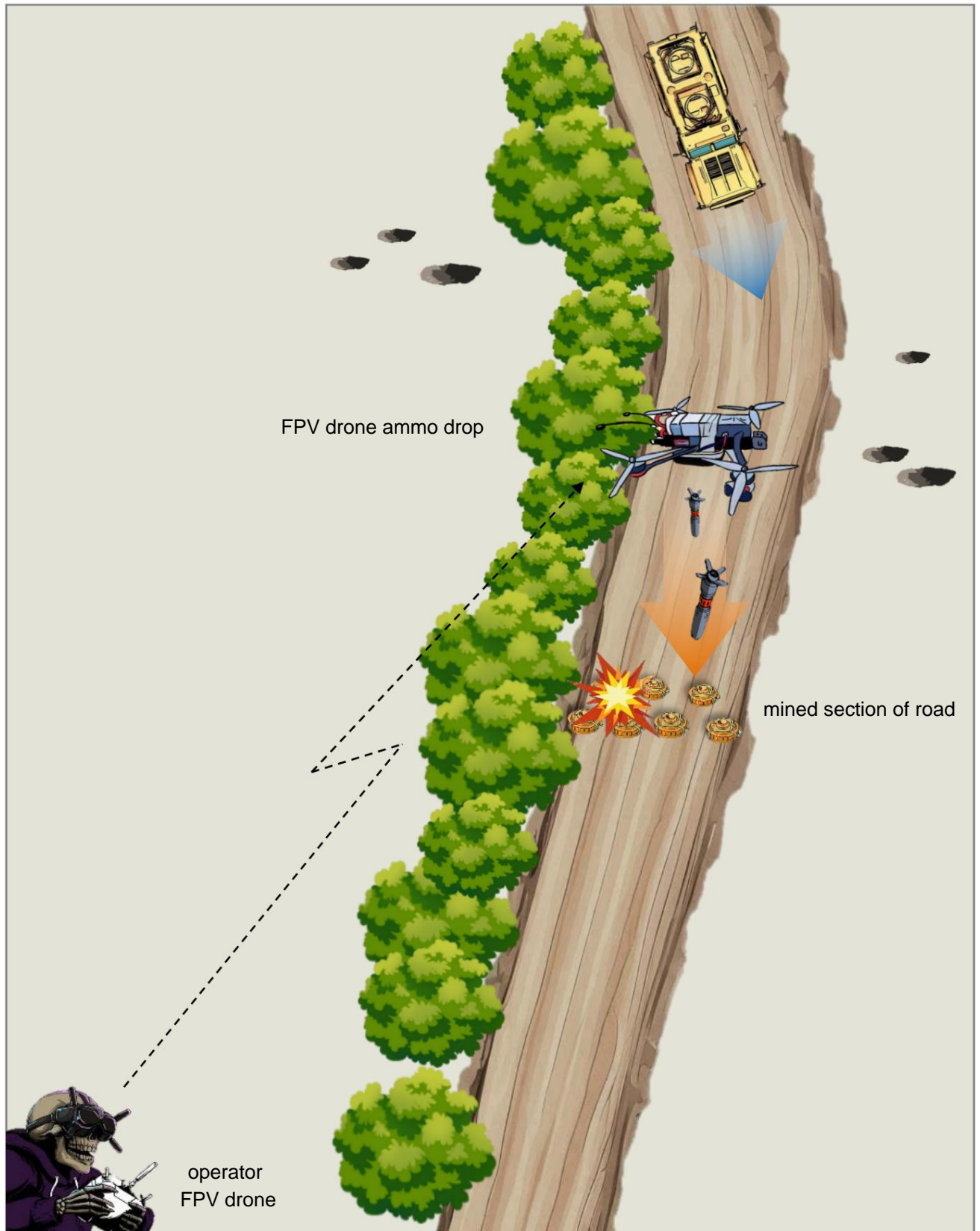
This tactical technique is used for covert installation of anti-personnel, anti-tank mines, as well as camouflaged IEDs by FPV drones on rotation routes, evacuation routes or near positions (objects) to destroy living strength and technology.



10. "FPV-sapper"

(dropping ammunition or installing a charge on mines)

Demining of an area, usually roads and paths, is carried out by dropping ammunition from an FPV drone or by installing a surface charge on openly located and uncamouflaged mines.



11. "FPV reset"

(dropping ammunition on target)

The tactic involves dropping ammunition from an FPV drone to kill personnel in open areas or in poorly protected shelters.

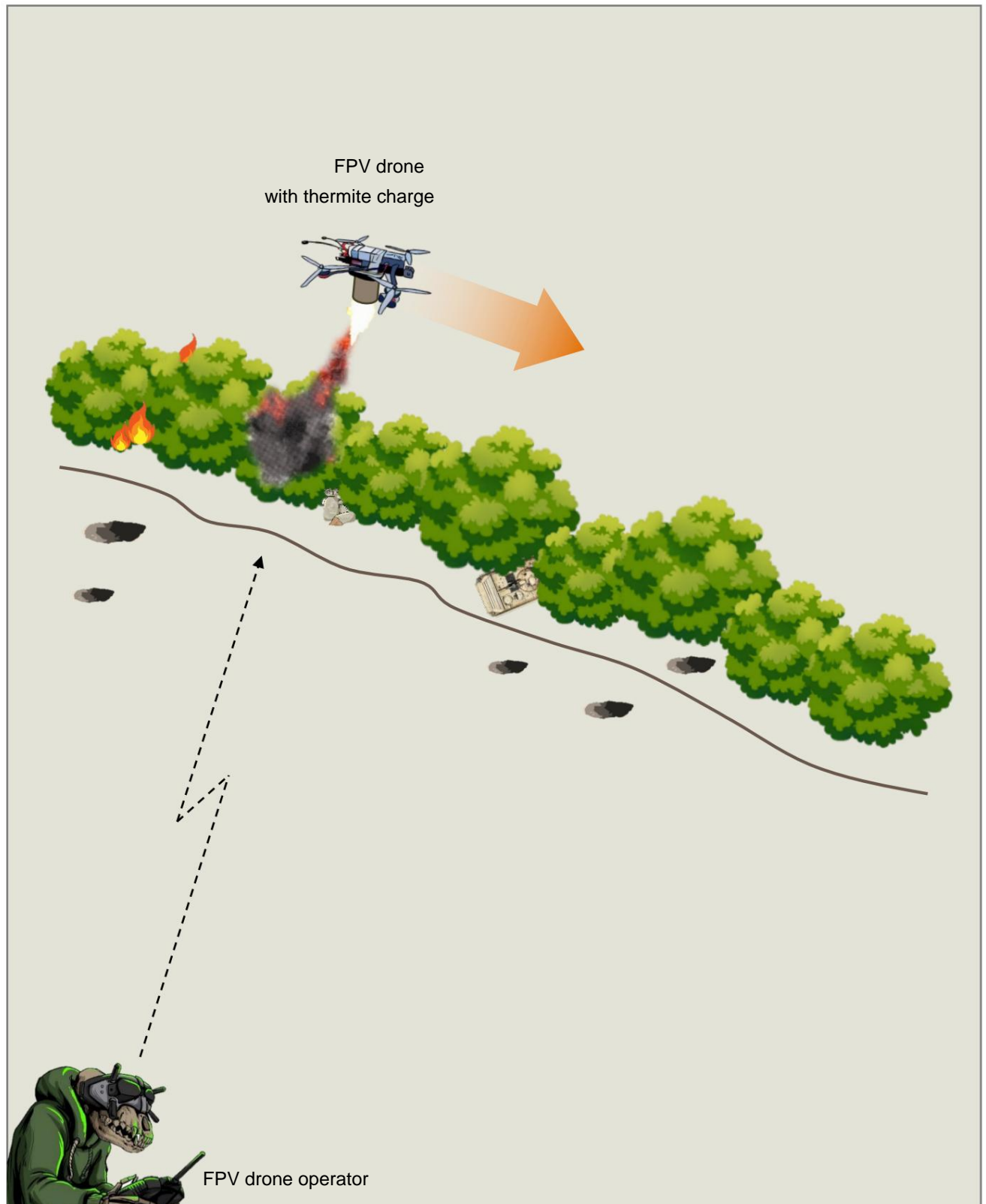
("hole"). The reconnaissance UAV directs the FPV to the target. There have been cases of using ammunition with toxic substances. In addition, this method is often used to drop payloads to friendly troops.



12. "FPV-dragon"

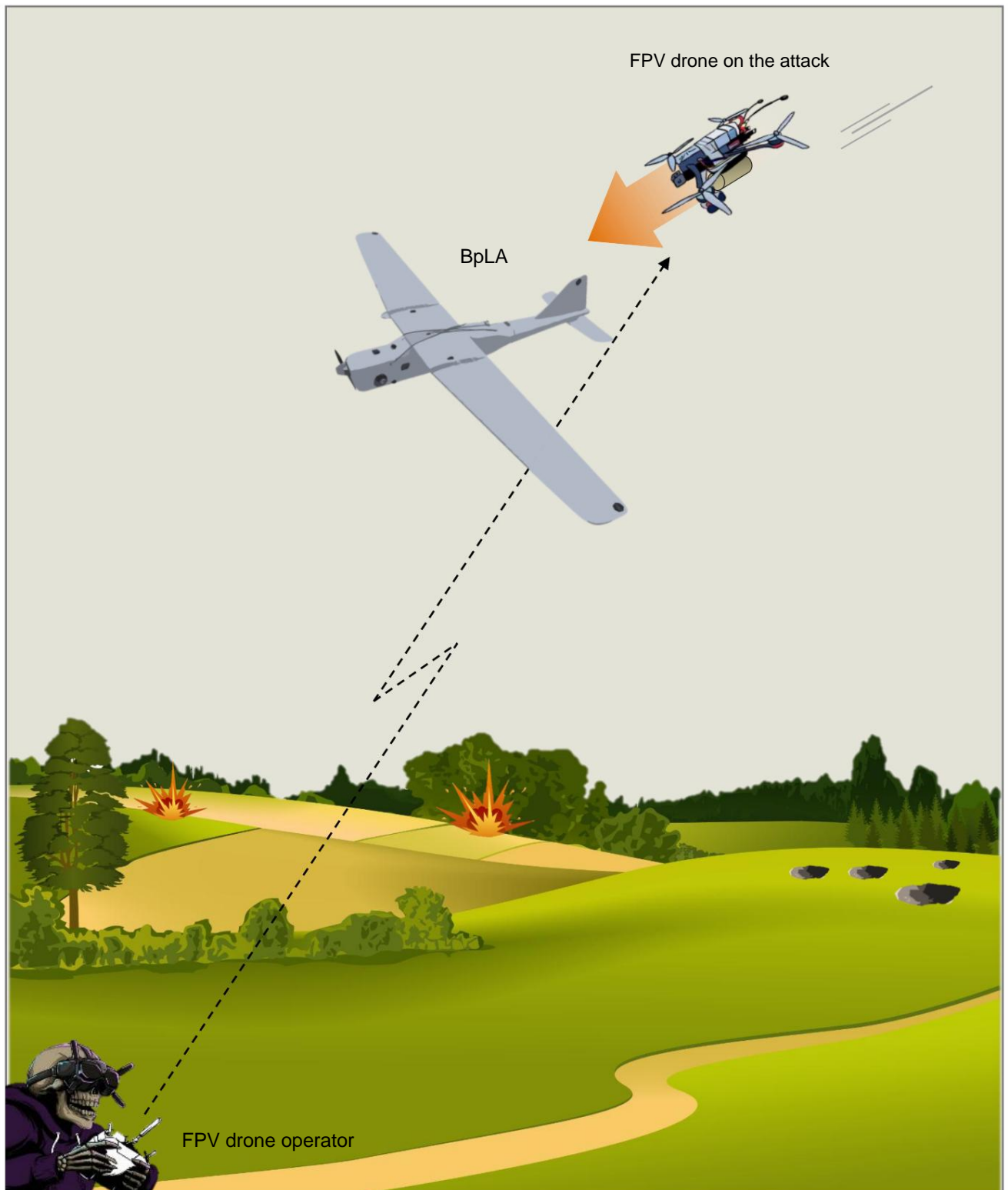
(spraying incendiary mixture over enemy positions)

For the purpose of setting fire to and disabling personnel, equipment, openly located ammunition and property, an FPV equipped with a thermite charge (based on a 120-mm artillery incendiary munition) is used. The average height of spraying the incendiary mixture is 20-50 m. Burning time is up to 2 minutes, temperature is over 2300 degrees C.



13. "FPV-PVO" (UAV destruction)

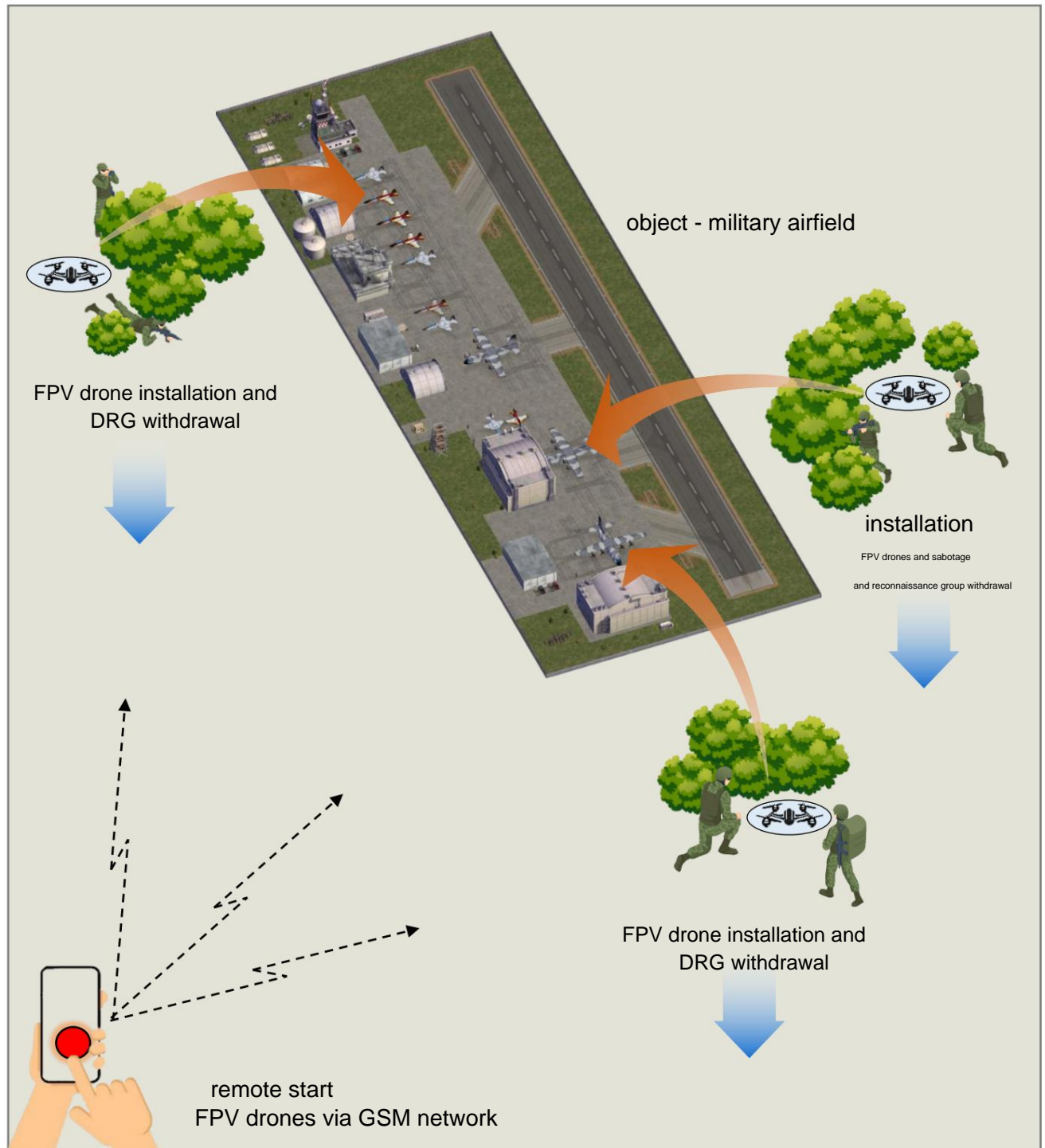
FPV drones are used to combat aircraft-type reconnaissance UAVs and hexacopters. When UAVs are detected by radio-technical means, (operating altitude – up to 3 km, speed – up to 110 km/h) FPV drones are launched to intercept and destroy them. UAVs are disabled by detonating a fragmentation charge when approaching or by ramming. Target designation is performed by the radar operator.



14. "FPV-saboteur"

(covert installation of FPV drone sabotage and reconnaissance systems at objects in the rear – remote activation of them according to pre-loaded coordinates)

This method of using FPV drones is used by sabotage and reconnaissance groups to destroy (disable) enemy military equipment and facilities. After the sabotage and reconnaissance group has covertly installed kamikaze drones (4-6 pcs.) near the facility at a distance of up to 2-3 km and switched to the "standby" mode, the UAVs are remotely activated by a GSM network signal to strike targets in accordance with pre-loaded coordinates.



15. "FPV-on the uterus"

(increase in combat radius)

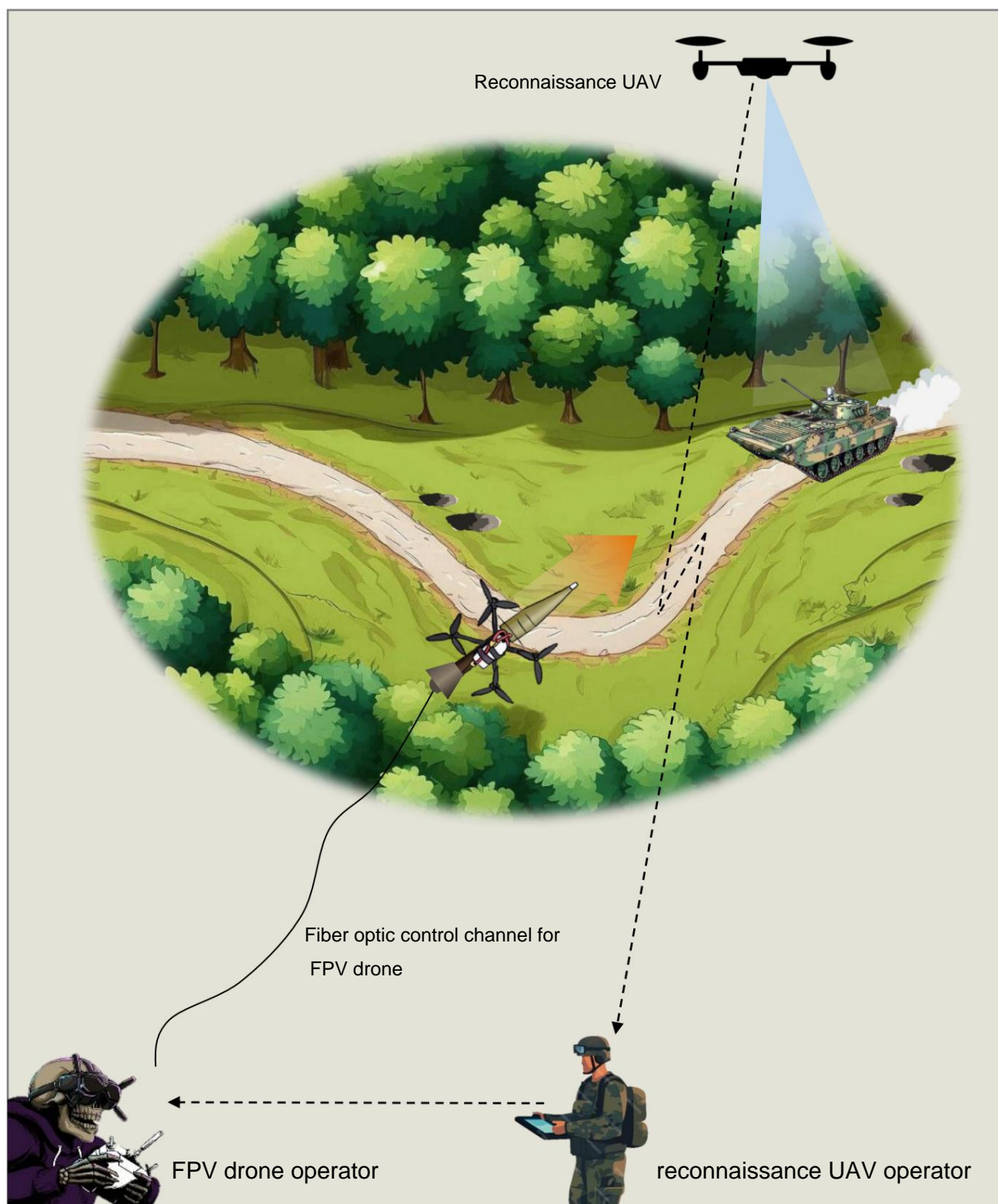
In order to increase the combat radius of FPV drones, UAVs are used - "mother" of both aircraft and "copter" types, which also act as a repeater. The total load capacity is two or three FPV. At the same time, their range of use (depending on the type of "mother") can be up to 60-70 km. In addition, unmanned boats (UBC) can act as "mothers" for FPV drones.



16. "FPV-on-wires"

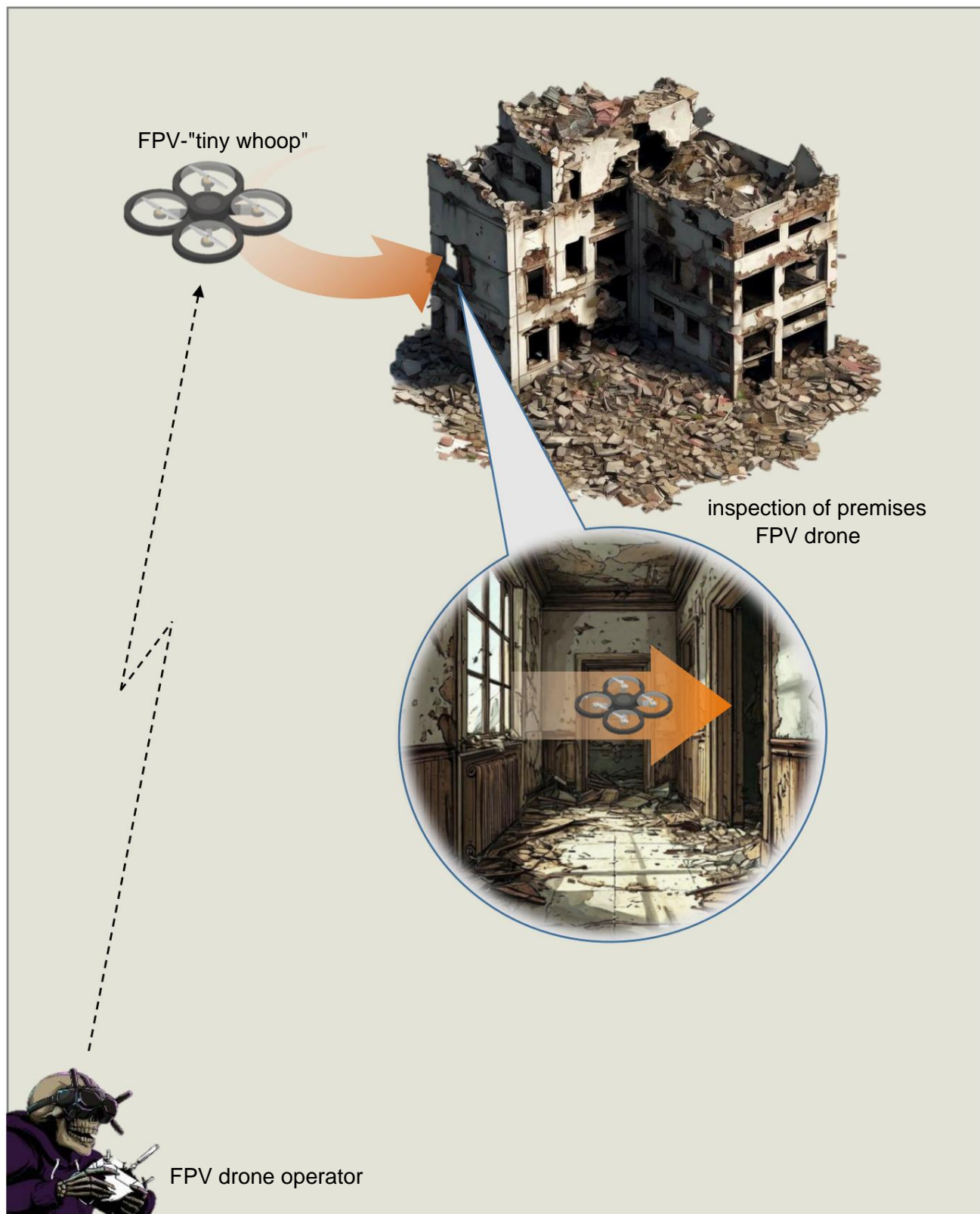
(ensuring stable control of the drone)

To ensure stable control of the FPV drone from the impact of electronic warfare systems and guaranteed target destruction at a range of up to 10 km (in some models up to 25 km), UAVs on a fiber-optic cable are being introduced. A characteristic feature of their use is the clarity of the video image to the final point of the route. Features of use - preventing abrupt maneuvers, avoiding fires along the route.



17. "Inspection of buildings" (control of premises inside buildings)

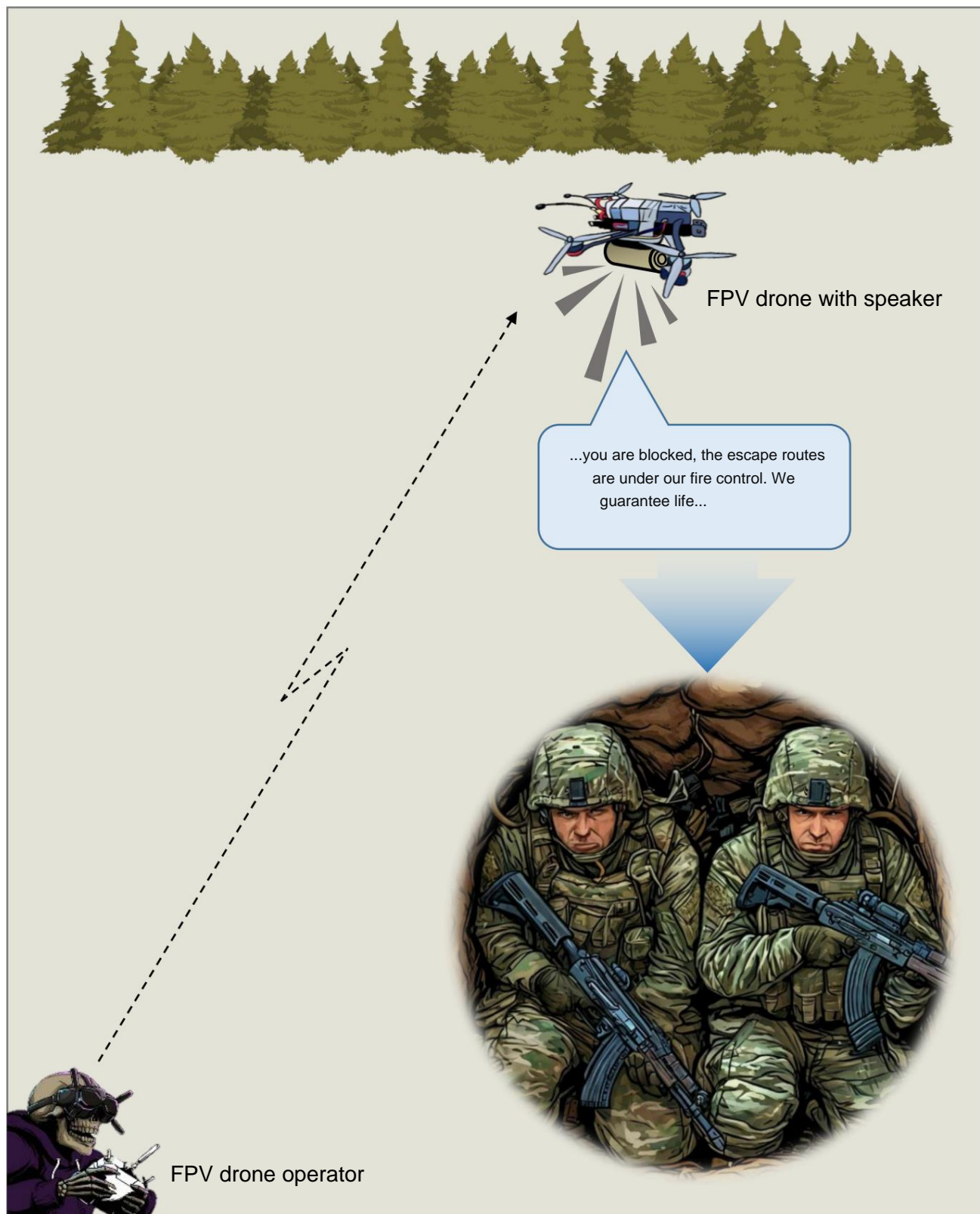
To detect the enemy and control the interior of buildings during assault operations, short-range FPV drones "tiny whoops" (microcopters with blade protection) are used. General performance characteristics: dimensions up to 100 mm in diameter, weight - up to 50 g, flight time - up to 4 min. Communication range (in buildings) - up to 500 m.



18. "FPV-swearing speaker"

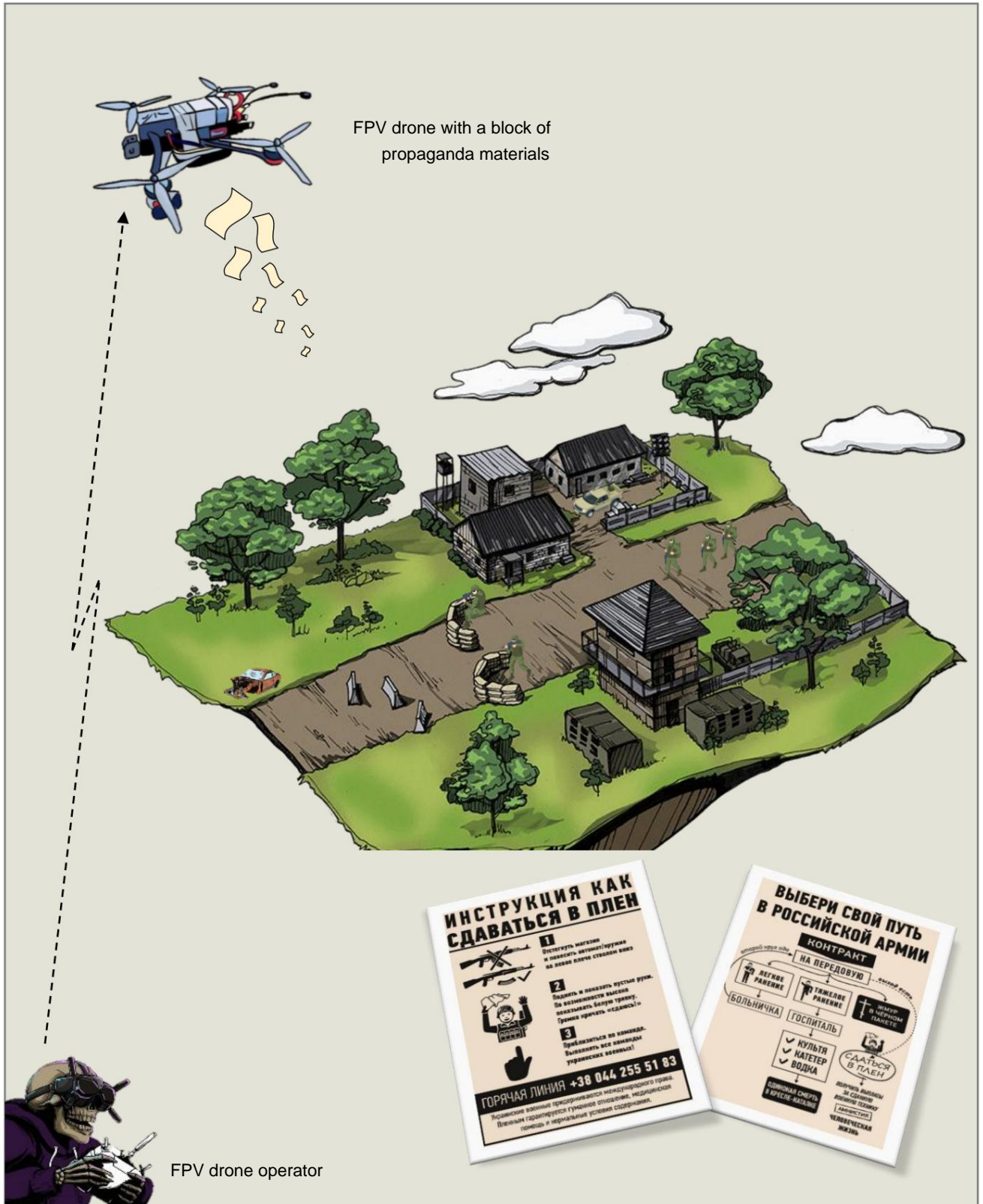
(information and psychological impact on the enemy)

In order to reduce the moral and psychological state of the personnel and forced to surrender, FPV drones with speakers for broadcasting audio messages are sent to the positions. Hovering height is up to 50 m.



19. "Flying" (dropping leaflets from an FPV drone onto enemy positions)

As part of the information and psychological impact on personnel and the population, FPV drones are used by the enemy to drop leaflets. The weight of the printed materials dropped is up to 2 kg (about 200 leaflets).



FPV drone with a block of propaganda materials

FPV drone operator

IV. Methods of countering FPV drones

The fight against FPV drones requires a comprehensive approach to protection from UAVs in the form of **active** and **passive** measures that must be implemented both in the unit and as individual elements by each serviceman.



Active events include :

identification and destruction of kamikaze drone operator crews (probable launch sites, presence of antennas, specially prepared area for FPV launch, traces of ammunition dismantling, packaging and boxes, inconspicuous passenger cars, repeaters on high-rise buildings and infrastructure elements);

early detection of UAVs (visually, by ear, by detector or analyzer signal) **and notification** (receiving a command or message from a senior officer, observation post, neighbors about the presence of a drone in the area of your operations);

electronic suppression of radio frequencies of control channels by means of electronic warfare transmission of video signals and satellite navigation;

reducing the time spent in the potential affected area due to the speed of the vehicle (an Induro-type motorcycle at a speed of about 80 km/h covers 5 km in 4 minutes);

fire impact - destruction of drones by small arms fire, primarily from smoothbore guns (up to 50 m);

mechanical impact – capture of drones by using special devices – “net throwers” – at close range (20-30 m);

maneuver – actions of personnel to avoid being hit by a drone (dispersal, taking cover, active movement in open areas in case of threat of defeat);

Providing logistics of ammunition, water, and food to units on LBS through the use of “heavy copters” and ground-based robotic systems for delivering cargo and evacuating the wounded.

As a promising method of countering UAVs, developments are underway to **optically influence** the drone's camera by using a laser device with a wide light beam.

Passive activities:

additional fortification equipment of positions (preparation of anti-drone niches and "holes", bends at the entrance to dugouts and shelters, installation of hanging protective nets and barriers);

camouflage of positions and equipment (installation of camouflage nets with irregular geometric shapes at a distance of 0.3-0.5 m from equipment in the shade of trees and bushes, inside destroyed buildings, use of heat-protective capes, monitoring of unmasking signs from a drone);

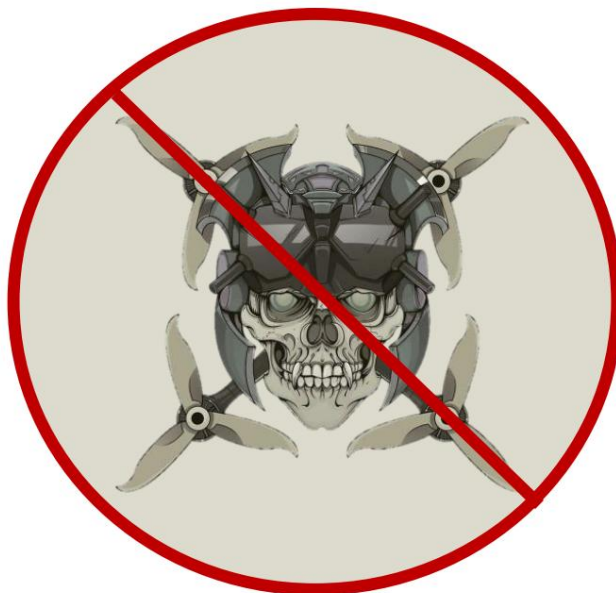
creation of false positions (equipped with heat and light sources)
with the installation of models of military equipment and transport (including unsuitable ones) to exploitation) and imitation of their activities;

installation of protective nets (screens) from fishing nets on rotation routes, evacuation of personnel, delivery of ammunition, water and food;

installation of hanging protective elements (canopies, awnings) and "**domes**"
electronic warfare systems for equipment;

taking into account weather conditions, terrain features and time of day when planning active actions and movements;

setting up aerosol curtains, creating smoke sources in positions (objects) and **routes of movement** (including false ones).



General recommendations for personnel to counteract FPV drones (based on SVO experience)

The number of UAVs at the front is growing exponentially. Drone duty in the air has led to decentralization and a reduction in troops at the front. Where there used to be a platoon, now they make do with a squad. Where there used to be a "support", there are now three "holes" with 2 people each. Both sides are trying to minimize movements on the LBS. One "armor" can attract up to a dozen "birds", and 2-3 drones participate in the race for a soldier. In the LBS area, reconnaissance drones, "bombers" and FPV crews take turns in their sectors to conduct surveillance in readiness for work. Some search, others strike.

Disguise.

1. Camouflage yourself from aerial observation, use awnings, fabric nets, branches, grass, foliage. The following things will give away your position: polyethylene film, white bags, household garbage, fresh earth, and the movement of fighters.
2. You are less visible from the air if you: are not moving; are in the shadow of buildings (objects); are sitting instead of lying down (reducing your dimensions); match the color of your uniform with the terrain, that is, do not fuss and do not "reflect"
"you're chilling."
3. It is better to move and hide in the shade of trees and slopes. Do not make sudden movements and do not run - it is noticeable. Relatively safe time and weather - twilight, night, fog, rain. Protective capes from "hothouses" - in the theme.
4. Place and camouflage equipment in forest belts, along (inside) buildings and hangars, change its location, equip simple camouflaged canopies. Pay special attention to covering car windows - they glare. If the enemy is in the north, place the equipment behind the building on the south side.
5. Do not place transport near the positions, put it in a hidden place for a quick "move". Collect all the garbage in bags and a separate pit. Scattered packages of rations, cans, plastic bottles, polyethylene perfectly unmask the position. To control the camouflage "quietly" launch your drone and inspect the area to identify unmasking signs.
6. Camouflage nets are always needed in large quantities. When installing, change their configuration, the more unclear and blurry the silhouette, the more difficult it is to detect the object. Satellite dishes heat up, they should be hidden in a hole and camouflaged from both daytime and thermal imaging cameras.
7. Create false positions with unmasking signs. Install mock-ups of military equipment or disabled transport. Simulate their activity. Make a fire at night in empty shelters, place "trenches"
"new" candles.

8. Observe light masking at night. Light from a cigarette, a campfire, light flashlights, headlights, phone screens – attracts drones like moths to a flame.

9. Conversations about life should only be made in cover. No need to huddle together with cigarettes if you are bored. Do not wander around your positions without doing anything. If you are called on command, warn another soldier. The main criterion for the enemy to detect you from the air is movement during the day and heat reflections at night. Keep quiet, try to communicate in a whisper and with gestures, listen to sounds.

Fortification and transport.

10. When equipping a trench, make a side niche at the bottom - it will protect against shrapnel during shelling, FPV strikes and ammunition drops. Exits from dugouts - in the shape of the letter "G". Hang a protective blanket at the entrance to the shelter. Equip a second entrance to the dugout (the first can be blocked as a result of a hit).

11. As obstacles for FPV drones, prepare and secure cord anti-drone curtains made of 4-5 mm thick ropes in front of the positions: length – 6 m, height – up to 4 m, interval between hanging ropes – 20 cm.

12. Another option for protection is to install screens made of cheap fishing nets (length - up to 80, height - 4 m, cost up to 1000 rubles) - they are invisible to the operator, equip additional awnings and canopies. No ingenuity - no shelter!

13. It is advisable to prepare and install smoke grenades in advance at the position (at a distance of 20-30 m) for their activation in the event of a threat of strikes by kamikaze drones. Each person has instant-action hand smoke grenades.

14. The presence of additional protective elements on equipment ("visors", "barbecues", shields, nets, chains, anti-fragmentation protection in the form of 1 cm thick pieces of rubber on "self-tapping screws") will increase the survivability of the crew and passengers when attacked by drones. The main thing is not to overdo it.

15. The desired ideal version of technical means of electronic warfare at the platoon position: spectrum analyzer and UAV detector, device for intercepting video images from FPV drones, portable broadband "dome" system of electronic suppression, individual mobile "suppressors". On the equipment - a mobile version of the "dome system". Bold, but it does no harm to dream.

16. Getting a proven electronic warfare drone suppressor for your vehicle is a military blessing. Don't cover it with a camouflage net. Monitor the battery charge of the miracle device. It's sad when you thoughtlessly "jam" the vehicle during a mission and are unknowingly left without a "dome". Wait for the evil spirits...

17. In order to combat the "hunters" of aircraft-type UAVs, It is necessary to install onboard electronic warfare systems.

18. How else can you influence the video transmission channel of an approaching enemy FPV drone? To detect it, you can use an FPV monitor or glasses, with which you search for the transmission channel (usually 5.8 GHz). On your drone's video transmitter, set the same channel and maximum power. After launch, interference is created in the control of the video transmission channel (the drones "work" on the same frequency).

19. Mechanical robotic platforms and "heavy" drones for providing logistics of ammunition, water, food and evacuation of the wounded significantly reduce personnel losses from FPV drones. We are looking forward to
nim.

Actions when a drone is detected.

20. Always listen to sounds, feel the "sky". First, detect by sound (you can hear better at night), then visually. Spread your ears like Cheburashka and keep your eyes open. Notify in a timely manner. Treat all UAVs as hostile.

21. Learn to distinguish between a Maywick and an FPV by sound. The first one works quieter and smoother. no, the second one is more piercing and has sharp changes during acceleration.

22. In order to increase security, movement should be carried out (in time and place) based on an analysis of the activity of enemy drones in a specific combat zone (the enemy knows about the "gray" time).

23. Try to avoid the "postcard", move along the plantings, in a populated area - from building to building. The interval in the "troika" is at least 5 m. It is advisable to move covertly along the "troikas" to the checkpoint (shelter).

24. Reconnaissance drone – a precursor to FPV. If you spot an enemy UAV while moving (including in a car), don't lead it to yours. Take cover, wait, observe and don't reveal your unit's position. When landing, lean against a tree trunk and don't move.

25. Always control the "sky" in sectors while moving. Keep your distance and notice the nearest shelters (destroyed buildings, "holes", plantings, bushes, etc.) for a "dash" when there is a threat of being hit by a drone. A shell crater, as a "safe place", will act as a grave. Do not gather "in a bunch" in one place. Dispersion, maneuver and speed.

26. Heard FPV – take cover immediately. If you are on a "postcard" – make sudden sharp movements. Leave the operator's observation sector, (fall) to the side during an attack. The chances are better for the masters of "shuttle" running. It is advisable to practice.

27. If the drone is in close proximity (20-30 m) – don't try to "freeze" in the hope that it won't notice and will fly past. Move the tomatoes! Salvation is in reaction and movement.

28. Firing from small arms is ineffective (small target size, high speed). In addition, when shooting you are static, which makes it easier for the operator to aim the drone. At close range (up to 50 m), there is a chance for a shooter (better two) with hunting or pump-action shotguns. To prepare them, practice on "skeet".

29. There have been cases of the operator playing with the "victim". If you are quick and skillfully dodge, hide behind cover (a 40 cm tree trunk is also an option), and are also able to attack the drone by throwing a "club" or other objects - the chances of survival increase. Almost recorded.

30. When driving a vehicle, pay special attention to monitoring the "sky" from the rear and flanks (up to 80% of FPV drone attacks are on the rear and sides of the vehicle).

31. In dangerous areas, move at the maximum safe speed. Do not choose long routes. If a kamikaze drone is detected, it is advisable to move to the side (preferably to a forest plantation, to buildings), stop and quickly disperse. The chances of escaping from FPV along the route are negligible.

a little.

32. When the vehicle stops, everyone leaves the vehicle very quickly, no one "huddles" or argues about who will unload the ammunition. Otherwise, the target's priority increases. Time is against you.

33. The availability of high-speed motorcycles such as "induro", "buggy", and quad bikes with trained drivers contributes to increased survivability and cargo logistics in the LBS area. At the same time, electric models ensure silent movement and higher sensitivity of drivers and passengers to early detection of drones by sound.

34. Extreme driving requires serious training of drivers. Train day and night. Be able to identify and remember landmarks during the day and then find them at night.

35. If you spot an FPV drone on the ground (especially if it "beeps" near your positions), don't run to it with joy and spread your fingers in the hope of a new trophy. It could be a "trap". Don't approach it from the camera's side (the operator is waiting for you to appear in the frame), don't touch it, mark it with a marker, and report it to the commander. A specialist will sort it out.

V. Conclusion

Thus, the technical leap in the application and adaptation of FPV drones to the modern theatre of military operations has led to a significant expansion of the range of combat missions they perform.

The demand of combat units for trained and provided kamikaze drone crews exceeds the supply on the war market. Innovative development of this type of weapon will undoubtedly entail the search for and implementation of new technical solutions and methods of counteraction (electronic, optical, mechanical, etc.), and will also lead to the creation of separate structural units (crews), both for their use and for combating them.

At the same time, in the near future, individual elements of counteraction touch every serviceman in combat units. The competition in the drone-anti-drone confrontation category is just beginning...



Without effort, you can't catch
even an enemy drone!

