



FEATURES OF THE USE OF COMBAT DRONES IN MODERN ARMED CONFLICTS

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Abstract. In given article the analysis of designs, principles of work and features of application modern UAV, their advantages over usual aviation.

Keywords. FPV – drone, unmanned aerial vehicles (UAV), camera, operator, virtual reality (VR) video-spectacles, construction.

During modern military conflicts, UAVs solve a considerable range of problems, essentially enhancing the overall efficiency of army group actions. They are applied to conducting aerial reconnaissance and detecting objects (control stations), warehouses, communication centers, clusters of vehicles and enemy armies, delivering real-time information about them to the control station for organizing attacks, and providing guidance for means of attack. Combat UAVs, also known simply as UAVs or drones, appeared much earlier than many realize. However, with the development of technology, the capabilities of drones began to expand. They have been equipped with aviation rockets, bombs, and other weapons. As it turns out, they are effective offensive tools capable of targeting both land and sea-based objectives. Modern UAVs are also becoming increasingly automated, with some capable of carrying out combat missions in fully autonomous mode [1].

It is proposed to delve into this type of weaponry, its variations, capabilities, and prospects in more detail. The content is as follows:

1. FPV Drones
2. Combat Quadcopters (Multicopters)
3. Unmanned Aerial Vehicles
 - 3.1. Missions UAVs Can Undertake
 - 3.2. Advantages of UAVs
4. Kamikaze Drones
5. Primary Drawbacks of UAVs

FPV drones (First-Person View or "the view from the first person") are UAVs equipped with cameras whose images are transmitted wirelessly to virtual reality goggles or special video goggles worn by the operator. Thanks to this technology, the operator, sitting in a comfortable location, experiences the sensation of being in the air and sees everything as if they were inside the drone. FPV drones are unmanned aerial vehicles that allow the pilot to immerse themselves in the flight experience without leaving the ground. Today, FPV drones have found wide application in various fields, from entertainment and photography to military operations. In this article, we will discuss the design and operation principles of FPV drones, as well as their types and advantages over conventional multicopters.

FPV drones have a design similar to that of multicopter, consisting of a frame, electronics, motors, and a gyroscope. Recently, new FPV drones designed for military use have begun to emerge. They are equipped with special means for dropping ammunition, use secure communication channels, and are resistant to enemy electronic warfare systems.

Advantages of FPV drones over conventional multicopter:

1. High Speed: Their small size, lightweight, and aerodynamic design allow FPV drones to achieve higher speeds than their traditional counterparts.
2. Sensation of Flight: FPV UAVs provide a first-person view, allowing the operator to feel as if they are inside the drone. This immersive experience helps pilots to deeply engage in flight operations.
3. Precise Control: Through the goggles, operators have a UAV's-eye view of the surroundings, enabling them to maneuver the drone more accurately and navigate through various obstacles.
4. Enhanced Aerial Photography and Videography: FPV UAVs offer unique perspectives for capturing aerial photos and videos. The ability to see what the UAV sees allows operators to creatively approach shot composition and capture dynamic footage.



Thus, military personnel currently use FPV drones for aerial reconnaissance, surveillance, and direct combat operations. The maneuverability of these devices and their ability to operate in risky environments make them effective military assets. As scouts, their main advantage lies in their ability to gather information without risking personnel. These UAVs can observe enemy movements, identify various objects, and collect other reconnaissance data. Due to their high maneuverability and compact size, they can access hard-to-reach areas and gather valuable intelligence without being detected. Additionally, FPV drones can serve as support assets for operations, acting as observation posts to gather data on enemy positions, obstacles, and other relevant information. Finally, equipped with various munitions, FPV drones can be transformed into kamikaze UAVs, detonating upon impact with a target, causing damage. As demonstrated in operations in Ukraine, FPV drones are capable of targeting even enemy armored vehicles with remarkable precision [2].

Combat Multicopter: Multicopter are perhaps the most common type of UAV used in military operations, as they are simple and inexpensive devices. They offer advantages such as

high maneuverability, quick deployment, and ease of operation. A standard multicopter configuration consists of four electric motors and four propellers. Two of the propellers rotate clockwise, while the other two rotate counterclockwise. This rotation provides lift. Multicopter are inherently unstable aerodynamically, as they lack wings. Therefore, onboard computers stabilize their flight by adjusting the frequency of rotation of the propellers.

Multicopter can hover in place, make turns, and perform other maneuvers. To move forward, the motors at the front decrease in frequency, causing the copter to tilt forward, while the rear motors increase in frequency to provide the necessary thrust.

It is worth noting that there are hexacopters, which have six propellers and motors, and even more advanced models with eight propellers. The latter have high payload capacities, allowing them to transport cargo. There are also models capable of evacuating wounded personnel.

However, multicopter are most often used for reconnaissance purposes. They can also be equipped with firearms or light grenade launchers to engage enemy personnel and vehicles. Sometimes, military personnel even use commercially available consumer drones equipped with improvised explosive devices or grenades for attacking enemy targets. A significant challenge for military drone manufacturers is the development of high-precision targeting systems and optical systems. However, this challenge is likely to be addressed in the near future, further enhancing their effectiveness as weapons [3].

Unmanned aerial vehicles, or UAVs, typically refer to aircraft without pilots on board, including both multicopter and fixed-wing UAVs that resemble planes. In fact, they encompass both types. Currently, they are considered one of the most promising weapons.

Although the first UAV capable of military tasks appeared in 1948, combat UAVs were widely adopted only in the 1990s and 2000s. Thanks to modern technologies, their capabilities have approached those of attack planes and bombers, and they even surpass many aircraft in terms of flight duration.



Multipurpose UAVs in the USA, the most well-known being the MQ-9 Reaper and MQ-1 Predator. The MQ-9 Reaper is a heavy-class reconnaissance and attack drone. It is heavier than the Bayraktar and Orion and can carry payloads weighing up to 1700 kg. Russia is currently testing a similar drone named "Hunter".

Advantages of UAVs: In modern warfare, where armies are becoming increasingly technologically advanced, UAVs have the potential to become one of the leading types of weaponry.

UAVs are currently used for: conducting aerial reconnaissance; updating fire missions; creating decoy targets for the enemy and executing direct strikes [4].

The spectrum of tasks performed by UAVs will only expand with the advancement of science, technology, and engineering. One of the main advantages of UAVs is their low cost compared to manned aircraft. A conventional UAV can be ten times cheaper than a plane or helicopter, and considering the expensive infrastructure required for manned aircraft, the difference in total costs can be hundreds of times. UAVs are mobile and easier to operate and maintain. Moreover, they can perform combat missions in conditions where human pilots would face extreme physical strain.

The main advantage of UAVs is their low cost compared to manned aircraft. Frontline combat UAVs cost between 5 and 7 million dollars. While this may seem substantial, it pales in comparison to the cost of fifth-generation fighter-bombers like the Su-57 or F-35, which can reach 100 million dollars. Additionally, the purchase of an aircraft is just the beginning; training pilots is also necessary.

Certainly, UAV operators also require training, but as mentioned earlier, many modern UAV actions are performed automatically. They can take off and land on their own. Another significant advantage of UAVs is that operators do not risk their lives when carrying out combat missions. UAVs can be made in any size, including the smallest, as they do not require a pilot cabin. Furthermore, UAVs do not experience physiological stress, allowing them to perform various maneuvers.

Tasks performed by UAVs: As mentioned earlier, the primary task of UAVs is aerial reconnaissance. However, their capabilities have significantly expanded in recent years. They can conduct bombing raids on land and sea targets, intercept aerial targets, provide fire support, designate targets, relay data, and deliver payloads. The list of tasks performed by UAVs will continue to grow as their capabilities expand. For this reason, many experts consider them one of the most promising weapons of the future [5].

Kamikaze drones can be classified as a separate type of UAV, also known as smart bombs or loitering munitions. An example of these is the American "Switchblade" and the Russian "Lancet".

The Switchblade is equipped with an engine, advanced guidance systems, and a warhead. It can be programmed to independently attack targets located several kilometers away from its launch point. Its most interesting feature is its ability to loiter around a designated target and strike when the moment is right.





After being launched from a mortar, the Switchblade deploys wings, transforming into a small cruise missile. The lighter version of this drone can operate within a radius of 10 km and has a flight duration of about 10 minutes. It can attack autonomously during this time. The device is propelled by an electric motor, allowing it to fly silently at speeds of up to 160 km/h. The heavier version of the Switchblade can attack targets up to 40 km away and has a flight duration of 40 minutes, flying at speeds of up to 185 km/h. Due to its high speed, silence, and small size, the kamikaze drone is difficult to detect and nearly impossible to intercept, making it even more effective than conventional UAVs, which are relatively easy to shoot down. Although the UAV cannot be retrieved after launch, the operator can cancel the attack and redirect the drone. Smart bombs can be used to engage enemy armored vehicles and infantry, and some models can target aerial threats. Essentially, these drones can fulfill fighter functions [6].

Recently, the Russian Federation has begun to actively deploy combat UAVs against the Ukrainian army. Russian experts predict that the mass deployment of the "Lancet" kamikaze drone will significantly change the situation on the front lines.



The "Lancet" is a loitering munition, a drone capable of hovering for an extended period, tracking a target, and swiftly attacking by diving onto it. The latest version, "Lancet-3", has a maximum horizontal flight speed of 110 km/h and can reach speeds of up to 300 km/h when attacking a target. It has a range of 40-50 km and carries a warhead weighing about 12 kg, making it capable of remaining airborne for about an hour.

Primary drawbacks of UAVs: The role of UAVs has greatly increased in modern military conflicts, and there have been instances where they have determined the outcome of battles. However, it is impossible to consider this weapon ideal at present. The main drawback lies in the vulnerability of remote-control systems. The enemy can jam or intercept drone controls, rendering the device unusable or, worse, turning it against its own forces.

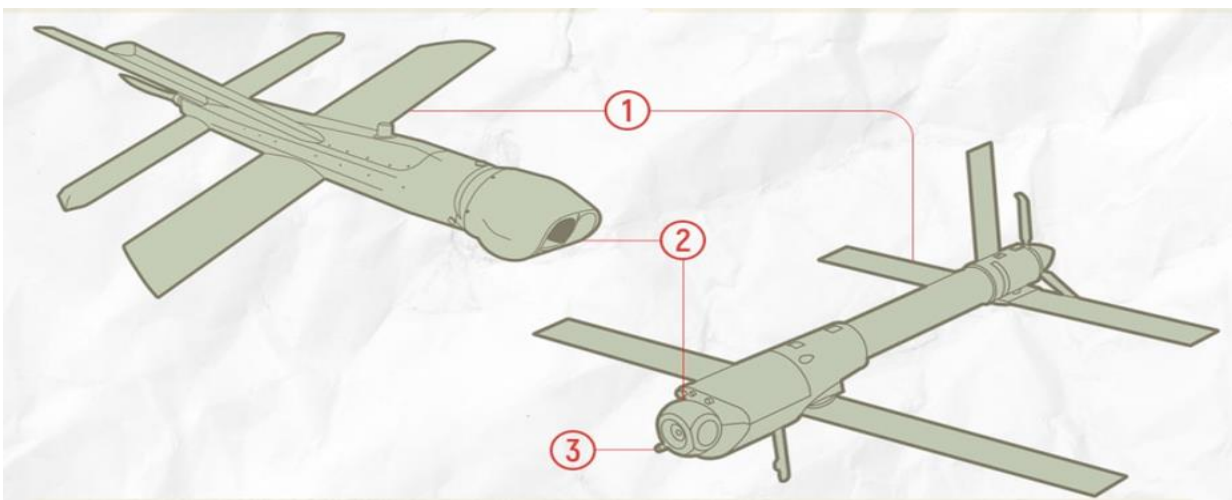


UAVs also have other drawbacks. For example, their signals can be intercepted by the enemy's air defense systems with relative ease, posing serious risks, ranging from physical destruction to reprogramming and attacks on friendly positions [7].

In conclusion, UAVs are becoming increasingly significant players in military operations, and their importance in future conflicts will only grow. Any potential drawbacks of UAVs can be mitigated with careful tactics. For example, using UAVs in conjunction with other forces, such as tanks or artillery, can increase their effectiveness while reducing the risk of losing drones. In recent conflicts, various tactics involving UAVs have been widely employed, resulting in significant damage to enemy targets and personnel.

A comparison of the Kamikaze drones "Switchblade-600" from the USA and "Lancet-3" from Russia, both of which are widely used on battlefields by warring factions to directly attack enemy air defense and artillery installations, as well as armored vehicles and troops.

UAV "Switchblade-600" Kamikaze drone (USA)	UAV "Lanset-3" Kamikaze drone (RF)
Type once-through striking kamikaze drone Purpose defeat overland integer Begin production 2014 - a present time The Operator 1 person The Mass 23 kgs Range of the flight 70 km The Velocity (the max) 150 KPH Length of the flight 40 minutes The Combat part cumulative, mass 4 kgs The Type of the start from transport-triggering	Type once-through striking kamikaze drone Purpose defeat air and overland integer Begin production 2016 - a present time The Operator 1 person The Mass 12 kgs Range of the flight 40 km The Velocity (the max) 110 KPH Length of the flight 1,5 h The Combat part fragmentation-hugh-explosive, mass 5 kgs



- 1 «Lancet-3» has double X- figurative wing, beside «Switchblade-600» wings direct.
- 2 The Optical module «Lancet-3» is located inwardly main part drones, beside «Switchblade-600» module open.
- 3 The Antenna-transmitter "Lancet" is found inwardly, beside UAV USA she is situated in main part.

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