

UNMANNED COMBAT AERIAL VEHICLE (UCAV) – WEAPON OF THE FUTURE –

Ivaylo BOZOV

Faculty of Artillery, Air Defence and Communication and Information Systems,
National Military University, Shumen, Bulgaria
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Unmanned combat aerial vehicles (UCAVs) are an integral part of modern military conflicts, being increasingly relied upon to perform various tasks in the interest of the armed forces. The article aims to review the most popular and used UCAVs, consider their advantages and disadvantages and describe the tasks they perform.

Keywords: unmanned combat aerial vehicle; cruise missiles; loitering munitions; drones; targeting;

INTRODUCTION

Nowadays, military conflicts place new demands on the conduct of military operations, in which high-precision weapons and high-tech military equipment are increasingly used. Unmanned aerial vehicles are no exception, on the contrary. In the 21st century, we cannot imagine conducting military operations without the participation of UAVs performing a wide variety of tasks – surveillance, reconnaissance, adjusting artillery fire, direct fire, retranslation, electronic warfare among other tasks.

The mass use of UAVs began in the second half of the 20th century, and for decades UAVs were mainly used for surveillance and reconnaissance (additional reconnaissance) of previously identified enemy targets and for transmitting data about them. The rapid technological progress has allowed the developers to create reconnaissance and striking systems with UAVs, capable of carrying various missile and bomb weapons. Currently, the combat UAVs (UCAVs) are fully-fledged used, their main task being to strike various objects (targets) of the opponent.

UNMANNED COMBAT AERIAL VEHICLES – UCAVs

Nowadays, when troops have become more technologically advanced, UAVs can become one of the leading types of weapons. Many countries adopt and rely on UAVs as means that enhance combat effectiveness. Economically less developed countries also rely on UAVs, since rearmament with new and modern equipment is more expensive.

UAVs are currently used for:

- *surveillance and reconnaissance;*
- *adjusting fire;*
- *creating deceptive targets for the enemy;*
- *launching missile and bomb attacks on land and sea targets – by UCAVs*
- *others (FMI 3-04.155, 2006; Dimitrov, Antonov, 2009, pp. 531-537).*

Thanks to modern target detection systems and guided munitions, the UAV has a higher efficiency in destroying enemy equipment, structures and troops. They execute unexpected almost silent attacks, compared to combat aircraft or helicopters, thus being a very strong demoralizing factor for enemy military

personnel. Also, UAVs, which can circle over the target area for many hours, greatly exhaust the enemy's air defence personnel, who have to be constantly on edge of their abilities.

The use of UCAVs has increased several times in the military conflicts in Syria, Armenia and Ukraine, where their usefulness has been demonstrated. They are equipped with a diverse array of armament – guided missiles, aviation bombs and other weapons (Conev, 2007, pp. 120-126).

UCAVs are mainly separated into two groups:

- *UAVs carrying a certain type of ammunition – with fixed wings or powered by a multicopter system;*
- *loitering munitions (“kamikaze”).*

The main purpose of this type of weapon is to find an enemy target, and if the commander decides to strike it, the UCAV hits the target by launching missile, bomb attack or direct hit – for loitering munitions. If the target is not appropriate, the flying system searches another target, while the reconnaissance one should be hit with another fire means (artillery).

PERFORMED TASKS BY UCAVs

UCAVs can perform a large array of tasks, ranging from several tens of meters to under one meter. Although the tasks are different, in general, they can be divided into the following groups:

❖ *reconnaissance-strike* – the implementation of reconnaissance and search actions in order to detect a target (group of targets), identify dangerous targets, and, if necessary, immediately attack in automatic mode or at the commands of the UAV operator;

❖ *strike* – striking with missile or bomb weapons against pre-identified stationary or mobile targets with known coordinates or located in a limited area of the theatre of operations, at an enemy with weak air defence/missile defence system. As a rule, these targets are scouted by another source (optical reconnaissance, radar stations, reconnaissance UAVs) and are engaged by means of artillery, aviation or attack UAVs;

❖ *suppression of the air defence/missile defence system* – delivering strikes using high-precision missile and bomb weapons on objects of the enemy's air and missile defence system, especially in cases where the solution of the same task using manned aircraft is difficult for various reasons (for example, striking

at objects air defence/missile defence system requires the attacking aircraft to perform manoeuvres that exceed the limit set for pilots), or is associated with a high risk of loss of life. In this case, strikes can be delivered both against objects with coordinates known in advance and on objects that are quickly detected in the course of a particular operation;

❖ *electronic warfare* – the implementation of electronic warfare measures, namely the suppression of various electronic means of the enemy. In particular, they are related to the control systems of the enemy's radar and air/missile defence as well as to the disruption of its communications.

The first two tasks can be performed by many different UAVs, including those modified to carry munitions. Task performance depends on payload characteristics and the range and flight duration of a particular UAV.

The implementation of the third task is related to the almost inevitable contact of the enemy's air/missile defence forces and means under intense fire, which is why it is necessary to use specially developed unmanned aerial vehicles characterized by higher flight characteristics and manoeuvrability (especially in flights at low and extremely low altitudes), significantly less visibility at various ranges (including the active use of “*stealth*” technologies) and higher survivability, including high resistance to various combat damage.

In addition, if in the first two cases it is possible to equally effectively use the UAV in manual (by operator commands), semi-automatic or automatic control mode, while performing tasks when striking elements of the enemy's air/missile defence system, the automatic mode of operation can be used most effectively. In rare cases, the semi-automatic control mode can also be used. The reason is that in the event of a breach in the enemy's air/missile defence system, it is very likely that the data exchange system will be disrupted on all channels, as a result of the enemy's active use of electronic warfare systems.

POPULAR UCAVs USED IN RECENT MILITARY CONFLICTS

Recent military conflicts in Syria, Armenia, Nagorno-Karabakh and Ukraine have shown that UCAVs will be heavily relied upon to strike enemy targets, especially forces with a weak or unprepared air defence system (<https://topwar.ru>).

Some of the most used and popular UCAVs with fixed wings in the 21st century are shown in *table 1*.

Table 1: UCAVs mostly used in military conflicts
(<https://www.militaryfactory.com/aircraft/unmanned-combat-air-vehicle-ucav.php>)

UCAV	Length (m)	Width/ span (m)	Height (m)	Weight (kg)	Max speed (km/h)	Ceiling (m)	Range (km)	Armament	Country
Bayraktar TB2	11.2	12.0	3.2	420	250	8230	6000	2xUMTAS; MAM-L;MAM-C	Turkey
Bayraktar TB3 (2023) new*	8.35	14.0	2.6	1170	300	9500	200	PGMs; LGR; Anti-infantry mortars	Turkey
TAI Anka	8.0	17.3	3.4	700	217	9140	4900	PGBs	Turkey
Hermes 450	6.1	10.5		450	176	5486	200	2xHellfire ATGM	Israel
MQ-20 Avenger (Predator C)	12.5	20.12	2.1	4650	740	18288	5835	AGM-114 Hellfire; GBU-24 Paveway III guided bomb; GBU-31 JDAM; GBU-38	USA
MQ-9A Reaper	11.0	20.0	3.81	2223	Up to 400	15000	5920	Up to four AGM-114 Hellfire; GBU-12 Paveway II	USA
Orion (Inokhodets)	8.0	16.0	2.0	500	255	7500	700	Payload up to 200 kg	Russia
Forpost	7.22	8.55		350	200	4500	250	ATR Kornet; KAB-20	Russia
Punisher		2.55			198	400	45	UB-75HE; MACE	Ukraine

*The model is given for comparison with the previous and most widely used model – Bayraktar TB2.

The battles in Ukraine demonstrated the effectiveness of Turkish Bayraktar TB2 and the Russian Forpost and Orion, especially in the initial stage of the conflict. At the present moment, this kind of weapon is rarely used.

Some of the most used loitering munitions in the 21st century are shown in table 2.

Table 2: Loitering munitions/“kamikaze” mostly used in military conflicts (lb.).

UAV “kamikaze”	Weight (kg)	Width/span (m)	Range (km)	Endurance, (min)	Max speed (km/h)	Country
Zala KYB	6	0.95	65	30	130	Russia
ZALA Lancet			40			Russia
Switchblade 300	2.5	1.20	10	15	160	USA
Switchblade 600	22.7	1.80	40	40	185	USA
Phoenix Ghost				360		USA
Warmate	5.7	1.4	40	50	80	Poland
IAI Harop (Harpy)	23.0	3.0	1000	540	417	Israel
HESA Shahed 136	200	2.5	2500		185	Iran
Athlon-Avia ST-35	3		30		150	Ukraine

Unlike UCAVs, loitering munitions are now increasingly being used. It is due to the fact that both countries have adapted their air defence systems to combat drones, while neutralizing “kamikazes”, especially when they are in a swarm, is still a problem.

ADVANTAGES AND DISADVANTAGES OF UCAVs

UAVs have an **advantage** over manned systems when immediate target engagement is required after reconnaissance. The use of UAVs is not associated with the risk of loss of the crew, which expands the conditions for their rational use, including in situations where the enemy’s air defence systems create too high a risk of loss for manned systems. UAVs flight time has no limitations related to the pilot’s life support system. Furthermore, the battle stress is less when UAVs are used than when a mission is fulfilled by aircraft with a pilot. All this allows the use of UAVs in situations where the use of aviation is impractical or even impossible. In particular, they are often used in risky operations. After all, losing a drone is not as dangerous as losing an expensive aircraft and pilot.

Projects are being developed for unmanned aerial vehicles that can be charged with solar energy. This will greatly extend the stay of such devices in the air.

Despite the many obvious advantages that attack UAVs have in combat, manned aircraft still have a clear advantage in dynamic combat operations and when close integration with ground or naval forces is required. Achieving air superiority

and maintaining ground forces in direct contact with the enemy are two combat tasks that fall within the stated conditions.

At the same time, there is a large number of combat missions in which UAVs are more effective. The mentioned aspects create possibilities for increasing efficiency through the rational joint use of UAVs and aviation while benefitting from the advantages of both systems.

The role of UAVs in modern military conflicts has significantly increased. The perfect weapon does not yet exist, and drones also have their **disadvantages** (Antonov, 2020, pp. 8-13). For example, the fact that the signals of these devices can be easily intercepted by the enemy's air defence systems, and therefore the device is exposed to serious risks, from physical destruction to reprogramming and striking its own positions.

Another drawback is that, in order to be able to carry a heavy payload, some of them acquire impressive dimensions. As a result, they become an easy target for air defence assets. Part of this shortcoming is solved by changing the construction and using certain materials to reduce their reflectivity.

All possible disadvantages of UAVs can be compensated by proper tactics of their use. For example, if not only individual UAVs are used for strikes but they are used together with other forces (e.g., artillery), then the effectiveness of their use increases and the loss rate can be reduced. In recent conflicts, the UAV swarm tactic has become widely used, thanks to which it is possible to carry out massive strikes against enemy targets (Chanev, 2021, pp. 86-91).

CONCLUSIONS

The main task of drones is aerial reconnaissance. However, in recent years, the list of tasks that they can perform has expanded significantly. They are capable of launching missile and bomb attacks on land and sea targets, intercepting air targets, correcting fire and indicating targets, transmitting data and delivering cargo.

UAVs have proven their viability as a separate type of weapon, and their neutralization requires an expensive and modern air defence system that is not "affordable" to many countries.

UAVs have become an integral part of armed conflicts and the experience of their combat use have a serious impact on military science and military development in many countries, resulting in a significant change in the organization of air defence systems and the tactics of combined weapon systems.

In the future, the range of tasks performed by unmanned aerial vehicles will expand due to the development of science, technology and engineering. Moreover artificial intelligence is expected to be inserted in the design of UAVs. That is why many experts call them one of the most promising types of weapons of the future.

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