

THE ROLE OF UNMANNED AERIAL VEHICLES (UAVs) IN MODERN ARMED CONFLICTS: TACTICAL, STRATEGIC AND TECHNOLOGICAL ANALYSIS**Elmurod Narzullayevich Pirimqulov**

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Annotatsiya: Ushbu maqolada zamonaviy qurolli mojarolarda uchuvchisiz uchish apparatlarining (UUA) harbiy jihatdan tutgan o'rni va strategik ahamiyati tahlil qilinadi. UUALarning texnologik tasnifi, razvedka va zarba berish vazifalarida qo'llanilishi, shuningdek, radioelektron kurash (REK) sharoitida samaradorligi ko'rib chiqiladi. Qorabog' urushi (2020) va Ukraina mojarosi (2022–2024) misollarida UUALarning harbiy doktrinaga ta'siri o'rganiladi.

Kalit so'zlar: UUA, uchuvchisiz uchish apparati, razvedka, taktik zarba, radioelektron kurash, C-UAS, harbiy doktrina, assimetrik urush, swarm taktikasi, ISR.

Аннотация: В статье анализируется роль беспилотных летательных аппаратов (БПЛА) в современных вооружённых конфликтах. Рассматриваются классификация БПЛА по техническим и функциональным критериям, их применение в задачах разведки, нанесения высокоточных ударов, радиоэлектронной борьбы, а также эффективность в условиях современного поля боя. На основе анализа конфликтов в Нагорном Карабахе и Украине исследуется влияние БПЛА на трансформацию военной доктрины.

Ключевые слова: БПЛА, беспилотник, разведка, тактический удар, радиоэлектронная борьба, C-UAS, военная доктрина, асимметричная война, роевая тактика, ISR.

Abstract: This article analyses the role of unmanned aerial vehicles (UAVs) in modern armed conflicts from tactical, strategic, and technological perspectives. It examines UAV classification frameworks, their employment in intelligence, surveillance, and reconnaissance (ISR) missions, precision strike operations, and electronic warfare (EW) environments. Drawing on case studies from the 2020 Nagorno-Karabakh War and the ongoing Ukraine conflict (2022–2024), the paper investigates how UAVs are reshaping contemporary military doctrine. The study employs comparative analysis and open-source military data from IISS, SIPRI, and NATO publications. The principal finding is that UAVs have become a central element of modern warfare, fundamentally transforming traditional military doctrine and creating a strategic imperative for investment in counter-UAV (C-UAS) systems.

Keywords: UAV, unmanned aerial vehicle, reconnaissance, precision strike, electronic warfare, C-UAS, military doctrine, asymmetric warfare, swarm tactics, ISR.

Introduction

In the second decade of the twenty-first century, unmanned aerial vehicles (UAVs) have emerged as a decisive instrument of armed conflict. The 2020 Nagorno-Karabakh War, operations in Syria and Libya, and the full-scale war in Ukraine that began in 2022 have provided extensive empirical evidence of how UAVs are transforming the modern battlefield. The relevance of this study lies in the fact that the rapid development of UAV technology is driving fundamental changes not only in military hardware, but also in military doctrine, strategic planning, and the architecture of international security.

The principal objective of this article is to classify contemporary UAVs, assess their impact on armed conflict from a military-technical and strategic perspective, and demonstrate how traditional military doctrine is undergoing transformation. The following specific tasks are set: (1) to classify UAVs according to technical and functional criteria; (2) to analyse their tactical and strategic employment; (3) to evaluate effectiveness through real-world conflict case studies; and (4) to identify the strategic demand for counter-UAV (C-UAS) systems.

The research methodology is based on comparative analysis, real-conflict case-study method, and open-source military databases from IISS (International Institute for Strategic Studies), SIPRI (Stockholm International Peace Research Institute), and NATO publications. The analysis draws on documented combat UAVs including the Bayraktar TB2, MQ-9 Reaper, Shahed-136, and Lancet-3.

Methodology and Analysis

2.1. Contemporary Classification of UAVs

To enable systematic analysis, UAVs must first be classified according to two criteria, drawing on the NATO STANAG 4671 standard and international military practice: (1) technical and design characteristics, and (2) functional roles.

2.1.1. Technical classification: mass and altitude

According to NATO classification, UAVs fall into four primary categories. The MALE (Medium Altitude Long Endurance) class encompasses platforms capable of sustained flight at medium altitude, such as the Bayraktar TB2 and MQ-1 Predator. The HALE (High Altitude Long Endurance) class comprises strategic platforms with flight endurance exceeding 24 hours, such as the RQ-4 Global Hawk and MQ-9 Reaper. The tactical class covers smaller UAVs employed at battalion and brigade level, such as the Elbit Hermes 900. Micro and nano-class UAVs are designed for specialist reconnaissance and urban combat operations, such as the Black Hornet and Skydio X2D.

2.1.2. Functional classification: ISR, strike, EW, and logistics

By functional criterion, UAVs are grouped as follows: intelligence, surveillance, and reconnaissance (ISR); precision strike; kamikaze or loitering munition platforms; electronic warfare (EW) UAVs; and logistics and cargo UAVs. The Shahed-136 and Lancet-3 belong to the loitering munition class — single-use strike platforms that autonomously home onto their targets.

2.1.3. Control mode: remote, semi-autonomous, and fully autonomous

The degree of autonomy defines the primary direction of UAV development. Remote control implies that an operator guides the UAV in real time via a video link (e.g. Bayraktar TB2). Semi-autonomous systems fly autonomously but require human authorisation to execute a strike (e.g. MQ-9 Reaper). Fully autonomous systems are capable of independently identifying and engaging targets using artificial intelligence (AI). The latter category is the subject of intense controversy under international humanitarian law within the framework of Lethal Autonomous Weapons Systems (LAWS).

2.2. Tactical Employment of UAVs

2.2.1. ISR and the sensor-to-shooter cycle

The foremost advantage of UAVs in the reconnaissance role is the ability to provide continuous surveillance in real time. Traditional reconnaissance aircraft were limited in the duration of their loiter over a target area, resulting in gaps in intelligence collection. UAVs, with endurance of 24–27 hours, resolved this problem. The sensor-to-shooter cycle operates as follows: the UAV identifies the target → transmits coordinates to the ground control station in real time → a strike system (missile or strike UAV) is directed against the target → the UAV conducts battle damage assessment (BDA). This cycle has reduced engagement timelines from several hours to minutes compared with classical military doctrine.

2.2.2. Precision strike and the SEAD mission

UAVs possess a number of systemic advantages over conventional manned aircraft in SEAD (Suppression of Enemy Air Defences) and CAS (Close Air Support) missions. First, there is no risk to pilot life; second, operating costs are five to ten times lower; third, extended endurance permits more precise target engagement. During the 2020 Nagorno-Karabakh War, Azerbaijani armed forces successfully employed Bayraktar TB2 platforms and Israeli-manufactured Harop loitering munitions against Armenian S-300, Buk-M2, and TOR-M2KM air defence systems.

2.2.3. Swarm tactics — a new combat paradigm

Swarm or mass-attack tactics represent one of the most challenging problems in contemporary UAV warfare. The simultaneous attack of numerous low-cost UAVs from multiple directions saturates enemy air defence systems — the defensive system is unable to intercept all threats simultaneously. Shahed-136 attacks on Ukrainian infrastructure launched by Russia from September 2022 (20–50 UAVs per night) demonstrated the real combat effectiveness of this tactic. Countering swarm tactics demands complex solutions under the C-UAS concept.

2.3. Strategic Impact of UAVs and Doctrinal Change

2.3.1. UAVs in the A2/AD environment

Anti-Access/Area-Denial (A2/AD) is a strategy designed to prevent adversary forces from entering a defined area. Under traditional military doctrine, adversary forces were unable to conduct operations in an A2/AD environment due to high risk. UAVs have changed this paradigm: relatively low-cost platforms can penetrate A2/AD defensive belts to identify and engage targets. This has compelled NATO doctrine to revisit the concept of 'low-cost attrition warfare'.

2.3.2. Asymmetric warfare and non-state actors

UAVs have fundamentally altered the balance of power in asymmetric warfare. Whereas previously only major states (USA, Russia, China, Israel) possessed military UAVs, commercial DJI Mavic-series drones are now being converted into tactical weapons by small combat units and even non-state armed groups. In the Ukraine conflict, battalion-level units on both sides have adapted commercial platforms such as the DJI Mavic 3 and Autel Evo II — fitted with specialist equipment — for tactical reconnaissance and artillery target designation.

2.3.3. Electronic warfare (EW) and C-UAS systems

The proliferation of UAVs has sharply increased demand for neutralisation technologies. Contemporary C-UAS systems are based on the following approaches: (1) RF jamming — suppressing the radio frequency link to sever communication with the UAV; (2) GPS spoofing — falsifying the GPS signal to redirect the UAV; (3) directed-energy weapons — laser systems such as DefenseShield and Iron Beam; (4) kinetic methods — missiles and artillery. However, EW

methods have their own limitations: fully autonomous UAVs are not dependent on GPS or radio links, making neutralisation considerably more complex.

Results and Discussion

3.1. Comparative Effectiveness Analysis of Principal UAV Types (Table 1)

Table 1 presents a comparative analysis of four documented combat UAV models on a range of indicators:

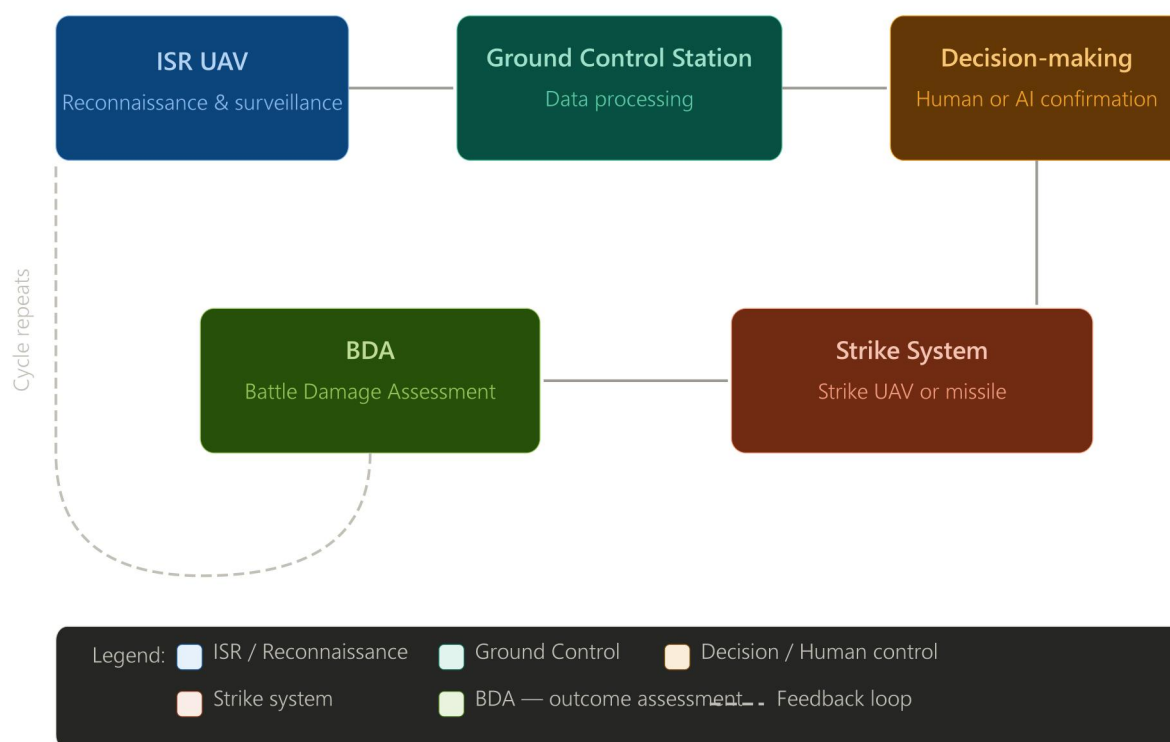
Indicator	Bayraktar TB2	MQ-9 Reaper	Shahed-136	Lancet-3
Class	MALE tactical	MALE strategic	Kamikaze UAV	Kamikaze UAV
Range	150 km	1,850 km	2,000+ km	40–70 km
Endurance	27 hours	27 hours	~2 hours	~40 minutes
Max speed	220 km/h	480 km/h	185 km/h	110 km/h
Armament	MAM-L/MAM-C missiles	Hellfire missiles	Explosive warhead	Explosive warhead
Unit cost (approx.)	~\$5 million	~\$32 million	~\$20,000–50,000	~\$35,000
EW resilience	Moderate	High	Low	Moderate
Autonomy level	Semi-autonomous	Semi-autonomous	Fully autonomous	Semi-autonomous
Primary role	ISR + strike	ISR + strike	Infrastructure attack	Armour destruction

Table 1. Comparative specifications of principal UAV models (compiled by the author from IISS, Jane's Defence, and SIPRI data)

3.2. Diagram Description — Figure 1

Figure 1: 'UAV Combat Kill Chain' block diagram. The diagram comprises five sequential blocks:

Figure 1. UAV Combat Kill Chain (Sensor-to-Shooter Cycle)



[1] ISR UAV (blue) — reconnaissance and real-time surveillance; [2] Ground Control Station (green) — data processing centre; [3] Decision-making (yellow) — target confirmation by human or AI; [4] Strike system (red) — strike UAV or missile directed at the target; [5] BDA — Battle Damage Assessment (green) — strike outcome assessed and cycle returns to block [1]. Blocks are connected by arrows; a dashed return arrow from the final block to the first represents the feedback loop. This constitutes a complete visual model of the sensor-to-shooter cycle.

3.3. Case Studies: Nagorno-Karabakh 2020 and Ukraine 2022–2024

The Nagorno-Karabakh War (2020, 44-day war) provided the first large-scale demonstration of the strategic impact of UAVs. Employing Bayraktar TB2 platforms and Israeli-manufactured Harop loitering munitions, Azerbaijani forces destroyed 185 tanks, 90 armoured vehicles, 182 artillery systems, and 27 air defence systems belonging to Armenian forces (IISS, 2021). This statistical record was assessed by contemporary military analysts as a 'drone warfare turning point'.

The Ukraine conflict (2022–2024) presented a more complex picture of UAV employment by both sides. Russia mass-deployed Shahed-136 (Geran-2) loitering munitions against energy infrastructure: over 2,000 UAV attacks were recorded in 2022–2023, of which approximately 55–65% were intercepted by Ukrainian C-UAS systems (SIPRI, 2024). Ukraine, in turn, employed commercial and purpose-built drones for artillery target designation and FPV (First Person View) kamikaze strikes, partially offsetting the conventional military equipment imbalance.

3.4. Discussion: Limitations and Ethical Issues

The combat effectiveness of UAVs coexists with a number of systemic limitations. Meteorological factors (high winds, rain, low cloud ceiling) restrict the employment of small and medium-class UAVs. As the EW environment intensifies, UAV dependence on GPS and radio links becomes an increasing vulnerability. Furthermore, the absence of human involvement in target selection by fully autonomous UAVs may conflict with the principles of international humanitarian law (IHL) — proportionality and precaution — enshrined in the Geneva Conventions. These issues make the international regulation of LAWS technologies increasingly urgent.

Conclusion

The research yielded the following principal conclusions:

First, UAVs have become a central combat instrument in modern armed conflicts, combining reconnaissance, precision strike, and psychological effect functions, thereby assuming a number of roles previously performed by conventional aviation and artillery. The conflicts in Nagorno-Karabakh and Ukraine have confirmed this empirically.

Second, UAVs have substantially reduced the asymmetric warfare gap: the widespread availability of commercial drones means their use is no longer a military-technical privilege but an accessible tactical tool. This necessitates a fundamental review of the concept of conventional military superiority.

Third, the mass deployment of UAVs has made investment in C-UAS systems — including electronic warfare, kinetic, and laser-based defence — a strategic necessity.

The following recommendations are proposed: (1) to establish an international legal mechanism regulating LAWS technologies; (2) to develop national UAV industries and invest in indigenous C-UAS technologies; (3) to establish UAV tactics and electronic warfare as a dedicated discipline within military education systems.

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