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ANALYSIS OF TRENDS IN THE DEVELOPMENT OF AERIAL ATTACK SYSTEMS AND THE FORMS OF THEIR EMPLOYMENT IN CONTEMPORARY CONDITIONS

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Abstract. This article examines the evolution of aerial attack systems in contemporary armed conflicts through a structured review of publicly available international and Uzbek scholarly literature. The analysis focuses on the diversification of uncrewed aerial vehicles, the coexistence of crewed aircraft and missile systems, the growing role of software-enabled functions, and the economic, legal, and humanitarian implications of technological proliferation. A qualitative thematic framework is used to compare broad trends across source categories. The findings are interpretive rather than experimental: they identify increasing system diversity, faster innovation cycles, and the importance of distinguishing observed conflict-specific practices from generalizable trends. The article proposes a transparent framework for future academic monitoring and education without presenting operational employment instructions.

Keywords: aerial attack systems; unmanned aerial vehicles; contemporary conflicts; technological trends; military studies; open-source analysis; international humanitarian law.

Annotatsiya. Ushbu maqolada zamonaviy qurolli mojarolarda havo hujumi tizimlarining evolyutsiyasi ommaga ochiq bo'lgan xalqaro va o'zbek ilmiy adabiyotlarining tizimli sharhi orqali o'rganiladi. Tahlil ekipajsiz havo kemalarining diversifikatsiyasi, ekipajli samolyotlar va raketa tizimlarining birgalikda mavjudligi, dasturiy ta'minotga asoslangan funktsiyalarning ortib borayotgan roli va texnologik tarqalishining iqtisodiy, huquqiy va gumanitar oqibatlariga qaratilgan. Manba toifalari bo'yicha keng tendentsiyalarni taqqoslash uchun sifatli tematik asos qo'llaniladi. Topilmalar eksperimental emas, balki sharhlovchidir: ular tizim xilma-xilligining ortib borishini, tezroq innovatsiya sikllarini va kuzatilgan mojaroga xos amaliyotlarni umumlashtiriladigan tendentsiyalardan farqlash muhimligini aniqlaydi. Maqolada operatsion ishga yollash bo'yicha ko'rsatmalarni taqdim etmasdan kelajakdagi akademik monitoring va ta'lim uchun shaffof asos taklif qilinadi.

Kalit so'zlar: havo hujumi tizimlari; uchuvchisiz uchish apparatlari; zamonaviy mojarolar; texnologik tendentsiyalar; harbiy tadqiqotlar; ochiq manbali tahlil; xalqaro gumanitar huquq.

Аннотация. В данной статье рассматривается эволюция систем воздушного нападения в современных вооруженных конфликтах на основе структурированного обзора общедоступной

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международной и узбекской научной литературы. Анализ фокусируется на диверсификации беспилотных летательных аппаратов, сосуществовании пилотируемых самолетов и ракетных систем, растущей роли программно-определяемых функций, а также экономических, правовых и гуманитарных последствиях распространения технологий. Для сравнения общих тенденций в различных категориях источников используется качественная тематическая структура. Полученные результаты носят скорее интерпретативный, чем экспериментальный характер: они указывают на растущее разнообразие систем, ускорение циклов инноваций и важность различения наблюдаемых практик, специфичных для конкретного конфликта, от обобщаемых тенденций. В статье предлагается прозрачная структура для будущего академического мониторинга и образования без представления инструкций по оперативному применению.

Ключевые слова: системы воздушного нападения; беспилотные летательные аппараты; современные конфликты; технологические тенденции; военные исследования; анализ открытых источников; международное гуманитарное право.

INTRODUCTION

The expression “aerial attack systems” encompasses diverse technological categories, including crewed combat aircraft, missiles, loitering munitions, and uncrewed aerial vehicles (UAVs). Their development cannot be adequately understood through platform performance alone. Contemporary scholarship increasingly examines production scale, information technologies, autonomy, affordability, regulatory challenges, and the interaction between military innovation and civilian technological markets. The boundaries between some categories have also become less distinct, particularly where one-way attack UAVs combine characteristics traditionally associated with aircraft and guided munitions [1, 3].

The study of recent conflicts offers relevant observations but presents substantial methodological limitations. Publicly reported events may be incomplete, selectively documented, or subject to contradictory claims. The performance of a system in one conflict does not automatically predict its performance in a different geographical, institutional, or technological context. Consequently, academically responsible analysis must distinguish verified observations, source interpretations, and prospective hypotheses.

Uzbek academic publications have also examined the expanding roles of UAVs in security and armed conflict. Toshaliyev discusses the significance of UAVs in armed conflicts, while Majidov reviews their diverse contemporary applications [4, 5]. Sharofiddinov examines UAV development in the context of public safety, offering a useful non-combat perspective on the diffusion of the underlying technology [6]. These studies help situate international developments within a regional scholarly discussion.

The purpose of this article is to identify and systematize major development trends in aerial attack systems and to characterize, at a broad descriptive level, the changing forms of their use in contemporary

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conditions. The objectives are to establish an analytical taxonomy, compare recurring themes across international and Uzbek sources, assess evidentiary limitations, and formulate directions for future research.

MATERIALS AND METHODS

The study employs a qualitative narrative literature review with structured thematic comparison. Sources were selected for their identifiable authorship or institutional provenance, relevance to aerial systems, accessible publication information, and capacity to support verifiable, non-classified claims. The review includes institutional analysis from the Center for Strategic and International Studies (CSIS), open academic publications by Uzbek authors, and a policy-oriented report on technological adaptation in contemporary conflict [1, 7]. The literature reviewed is primarily from 2024–2025, supplemented by relevant background scholarship.

Five themes were defined before synthesis: platform diversification; affordability and industrial diffusion; digitalization and autonomy; organizational and societal consequences; and legal and ethical governance. Findings were compared across sources without assigning artificial numerical weights or claiming statistical representativeness. No interviews, field tests, classified records, or original performance experiments were conducted.

Table 1. Analytical classification of aerial system development trends

Theme	Scope of analysis	Evidence limitation
Platform diversification	Crewed aircraft, missiles, UAVs, loitering systems	Categories overlap and vary across publications
Industrial diffusion	Cost pressures, production capacity, commercial technologies	Reported cost estimates are not consistently comparable
Digitalization	Software, sensors, autonomy and data-dependent functions	Public accounts rarely reveal full system capabilities
Societal effects	Infrastructure risk, civilian exposure, public safety	Outcomes depend strongly on local context
Governance	Accountability, compliance, export-control debates	Legal interpretations and enforcement vary

Table 1 shows that technological development is multidimensional. A comparison based only on the number or nominal specifications of platforms would overlook production, information, legal, and societal factors. The categories also clarify why evidence from a single conflict should not be treated as a universal technical benchmark.

RESULTS

Diversification and convergence of aerial technologies

The reviewed literature indicates a widening spectrum of aerial systems rather than the replacement of all established platforms by one new technology. Crewed aviation, guided missiles, and UAVs

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continue to occupy different roles, while some technological functions converge. In particular, one-way UAVs and loitering systems challenge older distinctions between aircraft and munitions. This convergence complicates consistent terminology and cross-study comparison [1, 2].

The broad forms of use described in public research include observation and reconnaissance, stand-off attack, one-way missions, and combinations of different aerial systems within a single campaign. These are reported categories of activity, not recommendations for force employment. The literature also emphasizes that public reporting tends to concentrate on visually documented events, potentially distorting estimates of prevalence [1, 3].

Industrial scalability and changing innovation cycles

An important trend is the increased influence of commercially available components, software iteration, and manufacturing capacity on the diffusion of UAV technology. The literature associates these changes with shortened innovation cycles and wider access to some categories of aerial systems. However, affordability at the platform level should not be confused with the total lifecycle cost of development, maintenance, training, and associated infrastructure [2, 3].

Recent institutional analyses of the Russia–Ukraine conflict document a marked increase in the scale of publicly reported mixed aerial attacks over the period examined. These observations illustrate the relevance of production and sustainability to contemporary conflict analysis, but the reported quantities depend on source definitions and are not transferred here into predictive models or operational recommendations [1].

Information technologies and human oversight

Software-defined capabilities, data processing, and varying degrees of autonomy are prominent themes across contemporary literature. Yet the term “autonomous” is frequently used imprecisely. Systems differ in whether humans select objectives, authorize actions, monitor behavior, or intervene during operation. Consequently, academic comparison should specify the degree of human control rather than grouping all digitally enabled platforms into a single category [2, 3].

The expansion of automated functions also raises concerns about reliability, accountability, data quality, and compliance with international humanitarian law. These questions are relevant to technological evaluation regardless of the military actor or conflict under consideration.

Table 2. Synthesis of recurring findings in the reviewed literature

Observed trend	General interpretation	Research implication
Greater platform variety	Different technologies coexist and partially converge	Use consistent definitions
Wider availability of UAV technology	Commercial and industrial ecosystems influence diffusion	Study lifecycle and supply-chain factors
Faster software-centered change	Technology evolves during ongoing conflicts	Date and contextualize findings

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Increased visibility of civilian effects	Infrastructure and civilian protection are central concerns	Include humanitarian indicators
Expanded autonomy debate	Human oversight remains a contested design and legal issue	Define human-control levels precisely

The synthesis in Table 2 is qualitative. It identifies patterns recurring across the selected sources but does not estimate their prevalence across all conflicts. Its principal contribution is a transparent organization of research questions for future evidence-based studies.

Contributions of Uzbek scholarly publications

Regional scholarship provides a valuable complement to international institutional reports. Toshaliyev [4] discusses UAVs in armed conflicts; Majidov [5] addresses the diversity of UAV applications and limitations; and Sharofiddinov [6] examines the historical development of UAVs in public-safety settings. Taken together, these publications demonstrate that the regional discussion extends beyond technical characteristics to applications, institutional context, and safety.

The selected Uzbek sources are not treated as equivalent in evidentiary scope to comprehensive conflict datasets. Their value lies in regional framing, terminology, and the identification of themes requiring further empirical verification. A rigorous future review should expand the domestic corpus and evaluate each publication's methods, citations, and originality individually.

Table 3. Role of Uzbek and international sources in the present review

Source group	Primary contribution	Use in this article
CSIS institutional research	Documented trends and analytical interpretation	Contextual comparison of recent developments
Toshaliyev (2024)	Uzbek-language discussion of UAVs in armed conflict	Regional conceptual framing
Majidov (2025)	Discussion of UAV applications and limitations	Regional thematic comparison
Sharofiddinov (2025)	Historical and public-safety dimensions of UAVs	Civilian technology context

Table 3 demonstrates that source diversity is useful only when differences in evidence quality are made explicit. Institutional reports, regional academic articles, and public-safety studies address related but nonidentical questions. Their combined use therefore supports triangulation of broad themes, not confirmation of precise performance claims.

DISCUSSION

The findings suggest that the evolution of aerial attack systems is better understood as an interaction among technology, production, institutions, and governance than as a linear sequence of

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increasingly advanced platforms. This perspective helps explain why established and emerging categories continue to coexist. It also avoids assuming that the most visible technologies in one conflict will necessarily dominate every future setting.

A second issue is the distinction between the form of use and its consequences. Open reports can describe broad patterns, such as the coexistence of different aerial technologies in the same conflict, without establishing that these patterns are optimal, transferable, or lawful in every context. Research should evaluate claims about effectiveness against independently documented evidence and consider humanitarian consequences alongside technological observations.

A third issue concerns methodological transparency. Open-source conflict data may suffer from selection bias, inconsistent terminology, delayed reporting, and uncertainty about attribution. The present study therefore avoids fabricated empirical indicators, invented survey findings, and unsupported claims of causal effectiveness. The proposed thematic framework should be tested through a future systematic review with explicit search strings, inclusion criteria, coding rules, and inter-coder agreement.

For military education and public policy research, the principal implication is the need for evidence literacy: distinguishing a technological claim from a verified observation, recognizing the limits of case studies, and integrating technical change with legal and societal analysis. The article does not provide target-selection procedures, attack planning, or tactical employment optimization.

CONCLUSION

The literature reviewed indicates five interconnected trends in the development of contemporary aerial attack systems: diversification of platforms; partial convergence between UAVs and missile-like systems; growing influence of production capacity and commercial technologies; accelerated software-centered innovation; and heightened attention to autonomy, accountability, and civilian protection. These findings are qualitative and conditional on the sources examined.

International analyses and Uzbek publications jointly support the need for an interdisciplinary approach to the topic. The proposed classification provides a basis for academic comparison and future curriculum development, but it does not establish universal performance rankings or experimentally verified causal relationships. Further research should prioritize reproducible source selection, transparent definitions, and independently validated evidence.

REFERENCES

1. Jensen, B., Atalan, Y., & Tiersten-Nyman, E. (2025, July 31). The New Salvo War. Center for Strategic and International Studies. https://www.csis.org/analysis/new-salvo-war
2. Slusher, M. (2025, May 2). Lessons from the Ukraine Conflict: Modern Warfare in the Age of Autonomy, Information, and Resilience. Center for Strategic and International Studies. https://www.csis.org/analysis/lessons-ukraine-conflict-modern-warfare-age-autonomy-information-and-resilience

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
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http://houghtonstreetreview.com/index.php/hsr

3. Singer, P. W. (2009). Wired for War: The Robotics Revolution and Conflict in the 21st Century. Penguin Press.
4. Toshaliyev, A. E. (2024). Uchuvchisiz uchish apparatlarini qurolli mojarolarda qo‘llashning ahamiyati to‘g‘risida [On the significance of using UAVs in armed conflicts]. 1(10), 361–366. https://inlibrary.uz/index.php/science-research/article/view/54411
5. Majidov, A. T. (2025). Uchuvchisiz uchish apparatlarining qo‘llashning o‘ziga xos xususiyatlari [Specific features of UAV use]. International Journal of Scientific Researchers, 14(1), 8–11. https://doi.org/10.5281/zenodo.17361246
6. Sharofiddinov, B. B. (2025). Jamoat tartibini saqlashda uchuvchisiz uchish apparatlarining rivojlanish bosqichlari [Stages of UAV development in public-order protection]. Jamoat Xavfsizligi, 2. https://mgjxu.uz/uploads/pages/ilmiy%20faoliyat/Jurnal/2025/Jurnal%202-son%202025%20y.pdf
7. Fayziyev, Z. Kh., & Ruziyev, Sh. Yu. (2025). Zamonaviy radioelektron bosim berish qurilmalari va ularning uchuvchisiz uchish apparatlariga ta’siri [Modern electronic interference equipment and its effects on UAVs]. Innovation Technosystems, 3(19). https://mvahi.uz/storage/INNOVATION%20TECHNOSYSTEMS%203.19_compressed.pdf