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MG CONSTANTIN-ADRIAN CIOLPONEA

TRANSFORMING FUTURE MILITARY OPERATIONS

DRONE (R)EVOLUTION

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Chapter I

RESEARCH METHODOLOGY AND THE CURRENT LEVEL OF STUDY OF UAS INTEGRATION IN OPERATIONS

It is mandatory to conduct an in-depth examination of the advancement of UAVs within the context of contemporary military operations. It encompasses a comprehensive analysis of the role, missions, configurations, advantages, and vulnerabilities associated with UAVs, situated within the broader framework of the information cycle and targeting process.

The presented case studies demonstrate that all modern armies place a significant emphasis on the targeting process, which is primarily based on the data and information transmitted by UAV reconnaissance and surveillance platforms

Additionally, in the context of Afghanistan, it was determined that the configuration of a mission network in an allied context is crucial for the real-time support of UAV operations.

Furthermore, it was established that, at the alliance level, the implementation of a specialized language and standard procedures for the collection, dissemination, and exploitation of data are essential. These initial analyses have effectively led to the development of ideas for the integration/utilization of UAS in military operations and the substantiation of concepts with a scientific character.

The purpose of this study aims to demonstrate these concepts through comparative analysis. The following instruments will be utilized in the intellectual approach:

- Historical research (case study: The war in Ukraine, Syria, Libya, Afghanistan);
- Individual interviews with prominent experts in the field (Drones and C-Drones);
- Direct quantitative and qualitative observations in the research field;
- Comparative analysis and statistical analysis;
- Analytical review of sources and resources;
- Bibliographical study;
- Participation in colloquia, symposia, and specialized conferences on Drone and Counter-Drone Integration (London, Brussels, Norfolk, Prague, Amman).

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Historical research will also be used to describe NATO's strategy and doctrine in this field in comparison with Russian doctrine on drone integration, to identify the concepts of use and counteraction of UAS in NATO, to apply on those principles and characteristics that enable UAS capabilities to successfully execute complex military actions.

In order to substantiate the proposals outlined in this project, I will use the method of bibliographic study consisting in the coverage of the *doctrinal basis in the field*. A comprehensive approach to countering UAVs is reflected by Joint Air Power Competence Centre in NATO or US TRADOC publications, such as: NATO C-UAS doctrine 2024, ATP-7 1001, TRADOC US Army publication on Russian Tactics, 2024, ATP-7 1003 TRADOC US Army Publication on Chinese Tactics 2021, Countermeasures for Class I UAS, NATO Handbook 2020, SHAPE (Unclassified), AJP 3.5.0 *NATO Special Operations Doctrine*, 2016, US Strategy for Countering UAS, Allied Joint Publications AJP-5, specialized treatises in the field of UAS. Many common principles and methodologies when countering UAS are identified in these works, are reflected in a predictive analysis in chapter IV.

The author's scientif approach and proposed theoretical solutions proposals were presented for scientific scrutiny in specialized conferences such as: *Future Force Technology London 2024-2025, C-UAS Europe Conference 2024-2025, Loitering Ammunition Conference November 2024, March 2025, Future Land Force Warsaw, November 2024, Black Sea Defense Aerospace Symposium (BSDA 2024), ACT MDO Conference (2024-2025), Space Symposium 2024-2025, NATO Integrated Air Missile Defence Conference May 2025, Future Armoured and Helicopter Technology conference May 2024, NATO Multi-Domain Operations, Ankara 2025, C-UAS MENA (Middle East and North Africa) in Amman, Jordan, Future Armoured Technology Prague 2026, Strategic Robotic Integration and Knowledge Exchange for SOF, Lisbon, 2026 Kiev Security Forum 2026*. These briefings included, but were not limited to, the impact on *tactical equipment, dismounted soldier technology, surveillance and reconnaissance, special operations, tactical networks, lessons learned from Ukraine, integrated air missile defence, armoured technology, helicopter technology, command and control systems, communications.* The employment of a predictive research method facilitates the identification of the accelerated modernization trend of UAS at both the doctrinal and operational levels. This identification is achieved through a comparative analysis of the vulnerabilities and disadvantages of UAS. These vulnerabilities can be exploited by military forces when designing the overarching air defence (AD) and C-UAS architecture and measures for force protection, *"as described by David Hambling in his analysis of drone swarm threats and adaptive countermeasures."*[34]

[34] David Hambling, Swarm Troopers: How Small Drones Will Conquer the World (London: Archangel Ink, 2023), pp. 145–153.

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The following scientific objectives have been set by employing a descriptive method, qualitative empirical research, and cross-cutting empirical research, as well as observational and predictive research: to identify the features and characteristics of UAS and development trends that will have a direct impact on the character of warfare, the minimum level of integration of UAV systems in operations, the impact on force structure and readiness, and the education and training of the force. Finally, we will underline in our findings the causality that requires the standardized emergence of UAS countermeasures, in each army but especially in NATO as an alliance, to become more agile and ready for the future conflicts.

1.1. RESEARCH METHODOLOGY

Research Design

This research employs a mixed-methods approach combining qualitative and quantitative analysis. The qualitative component is based on doctrinal review, historical case studies, semi-structured expert interviews, direct observation, and comparative analysis. The quantitative component relies on statistical data regarding UAS employment, production, attrition rates, operational effects, and counter-UAS developments observed during recent conflicts, particularly the war in Ukraine (2022–2025). The objective is to identify the operational implications of UAS integration at tactical, operational, and strategic levels and to assess the parallel development of counter-UAS capabilities.

1.1.1. Descriptive Research Method

Descriptive research proposes a three-level analytical framework, comprising tactical, operational, and strategic levels of analysis.

The analysis will concentrate on the classification of military UAVs from the perspective of NATO or countries with developed military potential. It will also address the analysis of current and future missions, the integration of military UAVs into operations, operational concepts, and UAV development trends. It is equally imperative to acknowledge that the implementation and integration of UAVs hinge on the availability of adequately qualified personnel and training programs, encompassing those engaged in intelligence analysis and fusion, as well as support personnel. This necessity is substantiated by statistical and comparative analyses of UAS integration in SO, C-UAS integration in operation, and Integration of UAS in Land Operations. The study cases presented encompass Russian Federation UAS development, Turkey UAS development, and UAS in the United States, inclusive of lessons learned from Afghanistan.

In the equation of successful UAV integration are identified in the analysis, present critical elements:

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- platforms with performances that recommend them for the target acquisition missions,
- support systems to include long-range communications and radio-electronic warfare means,
- properly trained technical personnel, teams for analysing and disseminating data transmitted by UAVs along AI-assisted programs to help the decision-making process;
- airspace de-confliction during the targeting process and execution;
- connectivity across the entire spectrum of forces (air, land and sea), integrated at the joint level.

The lack of any of the elements listed above leads to system malfunction or creates breaches easy to be exploited by the adversary. Additionally, drone utilization directly impacts the education, training, and specialization of military personnel.

These variables introduce new elements to the domain of force training and major joint MDO exercises, which in return give rise to several dilemmas for participants and planners.

The integration of UAS into operations introduces new considerations to the field of training and joint exercises, as a result of the challenges it presents.

The digitization of military operations ensures the requisite battlefield reaction, speed for a high tempo of action, adaptability, and survivability of forces, having UAS playing a pivotal role in this process. As described, in NATO Countering Class I Unmanned Aircraft Systems (C-UAS) Doctrine, air defence and force protection are tightly interconnected and ensure the survivability of any ground/naval force in combat operations, especially in a very saturated airspace with sensors and striking vectors.

1.1.2. Predictive Research Method

Using the predictive research method, it would be possible to identify the trend of accelerated modernization in the field of UAS, the impact at the doctrinal and operational level by identifying vulnerabilities, disadvantages (UAS) which can be exploited by military forces in order to counter UAS. Similar ideas were reflected by Greg Melcher, Dr. Ulrike Franke, Dr. Bruno Martins, Phil Skorge, Dr. Scott Crino, James Cross, New Strategy Centre, *and the Unmanned Systems Forum. Smart Approach: Fast Development on Drone Detection and Countermeasure Systems Against Drones*, Bucharest, October 2021.

The analysis will concentrate on the classification of military UAVs from the perspective of NATO or countries with developed military potential. The analysis will encompass both current and future missions, the integration of military UAVs in operations, concepts of employment, and UAV development trends.

It is equally imperative to acknowledge that the implementation and integration of UAVs hinge on the availability of adequately qualified personnel, encompassing those engaged in intelligence analysis and fusion, as well as

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support personnel. This necessity is substantiated by statistical and comparative analyses of UAS integration in SO, C-UAS integration in Operations, and Integration of UAS in land operations.

The case studies presented encompass the development of Unmanned Aircraft Systems (UAS) in the Russian Federation, Turkey, Ukrainian conflict, and the United States, including the lessons learned from Afghanistan.

The information presented in the chapter III are based on several briefings describing the conflict in Ukraine, London (*Drone integration in operations 2024*) Prague (C-UAS conference Europe 2025, C-UAS MENA Amman 2025).

The descriptive research used in this case aims to understand the interdependence between the targeting process and the connectivity of sensor network, where a segment of the sensor layer is identified with all classes of ISR platforms, ground radars, surveillance GEO and LEO satellites, AWACS aircraft and more. Starlink, support for Ukrainian operations was and still is critical for success. "*Communication channels today rely primarily on the Star-link satellite constellation for video transmission, and on civilian radio frequencies such as TBS/Crossfire for transmitting commands.*"[35] The comparative analysis was used to describe the differences between missions performed by UAVs, different categories of drones in conflict which are coming with different infrastructure and support is essential for further force design. When constructing a feasible multilayered C-UAS architecture, we utilized the descriptive and comparative analysis to extract the differences between classical capabilities and latest hybrid mixture of force and measures. The comparative analysis of the conventional targeting process and the SO targeting process aims to show the common role of ISR platforms in the basis of the process and the particularities of each case.

1.1.3. Statistical Analysis Method

The statistics presented here will demonstrate that accelerated introduction of drones across all operational levels and domains, triggered an innovation race between both sides and, consequently, accelerated adoption of counter-drone technology.

Statistical data demonstrate the exponential surge in drone deployment during the Ukrainian conflict, where the saturation concept materialized through orchestrated attacks conducted by Russian forces. The evolving relationship between drones and counter-drone systems has driven parallel development and integration within both opposing forces. The research incorporates four semi-structured expert interviews conducted between 2025 and 2026 with practitioners and specialists directly involved in drone development, military innovation, and defence technology. Interviewees were selected through

[35] *Ground Robotics and the Transformation of the Battlefield: A Ukrainian Military testimony*, March 2026, Ifri Seminar Paris.