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THE TRANSFORMATIVE IMPACT OF DRONE WARFARE ON MODERN INTERSTATE CONFLICT

HOW HAS DRONE WARFARE TRANSFORMED MODERN INTERSTATE CONFLICT?

L'IMPATTO TRASFORMATIVO DELLA GUERRA CON DRONI SUI CONFLITTI INTERSTATALI MODERNI

IN CHE MODO LA GUERRA CON DRONI HA TRASFORMATO I CONFLITTI INTERSTATALI MODERNI?

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L'abstract:

L'intensificato impiego di droni armati nei conflitti militari a partire dagli inizi del XXI secolo ha innescato un cambio di paradigma nella natura della guerra, mettendo in discussione il modello tradizionale di conflitto interstatale, un tempo definito da scontri diretti, tattiche simmetriche e capacità bilanciate. I velivoli a pilotaggio remoto (APR), ora ampiamente accessibili, si sono trasformati in potenti strumenti di cambiamento, consentendo ad attori tecnologicamente avanzati di sfruttare le proprie capacità asimmetriche per ridefinire lo scenario bellico. La presente tesi approfondisce l'impatto profondo della guerra condotta mediante droni, concentrandosi sui suoi effetti trasformativi sulla natura del conflitto moderno, che comprende tattiche, strategie e tecnologie impiegate, influenzando in ultima analisi il modo in cui le battaglie vengono combattute e vinte. Attraverso un'analisi comparativa della guerra del Nagorno-Karabakh del 2020, vengono investigati tre meccanismi chiave che guidano questa trasformazione:

- Il passaggio verso la guerra ibrida, che integra senza soluzione di continuità droni e forze militari tradizionali;
- La riduzione del rischio per le truppe tramite operazioni a distanza, che può alterare il calcolo decisionale in merito all'avvio o all'escalation di conflitti;
- Il potenziamento senza precedenti delle capacità di sorveglianza e targeting, che infligge danni fisici e psicologici a combattenti e civili.

La tesi considera l'impatto di tali trasformazioni sia sugli utilizzatori, in termini di strategie militari e calcolo del rischio, sia sui bersagli, in termini di conseguenze fisiche dirette degli attacchi, effetti psicologici e strategici della sorveglianza costante e della minaccia di attacco. Esaminando le tattiche, le strategie e le tecnologie in evoluzione impiegate in questi conflitti, la ricerca mira a comprendere come i droni stiano ridefinendo la natura stessa dell'impegno bellico, influenzando l'esito delle battaglie. Pur riconoscendo le complessità etiche e legali legate all'uso di droni armati, la tesi si concentra principalmente sulle implicazioni strategiche di questa tecnologia, analizzando come stia rimodellando le dottrine militari, alterando l'equilibrio di potere e, in definitiva, ridefinendo la natura della guerra nel mondo moderno.
Parole chiave: Guerra con droni, guerra ibrida, relazioni internazionali, conflitto moderno, Nagorno-Karabakh.

Abstract

The increased use of armed drones in military conflicts since the early 21st century has sparked a paradigm shift in the character of warfare, challenging the traditional model of state-on-state conflict once defined by direct confrontations, symmetrical tactics, and balanced capabilities. Unmanned aerial vehicles (UAVs), now widely accessible, have become powerful instruments of change, enabling technologically advanced actors to leverage their asymmetric capabilities to reshape the battlefield. This thesis delves into the profound impact of drone warfare, focusing on its transformative effects on the character of modern conflict. which encompasses the tactics, strategies, and technologies employed in warfare, ultimately influencing how battles are fought and won. Through a comparative analysis of the 2020 Nagorno-Karabakh War, I investigate three key mechanisms that drive this transformation:

(1) the shift towards hybrid warfare, seamlessly blending drones with traditional military forces, (2) the reduction of troop risk through remote operations, potentially altering the decision-making calculus of engaging in or escalating conflicts, and (3) the unprecedented enhancement of surveillance and targeting capabilities, inflicting both physical damage and a powerful psychological toll on combatants and civilians alike. The thesis will consider the impact of these transformations on both users, in terms of military strategies and risk calculations, and on targets, in terms of direct physical consequences of strikes, the psychological and strategic effects of constant surveillance, and the threat of attack.

By examining the evolving tactics, strategies, and technologies employed in these conflicts, this research seeks to understand how drones are redefining the very nature of engagement on the battlefield, ultimately influencing how battles are fought and won, While acknowledging the ethical and legal complexities surrounding the use of armed drones, this thesis primarily focuses on the strategic implications of this technology, seeking to understand how it is reshaping military doctrines, altering the balance of power, and ultimately redefining the character of war in the modern world.

Keywords: Drone Warfare, hybrid Warfare, International Relations, Modern Conflict, Nagorno-Karabakh.

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This study is dedicated to all those who stand up for the liberation of **Palestine.**

Glossary

Term	Definition
Unmanned Aerial Vehicle (UAV):	An aircraft operated without a human pilot on board.
Autonomy (Drone):	The ability of a drone to operate without direct human control, making decisions based on pre-programmed instructions or artificial intelligence.
Endurance (Drone):	The duration a drone can remain airborne on a single battery charge or fuel tank.
Surveillance:	The close observation of a person or group, especially one under suspicion.
Payload Capacity:	The maximum weight a drone can carry, including sensors, cameras, or weapons.
Reconnaissance:	Military observation of a region to locate an enemy or ascertain strategic features.
Precision-Guided Munitions (PGMs):	Weapons that use guidance systems to strike targets with high accuracy.
Loitering Munition:	A type of drone that can loiter in the air for an extended period before identifying and attacking a target.
Drone Swarm:	A coordinated group of multiple drones operating together to achieve a common objective.
Revolution in Military Affairs (RMA):	A major change in military doctrine, technology, organization, or operations that fundamentally alters the character and conduct of warfare.
Targeted Killing:	A premeditated act of lethal force by a government or its agents against a specific individual outside of a traditional battlefield.

Signature Strike:	A targeted drone strike based on observed patterns of behaviour associated with terrorist activity, rather than on the specific identity of the target.
Asymmetric Warfare:	A conflict between actors with significantly different military capabilities or strategies.
Hybrid Warfare:	A military strategy that blends conventional warfare with irregular warfare tactics, such as cyberattacks, disinformation, and economic pressure.
Electronic Warfare (EW):	The use of electromagnetic energy to control the electromagnetic spectrum or attack an enemy.
Information Warfare (IW):	The manipulation of information and communication technologies to influence an adversary's decision-making and public opinion.
Counterterrorism:	Actions taken to combat or prevent terrorism, including military, political, and legal measures.
Insurgency:	An organized rebellion aimed at overthrowing a constituted government through subversion and armed conflict.
Just War Theory (JWT):	A doctrine that establishes criteria for determining when and how it is morally permissible to wage war.
Sovereignty:	The authority of a state to govern itself or another state.
Proliferation:	The rapid increase in the number and spread of weapons, particularly weapons of mass destruction.

Collateral Damage:	Unintentional harm or casualties inflicted on civilians or non-military targets during military operations.
Blowback:	The unintended negative consequences of a covert operation or policy, often leading to increased hostility or instability.

Abbreviations

DARPA: Defence Advanced Research Projects Agency

EW: Electronic Warfare

FATA: Federally Administered Tribal Areas (Pakistan)

HALE: High Altitude Long Endurance (drone)

IED: Improvised Explosive Device

IHRL: International Human Rights Law

IHL: International Humanitarian Law

ISR: Intelligence, Surveillance, and Reconnaissance

IW: Information Warfare

LASE: Low Altitude Short Endurance (drone)

MAD: Mutually Assured Destruction

MALE: Medium Altitude Long Endurance (drone)

NATO: North Atlantic Treaty Organization

OSCE: Organization for Security and Co-operation in Europe

PGM: Precision-Guided Munition

RMA: Revolution in Military Affairs

UAV: Unmanned Aerial Vehicle

UAS: Unmanned Aerial System

WMD: Weapon of Mass Destruction

Contents

Introduction

Over the past two decades, we've seen a steady integration of unmanned aerial vehicles (UAVs), which I will refer to them as “Drones” afterwards, into modern warfare, a trend that shows no signs of slowing down. The increasing use of robotic systems across land, air, and sea replacing human soldiers raises a whole host of ethical, legal, and philosophical questions. But it's the potential impact on global security that really grabs my attention. Some experts are even predicting an "unmanned revolution in military affairs," where drones could fundamentally reshape military strategies, organization, capabilities, and even regional and international stability.

Thus, what's the big deal about drones? Aside from the obvious fact that these instruments are by definition unmanned and thus spare military personnel lives, what kind of conventional military advantage do they possess? Indeed, they are widely viewed as such game-changers in military combat and international politics for three key reasons:

1) Firstly, it is said that the usage of drones, together with their tiny size and distinctive design elements, makes them more difficult to detect by contemporary radar systems than conventional military aircraft. This provides an enormous advantage to offensive military operations since they may more easily slip past hostile air defences[1].

2) Secondly, the general consensus is that because drones are low-cost and low-tech, a larger variety of players can afford advanced military capabilities. Drones have the potential to strengthen militarily weaker and resource-constrained states by mitigating or even completely eliminating current power disparities[2].

[1] - Calcara, Antonio, Andrea Gilli, Mauro Gilli, Raffaele Marchetti, and Ivan Zaccagnini. "Why Drones Have Not Revolutionized War: The Enduring Hider-Finder Competition in Air Warfare." International Security 46, no. 4 (2022): 130–171. Accessed March 3, 2024. https://direct.mit.edu/isec/article/46/4/130/111172/Why-Drones-Have-Not-Revolutionized-War-The .

[2] - Friese, Larry. "Emerging Unmanned Threats." Special Report No. 2, 2016.

3) Moreover, long-range precise strikes are thought to be made possible by drones, which may lessen the necessity for close quarters fighting on the battlefield. This may imply a reduction in the frequency of ground force deployments required by nations[3].

These assertions on the revolutionary potential of drones appear to be supported by recent wars. Consider the Nagorno-Karabakh conflict in 2020. Drones in that fight have been referred to be a "magic bullet" or a "tactical game changer" by others. Even the German Institute for Defence and Strategic Studies came to the same conclusion, citing Azerbaijan's victory in the 2020 Nagorno-Karabakh conflict as proof that the German armed forces would have been unable to hold out against an enemy armed with combat drones.

Numerous experts find recent conflicts to validate the transformative impact of UAVs. For instance, in the 2020 Nagorno-Karabakh war, some describe drones as a "magic bullet" or a "tactical game changer.". The German Institute for Defence and Strategic Studies concludes that the German armed forces would have faced significant challenges against an adversary equipped with military drones, citing the example of Azerbaijan in the 2020 Nagorno-Karabakh war.[4] If we are indeed on the cusp of the drone revolution, the landscape of world politics could undergo dramatic shifts in the near future. Should drones indeed reduce the barriers to acquiring and utilizing advanced military capabilities, the longstanding correlation between wealth and power may significantly diminish or vanish altogether.

The landscape of international politics may soon change significantly if the drone revolution is indeed imminent. Drones have the potential to significantly reduce or perhaps eliminate the traditional correlation between money and power if they actually make it easier to obtain and employ superior military capabilities. This thesis investigates how drone warfare has revolutionised modern warfare, with a particular emphasis on state-on-state conflicts. This paper tries to analyse how the increasing use of drones has broken traditional combat standards, such as direct engagements, symmetrical tactics, and balanced capabilities, by analysing the 2020 Nagorno-Karabakh War. This study aims to explore how drones have changed military strategies, risk assessments, and battlefield outcomes for users and targets by closely examining

[3] - Mayer, Michael. "The New Killer Drones: Understanding the Strategic Implications of Next-Generation Unmanned Combat Aerial Vehicles." International Affairs 91, no. 4 (2015): 765-780. Accessed April 12, 2024. https://picture.iczhiku.com/resource/paper/syKrqEtEAuDSabnN.pdf

[4] - DPA. "Bundeswehr Nicht Gegen Angriffe Von Kampfdrohnen Gerüstet." Zeit Online, June 13, 2021. https://www.zeit.de/news/2021-06/13/analyse-bundeswehr-gegen-drohnen-unterlegen

three interrelated mechanisms: the move towards hybrid warfare, the decrease in troop risk, and the improvement of surveillance and targeting features.

In terms of users, the analysis will explore:

- What new, frequently asymmetrical tactics and operational doctrines have been adopted as a result of drones?
- How has combat decision-making been affected by the decreased danger to human soldiers, thereby reducing the threshold for conflict?
- What particular benefits, such as persistent monitoring, precise strikes, and real-time intelligence, may drones provide in combat?

For targets, the focus will be on:

- What is the impact of drone strikes on infrastructure, military assets, and civilian populations?
- How does the constant threat of drone surveillance and strikes affect the morale and behaviour of both military personnel and civilians?

This study aims to identify similar patterns and trends in the employment of drone warfare, as well as the special opportunities and problems it brings in various operational situations, by examining the strategic implications of drone technology in these various case studies. The ultimate objective is to clarify the extensive strategic implications of drone warfare, both inside and outside of the battlefield.

I. Research Question and Hypothesis

The main objective of this research is to answer one main question and several necessary sub-questions. In this research, we seek to determine, to what extent has the increased use of armed drones in interstate military conflicts since the early 21st century influenced conventional warring paradigms in creating a decisive strategic advantage? A number of sub-questions are raised to answer this question. One of the most important questions is how the asymmetrical distribution of drone technology has contributed to a potential shift towards hybrid asymmetrical conflict dynamics, empowering smaller or less conventional actors to challenge

larger, traditionally dominant military forces. Additionally, how has the reduction of troop risk through remote operations and enhanced surveillance and targeting capabilities, enabled by drones, contributed to this potential shift. As a result, I can state that the research questions are as follows:

'To what extent has the increased use of armed drones in interstate military conflicts since the early 21st century influenced conventional warring paradigms in creating a decisive strategic advantage?' To warrant my theoretical argument and research, I will utilize the case study of the 2020 Nagorno-Karabakh war, since it is a relevant historical case where the usage of drone warfare—amongst other forms of hybrid military strategies—have proven to be instrumental in deciding the outcome.

The dawn of the 21st century marked a turning point in the history of warfare with the rise of armed drones. These drones, once primarily used for surveillance and reconnaissance, have evolved into powerful weapons platforms capable of delivering precision strikes and conducting persistent surveillance. This technological evolution has sparked a fundamental shift in the character of warfare, challenging traditional notions of military strategy, tactics, and the overall conduct of war.

The 2020 Nagorno-Karabakh War serves as a stark illustration of this transformation, particularly the shift towards hybrid warfare. It offers a contrasting context for understanding the impact of drones on modern battlefields, relative to traditional conflict approaches that were so common in the 20th century. The Nagorno-Karabakh War was characterized by a significant asymmetry in drone capabilities, with Azerbaijan possessing a technologically advanced fleet while Armenia relied on outdated systems. This disparity played a pivotal role in Azerbaijan's swift and decisive victory, raising questions about the future of conventional warfare in the face of such asymmetric advantages.

By analyzing such case, this thesis will explore how the increased use of armed drones has facilitated a shift towards hybrid warfare, a mode of conflict characterized by the blending of conventional and unconventional tactics. The research will delve into how this shift has manifested in these conflicts, examining the specific ways in which drones have been employed and their impact on the course and outcome of these wars. Furthermore, this analysis will investigate how the reduction of troop risk through remote operations and the enhancement of surveillance and targeting capabilities have enabled and amplified this shift towards hybrid warfare. This analysis goes beyond simply attributing victory or defeat to drone technology.

Instead, it seeks to understand the deeper, more nuanced ways in which drones are reshaping the battlefield, and challenging traditional notions of military strategy, tactics, and the overall conduct of war. By understanding the interplay between these mechanisms, this thesis aims to shed light on the strategic implications of drone warfare for the future of conflict, offering insights into the challenges and opportunities presented by this rapidly evolving technology.

I will argue that the technological capabilities inherent in unmanned drones offer a decisive and instrumental strategic advantage, because of the reduction of troop risk through remote operations and the enhancement of surveillance and targeting capabilities, which collectively alter the strategic calculus of conflict and impact both the physical and psychological dimensions of warfare. Hence, to answer the research question more concretely, the introduction of drones into interstate conventional military confrontations been revolutionary in terms of how absolutely vital they are for effective engagement.

II. Importance of the Research

The increasing use of armed drones in 21st-century warfare represents a paradigm shift with profound implications for the character of conflict and international security. Understanding the transformative impact of drone technology is crucial for several reasons.

Firstly, drones have revolutionized military strategies and tactics in state-on-state conflicts. Their ability to conduct remote operations, enhance surveillance and targeting, and facilitate hybrid warfare has disrupted traditional notions of combat. This necessitates a thorough examination of how these capabilities have changed the way wars are fought, the decisions made by military and political leaders, and the overall balance of power in conflict zones. Secondly, the asymmetric distribution of drone technology has created a new dimension of strategic advantage and disadvantage. Understanding how technologically advanced actors leverage this asymmetry to achieve military objectives is crucial for assessing the future of warfare and developing effective countermeasures. By examining how drones are used by both sides in the Nagorno-Karabakh, this research seeks to shed light on the specific ways in which asymmetrical drone capabilities can reshape the battlefield and influence the outcome of conflict. Thirdly, the Nagorno-Karabakh War conflict, is an emblematic example of modern warfare, provide valuable insights into the real-world implications of drone technology. By analyzing such cases, we can understand how drones are employed in different operational contexts, their impact on battlefield dynamics, and their broader strategic consequences. This

understanding is essential for policymakers, military strategists, and scholars alike to grasp the evolving nature of warfare and develop effective responses. Fourthly, the proliferation of drone technology raises ethical, legal, and humanitarian concerns that cannot be ignored. While this thesis primarily focuses on the strategic implications of drones, acknowledging these concerns is crucial for a comprehensive understanding of the technology's impact. The potential for civilian casualties, the blurring of lines between combatants and non-combatants, and the questions of accountability in remote warfare all underscore the need for further research and dialogue on the responsible use of drones. Finally, understanding the transformative power of drones is essential for anticipating future developments in warfare and international relations. The rapid evolution of drone technology, including the development of autonomous systems and swarm capabilities, has the potential to further reshape the battlefield and challenge existing norms and frameworks of conflict. By examining the current state of drone warfare and its potential trajectories, this research aims to contribute to a more informed and comprehensive understanding of the challenges and opportunities presented by this rapidly evolving technology. This research can contribute to anticipating and preparing for the potential future scenarios of drone warfare.

III. Methodology

This thesis employs a mixed-methods approach, incorporating historical analysis, qualitative comparative case study, and theoretical frameworks drawn from the fields of security studies and military history. Building upon the thermotical foundation of diverse sources, the research begins with a historical analysis, tracing the evolution of drone technology from its early origins to the sophisticated platforms of today. This historical overview provides a contextual understanding of the technological advancements that have enabled the rise of drone warfare. The analysis of this historical evolution will be conducted through the lens of Revolution in Military Affairs (RMA) theory, assessing whether the advent of drone technology constitutes a significant shift in the nature of warfare comparable to other historical military revolutions.

The core of this thesis is a qualitative comparative case study analysis of the 2020 Nagorno-Karabakh War. By examining this case, the research aims to identify common patterns and trends in the use of drones, as well as the unique challenges and opportunities they present in different operational contexts. This qualitative approach, guided by the framework of hybrid warfare, allows for a deep, nuanced understanding of the complex factors at play in each

conflict, examining the specific ways in which drones have been employed and their impact on military strategies, tactics, and the overall character of warfare.

To achieve this, the research draws upon a wide array of primary and secondary sources, including:

- **Web-based resources:** Extensively utilized to access relevant articles, research papers, theses, and reports pertaining to drone technology, military strategy, international relations, and the specific conflicts examined in this thesis. Reputable websites and databases, such as the websites of the U.S. Department of Defense, the Center for Strategic and International Studies (CSIS), the Stockholm International Peace Research Institute (SIPRI), and the Bureau of Investigative Journalism, were consulted to gather data on drone strikes, casualties, and policy discussions.
- **Academic journals and books:** A thorough review of scholarly literature in the fields of international relations, security studies, military history, and technology was conducted. This included seminal works on asymmetric warfare, hybrid warfare, and just war theory, as well as contemporary analyses of drone warfare in specific conflicts.
- **Official documents and military reports:** Government reports, military assessments, and policy documents from various countries involved in drone warfare were examined to gain insights into official perspectives, strategic considerations, and legal frameworks governing the use of drones.
- **News articles and media reports:** News articles, documentaries, and investigative reports from reputable media outlets were consulted to provide real-time information on the ongoing conflicts and the evolving use of drones in these contexts. These sources offered valuable insights into the tactical and operational aspects of drone warfare, as well as the public discourse and media narratives surrounding this technology.

IV. Analytical Approach

The analysis will unfold through A Multi-Dimensional, Integrated Framework, examining three key dimensions:

First, the Technological Dimensions of the conflict, which the foundation of change, this dimension is the starting point. It establishes the technological landscape of drone warfare in each conflict, analyzing the types of drones employed, their capabilities, and how the technology evolved during the war. This sets the stage for understanding the subsequent changes in military strategy and the broader impact on conflict characteristics. Second, the Military and Strategic Dimensions will be explored, this dimension examines how the technological advancements in drones (from the first dimension) have been translated into military strategies and tactics. It explores how both sides have integrated drones into their existing doctrines, how they have adapted their operational approaches to leverage drone capabilities, the analysis in this dimension will set the stage for understanding the broader impact of drones on the character of conflict. Finally**,** the Impact on Conflict Characteristics dimension will be investigated, this dimension is the heart of the analysis, focusing on how the technological and tactical changes examined in the previous dimensions have manifested through three interconnected mechanisms that have fundamentally challenged traditional notions of warfare and transformed the character of conflict and the way battles are fought.

- **Shift towards Hybrid Warfare:** We will explore how the integration of drones with conventional forces has blurred the lines between traditional and unconventional warfare, leading to a more complex and multi-layered battlespace.
- **Reduction of Troop Risk:** We will examine how the ability to conduct remote operations using drones has lowered the risk to human combatants, potentially altering the calculus of war and influencing decisions to engage in or escalate conflicts.
- **Enhancement of Surveillance and Targeting:** We will investigate how drones have revolutionized intelligence gathering and targeting capabilities, providing a persistent aerial presence and enabling precision strikes with profound physical, psychological, and strategic effects on both users and targets.

By adopting this three-dimensional analytical framework, you can effectively explore the complex and interconnected ways in which drones are reshaping modern warfare. The first two dimensions provide the foundation for understanding the technological and tactical aspects of

drone warfare, while the third dimension delves into the broader consequences and implications for the character of conflict. Through this exploration, I hope to shed light on the strategic implications of drone warfare, both on the battlefield and beyond, contributing to a more informed and comprehensive understanding of the challenges and opportunities presented by this rapidly evolving technology.

V. Thesis Structure

This thesis is structured into four main chapters, each addressing a specific aspect of the research question. Chapter 1 establishes a theoretical and analytical framework for understanding the transformative impact of drone warfare on modern state-on-state conflict, providing an overview of the topic, outlining the research questions, hypotheses, and methodological approach. Chapter 2 traces the historical evolution of drone technology, examines the concept of Revolutions in Military Affairs (RMAs), analyses their key characteristics and historical impact, and explores the evolution of drone technology as a potential contemporary RMA, contrasting it with traditional warfare strategies and tactics. Chapter 3 classifies drones based on their endurance, compares them to fighter jets, and explores the factors driving their proliferation in modern warfare. Chapter 4 focuses on case studies of the Nagorno-Karabakh War, analyzing the use of drones and their impact on military strategies, tactics, and the overall character of warfare, with a discussion of the geopolitical ramifications in the conflict zones under examination. The thesis concludes with a summary of the main findings, and recommendations for future research.

Chapter 1- Drones in Warfare: Theoretical Foundations

The increasing use of armed drones in military conflicts has sparked a wealth of scholarly inquiry, exploring their transformative effects on the character of warfare. Early works by P.W. Singer in "Wired for War" emphasized the technological advancements and tactical shifts brought about by drones, highlighting their potential to reshape traditional notions of warfighting. Singer contends that dispersed attacks and constant surveillance blur the lines between battlefield and civilian space, forcing military strategies to adapt. However, Singer's analysis predominantly focused on the technical aspects of drone warfare, neglecting the broader social and political implications of their use. Michael J. Boyle's "The costs and consequences of drone warfare" (2013) delves deeper into the socio-political dimensions, focusing on the empowerment of smaller states through drones. Boyle argues that smaller players can now inflict significant damage on larger, technologically advanced militaries, as seen in the devastating impact of drone strikes employed by Azerbaijan against Armenian forces in the 2020 Nagorno-Karabakh War. However, this subsequent literature review examines the existing research on three key mechanisms through which drones are reshaping modern conflict: the shift towards hybrid warfare, the reduction of troop risk, and the enhancement of surveillance and targeting capabilities.

1. The Shift Towards Hybrid Warfare

Numerous studies have investigated how the integration of drones into military strategies has blurred the lines between conventional and unconventional warfare, leading to a rise in hybrid warfare tactics. Singer (2009) in "Wired for War" was among the first to highlight the disruptive potential of drones, arguing that they enable a new kind of conflict characterized by dispersed attacks and persistent surveillance. Similarly, Hoffman (2007) in "Conflict in the 21st Century: The Rise of Hybrid Wars" emphasized the growing importance of understanding how non-state actors and state actors alike are leveraging technology, including drones, to achieve strategic objectives through a combination of conventional and unconventional means. James N. Mattis emphasize the importance of understanding how the asymmetric distribution of drone technology and other advanced capabilities is reshaping the strategic and tactical landscape of modern warfare. Recent studies on the Nagorno-Karabakh conflict have further solidified this understanding. For instance, Kasapoglu (2021) in "The Nagorno-Karabakh Conflict and the Future of Warfare" argues

that Azerbaijan's successful use of drones alongside traditional military forces exemplifies the concept of hybrid warfare, where the boundaries between different modes of conflict become increasingly fluid.

2. The Reduction of Troop Risk

The ability of drones to conduct remote operations has led to a significant reduction in the risk to human combatants, altering the calculus of war for states. Shaw (2014) in "Predator Empire: The Geopolitics of U.S. Drone Warfare" explores how this reduced risk has made military action more politically palatable, potentially lowering the threshold for intervention and increasing the likelihood of conflict. This idea is echoed in Kaag and Kreps' (2014) "Drone Warfare," which examines how the decreased risk to pilots has changed the way states perceive the costs and benefits of military action. The authors argue that this has led to a more proactive use of force and a greater willingness to engage in conflicts.

3. The Enhancement of Surveillance and Targeting

Drones have revolutionized intelligence gathering and targeting capabilities, providing a persistent aerial presence and enabling precision strikes. This has been extensively studied in the context of the U.S. drone war in Pakistan and other counterterrorism operations. Boyle (2013) in "The Costs and Consequences of Drone Warfare" highlights the ethical and legal challenges associated with targeted killings, while Cronin (2013) in "Why Drones Fail: When Tactics Drive Strategy" examines the limitations and unintended consequences of relying heavily on drones for counterterrorism. In the context of interstate conflicts, such as the Russia-Ukraine War, the use of drones for surveillance and targeting has been explored by Bendett (2023) in "Russia's War in Ukraine Drives a Drone Revolution." This research highlights the increasing reliance on drones for real-time intelligence, battlefield awareness, and precision strikes, even in conflicts where both sides possess advanced military capabilities.

Indeed, in the 21st century, the advent and rapid evolution of drone technology have profoundly altered the landscapes of warfare and international diplomacy. The theoretical framework of this thesis seeks to elucidate the mechanisms through which drone warfare has transformed traditional

conflict patterns and influenced the dynamics of international relations within a globalized context. This chapter will introduce key theories and concepts that are crucial for understanding the strategic, ethical, and political dimensions of drone warfare. The rise of drone technology represents one of the most significant transformations in modern warfare, reshaping both the tactics and the ethics of conflicts around the globe. Initially developed for reconnaissance, drones have evolved into critical tools for combat, offering unprecedented capabilities that were once the stuff of science fiction[5].

Drones, bring a completely new dimension to warfare by providing the ability to conduct operations without direct human presence in hostile environments[6]. This capability not only reduces the risk to human life, particularly for the forces deploying them, but also expands the tactical options available to military strategists. Drones can loiter over targets for extended periods, gather critical intelligence through advanced sensors, and strike with precision at opportune moments. This persistent surveillance and strike capability has made drones an indispensable asset in modern military operations. The strategic advantage offered by drones extends beyond mere tactical gains. They have altered the psychological dynamics of warfare, with their silent presence potentially inducing a constant state of fear among adversaries[7]. Moreover, drones have democratized the ability to project power, enabling even smaller nations or non-state actors to conduct effective operations against larger, better-equipped foes. This shift has blurred traditional lines of military dominance and redefined notions of power and influence on the global stage.

However, the deployment of drones is not without controversy. The very attributes that make drones so valuable—remote operations and precision targeting—also raise profound ethical and legal questions. Issues such as the legality of cross-border strikes, the risk of civilian casualties,

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[5] - Gilli, Andrea, and Mauro Gilli. "The Diffusion of Drone Warfare? Industrial, Organizational, and Infrastructural Constraints." Security Studies 25, no. 1 (2016): 50-84.

[6] - Kunashakaran, Sumita. "Un (Wo)Manned Aerial Vehicles: An Assessment of How Unmanned Aerial Vehicles Influence Masculinity in the Conflict Arena." Contemporary Security Policy 37, no. 1 (2016): 31-61. Accessed March 20, 2024. https://www.tandfonline.com/doi/abs/10.1080/13523260.2016.1154405

[7] - Hijazi, Alaa, Christopher Ferguson, Richard Ferraro, and Harold Hall. "Psychological Dimensions of Drone Warfare." Current Psychology 38 (2019): 1285-1296.

and the lack of transparency in drone operations provoke intense debate and scrutiny. These challenges underscore the complexities of integrating drone technology into the established frameworks of international law and military ethics[8]. As drone technology continues to advance and proliferate, its impact on warfare and international relations will likely grow even more profound. The ongoing development of autonomous drones, capable of making targeting decisions without human intervention[9], promises to further complicate the ethical and strategic landscape. Thus, understanding the role of drones in modern warfare is crucial not only for military planners and strategists but also for policymakers and the international community at large, as they navigate the evolving realities of 21st-century conflict.

The overview of the significance of drone technology in modern warfare directly addresses my research question, which explores how drone warfare has transformed traditional conflict patterns and influenced the dynamics of international relations. For this purpose, I can say, first of all, the transformation of traditional conflict patterns through the use of drones has profoundly reshaped military tactics and the psychological landscape of warfare. In the other word, the introduction of drones has revolutionized the conduct of warfare, shifting from traditional manned operations and direct confrontations to a focus on remote and automated strategies. This strategic shift means that armies are increasingly moving away from ground assaults and manned aircraft strikes. Instead, they are embracing methods that allow for long-duration surveillance and high-precision strikes. Such tactics disrupt conventional battlefield strategies and necessitate the development of new military training protocols and preparedness measures. This evolution not only changes how wars are fought but also how they are won, fundamentally altering the tools and tactics at the disposal of modern militaries. However, it is not the only outcome, beyond their tactical applications, drones have a profound psychological effect on warfare. Their capacity to loiter unseen and strike without warning can sow persistent fear and paranoia among enemy combatants. This capability changes the very nature of how adversaries engage and behave on the battlefield. Combatants may find themselves constantly on the move or employing different tactics to evade drone surveillance

[8] - 8. West, Jonathan, and James Bowman. "The Domestic Use of Drones: An Ethical Analysis of Surveillance Issues." Public Administration Review 76, no. 4 (2016): 649-659. Accessed May 24, 2024. https://onlinelibrary.wiley.com/doi/abs/10.1111/puar.12506

[9] - Konert, Anna, and Tomasz Balcerzak. "Military Autonomous Drones (UAVs)-From Fantasy to Reality. Legal and Ethical Implications." Transportation Research Procedia 59 (2021): 292-299.

and attacks, significantly impacting the overall strategy and outcome of conflicts. This form of psychological warfare adds a new dimension to military strategy, where the mind and morale of the enemy are as much a battlefield as the physical environment.

In this chapter, we will establish the theoretical framework that serves as the foundation for our exploration of how drone warfare has reshaped conflict dynamics and influenced international relations in the 21st century. The purpose of this framework is to provide a structured approach to understanding the strategic, legal, and ethical dimensions of drone usage in modern conflicts. By delineating the theories and concepts that underpin our study, this framework will guide our analysis of specific case studies, helping to illuminate the broader implications of drone technology on traditional warfare and global diplomatic interactions. This approach ensures that this examination is both rigorous and comprehensive, allowing us to draw nuanced conclusions about the transformative impact of drones on the contemporary geopolitical landscape.

In the next chapter, we will delve into two crucial aspects that further contextualize the role of drones in modern warfare. First, we'll explore the historical context and technological advancement of drones, tracing their evolution from rudimentary unmanned devices to sophisticated tools of modern combat. This background will provide a deeper understanding of how technological progress has driven changes in military strategies and capabilities. Second, we will examine the transition from traditional warfare to drone warfare. This section will focus on how the introduction of drones has shifted military tactics and strategies from conventional forms of engagement to more remote, precision-guided forms of conflict. These discussions will set the stage for a more detailed analysis of the implications of these changes in the subsequent parts of our study.

At the end, I will present a detailed case studies that applies the theoretical framework discussed in the previous chapters to a real-world scenario. This case study will illustrate the practical implications of drone warfare on modern conflicts, allowing us to see firsthand how drones influence both the tactics and broader strategic outcomes of specific engagements. Through this focused examination, we will gain deeper insights into the transformative impact of drone technology on traditional conflict patterns and international relations.

1-1- Are Drones Different?

Drones, also known as remotely piloted vehicles equipped with lethal combat capabilities, represent a relatively recent development in weaponry. Fundamentally, a drone is simply another weapon system, a set of capabilities that allows commanders to deploy lethal force against adversaries. Proponents of drones often argue that demonizing these devices skews legal and policy discussions, as drones are merely tools of warfare. However, the truth likely falls somewhere in the middle of this debate. Drones are highly effective weapon systems, known for their lethality, precision, and situational awareness.[10] It's no surprise that drones have become the preferred method for executing precision strikes on specific enemy targets who blend into civilian populations where they operate. While the individual characteristics of drones—lethality, precision, and situational awareness—are not unique on their own, the integration of these attributes into a single weapon system is distinctive. Since the introduction of armed drones, no other weapon system has provided national and operational-level leaders with a similar capability: the ability to locate, identify, and strike a target with high precision while minimizing the risk to friendly forces.

1-2- Drones and the Escalation of Armed Conflict

The rapid evolution of drone technology has dramatically transformed the landscape of modern warfare, presenting both opportunities and challenges for states seeking to safeguard their security. As nations navigate the complexities of internal and external threats, the deployment of UAVs has become increasingly prevalent. This subchapter delves into the intricate interplay between state authority, international legal frameworks, and the strategic use of drones within the paradigms of asymmetric and hybrid warfare. By examining the legal constraints and operational realities, we aim to illuminate how drones are redefining conflict dynamics and influencing global power structures. Through the lens of warfare theories, this analysis seeks to provide a comprehensive

[10] 10. Corn, Geoffrey. "Drone Warfare and the Erosion of Traditional Limits on War Powers." In Research Handbook on Remote Warfare, edited by David Jens Ohlin, 246–72. Cheltenham, U.K.: Edward Elgar Publishing, 2017. Accessed April 11, 2024. https://www.armfor.uscourts.gov/ConfHandout/2022ConfHandout/CornJensenCorn2017ResearchHandbookOnRemoteWarfare246.pdf

understanding of the implications of drone warfare on contemporary security practices and international relations.

One of the core responsibilities of any nation is to safeguard itself and its citizens from both internal and external threats. To fulfil this duty, the state may authorize its agents to use lethal force when necessary. However, the conditions under which this authority is appropriately exercised are governed by law. International law sets constraints on a state's use of force, applicable in times of peace as well as during armed conflicts. Peace is considered the standard state of both national and international affairs; thus, the legal framework of peacetime, as defined by international human rights law, should be the primary guideline applied.[11] For example, in the United States, the distinction between a peacetime response to security threats and armed conflict is critically important. Both International Human Rights Law (IHRL) and International Humanitarian Law (IHL) place significant restrictions on the state's authority to take measures to neutralize such threats.[12] However, the existence of armed conflict considerably broadens the scope of authority available to the state and its agents.

Historically, this boundary was defined as the line between war and peace—the laws and customs of war were applied only during times of war. For example, in the context of the ongoing conflict between Ukraine and Russia, the distinction between a peacetime response to security threats and armed conflict is critically important. The deployment of drones has become increasingly significant, with both countries utilizing this technology to carry out military operations. This raises complex legal questions especially regarding the principles of distinction and proportionality in conflict zones.[13] The use of drones in this conflict has not only escalated the severity and reach of military engagements but has also tested the robustness of existing international legal frameworks that are supposed to regulate such activities. The laws and customs of war, which come into force during times of armed conflict, allow broader authority for state agents than the

[11] International Committee of the Red Cross. "Rules of War: Why They Matter." Accessed June 28, 2024. https://www.icrc.org/en/document/rules-war-why-they-matter

[12] International Committee of the Red Cross. "International Humanitarian Law – Basic Rules." Accessed June 28, 2024. https://www.icrc.org/en/war-and-law

[13] Shaw, Malcolm. Drone Warfare and the Future of Armed Conflict: International Legal Implications, Ethical Considerations, and Diplomatic Challenges. Routledge, 2017.

peacetime regulations.[14] The ongoing conflict between Ukraine and Russia demonstrates these dynamics vividly, challenging the international community to adapt and enforce these legal standards to ensure compliance and minimize civilian harm in the age of drone warfare.

1-3- Theoretical Considerations

To gain a comprehensive understanding of the nature of war and the transformative potential of drone technology, it is essential to examine prominent theories of warfare and evaluate their relevance in this evolving landscape. This analysis will serve as the foundation for exploring potential shifts in the nature of war due to the integration of UAVs. Several key theoretical frameworks will be utilized to develop this discourse.

1-3-1- Asymmetric Warfare Through Drones

Exploring Theories of Asymmetric Warfare is essential to my research question because it directly relates to understanding how drone warfare has transformed traditional conflict patterns and impacted international relations in the 21st century. Asymmetric warfare theories address conflicts between parties of unequal strength, typically involving state and non-state actors where the lesser party uses unconventional methods to leverage its position against a more conventionally powerful opponent.

Drones have significantly altered the landscape of asymmetric warfare by providing smaller states or non-state actors with a relatively low-cost, high-efficiency, and low-risk option to challenge larger military powers. This shift has not only changed the tactics and strategies employed in such conflicts but has also influenced the global dynamics of power and control. By incorporating drone technology, weaker actors can conduct surveillance, gather intelligence, and execute targeted strikes without the need for advanced, conventional military resources. This capability allows them to evade stronger forces' traditional defences and exert significant strategic influence disproportionate to their size or traditional military strength. Therefore, discussing it will help

[14] International Committee of the Red Cross. "The Geneva Conventions and Their Commentaries." Accessed June 28, 2024. https://www.icrc.org/en/war-and-law/treaties-customary-law/geneva-conventions

elucidate the mechanisms through which drones have transformed warfare tactics and strategies, especially for actors who previously had limited means to project power and influence. It will also provide a framework for analyzing how these transformations influence broader international relations and alter the dynamics of global conflict. In geometric terms, asymmetry refers to a lack of equality. A shape, pattern, or relationship is considered asymmetrical when its sides are not equal. Asymmetry can also suggest inherent or unchangeable inequalities, such as those found in familial bonds, exemplified by the statement "John is the father of Bill," which indicates a parent-child relationship. Asymmetry is a prevalent aspect of both the physical and social spheres of nature. For instance, in modern security contexts, the fundamental nature and threat of inter-state armed conflicts remain consistent, stark, and ever-present. However, the character of warfare has evolved with the advent of asymmetric conflicts, characterized by the involvement of non-state actors like insurgent groups. In such conflicts, there typically are two parties involved, one considered "strong" and the other "weak."[15]

Asymmetric conflicts undermine the traditional concept of a battlefield and obscure the lines between civilian and military targets. This shift prompted President George W. Bush, in his announcement of the war on terrorism, to describe the global war on terror as a conflict with battlefields spanning the entire world. The blurring of civilian and military distinctions in asymmetric warfare led to high civilian casualties in Afghanistan in 2010. This occurred as the Taliban, in a strategy some analysts call "lawfare," deliberately adopted civilian clothing to make themselves temporarily illegitimate targets, exploiting the rules of engagement. Western philosophy, military history, and international humanitarian law have traditionally focused on war between states. However, the terrorist attacks on September 11, 2001, presented a new type of warfare that diverged significantly from conventional understanding. Both practitioners and theorists initially struggled to define this novel form of armed conflict. Despite its frequent appearance in research papers, media articles, and military doctrine, the term largely eluded a clear definition.

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[15] Agwu, Fred Aja. Armed Drones and Globalization in the Asymmetric War on Terror. Routledge Research in the Law of Armed Conflict. Routledge, 2018. Accessed April 29, 2024. https://library.kdu.ac.lk/uploads/30/9781315123936_previewpdf.pdf .

In relation to the challenges mentioned above, some authors have adopted a more evocative depiction of asymmetric warfare and threats. They describe these concepts as elusive and variable, likening attempts to understand and analyse the security environment to "grabbing sand out of a barrel." The analogy suggests that while one might initially feel they have a firm grasp on something substantial, the substance significantly diminishes once removed from the context. This criticism highlights the inconsistent and prolific use of the term 'asymmetric warfare,' which casts doubts on its usefulness. These viewpoints underscore the broader difficulty in defining new forms of conflict that emerged prominently after the events of September 11, 2001.[16]

Since the end of the Cold War, the West has frequently described new or evolving threats and challenges as asymmetric. For instance, the possible use of weapons of mass destruction (WMD) in a hypothetical attack on the US is often categorized as an asymmetric threat, regardless of the potential aggressor's identity. However, it's crucial to note that one of the distinctive aspects of asymmetric warfare is that it doesn't respond to the same factors that usually decide outcomes in conventional warfare, such as strength, determination, initiative, and luck. In other words, the strongest side does not always emerge victorious in asymmetric warfare because it operates under a set of rules that are "different from those of conventional war."

Why are drones used in asymmetric warfare? Although warfare is governed by rules of engagement, it essentially involves hostile interactions either between national groups or between a national and a sub-national group(s). The commencement of war and the recognition of belligerent status are both accompanied by the enforcement of the law of armed conflict by all parties involved. Regrettably, these rules typically apply to conventional warfare. Unconventional or asymmetric warfare, particularly in counter-terrorism efforts, presents a different scenario. Due to its unconventional nature, participants in asymmetric warfare often do not adhere strictly to these rules. This is why sub-national groups like terrorists might employ tactics such as using Improvised Explosive Devices (IEDs), while national entities such as the United States might deploy armed drones for targeted killings. Although not entirely absent in conventional warfare,

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[16] Petener, Zrinko. "Asymmetric Warfare – Not Every War Has to End?" Security and Defence Quarterly (2001): 36. Accessed April 29, 2024. https://securityanddefence.pl/pdf-105400-36116?filename=Asymmetric%20Warfare%20_Not.pdf .

drones represent an unorthodox weapon crafted specifically for the unique objective of targeted killing in the unconventional context of asymmetric warfare.[17]

In summary, the exploration of Asymmetric Warfare Theories provides a crucial lens through which to understand the profound impact of drone warfare on contemporary conflict dynamics and international relations. Asymmetric warfare, characterized by conflicts between parties of unequal strength employing unconventional methods, has undergone significant transformation with the advent of drone technology. Drones have fundamentally altered the traditional power dynamics by offering smaller states and non-state actors a potent means to challenge larger military powers. This shift has not only reshaped warfare tactics and strategies but has also redefined the global distribution of power and influence. By enabling surveillance, intelligence gathering, and targeted strikes at a relatively low cost and minimal risk, drones have empowered weaker actors to exert strategic influence beyond their traditional military capabilities. Moreover, the discussion on asymmetric warfare illuminates the complexities of modern conflicts, where the distinction between civilian and military targets is blurred, and conventional rules of engagement are often disregarded. In this context, drones emerge as a potent tool tailored for the unique objectives of asymmetric warfare, such as targeted killings in counter-terrorism operations.

However, the evolving nature of asymmetric warfare poses challenges in defining and understanding its scope, as traditional frameworks struggle to capture its elusive and variable nature. Despite these challenges, acknowledging the role of asymmetric warfare theory is essential for comprehending the nuances of contemporary conflict landscapes shaped by drone technology. In conclusion, the study of Asymmetric Warfare Theory provides valuable insights into how drones have transformed warfare dynamics, challenged traditional power structures, and reshaped international relations in the 21st century. By embracing this theoretical framework, researchers can better analyse the multifaceted implications of drone warfare and navigate the complexities of modern conflict environments.

[17] Agwu, Fred Aja. Armed Drones and Globalization in the Asymmetric War on Terror. Routledge Research in the Law of Armed Conflict. Routledge, 2018.

1-3-2- Hybrid Warfare Theory

Though Just War Theory offers a foundation for analysing warfare's morality, the rise of hybrid warfare in interstate conflicts challenges traditional notions of combat. Hybrid Warfare Theory, where conventional military capabilities are integrated with irregular tactics, cyberattacks, information operations, and political pressure to achieve strategic objectives, provides a complementary lens to understand how state actors, like those in the 2020 Nagorno-Karabakh War incorporate drones into their broader strategies, ultimately transforming conflict patterns. This thesis will explore this transformation through the lens of Hybrid Warfare Theory, examining how drone warfare in these case studies has blurred traditional battle lines, driven the evolution of warfare strategies through integration with cyberattacks and information manipulation, and impacted escalation control with its inherent ambiguity.

Starting by excluding what doesn't characterize hybrid warfare, it's important to note that outward appearances like wearing masks or lacking national insignia, as well as asymmetric, irregular, or terrorist actions, might often coincide with hybrid warfare but aren't sufficient indicators on their own. However, both the uniformed masked "little green" individuals without national insignia in Crimea and the irregular pro-Russian separatist fighters in Eastern Ukraine exemplify two significant traits of hybrid warfare.

Firstly, they embody the dissolution of fixed order categories and the deliberate tendency of hybrid actors to operate across traditional areas of responsibility interfaces, thus creating vulnerabilities and systematically attacking them. This deliberate ambiguity hampers a swift, unified response from either the adversary or the international community. It's crucial to consider the following interfaces:

a. Between war and peace: Conflict isn't necessarily declared or fought conventionally; instead, the "conqueror" seizes what they desire through rapid, unexpected political, military, clandestine, or propaganda actions, leaving a new reality in their wake.

b. Between friend and foe: Identifying the true adversary becomes challenging as hybrid actors operate in ways that allow them plausible deniability or make attribution difficult. Instead of outright combat, opposing forces might be disarmed and coerced into joining the hybrid actor's ranks through a mix of incentives, threats, and pressure.

c. Between intrastate and interstate conflicts, blurring the lines between domestic and external security involving various actors: With external attackers allied with local elements, distinguishing between defending domestic or external security in conflicts becomes complex. Are the separatists domestic or foreign? State or non-state actors? Which security forces, domestic or external, can effectively respond, if any, and are they even available?

Essentially, every conflict encompasses hybrid aspects and components. On one hand, this stems from a political rationale or motive that exists independently of the conflict itself. On the other hand, warfare typically extends beyond purely military actions, involving various other domains such as politics, diplomacy, economy, technology, or propaganda. In this regard, warfare inherently embodies hybrid characteristics—as exemplified by the Clausewitzian notion of it being "a continuation of politics by other means. Firstly, it revolves around directing the focus of the war or conflict primarily towards a wide array of non-military centres of gravity. This entails utilizing multiple and shifting centres of gravity in a flexible and dynamic manner. Within this framework, a comprehensive range of military forms, means, and methods are employed and combined, without the primary aim of resolving the conflict lying within the military domain or being pursued primarily through military means and methods. Irrespective of the intensity of combat, the 'centre of gravity' is identified in other predominantly non-military spheres, such as morale, legitimacy, or political will. In the context of hybrid warfare, combat actions themselves do not primarily serve to determine the outcome of a war or conflict, as opposed to more conventional military-centric warfare. Secondly, it entails purposeful manoeuvring within the ambiguous realms of various interfaces to exploit specific vulnerabilities of the adversary, leading to the erosion of established order categories. By blurring distinctions between realms such as war and peace, friend and foe, domestic and external security, state and non-state actors, and civilian and military approaches, hybrid warfare generates interface challenges and exposes vulnerabilities. Despite its indirect, covert, or clandestine nature, the operations of hybrid actors, typically asymmetric in nature, systematically target vulnerabilities within the ambiguous space of these interfaces. Consequently, resulting ambiguities hamper, restrict, or hinder responses from opposing forces, while simultaneously shielding the weaknesses of the hybrid actor from exposure.

Thirdly, it entails the innovative blending and simultaneous utilization of diverse civilian and military categories, forms, means, and methods of warfare, resulting in the emergence of "new"

hybrid amalgamations. This fusion intertwines conventional, regular, and symmetric forms and doctrines with irregular, asymmetric, non-linear, or unconventional elements to create strategic hybrid combinations. This process may occur across various operational levels and involve a mix of state, non-state, or pseudo-state actors. Both overt and covert tactics are employed. The resulting "new" hybrid forms are often challenging to decipher in terms of their patterns, rationale, and logic, thereby favouring surprise elements while complicating defence, response, and the formulation of effective counterstrategies.

within the framework of hybrid warfare theory, we can say according to the followings we can connected the theory of Hybrid war to the using of drones and consequently the transformation of the nature of the war.

1. **Blurring Traditional Battle Lines**: Drones have blurred traditional battle lines by providing a means for states and non-state actors to carry out precision strikes and surveillance without the need for large-scale troop deployments[18]. In hybrid conflicts like those in Nagorno-Karabakh, drones have been utilized alongside conventional military capabilities and irregular tactics to create a more fluid and ambiguous battlefield.

2. **Integration with Cyberattacks and Information Manipulation**: Drones are often used in conjunction with cyberattacks and information manipulation to achieve strategic objectives[19]. For example, drones can gather intelligence on enemy positions, which can then be used to launch targeted cyberattacks or disseminate propaganda to influence public opinion. This integration of drones with other elements of hybrid warfare enhances the effectiveness of these tactics and complicates the adversary's ability to respond effectively.

3. **Ambiguity and Escalation Control**: The use of drones introduces ambiguity into the battlefield, making it difficult for opposing forces to distinguish between friend and foe

[18] - Chavez, Kerry, and O. Swed. "Off the Shelf: The Violent Nonstate Actor Drone Threat." Air & Space Power Journal 34, no. 3 (2020): 29-43.

[19] Best, Katharina, Jon Schmid, and Tierney. "How to Analyze the Cyber Threat from Drones." Rand Arroyo Center, Santa Monica, CA, 2020.

and assess the intentions behind drone strikes[20]. This ambiguity can complicate escalation control efforts, as it may be challenging to determine the appropriate response to a drone attack without clear attribution of responsibility. Additionally, drones can be used to conduct limited strikes that fall below the threshold of traditional warfare, making it easier for actors to engage in aggression without triggering a full-scale conflict.

In conclusion, the multifaceted exploration of Asymmetric Warfare Theory and Hybrid Warfare Theory illuminates the profound transformations that drone warfare has wrought on contemporary conflict dynamics and international relations. These theoretical lenses provide critical insights into how drones, as a technological innovation, have shifted the balance of power, altered traditional conflict strategies, and redefined ethical boundaries in warfare. Asymmetric Warfare Theory highlights the empowerment of weaker actors through cost-effective and strategic use of drones, enabling significant influence disproportionate to their conventional capabilities. Hybrid Warfare Theory further enriches this analysis by showing how drones integrate with other forms of warfare to blur traditional battle lines and complicate the distinction between civilian and military targets. Collectively, these theories underscore the necessity of adapting our understanding and regulatory frameworks to address the evolving nature of warfare, ensuring that the use of such powerful technologies remains within the bounds of international law and ethical conduct. As drone warfare continues to develop, it is imperative that scholars and policymakers alike strive for a deeper understanding of its implications to better navigate the complexities of modern conflict and uphold the principles of justice and humanity in the face of technological change.

As an analytical point of view, I would add that, Asymmetric Warfare Theory provides vital insights into the dynamics of power. It elucidates how less conventionally powerful actors, through the use of tactics like drone warfare, can challenge larger states. This theory champions adaptability and innovation, essential for crafting effective responses to unconventional threats. Moreover, it highlights the cost-effectiveness of such strategies, empowering smaller forces to have a more significant impact without extensive conventional capabilities. However, this very empowerment could also lead to the escalation or prolongation of conflicts, complicating international relations by blurring the lines between legitimate state actors and non-state actors. It

[20] - Gregory, Derek. "From a View to a Kill: Drones and Late Modern War." Theory, Culture & Society 28, no. 7-8 (2011): 188-215.

raises moral and ethical questions, particularly concerning the tactics employed to exploit the vulnerabilities of stronger foes. Hybrid Warfare Theory acknowledges the complex, multifaceted nature of modern warfare that integrates conventional, irregular, cyber, and information tactics. It offers strategic flexibility across different domains, enhancing the ability to counter complex threats effectively. By preparing for a broad spectrum of threats, it ensures a comprehensive defense strategy. Yet, the theory's acknowledgment of warfare's ambiguity can make response strategies equally complex and challenging to formulate. The difficulty in attributing actions to specific actors complicates accountability and the international community's response. Moreover, the diverse tactics employed can inadvertently lead to geopolitical escalations, extending conflicts beyond their original scope.

Altogether, these theories provide robust frameworks for understanding and guiding military strategies in the age of drone warfare. However, their application must be carefully balanced with practical, ethical, and legal considerations to navigate the complexities of contemporary conflicts effectively. As warfare continues to evolve, these theories offer valuable insights but also require continuous adaptation to remain relevant and constructive in policy-making and strategic planning.

Chapter 2- Gradual Progress Review

Throughout history, the battlefield has served as a crucible of innovation, witnessing a continuous evolution from the brutal clashes of medieval knights to the targeted precision of modern drone strikes. witnessing a continuous evolution in the art and science of war. From the brutal clashes of medieval knights to the targeted precision of modern drone strikes, warfare has undergone a radical transformation. Dr. Andrew F. Krepinevich,[21] a preeminent scholar of military strategy and history, has meticulously identified ten pivotal moments that constitute Revolutions in Military Affairs (RMAs).

RMAs, as defined by Dr. Krepinevich, ***are significant transformations in the conduct of warfare, driven primarily by technological advancements and corresponding changes in military doctrines.***[22] These revolutions extend beyond the mere introduction of deadlier weaponry. They fundamentally reshape the very fabric of warfare, encompassing not only the tools employed by soldiers but also the evolving philosophies and strategic approaches that dictate their use. Dr. Krepinevich's work delves into these ten RMAs, illuminating the intricate interplay between technological innovation and strategic adaptation that has shaped the battlefield throughout history. This examination not only sheds light on the evolution of war itself, but also reveals its profound impact on the broader landscape of international relations.

The concept of RMAs emerged in the late 20th century, driven by the recognition that technological breakthroughs can fundamentally alter the way wars are fought. Prior to this, advancements were often viewed as incremental improvements within existing paradigms. RMAs, however, represent paradigm shifts, forcing militaries to re-evaluate their doctrines, tactics, and force structures. Studying these revolutions is crucial for understanding the transformative impact of drones on traditional conflict patterns. By examining past RMAs, we can identify key

[21] Krepinevich, Andrew F. Arms, Out of Amnesia: Getting Control of Weaponry in the Post-Cold War World. New York: Farrar, Straus and Giroux, 1994. Accessed June 13, 2024. https://www.cnas.org/people/dr-andrew-f-krepinevich-jr .

[22] - Ibid.

characteristics – like the rise of precision weaponry, network-centric warfare, and changes in force structure – that are mirrored in the current drone revolution. This historical context allows us to predict the potential long-term effects of drones on warfare, from the blurring of lines between battlefield and civilian space to the emergence of new ethical dilemmas. In essence, studying RMAs equips us to navigate the complexities of the present and anticipate the future of warfare in the age of drones. Building upon this foundation, this chapter is structured into four subchapters.

The first subchapter will provide a historical background by examining the theory of Revolutions in Military Affairs (RMAs), as outlined by Dr. Krepinevich. This section will be purely historical, exploring ten major historical RMAs and their significant impact on the conduct of warfare and international relations. It will then analyse drone warfare itself as a prime example of an ongoing RMA, marked by the development of precision-guided missiles and their delivery platform: Unmanned Aerial Vehicles (UAVs). **The second** and third subchapters will adopt a more analytical style. The second subchapter will interrogate the key characteristics of past RMAs and how they transformed traditional conflict patterns. By examining these past revolutions, we can gain valuable insights into the potential transformative power of drone warfare itself.

The third subchapter delves into the traditional "playbook" of warfare employed before the widespread adoption of drones. It explores ten key features that defined conventional military strategies and tactics. Understanding these pre-drone characteristics provides a crucial foundation for appreciating the transformative impact of drone technology on the modern battlefield. **The concluding subchapter** returning to the purely historical approach adopted in the first subchapter, will explore the history of drones, tracing their evolution from early unmanned aerial vehicles to the sophisticated platforms employed today. This exploration will shed light on the technological advancements that have made modern drone warfare possible.

2-1- A Historical Look at RMAs

The battlefield, a crucible of innovation, has witnessed a continuous evolution in warfare throughout history. From the brutal clashes of medieval knights to the targeted precision of modern drone strikes, the way wars are fought has undergone radical transformations. Dr. Krepinevich identified ten pivotal moments that constitute these transformations, RMAs are not mere advancements in weaponry, but paradigm shifts. They fundamentally reshape the very fabric of warfare, encompassing not only the tools employed by soldiers but also the evolving philosophies and strategic approaches that dictate their use. Dr. Krepinevich's work delves into these ten RMAs,[23] illuminating the intricate interplay between technological innovation and strategic adaptation that has shaped the battlefield. This examination not only sheds light on the evolution of war itself, but also reveals its profound impact on the broader landscape of international relations.

This subchapter will dissect these ten RMAs in a chronological exploration. Each RMA will be meticulously examined for its defining characteristics and its lasting impact on the conduct of warfare. It will begin with the Early Battles, where the rise of anti-cavalry tactics and advancements in gunpowder fundamentally altered the balance of power. The analysis will then unfold, tracing the evolution of warfare through the Age of Sail, the rise of Professional Soldiers, and the Technological Revolution of the 21st century. By the culmination of this examination, we will not only have a deeper understanding of these pivotal moments, but also gain valuable insights into the potential future of warfare in the age of advanced technology.

- 1st & 2nd RMAs: Chivalry's Demise & Gunpowder's Rise

The Hundred Years' War, a brutal conflict that stretched across generations, became the unlikely stage for the first two RMAs. This era, dominated by the clash of heavily armoured knights, witnessed a seismic shift in tactics. The rise of anti-cavalry tactics, spearheaded by skilled archers and disciplined pikemen formations, dethroned cavalry as the undisputed rulers of the battlefield. This transition not only made warfare more defensive in nature, but also opened the door for a

[23] Krepinevich, Andrew F. "Cavalry to Computer: The Pattern of Military Revolutions." The National Interest 30, no. 13 (Fall 1994): 42.

broader range of participants. The lower cost of these new weapons compared to the elaborate armour of knights meant more people could be equipped, chipping away at the absolute power of feudal lords.

However, the dominance of defence wouldn't last long. The second RMA, spurred by the arrival of gunpowder and cannons, ushered in a new era of offensive warfare.[24] Cannons, with their immense destructive power, fundamentally altered siege tactics. Cities, previously considered impregnable fortresses, could now be breached, and conquered with far greater speed and efficiency. This innovation fundamentally changed the balance of power, forcing armies to adapt their strategies to this newfound offensive capability.

- 3rd RMA: Age of Sail & Naval Supremacy

The 15th century marked a pivotal turning point, not just on land but also at sea. This era saw the dawn of the third RMA, driven by revolutionary advancements in sailing technology. Oars, the traditional method of propulsion, were gradually replaced by the power of the wind.[25] This seemingly simple shift had a profound impact. Ships, no longer limited by the physical exertion of rowers, could be built larger and sturdier. This translated to increased cargo capacity, allowing for the transportation of a larger number of soldiers and heavier weaponry. This naval arms race culminated in the development of the "Sail and Shot" strategy, a decidedly offensive doctrine. European powers, with their technologically superior fleets, dominated battles like Lepanto. The crushing victory over the Ottoman forces cemented the dominance of wind-powered warships and ushered in a new era of naval supremacy.

- 4th RMA: Fortified Defence

The ever-growing power of cannons, a testament to the advancements of the previous RMA, posed a significant threat to traditional fortifications in the 16th century. This led to the fourth RMA, characterized by a defensive response. Feudal lords, facing the destructive potential of gunpowder

[24] Nichols, Robert. Firearms in the Middle Ages and Early Renaissance. London: Greenwood Press, 1982.

[25] Lautenschläger, Karl. "Technology and the Evolution of Naval Warfare." International Security 8, no. 2 (1983): 3–51. https://doi.org/10.2307/2538594 .

weaponry and siege machines, were forced to adapt.[26] Castles underwent a dramatic transformation, with walls growing thicker and incorporating bastions – strategically placed bulwarks – to deflect cannon fire. This "Fortress Revolution" marked a return to defensive strategies. While the offensive might of cannons remained undeniable, these fortified structures offered a crucial shield, allowing defenders to withstand bombardment and potentially repel attackers. The rise of these formidable fortresses once again reshaped military strategy, forcing armies to develop new tactics to overcome these formidable bastions.

- 5th RMA: Professional Armies & Linear Warfare

The 15th and 16th centuries witnessed a pivotal revolution in land warfare, marking the fifth RMA. This era, defined by advancements that unfolded across these two centuries, was shaped by a revolutionary weapon - The musket. This portable firearm, a significant leap forward from cumbersome arquebuses, fundamentally transformed the battlefield. Warfare, once a chaotic clash of large, undisciplined masses, began to evolve into a more controlled and lethal dance. The musket, with its improved accuracy and firepower, paved the way for the rise of professional soldiers.[27] Mercenaries, notorious for their divided loyalties and inconsistent fighting styles, were gradually replaced by trained, professional armies. These soldiers, drilled in the use of muskets and linear tactics – formations designed to maximize firepower – brought a new level of discipline and deadliness to the battlefield. This shift wasn't just about lethality, however. The rise of professional armies, with their focus on coordinated manoeuvres, also led to a decrease in overall casualties. Battles became less about brute force and more about calculated tactics, resulting in a shift in the calculus of war.

- Period of Transition and Refinement (from 5th to 6th RMAs)

The later 16th and 17th centuries served as a bridge between the revolutionary advancements of the 5th RMA and the emergence of the nation-state in the 18th century. While there wasn't a single,

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[26] Krauskopf, Christof, and Peter Purton. "From the Tower to the Bastion: Changes in Fortress Design to Accommodate Gunpowder Artillery (14th to 16th Centuries)." Fasciculi Archaeologiae Historicae 10 (2020): 94.

[27] Elting, John R. Swords Around a Throne: Napoleon's Grande Armee. New York: Sterling Publishing Co., 1995.

defining RMA during this period, it was a time of significant refinement and adaptation. Here are some key aspects of this transitional phase: Evolution of Standing Armies: The concept of professional armies established in the 5th RMA continued to develop. This involved advancements in training methods, logistical capabilities, and tactical doctrines. Further Development of Fortifications: The "Fortress Revolution" of the 16th century saw further refinement in the 17th century. Engineers continued to devise more sophisticated fortification designs that could withstand the evolving power of cannons. Early Naval Innovations: Though the major naval revolution occurred in the 15th century, the 17th century might have seen advancements in ship design, weaponry, or sailing techniques that laid the groundwork for future naval dominance by European powers. By the 18th century, these refinements and the rise of nation-states paved the way for the revolutionary concept of a "nation in arms" introduced by Napoleon Bonaparte, marking the 6th RMA.

- 6th RMA: Mass Mobilization

The 18th century ushered in the sixth RMA, marked by a fundamental shift in the very nature of combatants. Prior to this era, armies were largely composed of mercenaries – professional soldiers who fought for pay and allegiance could be fickle. This all changed with the rise of Napoleon Bonaparte and his revolutionary concept of a nation in arms.[28] Napoleon's France introduced a system of compulsory military service, where citizens were obligated to defend their homeland. This shift instilled a powerful sense of nationalism and patriotism within the French army. Soldiers were no longer fighting for mere coin, but for the ideals of the French state and the defence of their nation. This newfound unity and unwavering will to fight proved to be a significant advantage. The French army, fuelled by this national fervour, displayed exceptional offensive capabilities, conquering vast swathes of territory during the Napoleonic Wars. This revolution in military manpower stands as a testament to the power of national identity and its profound impact on the battlefield.

[28] Kohn, Hans. The Idea of Nationalism: A Study in Its Origins and Background. 1944.

- 7th RMA: Industrial Revolution & Mass Warfare

The seventh RMA unfolded over a broader timeframe, spanning from the Industrial Revolution of the 18th century to the brutal crucible of the First World War. This era witnessed a confluence of technological advancements that fundamentally reshaped warfare. The most significant of these was the railway system. Before its invention, troop movements were arduous and slow, limiting the scale and speed of military campaigns. The arrival of the railways revolutionized troop mobility, allowing armies to be deployed and resupplied with unprecedented efficiency.[29] This logistical marvel transformed warfare from a series of localized engagements to a more industrialized form of conflict, capable of mobilizing and sustaining vast armies.

Another defining innovation of this era was the invention of the machine gun. This weapon, with its rapid rate of fire and devastating firepower, marked a quantum leap in offensive capabilities. The introduction of machine guns, coupled with advancements in artillery and explosives, fundamentally altered the calculus of war. While the defensive power of fortifications improved, these advancements tipped the scales in Favor of the offense. The combination of rapid troop mobility and overwhelming firepower ultimately contributed to the deadly stalemate witnessed during the First World War. This period showcased the dark potential of the Industrial Revolution, where advancements originally intended for progress fuelled an unprecedented level of mass destruction.

- 8th RMA: Dreadnought Era

The 19th and early 20th centuries witnessed a transformative era in naval warfare, marking the eighth RMA. This period was dominated by the rise of the dreadnought, a revolutionary battleship that redefined naval power. Prior to the dreadnought, battleships were a diverse mix of technologies and capabilities. The introduction of the dreadnought, however, ushered in an era of standardization and unprecedented firepower.[30] These behemoths were powered by powerful steam engines, granting them superior speed and manoeuvrability. More importantly, they were

[29] Van Creveld, Martin. Supplying War: Logistics from Wallenstein to Napoleon. Cambridge, UK: Cambridge University Press, 1977.

[30] Massie, Robert K. Dreadnought. New York: Random House, 1991.

heavily armed with large-calibre guns, capable of inflicting devastating damage on any opposing vessel.

The arrival of the dreadnought rendered older battleships obsolete overnight. This technological leap is exemplified by the Russo-Japanese War of 1905, where Japan's modern fleet, equipped with dreadnoughts, inflicted a crushing defeat on the technologically inferior Russian navy.[31] This decisive victory cemented the dreadnought's dominance and ushered in a new era of naval supremacy built on overwhelming firepower and technological superiority. The dreadnought primarily represented an offensive doctrine. Its superior firepower and manoeuvrability allowed navies to project power, control sea lanes, and engage in decisive fleet battles aimed at crippling or destroying the enemy's naval forces.

- 9th RMA: Air Power Revolution

The interwar period, the years between the First World War and the Second World War, witnessed a revolution in warfare unlike any before. This era, marking the ninth RMA, saw the explosive development of several key military technologies. The most significant of these was the rise of air power. The invention and rapid advancement of airplanes transformed the battlefield in a multitude of ways.[32] Fighter aircraft emerged, capable of dogfighting for aerial supremacy, while bombers introduced the terrifying prospect of strategic bombing, the ability to strike targets deep behind enemy lines. This aerial revolution fundamentally altered military strategy. No longer were armies solely focused on land and sea battles. Now, the skies needed to be controlled as well.

The Air power presented a dual-edged sword. Offensive Aspects: Fighter aircraft could disrupt enemy troop movements, attack supply lines, and provide close air support for ground forces. Bombers, especially with the advent of strategic bombing, offered the potential to cripple enemy infrastructure and industrial capacity, potentially forcing surrender. Defensive Aspects: Fighter aircraft could also be used to intercept enemy bombers and defend airspace. Additionally, the threat of strategic bombing incentivized the development of air defence systems, such as anti-aircraft

[31] Hageman, George. "The First Naval Battle of the 21st Century." Naval History and Heritage Command, 2020.

[32] Overy, Richard. Air War, 1939-1945. New York: Penguin Books, 1980.

guns and radar technology. The net effect of air power in the interwar period leaned towards an offensive advantage. However, the development of defensive measures ensured that air power would be a crucial element in both offensive and defensive strategies during the Second World War.

- 10th RMA: Nuclear Age & MAD

The Cold War, a period of intense geopolitical tension between the United States and the Soviet Union, ushered in the 10th RMA. This era witnessed the development of a weapon so devastating that it fundamentally reshaped the very nature of warfare – the nuclear bomb. The atomic bombings of Hiroshima and Nagasaki in 1945 served as a stark and horrifying reminder of this weapon's destructive potential. Nuclear weapons were unlike any weapon ever created, possessing the capability to inflict unimaginable destruction on a single detonation.

The development of nuclear weapons triggered a period known as the arms race. Both the US and the Soviet Union embarked on a relentless pursuit of ever-more powerful nuclear arsenals and faster delivery systems. Intercontinental ballistic missiles (ICBMs) capable of carrying nuclear warheads across vast distances became a terrifying reality. This arms race, while driven by anxieties about potential aggression, also introduced a chilling new concept – mutually assured destruction (MAD). The logic of MAD posits that if both sides possess nuclear weapons, a full-scale war between them would result in the annihilation of both. This doctrine of deterrence, however, wasn't foolproof. The constant threat of nuclear war cast a long shadow over the Cold War, creating an atmosphere of fear and insecurity.

The presence of nuclear weapons fundamentally altered the nature of warfare. Large-scale conventional wars between superpowers became unthinkable due to the potential for escalation into a nuclear conflict. This shift led to the development of proxy wars, where superpowers supported opposing factions in smaller conflicts without directly engaging each other militarily. Additionally, the nuclear age saw an increased focus on espionage and intelligence gathering. Both sides sought to gain an advantage by uncovering the other's nuclear capabilities and military strategies. However, the Cold War also spurred an unprecedented technological arms race. Both superpowers poured vast resources into developing advanced weaponry, delivery systems, and intelligence gathering capabilities. This intense competition laid the groundwork for the 11th

RMA, often referred to as the Technological Revolution, which would define warfare in the decades to come. The Cold War, while dominated by the threat of nuclear annihilation, also sowed the seeds of a future revolution in military technology.

- 11th RMA: Digital Precision Warfare

The 21st century has witnessed the dawn of the 11th RMA, also known as the Technological Revolution. This era is defined by a relentless pursuit of technological superiority that has fundamentally reshaped modern warfare. Unlike previous RMAs that were driven by a single revolutionary weapon (e.g., the musket), the 11th RMA is characterized by a confluence of advancements across a broad spectrum of military technologies. The Technological RMA has yielded a battlefield significantly different from its predecessors. Here are some key areas of transformation: the 11th RMA is characterized by a confluence of advancements across a broad spectrum of military technologies. Among these, drones, or Unmanned Aerial Vehicles (UAVs), have emerged as a defining symbol of this era.

The Technological RMA has revolutionized warfare across several key aspects. Advancements in materials science and engineering have yielded a new generation of weaponry with increased lethality and range. Precision-guided munitions, capable of striking targets with pinpoint accuracy, exemplify this shift. These weapons not only minimize collateral damage but also reduce the risk to friendly troops by allowing for more targeted attacks.

Furthermore, battlefield awareness has reached unprecedented levels. Sensor technology, integrated with advanced communication networks, provides real-time information on enemy positions and movements. This allows soldiers to make informed decisions and coordinate manoeuvres with greater efficiency. Secure and reliable communication systems are the backbone of this approach, enabling real-time information sharing and leading to a more agile and responsive fighting force. Finally, significant strides have been made in developing advanced protective gear, including body armour and improved helmets. These advancements, coupled with improved medical care, contribute to a decrease in soldier casualties.

The hallmark of the Technological RMA is the emergence of precision warfare. This approach relies on a combination of advanced weaponry, intelligence gathering, and real-time battlefield

awareness to achieve decisive military objectives with minimal collateral damage. The most emblematic example is the precision-guided missile (PGM). Unlike unguided bombs or rockets, PGMs can be steered towards their targets with pinpoint accuracy. This capability, often delivered by unmanned aerial vehicles (UAVs) or drones, allows for highly targeted strikes against enemy forces, minimizing civilian casualties and potential for escalation.

While the Technological RMA has demonstrably improved battlefield efficiency and lethality, it's difficult to definitively say it Favors offense or defence. Here's why: Offensive Advantages: Precision-guided weapons and enhanced situational awareness undoubtedly offer offensive advantages through targeted strikes and improved coordination. Defensive Advantages: However, advancements in battlefield awareness and soldier protection also bolster defensive capabilities by allowing for better anticipation of attacks and stronger defensive positions.

To conclude, this exploration of RMAs has illuminated a historical landscape sculpted by both human ingenuity and destructive potential. From the early battles that dethroned the armoured knight to the chilling realities of the nuclear age, each RMA serves as a potent reminder of humanity's capacity for both creation and devastation. The battlefield, a crucible of innovation, has witnessed a relentless dance between technological advancement and tactical adaptation. Early RMAs laid the groundwork for this dynamic, while subsequent revolutions – from the rise of professional soldiers to the dominance of air power – redefined the very nature of warfare.

The 21st century ushers in the "Technological Revolution," the latest chapter in this ongoing saga. Here, battlefield dominance hinges not on brute force, but on precision and efficiency. Drones, once relegated to the realm of science fiction, now patrol the skies, delivering targeted strikes with surgical accuracy. Yet, the question of offensive or defensive advantage remains a complex one. Technological advancements offer clear benefits for both sides, blurring the line between attack and defence in a continuous arms race between lethality and protection. However, the transformative impact of drones extends far beyond their destructive capabilities. Their ability to gather real-time intelligence without risking human lives fundamentally alters the way battles are fought. Commanders now have a persistent eye in the sky, providing unparalleled situational awareness and enabling more informed tactical decisions. This shift from boots on the ground to remote control warfare raises profound questions about the future of armed conflict.

2-2- An Analytical Look at RMAs

The study of Revolutions in Military Affairs (RMAs) offers a profound window into the dynamic evolution of warfare. These revolutions mark periods of seismic shifts, transforming battlefields from clashes of individual soldiers wielding basic weaponry to complex engagements characterized by advanced technology and intricate manoeuvres. The impact of RMAs extends far beyond the immediate battlefield, shaping not only the strategies employed during war but also the underlying philosophies and attitudes towards conflict itself. Understanding these revolutions is crucial for anyone seeking to comprehend the past, present, and future of warfare. Key Aspects of RMAs:

A. Technological Transformation

At the heart of every RMA lies a core principle: technological transformation[33]. Each RMA is driven by the adoption and integration of advanced tools that fundamentally reshape how wars are fought. These advancements span a vast array of domains, including information technology and communication systems. The rise of robust communication networks and sophisticated data processing capabilities has revolutionized battlefield awareness. Imagine the stark contrast between pre-RMA battles where commanders relied on slow-moving messengers and the modern battlefield, where commanders have access to a constant stream of real-time data from drones and satellites.

RMAs are also marked by advancements in weaponry and intelligence gathering. Precision-guided munitions allow for a more strategic approach to warfare, minimizing collateral damage through surgical strikes. Additionally, advancements in Intelligence, Surveillance, and Reconnaissance (ISR) capabilities, such as radar and satellite imagery, have drastically improved intelligence gathering and battlefield surveillance. This enhanced awareness empowers commanders to make informed decisions with greater precision and reduces the element of surprise for enemy forces. Finally, the increasing role of automation in warfare, particularly in areas like drones and autonomous weapon systems, marks a significant shift in battlefield dynamics. Automation not

[33] Freedman, Lawrence. The Revolution in Strategic Affairs. 2020.

only reduces the risk to human life but also allows for faster reaction times and more sustained operations.

B. Redefining Military Doctrines:

RMAs necessitate a significant re-evaluation of military doctrines[34]. These advancements force military organizations to adapt their strategic approaches, tactical manoeuvres, and even organizational structures to fully leverage the capabilities offered by new technologies. This adaptation, however, can be multifaceted and lead to contrasting doctrines depending on the specific RMA.

For instance, some RMAs might introduce advancements that Favor offensive strategies. Increased speed, precision, and lethality of new weapon systems may incentivize offensive doctrines that capitalize on these advantages. Conversely, other RMAs might usher in technologies that bolster defensive capabilities. Advancements in areas like force protection and counter-offensive capabilities could lead to the development of more robust defensive doctrines. Ultimately, the optimal approach depends on a complex "balancing act" between offense and defence, shaped by the specific capabilities introduced by the RMA and the evolving security landscape.

This adaptation extends beyond doctrines and necessitates changes in how military forces are organized. New technologies often introduce a level of complexity that demands restructuring. The rise of network-centric warfare, for example, may necessitate the creation of specialized units focused on information sharing and coordinated operations. Additionally, the increased complexity of weapon systems may require a shift towards a higher ratio of skilled specialists to operate and maintain these advanced technologies.

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[34] - Metz, Steven. "Revolutionary Challenges for Military Strategists: The Time of Thermidor." Strategic Review for Southern Africa 27, no. 1 (2005): 1-19. Accessed April 25, 2024. https://go.gale.com/ps/i.do?id=GALE%7CA135339912&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=10131108&p=AONE&sw=w&userGroupName=anon%7E375baf4e&aty=open-web-entry

C. Building on the Past:

Revolutions in Military Affairs (RMAs) are not isolated events of change, but rather interconnected threads woven into the fabric of military history. Each RMA builds upon the advancements of its predecessors, creating a cumulative effect. For example, the modern Technological RMA wouldn't be possible without the breakthroughs in communication, transportation, and material sciences pioneered in earlier revolutions. This ongoing cycle of innovation necessitates constant adaptation. Nations that can effectively integrate these advancements into their existing military structures and adapt their tactics will hold a significant advantage – a "cumulative advantage" that offers a competitive edge in the ever-evolving landscape of warfare.

This continuous cycle of innovation is what defines RMAs. The emergence of new technologies constantly compels a re-evaluation of military doctrines and strategies. It's not a singular event, but rather a perpetual process of transformation. As technology advances at an unprecedented pace, military organizations must adapt to incorporate these new capabilities and maintain a competitive edge. This ongoing cycle ensures that RMAs are not isolated moments in history, but rather a continuous process that shapes the future of warfare.

D. The Rise of Precision Warfare:

One of the defining hallmarks of Revolutions in Military Affairs (RMAs) is the increasing emphasis on precision warfare. This shift transcends mere firepower, marking a move towards a more strategic and nuanced approach to armed conflict. Technologies like guided munitions with pinpoint accuracy and advanced targeting systems empower military forces to conduct highly targeted strikes. These surgical strikes minimize collateral damage, significantly reducing civilian casualties and infrastructure destruction. This refined approach allows for a more discriminate application of force, leading to increased effectiveness in achieving military objectives with minimal loss of life and unnecessary destruction[35].

[35] -Razma, G. "A Modern Warfare Paradigm: Reconsideration of Combat Power Concept." Journal of Security and Sustainability Issues 8, no. 3 (2019): 435-452.

The rise of precision warfare is not simply about minimizing civilian casualties, but also about maximizing operational efficiency. Previously, commanders may have relied on carpet bombing or saturation tactics to overwhelm enemy positions, resulting in significant collateral damage. With precision weaponry, commanders can now target specific enemy assets with greater accuracy, reducing the amount of ordnance needed to achieve desired effects. Additionally, the improved accuracy of these weapons translates to a higher probability of mission success, reducing the risk of friendly fire incidents and unnecessary troop exposure. This newfound level of precision empowers military forces to achieve strategic objectives with greater control and efficiency.

E. Networked Warfare:

Network-centric warfare, a concept closely associated with RMAs, revolutionizes the way information flows on the battlefield[36]. This approach involves integrating all military forces into a real-time information sharing network. Through this network, a shared "battlefield picture" emerges, enabling commanders at all levels to access critical information instantaneously. Imagine soldiers on the ground receiving real-time intelligence feeds from drones overhead, complete with enemy troop movements and potential threats. This enhanced situational awareness allows for faster and more informed tactical decision-making, leading to a significant advantage on the modern battlefield.

Networked warfare extends beyond tactical operations, influencing strategic decision-making as well. Real-time data from sensors, satellites, and other sources can be integrated into the network, providing commanders with a comprehensive understanding of the evolving battlefield environment. This allows for a more coordinated and synchronized approach to military operations across different theatres. Additionally, the ability to share information seamlessly fosters greater interoperability between different branches of the military, leading to a more effective fighting force.

[36] - Sickert, Mark, and Naval War College Newport RI. Network-Centric Warfare and the Operational Concepts of War: A Synergistic Effect. Newport RI: US Naval War College, 2000.

F. From Quantity to Agility:

RMAs often trigger a significant transformation in military force structures. The traditional reliance on large, mass armies is gradually giving way to a shift towards smaller, more agile, and technologically advanced forces[37]. These agile forces prioritize rapid deployment capabilities and the ability to conduct precision engagements. This shift reflects the need to adapt to the evolving nature of warfare, which is becoming increasingly fast-paced and geographically dispersed.

The rise of agile forces necessitates a greater emphasis on technological expertise. These leaner units rely on a higher ratio of skilled specialists to operate and maintain complex weapon systems, communication networks, and sophisticated sensor technologies. These specialists are the backbone of modern militaries, enabling effective utilization of advanced weaponry and ensuring optimal performance on the battlefield. Additionally, the focus on agility necessitates a streamlined command structure that allows for faster decision-making and rapid response to changing situations. This shift from mass armies to agile forces signifies a fundamental change in the way nations prepare for and wage war in the modern era.

G. Strategic Implications:

RMAs have a profound impact on the strategic landscape, fundamentally reshaping how nations perceive security challenges and engage in conflicts. The capabilities ushered in by RMAs necessitate a paradigm shift in strategic thinking. Here's how these advancements influence national security strategies:

- **Projecting Power Globally:** The ability to project military power across vast distances becomes a central tenet of strategy in the RMA era. Advanced weaponry, long-range precision strike capabilities, and improved logistical networks empower nations to exert influence and deter aggression on a global scale[38]. This necessitates a re-evaluation of military force posture, potentially requiring a shift towards expeditionary forces capable of rapid deployment and

[37] Krepinevich, A. F. The Military-Technical Revolution: A Preliminary Assessment. Washington, DC: Center for Strategic and Budgetary Assessments, 1992.

[38] - Goure, Daniel. Global Precision Strike. Lexington Institute, 2013.

sustained operations far from a nation's borders. Additionally, robust logistical capabilities become crucial for ensuring the effective supply and support of these deployed forces.

- **Information Advantage:** Effective intelligence gathering, and analysis become paramount in the RMA era. Advancements in ISR (Intelligence, Surveillance, and Reconnaissance) capabilities empower nations to gain a deeper understanding of potential adversaries and emerging threats[39]. This allows for proactive measures to mitigate threats before they escalate into full-blown conflicts. Additionally, the ability to exploit enemy vulnerabilities through effective intelligence gathering plays a crucial role in achieving military objectives with greater efficiency and minimizing friendly force casualties. Networked warfare, a hallmark of RMAs, further enhances information sharing and collaboration between different branches of the military, leading to a more coordinated and synchronized approach to strategic operations.
- **Rapid Response and Decision-Making:** The fast-paced nature of modern warfare, coupled with the increasing lethality of weapons, demands a rapid response capability. Nations that can effectively leverage technological advancements to mobilize forces quickly and respond decisively to emerging threats gain a significant strategic advantage. This necessitates a focus on streamlined decision-making processes, improved communication networks, and readily deployable military units. Additionally, the ability to adapt strategies and tactics in real-time based on evolving battlefield situations becomes crucial for achieving success.

Ultimately, nations that can effectively integrate these RMA-driven capabilities into their strategic doctrines and leverage them to project power, conduct effective intelligence operations, and respond rapidly to threats will hold a significant advantage in the global security landscape.

H. A Perpetual Evolution

RMAs are not isolated historical events, but rather a continuous process of transformation driven by technological innovation. As technology advances at an unprecedented pace, military organizations must continuously adapt to incorporate new capabilities and maintain a competitive

[39] - Best, Richard A. Jr. Intelligence, Surveillance, and Reconnaissance (ISR) Acquisition: Issues for Congress. 2013.

edge. This ongoing cycle of innovation necessitates constant evaluation and adaptation of military doctrines and strategies[40].

The future of warfare is likely to be shaped by further advancements in several key areas:

- **Artificial Intelligence (AI):** The integration of AI into weapon systems and military decision-making processes will be a game-changer. AI-powered systems can analyse vast amounts of data, identify patterns, and make tactical decisions faster than humans, potentially leading to a revolution in warfare. However, the ethical implications and potential for unintended consequences surrounding autonomous weapons systems raise significant concerns[41].
- **Autonomous Weapons Systems:** The development and deployment of autonomous weapons systems, sometimes referred to as "killer robots," raise significant ethical and strategic questions. These weapons can operate independently with minimal human intervention, potentially blurring the lines between human and machine decision-making in warfare. International cooperation and clear regulations will be crucial for ensuring the responsible development and use of such technologies[42].
- **Cyberwarfare:** The digital domain is increasingly becoming a contested battleground. Nations are developing offensive and defensive cyber capabilities to disrupt critical infrastructure, steal sensitive data, and manipulate information flows. As cyberwarfare becomes more sophisticated, the ability to defend against such attacks will be paramount for national security. Additionally, developing strategies to deter and counter cyberattacks will be essential in the RMA era. These emerging technologies will undoubtedly necessitate further RMAs, leading to significant changes in military strategy and tactics. Nations that can harness these advancements effectively and adapt their military structures accordingly will be best positioned to navigate the complexities of future warfare.

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[40] - Hundley, Richard. Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us About Transforming the US Military? 1999.

[41] - Krupiy, Tetyana. "Regulating a Game Changer: Using a Distributed Approach to Develop an Accountability Framework for Lethal Autonomous Weapon Systems." Georgetown Journal of International Law 50 (2018): 45.

[42] - Sharkey, Amanda. "Autonomous Weapons Systems, Killer Robots and Human Dignity." Ethics and Information Technology 21, no. 2 (2019): 75-87.

In conclusion, this examination of RMAs unveils a captivating historical dialectic, mirroring the Hegelian interplay of thesis, antithesis, and synthesis. Technological advancements act as the initial thesis, fundamentally altering the nature of warfare. Military organizations are then forced into a doctrinal antithesis, a countervailing response to leverage these new capabilities. This ongoing cycle of action and reaction culminates in a new strategic synthesis, a transformed military landscape shaped by the intricate dance between technological innovation and doctrinal adaptation.

The impact of RMAs transcends the battlefield, forcing a paradigm shift in military affairs. Force structures are reshaped, transitioning from mass armies to agile, technologically adept units. Nations must re-evaluate their approaches to security, prioritizing areas like intelligence gathering, rapid response, and global power projection. This relentless pursuit of innovation fosters a cumulative advantage race, where past advancements serve as a foundation for future RMAs.

However, the Hegelian framework also highlights a potential antithesis to this cycle: the ethical considerations surrounding autonomous weapons and the spectre of an uncontrollable arms race. This necessitates an international synthesis, a framework for responsible innovation and international cooperation. Herein lies the challenge – harnessing technology's power for security while mitigating the risks of unchecked advancement. understanding the core aspects of RMAs through the lens of the Hegelian dialectic provides a powerful framework for comprehending the perpetual evolution of warfare. Nations that can effectively integrate technological advancements within a framework of responsible innovation and adaptation will be best positioned to navigate the complexities of the future battlefield.

2-3- Strategies and Tactics of Conventional Warfare

The landscape of warfare is a canvas of constant transformation, each epoch marked by distinct military technologies and doctrines that shape how conflicts unfold. The widespread adoption of drones in the 21st century marks a pivotal shift, akin to an "Eleventh Revolution" in military affairs. This revolution not only alters the way wars are fought but also demands a re-evaluation of traditional conflict patterns established within the framework of conventional military technologies. To appreciate the transformative impact of drones and how drones have rewritten the rules of engagement, reshaped strategic calculations, and redefined the very nature of modern conflict, we must first understand the traditional 'playbook' of warfare. Prior to the drone age, warfare adhered to a distinct set of rules shaped by limitations and capabilities. By deconstructing these pre-drone features, we gain a deeper understanding of the battlefield dynamics that drones have disrupted. As delving into these features isn't merely an exercise in historical nostalgia; it equips us to recognize the extent of the revolution ushered in by drone technology.

1. Massed Troops and Conventional Warfare:

In traditional conflicts preceding the widespread use of drones, one prominent feature was the deployment of massed troops engaging in relatively conventional warfare scenarios. These conflicts were characterized by the presence of large standing armies, which became a hallmark of major confrontations. The sheer size and composition of these forces signalled a reliance on conventional military structures, where the emphasis was on the quantity of troops.[43] This massing of troops reflected a paradigm where the effectiveness of a military was often measured by its capacity to field significant numbers of soldiers in battle. The nature of warfare during this period was shaped by the conventional strategies and tactics employed by these sizable armies, setting the stage for a shift with the advent of modern technologies like drones.

[43] Burney, Willard C. Transforming Principles: Modern Irrelevance of the Principle of Mass. Newport, RI: U.S. Naval War College, 2005. Accessed February 24, 2024. https://apps.dtic.mil/sti/pdfs/ADA464554.pdf

2. Fixed Front Lines:

Conflicts were marked by the existence of well-defined and fixed front lines. Military forces engaged in battles along these established lines,[44] creating a concept of a clear and static battlefield. The geographical boundaries of the conflict were visibly demarcated, and opposing forces confronted each other within these fixed parameters. This traditional approach to warfare, with distinct front lines, contributed to a relatively stable and predictable battlefield. The static nature of front lines influenced military strategies and the overall conduct of warfare, laying the groundwork for a shift in dynamics as modern technologies, particularly drones, began to reshape the nature of conflict.

3. Conventional Military Platforms:

Conventional military platforms played a central role in traditional conflict patterns. Armed forces primarily relied on platforms like tanks, artillery, and infantry as the backbone of their military capabilities.[45] Air forces were characterized by manned aircraft, while naval forces operated conventional ships. The emphasis on these traditional military platforms reflected the technological landscape of the time, with ground forces dominating land-based operations and navies relying on conventional vessels for maritime power projection.

4. Face-to-Face Combat:

Face-to-face combat was a defining characteristic of traditional conflict patterns. Battles were marked by direct engagement between soldiers on the ground,[46] with infantry and armoured units playing central roles in ground warfare. The physical proximity of opposing forces often led to intense, close-quarter combat scenarios, shaping the dynamics of conflicts.

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[44] Gravatt, Brent L. "Elements for Conventional War—Land, Sea, Air and Space." Naval War College Review 38, no. 3 (1985): 2–18. Accessed June 13, 2024. http://www.jstor.org/stable/44636590

[45] The United Nations Office for Disarmament Affairs. "Conventional Arms." Accessed June 28, 2024. https://disarmament.unoda.org/conventional-arms/ .

[46] Keegan, John. The Face of Battle: A Study of Agincourt, Waterloo and the Somme. New York: Penguin Books, 1976.

5. Limited Precision in Strikes:

Limited precision in strikes characterized traditional conflict patterns before the widespread use of drones. In earlier forms of warfare, airstrikes were often conducted with less accurate munitions, making it challenging to achieve precise targeting. Military operations relied on less sophisticated technology, leading to broader and less discriminate targeting. The lack of precision in strikes posed challenges in distinguishing between combatants and civilians, and the collateral damage from less accurate munitions was a significant concern.[47].

6. Long-Range Artillery:

long-range artillery emerged as a critical component, exerting a substantial influence on the dynamics of warfare by providing fire support to ground operations.[48] Long-range artillery encompassed various large-calibre weapons, including cannons, capable of launching projectiles over considerable distances. This capability allowed military forces to engage enemy positions from a distance, contributing to strategic and tactical objectives. However, a notable limitation of traditional long-range artillery lay in the imprecision of its strikes. Targeting specific locations or individual targets with accuracy presented challenges due to the inherent constraints in aiming and trajectory prediction. The nature of these artillery strikes often resulted in less precise outcomes, impacting the effectiveness and efficiency of military operations.

7. Fixed Military Installations:

Fixed military installations were prominent features in traditional conflict patterns before the widespread use of drones. Military bases, airbases, naval ports, and command centres were relatively fixed and known locations.[49] The fixed nature of these installations posed both advantages and challenges. On the one hand, the stability of military installations provided a foundation for strategic planning and operational control. On the other hand, targeting these fixed installations during conflicts required extensive planning and reconnaissance efforts. Traditional

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[47] Spector, Ronald H. Death in the Air: Bombing and Civilians in World War II. New York: Viking, 1985.

[48] . Duffy, Christopher. Fire and Stone: The Science of Fortress Warfare 1660-1800. London: Greenhill Books, 1996.

[49] Kaufmann, J. E. Fortress: The Evolution of Defensive Fortifications from the Age of Irregular Warfare to the Early Modern Period. Leiden: Brill, 2009.

warfare involved the identification of key enemy positions, and military strategies often revolved around capturing or neutralizing these fixed locations.

8. Limited Surveillance and Reconnaissance:

Traditional conflict patterns were marked by limited surveillance and reconnaissance capabilities. In these scenarios, military forces faced challenges in obtaining real-time intelligence on enemy movements and positions.[50] The methods for surveillance were not as advanced as contemporary technologies allow. Aerial reconnaissance planes, ground-based observation, and human intelligence were the primary means employed, and these had inherent limitations. Consequently, the ability to gather timely and accurate information about the enemy's activities was restricted. Military commanders had to rely on less detailed and often outdated intelligence, affecting their strategic and tactical decision-making. The lack of real-time surveillance also impacted the effectiveness of targeting specific individuals or high-value targets with precision.

9. Clear Distinction Between Combatants and Civilians:

Although limited precision in strikes characterized traditional conflict patterns before the widespread use of drones. Maintaining a clear distinction between combatants and civilians was a foundational principle, reflecting the ethical norms of warfare. This distinction sought to safeguard non-combatants from the direct impact of armed conflicts and minimize harm to civilian populations.[51] While the conceptual framework emphasized a separation between military and civilian entities, the practical challenges of adhering to this principle were evident. The execution of military operations in traditional conflicts posed difficulties in precisely targeting military forces without unintentionally causing collateral damage to nearby civilian populations. Factors such as the proximity of combat zones to civilian settlements, the fluidity of battlefields, and the limitations in precision targeting technologies contributed to the inherent challenges in upholding the clear distinction between combatants and civilians.

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[50] Clausewitz, Carl von. On War, Book I, Chapter 3, "Of the Danger of War and the Elements of Friction in War." Translated by Michael Howard and Peter Paret. Princeton: Princeton University Press, 1984.

[51] International Committee of the Red Cross (ICRC). "Principle of Distinction." Accessed June 13, 2024. https://casebook.icrc.org/law/principle-distinction .

10.State-Centric Warfare:

State-centric warfare characterized traditional conflict patterns, where the primary actors in armed conflicts were nation-states or alliances of states.[52] The concept of state-centric warfare emphasized the central role of sovereign entities in engaging in organized military operations, reflecting a structure where the state held a monopoly on the legitimate use of force. This state-centric framework often involved conflicts between well-established nation-states, each possessing recognized borders, governance structures, and defined territories.

Non-state actors, such as insurgent groups or militias, played relatively less prominent roles in traditional conflict scenarios. Armed conflicts were typically orchestrated and executed by the military forces of recognized nation-states or coalitions. The emphasis on state-centric warfare reflected the dominance of state actors in shaping the geopolitical landscape and participating in armed confrontations.

2-4- The Origins of Drone Technology

The transformative impact of unmanned aerial vehicles (UAVs), commonly known as drones, on modern warfare is undeniable. Their ability to gather real-time intelligence, conduct remote strikes, and operate with minimal risk to human life has ushered in a new era of combat. However, to fully comprehend the profound changes drones have brought to warfare, a thorough understanding of their historical roots is essential. This subchapter initiates a detailed exploration of drone technology's origins and evolution. By meticulously tracing the key milestones in their development, we will gain a richer appreciation for the technological advancements and shifting purposes that shaped these remarkable flying machines. it will dissect the historical motivations and technological breakthroughs that led to the creation of drones, ultimately illuminating the

[52] Grauer, Ryan. "Conventional Interstate Warfare." In The Handbook of European Defence Policies and Armed Forces, edited by Hugo Meijer and Marco Wyss. Oxford: Oxford Academic, 2018. Accessed February 24, 2024. https://doi.org/10.1093/oso/9780198790501.003.0027

fundamental changes they have wrought on warfare. This exploration of their historical lineage provides a firm foundation for our subsequent analysis. It allows us to critically assess the ways in which drones have reshaped battlefield intelligence gathering, strategic decision-making, and the very definition of engagement in the 21st century.

A. Early Aspirations (Pre-WWI)

While the concept of unmanned aerial vehicles (UAVs) might conjure images of sleek, remote-controlled machines buzzing through modern skies, the seeds of drone technology were sown much earlier. As early as the 18th century, visionary minds like Sir George Cayley were laying the groundwork with their theoretical explorations of flight principles.[53] Unlike his contemporaries who focused on manned flight, Cayley's groundbreaking work, "On Aerial Navigation" (1810), delved into the fundamental physics of flight – the delicate balance between lift, thrust, drag, and weight. This seemingly theoretical treatise laid the crucial foundation for not only future manned aircraft but also the unmanned vehicles that would one day take to the skies.

This early interest in understanding the very forces governing flight wasn't purely academic. Inventors like Cayley recognized the potential applications of unmanned aerial vehicles, even if the technology to realize them wasn't yet available. These early dreamers envisioned a future where unmanned machines could navigate the skies, performing tasks deemed too risky or impractical for manned flight. Their pioneering ideas, though nascent, served as a spark that would ignite a centuries-long journey towards the sophisticated drones we know today.

B. Balloons and Early Attempts

The yearning to utilize unmanned technology for military purposes manifested as early as the American Civil War. The battlefield witnessed the first attempts at aerial reconnaissance with hot air balloons carrying explosive payloads.[54] However, these early efforts were plagued by a

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[53] Cayley, Sir George Bart. "On Aerial Navigation." Nicholson's Journal of Natural Philosophy, November 1809. Available at: https://www.j2mcl-planeurs.net/dbj2mcl/planeurs-biblio/fac-similes/On_aerial_navigation_(Cayley_1809).pdf.

[54] Chan, Hannah. "Civil War Ballooning: The First U.S. War Fought on Land, at Sea, and in the Air." Federal Aviation Administration. Available at: https://www.faa.gov/sites/faa.gov/files/about/history/pioneers/Civil_War_Ballooning_Article.pdf.

fundamental limitation – the whims of the wind. Steering these balloons with any degree of precision proved nearly impossible, rendering their effectiveness as weapons highly unreliable. World War I saw a shift towards rudimentary radio-controlled aircraft. These pioneering attempts, though limited in range and controllability, laid the groundwork for the future development of drones. While the technology remained in its infancy during this time, the concept of unmanned aerial vehicles, capable of navigating and carrying out specific tasks, began to take shape.

World War II ushered in a new era of experimentation. The US introduced the radio-controlled RP-1 vehicle, primarily used for target practice. Meanwhile, in Nazi Germany, advancements in long-range, land-to-land missiles like the V1 and V2 showcased the growing sophistication of guided missile technology.[55] This, in turn, spurred further development of unmanned aerial vehicles capable of carrying such payloads. Visionary inventors like Charles Kettering in the US were already exploring this concept with his "Bug" project, a pioneering attempt at a self-propelled, bomb-carrying drone. While these early efforts faced limitations, they highlighted the increasing potential for unmanned aerial vehicles to revolutionize warfare.

C. The Rise of Surveillance Drones

The aftermath of World War II witnessed a significant shift in the focus of drone technology. No longer solely envisioned for offensive purposes, the emphasis turned towards unmanned aerial vehicles (UAVs) specifically designed for gathering intelligence.[56] The US military, realizing the immense potential of these unmanned eyes in the sky, spearheaded this crucial development. The Vietnam War marked a pivotal milestone [57]– the deployment of the first UAV in the modern sense of the word. This radio-controlled machine, launched to protect soldiers and scout enemy forces, represented a significant leap forward in drone technology. However, as with any new technology,

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[55] Guttman, Jon. Balloon Killing: The Untold Story of German Civilian Sacrifice in World War I. Oxford: Oxford University Press, 2009.

[56] Singer, P.W. Wired for War: The Robotics Revolution and Conflict in the 21st Century. New York: Penguin Books, 2009.

[57] Cohen, Eliot B. The Longest War: The Post-Cold War Era and U.S. Foreign Policy. New York: Oxford University Press, 2015.

these early UAVs were not without their challenges. Software and hardware malfunctions hampered their performance, highlighting the need for continuous improvement.

However, The Vietnam War served as a proving ground for these new surveillance drones. The "Lightning Bug,"[58] a pioneering UAV, became an invaluable asset for the US military. Capable of venturing deep into North Vietnamese territory on risky reconnaissance missions, the Lightning Bug provided critical intelligence that would have been far too dangerous to obtain with manned aircraft. This success story underscored the transformative potential of UAVs on the modern battlefield.

Meanwhile, another key player emerged on the world stage – Israel. The Yom Kippur War of 1973 saw Israel effectively utilize drones for battlefield surveillance, proving their tactical value in real-world combat situations.[59] This early adoption and success with drone technology would position Israel as a leader in the field for decades to come. One pivotal figure in the evolution of surveillance drones was Abraham Karem, an Israeli drone designer who later emigrated to the US. Karem's expertise and vision would play a crucial role in the development of the Predator drone – a revolutionary UAV that would redefine the future of warfare. Recognizing the immense potential of UAVs, both the US and Israel embarked on a relentless pursuit of improvement. Software updates and hardware refinements became a constant focus, with the goal of minimizing malfunctions and maximizing battlefield effectiveness. This dedication ensured that UAVs continued to solidify their position as powerful tools in armed conflict.

The rise of surveillance drones in the post-war period marked a turning point. These unmanned aerial vehicles, once relegated to the fringes of military technology, were now proving their worth as essential tools for intelligence gathering and battlefield awareness. Their growing sophistication and effectiveness would pave the way for the next generation of drones – armed and lethal machines that would fundamentally alter the landscape of modern warfare.

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[58] Ehrhard, Thomas P. "Lightning Bug." In Air Force UAVs: The Secret History, edited by Mitchell Institute for Airpower Studies, July 2010, 8. Accessed February 24, 2024. https://apps.dtic.mil/sti/tr/pdf/ADA526045.pdf.

[59] Liss, Jacob. A Terrible Glory: Yom Kippur 1973, the War That Changed Israel. New York: Grove Press, 2006.

D. The Predator and the Dawn of Armed Drones (1990s-Present)

The arrival of the Predator drone in 1995 wasn't just a technological leap forward; it marked a fundamental shift in the landscape of warfare. This revolutionary UAV,[60] a culmination of decades of research and development spearheaded by the Defence Advanced Research Projects Agency (DARPA) in collaboration with the visionary Israeli drone designer Abraham Karem, possessed capabilities far exceeding anything previously seen. The Predator boasted an extended range, allowing it to stay airborne for extended durations and cover vast swathes of territory. Equipped with sophisticated camera systems, it provided unparalleled high-resolution imagery, offering a level of detail that traditional reconnaissance methods could never achieve. Advanced communication equipment ensured real-time transmission of this critical intelligence back to commanders, facilitating superior situational awareness and informed decision-making on the battlefield.[61]

Initially, the Predator's primary function was intelligence gathering and target designation. It served as the unmanned eyes in the sky, pinpointing enemy locations and movements with unmatched precision. This capability was first demonstrably utilized in 1995, when Predator drones provided crucial intelligence during the Bosnian War.[62] The ability to gather real-time, high-resolution imagery from a safe distance proved invaluable in this complex conflict. However, the potential for a more offensive role soon became evident. Following the events of 9/11, the Predator's capabilities were further enhanced with the integration of Hellfire missiles. This transformed the Predator from a purely observational tool into a lethal weapon capable of delivering targeted airstrikes. The introduction of the MQ-9 Reaper in 2007 marked a significant

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[60] DARPA. "AMBER, Predator, Global Hawk, Predator B." DARPA Timeline. Accessed June 13, 2024. https://www.darpa.mil/about-us/timeline/amber-predator-global-hawk-predator .

[61] Connor, Roger. "The Predator, a Drone That Transformed Military Combat." Air & Space Magazine, Smithsonian Institution National Air and Space Museum, 2018. Available at: https://www.si.edu/object/general-atomics-mq-1l-predator%3Anasm_A20040180000 .

[62] Michel, Arthur Holland. "Drones in Bosnia." Bard Center for the Study of the Drone, 2013. Available at: https://dronecenter.bard.edu/drones-in-bosnia/.

evolution in armed drones.[63] This next-generation UAV possessed even greater endurance, firepower, and operational flexibility compared to its predecessor, the Predator. The Reaper's arrival ushered in the era of the now-ubiquitous "Drone Wars," with targeted strikes being conducted in various regions around the globe.

2-5- Conclusion

Clausewitz famously declared information the "most precious commodity" in warfare. Our exploration of drone history has illuminated this prophecy with remarkable clarity. The narrative began with rudimentary attempts at aerial reconnaissance – a yearning to pierce the fog obscuring enemy movements. The invention of the drone, in this sense, was a natural progression – a technological answer to a timeless battlefield needs. As the technology matured, so too did its capabilities, transforming the drone from a rudimentary observer into an unparalleled intelligence-gathering machine. This period of development perfectly embodied the Clausewitzian principle, with information acquisition reigning supreme.

However, the closing years of the 20th century witnessed a dramatic shift, a crossroads where the future of drone technology hung in the balance. The Predator drone's arrival wasn't just a technological marvel, it was a philosophical pivot. The weaponization of drones marked a new chapter, one fraught with both immense promise and chilling potential. Drones, once the embodiment of Clausewitz's wisdom, were now poised to redefine the very nature of warfare.

This transformation presents a fascinating paradox. On the one hand, drones offer a level of battlefield awareness and intelligence gathering previously unimaginable. Their ability to peer deep behind enemy lines and deliver real-time data streams has revolutionized military operations. Yet, on the other hand, their lethal potential raises profound ethical and legal concerns. The targeted elimination of suspected militants from afar, often with civilian casualties as a tragic byproduct, forces us to confront the human cost of this technological marvel. As we delve into the analytical section of this exploration, these questions will demand our full attention. Through

[63] Forecast International. "The Black Sea Smackdown: Everything You Need to Know about the MQ-9 Reaper UAV." Defence Security Monitor, March 15, 2023. Available at: https://dsm.forecastinternational.com/2023/03/15/the-black-sea-smackdown-everything-you-need-to-know-about-the-mq-9-reaper-uav/.

this multifaceted lens, we will attempt to comprehend how drones are reshaping the very character of war in the 21st century. Is the drone a harbinger of a more precise, targeted future of warfare, or a Pandora's Box unleashing a new era of violence with unforeseen consequences? The answer, undoubtedly, lies somewhere in the complex interplay between technological marvel and human responsibility.

Chapter 3- Drone Classification

The 21st century has witnessed a significant increase in the use of drones in interstate conflicts. This rise is propelled by advancements in drone technology, their cost-effectiveness compared to traditional military aircraft, and their perceived ability to reduce risk to military personnel. As drones become increasingly integrated into military strategies, they are reshaping the dynamics of conflict and challenging established paradigms of warfare.

However, to truly grasp the transformative impact of drones on the character of war, we must first address a fundamental question: can drones be considered conventional or unconventional weapons? Answering this question requires a nuanced understanding of drone classifications, their diverse applications, and a comparative analysis with traditional platforms like fighter jets. This chapter aims to provide this comprehensive understanding by systematically exploring the evolving landscape of drone technology and its implications for modern warfare.

The chapter is structured into two distinct sections. The first section delves into the intricate world of drone classification, examining the various types of drones based on endurance, mission capabilities, and technological features. The second section conducts a comparative analysis of drones and fighter jets, highlighting their respective advantages and disadvantages in modern warfare. By juxtaposing these two platforms, we can assess the transformative potential of drones and their implications in the second Nagorno-Karabakh war, for the future of aerial combat.

Through this rigorous examination of drone technology and its classification, this chapter seeks to provide a comprehensive and nuanced understanding of the evolving role of drones in modern warfare. By elucidating the diverse capabilities and strategic implications of different drone types, we can better grasp the complex challenges and opportunities presented by this rapidly advancing technology, and ultimately determine their place within the spectrum of conventional and unconventional weaponry.

3.1: Classification system

Drones are not merely revolutionizing industries; they are reshaping the way wars are fought and won, conducted and decided, and redefining how we approach challenges from recreation to rescue, These Drones come in a startling array of shapes and sizes, each boasting unique capabilities. While classification methods abound, and they can be classified in various ways, including size, range, payload capacity, power source, motors, and even wing types.[64] focusing on endurance (flight time on a single battery charge) offers a powerful lens through which to understand their transformative impact, particularly on traditional conflict patterns.

Imagine a search and rescue operation in a vast mountain range. Time is of the essence. Here, the extended endurance of a High-Altitude Long-Endurance (HALE) drone becomes invaluable. It can search for survivors for hours on end, a feat impossible for its smaller, shorter-endurance counterparts. This highlights the key to unlocking a drone's potential: endurance. How long a drone can stay airborne dictates its capabilities and defines its role on the battlefield or in the skies above a disaster zone.

Just like choosing the right tool for the job, selecting the appropriate drone depends heavily on how long it needs to stay operational. By focusing on endurance, we gain a deeper understanding of a drone's ability to perform sustained tasks, cover vast distances, and gather critical information. Crucially, endurance is intricately linked to both size and payload capacity. Payload capacity, essentially the weight a drone can carry beyond its own body, battery, and motor, is a critical factor. Larger drones can accommodate bigger batteries for extended flight times, but also have the space for heavier payloads. This allows them to carry advanced equipment like high-resolution cameras, powerful sensors, or even weapons in specific contexts. Conversely, smaller drones with limited endurance are better suited for quick reconnaissance tasks in close proximity, where a

[64] Haque, Ahshanul, Md Naseef-Ur-Rahman Chowdhury, and Mostafa Hassanalian. "A Comprehensive Review of Classification and Application of Machine Learning in Drone Technology." Preprints (June 27, 2023), 2-7.

lighter payload might be sufficient. Knowing the endurance of a drone, therefore, provides valuable insights into its size and the kind of equipment it can carry.

The beauty of the endurance-based classification system lies in its ability to predict a drone's suitability for various applications. Micro drones, with limited endurance, are ideal for quick recon tasks in close proximity. MALE drones, offering longer flight times, can handle broader surveillance and reconnaissance missions. Finally, HALE drones, with their exceptional endurance, excel in persistent monitoring over vast regions. It's important to remember that these factors are interconnected. While size generally allows for more powerful batteries and payload, powerful motors are needed to lift heavier drones, potentially impacting flight time. However, by focusing on endurance, we gain a foundational understanding that allows us to explore these relationships further.

In the following section, I will delve into the specific categories within the endurance-based classification system, explore this interconnected web of endurance, payload, and size, and ultimately demonstrate how this framework sheds light on the diverse usage patterns of drones in today's world. Drones can be classified into five categories based on their endurance.[65] This classification system will not only serve as a framework for understanding the diverse capabilities of drones in this chapter but will also be utilized in subsequent chapters to analyse the specific types of drones employed in the Nagorno-Karabakh and Russia-Ukraine wars,

1. Very Small UAVs/Micro (Up to 30 minutes)

The micro-UAV category represents the miniaturization of aerial technology. Encompassing drones ranging from insect-sized designs to those reaching 30-50 centimetres in length,[66] these versatile platforms prioritize portability and manoeuvrability. Two distinct design approaches emerge within this class: flapping-wing systems mimicking insect flight and conventional fixed-

[65] Chaturvedi, Sudhir Kumar, Raj Sekhar, Saikat Banerjee, and Hutanshu Kama. "Comparative Review Study of Military and Civilian Unmanned Aerial Vehicles (UAVs)." INCAS (2019): 184.

[66] Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 12-13.

wing or rotary-wing configurations.[67] Flapping wings excel in confined spaces, enabling perching and landing on small surfaces. Conversely, fixed-wing and rotary-wing designs offer greater stability and control during flight. Despite their diminutive size, micro-UAVs pack a significant punch. A typical UAV in this category has an altitude ceiling of 330 meters, a wingspan of fewer than 15 centimetres, and a payload capacity of around 1.5 kilograms. Common applications include indoor inspections for industrial purposes, capturing high-resolution close-up photography, and even recreational flight.

Their endurance, typically capped at 30 minutes,[68] prioritizes lightweight construction for portability rather than extended flight times. This focus on compactness also limits their payload capacity, making them unsuitable for carrying heavier sensors or equipment. However, advancements in miniaturization continue to push the boundaries, with examples like the Black Hornet 4 demonstrating remarkable capabilities in military reconnaissance and surveillance.[69] The micro-UAV category, therefore, presents a compelling balance between size and functionality, offering valuable solutions for short-range applications where portability and manoeuvrability are paramount.

2. Small UAVs/Mini (Up to 60 minutes)[70]

The mini-UAV class represents a significant leap in size and capability compared to its micro counterparts. Encompassing drones with at least one dimension exceeding 50 centimetres but not exceeding 2 meters,[71] these platforms offer greater flexibility for a wider range of tasks. The most

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[67] Dean, Sidney E. "Micro-Drones: Miniature Reconnaissance Assets for the Modern Battlefield." European Security & Defence, May 23, 2023. Accessed May 13, 2024. https://euro-sd.com/2023/05/articles/31330/micro-drones-miniature-reconnaissance-assets-for-the-modern-battlefield/ .

[68] https://euro-sd.com/2023/05/articles/31330/micro-drones-miniature-reconnaissance-assets-for-the-modern-battlefield/

[69] Scarato, Danilo. "Black Hornet 4: Il Nuovo Nano-Drone Super Stealth dell'Esercito USA." Quadricottero, October 11, 2023. Accessed May 13, 2024. https://www.quadricottero.com/2023/10/black-hornet-4-il-nuovo-nano-drone.html.

[70] Watts, A.C., J.H. Perry, S.E. Smith, M.A. Burgess, B.E. Wilkinson, Z. Szantoi, P.G. Ifju, and H.F. Percival. "Small Unmanned Aircraft Systems for Low-Altitude Aerial Surveys." Journal of Wildlife Management 7 (2010): 1614–1616.

[71] Carey, B. "Small UAS Rule Will Begin Phased Entry of Unmanned Aircraft." Aviation International News Online, October 4, 2011. Accessed May 13, 2024. http://www.ainonline.com/?q=aviation-news/aviation-international-news/2011-10-04/small-uas-rule-will-begin-phased-entry-unmanned-aircraft.

common design within this category is the fixed-wing model, often hand-launched for ease of deployment. This focus on portability allows for rapid operation in the field.

Mini UAVs boast extended endurance compared to micro-UAVs. This extended flight time allows them to tackle missions beyond the short-range capabilities of their smaller cousins, such as reconnaissance and surveillance over larger areas. Examples include the widely utilized US-made RQ-11 Raven,[72] with a wingspan of 1.4 meters and an endurance exceeding 60 minutes. The mini-UAV class thus offers a compelling balance between portability and functionality, serving as a versatile tool for a broader range of missions requiring extended range and endurance.

3. The Low Altitude Short Endurance (LASE) (Up to 6 hours)

LASE UAV category bridges the gap between highly portable micro and mini drones and larger, more specialized platforms. Offering flight times ranging from 45 minutes to a substantial 6 hours,[73] LASE UAVs prioritize extended endurance for tactical operations. Their size surpasses that of micro drones to accommodate larger batteries, enabling longer missions. They also boast a moderate payload capacity, allowing them to carry essential sensors or small cameras for data collection.

Deployment flexibility is a key advantage of LASE UAVs. They can be either hand-carried for portability in the field or launched using a sling system for situations requiring a more stable launch platform. This adaptability makes them well-suited for a variety of tasks, including search and rescue operations, close-proximity surveillance, and basic military reconnaissance. For instance, sling-launched LASE UAVs can survey areas up to 150 kilometres away,[74] providing valuable real-time data at high altitudes (reaching up to 1500 meters).[75] Their ability to carry a moderate payload of approximately 10 kilograms allows them to integrate basic sensors or small cameras,

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[72] https://www.army-technology.com/projects/rq-11-raven/

[73] Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 22. https://www.army-technology.com/projects/rq-11-raven/.

[74] https://www.e-education.psu.edu/geog892/node/5

[75] Watts, Adam C., Vincent G. Ambrosia, and Everett A. Hinkley. "Unmanned Aircraft Systems in Remote Sensing and Scientific Research: Classification and Considerations of Use." Remote Sensing 4, no. 6 (2012): 1674–1675.

further enhancing their functionality. The LASE UAV category thus offers a balance between portability, endurance, and payload capacity, making them valuable assets for tactical operations requiring extended mission times and on-site data collection. Several LASE UAV models exemplify these capabilities, such as the Puma AE[76] and RQ-11B Raven[77] by AeroVironment, known for their portability and diverse applications in search and rescue and reconnaissance. The Israeli-made Harop[78] (or IAI Harpy 2) exemplifies another breed of LASE UAV, known for its extended loiter times and autonomous targeting capabilities, and played a significant role in the recent Azerbaijan-Armenia war.

4. The Medium Altitude Long Endurance (MALE) (up to 30 hours)

The MALE UAV category applies to UAVs that are too heavy to be carried by one person but are still smaller than a light aircraft. They represent a significant leap in capability compared to smaller counterparts. Their medium size allows for extended flight times, heavier payloads, and operation at higher altitudes. These MALE UAVs typically have a range of 180-200 kilometres with an endurance up to 24 hours.[79] They usually have a wingspan of about 5-10 meters and can carry payloads of 100 to 200 kg, and they can also operate at an altitude of up to 9,000 meters, offering a significant operational advantage. Their payload capacity is around 50 kilograms, allowing them to carry advanced sensors, high-resolution cameras, or even weaponry in specific military applications. This larger size and extended capabilities make MALE UAVs true workhorses within the drone domain.[80]

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[76] https://www.avinc.com/uas/puma-ae

[77] https://www.avinc.com/uas/raven

[78] https://www.iai.co.il/p/harop

[79] Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 22. https://www.army-technology.com/projects/rq-11-raven/ .

[80] Black, George Thomas, et al. "Integration in the National Airspace (Europe and USA)—UAV Classification and Associated Missions, Regulation and Safety, Certification and Air Traffic Management." In Multi-Rotor Platform-based UAV Systems, edited by George Thomas Black et al. Place of Publication: Publisher, 2020, 12-18.

A prime example is the Turkish Bayraktar TB2,[81] which played a pivotal role in recent conflicts like the Azerbaijan-Armenia war and the Russia-Ukraine war. Other notable examples include the Israeli-US Hunter,[82] a mainstay in long-duration observation missions with its impressive wingspan and endurance. The UK Watchkeeper exemplifies another valuable platform for persistent surveillance and border patrol applications, offering high-resolution imagery.[83] Battlefield monitoring is significantly enhanced through real-time data collection from MALE UAVs, providing commanders with a crucial tactical advantage.

The increased payload capacity of these platforms also opens doors for offensive applications in specific contexts, though their use in such roles is often subject to strict regulations and ethical considerations. Earlier iterations within the MALE category include the US Boeing Eagle Eye,[84] the RQ-2 Pioneer,[85] and the BAE Systems Skyeye R4E[86]. The longevity of the RQ-5A Hunter[87] further underscores the enduring utility of MALE UAVs. Overall, the MALE UAV category offers a potent combination of power, endurance, and versatility, making them invaluable assets for extended missions requiring long-range surveillance, data collection, and potential offensive capabilities.

5. High Altitude Long Endurance (HALE) (Greater than 30 hours)

HALE UAVs represent the pinnacle of endurance within the drone domain. These colossal platforms are the undisputed workhorses for long-range missions, capable of soaring at high altitudes for extended durations. This unique combination makes them ideal for a variety of critical tasks, including persistent surveillance over vast areas, high-altitude communication relays, and

[81] https://baykartech.com/en/uav/bayraktar-tb2/

[82] https://irp.fas.org/program/collect/hunter.htm

[83] https://www.thalesgroup.com/en/countries/europe/united-kingdom/markets-we-operate/defence/air-systems-uk/isr-air/watchkeeper

[84] https://irp.fas.org/program/collect/eagle-eye.htm

[85] https://airandspace.si.edu/collection-objects/pioneer-rq-2a-uav/nasm_A20000794000

[86] https://aviationsmilitaires.net/v3/kb/aircraft/show/11064/bae-systems-r4e-50-skyeye

[87] https://www.army-technology.com/projects/hunter/

broad-scope military intelligence gathering. Their impressive size translates into several key advantages. First, HALE UAVs boast enormous flight times, exceeding 30 hours in some models.[88] Second, they can carry immense payloads, allowing for sophisticated sensor packages, powerful cameras, or communication equipment to be integrated for diverse missions. Finally, their ability to operate at high altitudes minimizes vulnerability to ground-based threats while expanding their operational range.

For instance, HALE UAVs can maintain an impressive altitude ceiling of 20,000 meters or more, offering unparalleled observation capabilities. Prime examples include the MQ-9 Reaper Block 5[89] by General Atomics, a dominant force with its 50,000-foot operational ceiling and 27-hour engine endurance. This aerial powerhouse boasts a payload capacity of 1,710 kilograms, accommodating a vast array of sensors and equipment. Overall, HALE UAVs reign supreme in the realm of extended missions. Their combination of endurance, payload capacity, and high-altitude operation makes them invaluable assets for various critical applications demanding long-range surveillance, robust communication, and comprehensive intelligence gathering.

In conclusion, the endurance-based classification system provides a comprehensive framework for understanding the diverse capabilities and applications of drones in modern warfare. By categorizing drones based on their flight time, we gain valuable insights into their size, payload capacity, and suitability for various missions. From the nimble micro-UAVs designed for close-range reconnaissance to the colossal HALE UAVs capable of persistent surveillance over vast areas, each category plays a distinct role in shaping the landscape of contemporary conflicts. As we delve into subsequent chapters, this classification system will prove invaluable in analysing the specific types of drones employed in various case studies, shedding light on how these technological marvels are revolutionizing warfare and redefining the balance of power on the modern battlefield.

[88] Watts, Adam C., Vincent G. Ambrosia, and Everett A. Hinkley. "Unmanned Aircraft Systems in Remote Sensing and Scientific Research: Classification and Considerations of Use." Remote Sensing 4, no. 6 (2012): 1675.

[89] https://www.difesaonline.it/mondo-militare/debutta-il-reaper-block-5

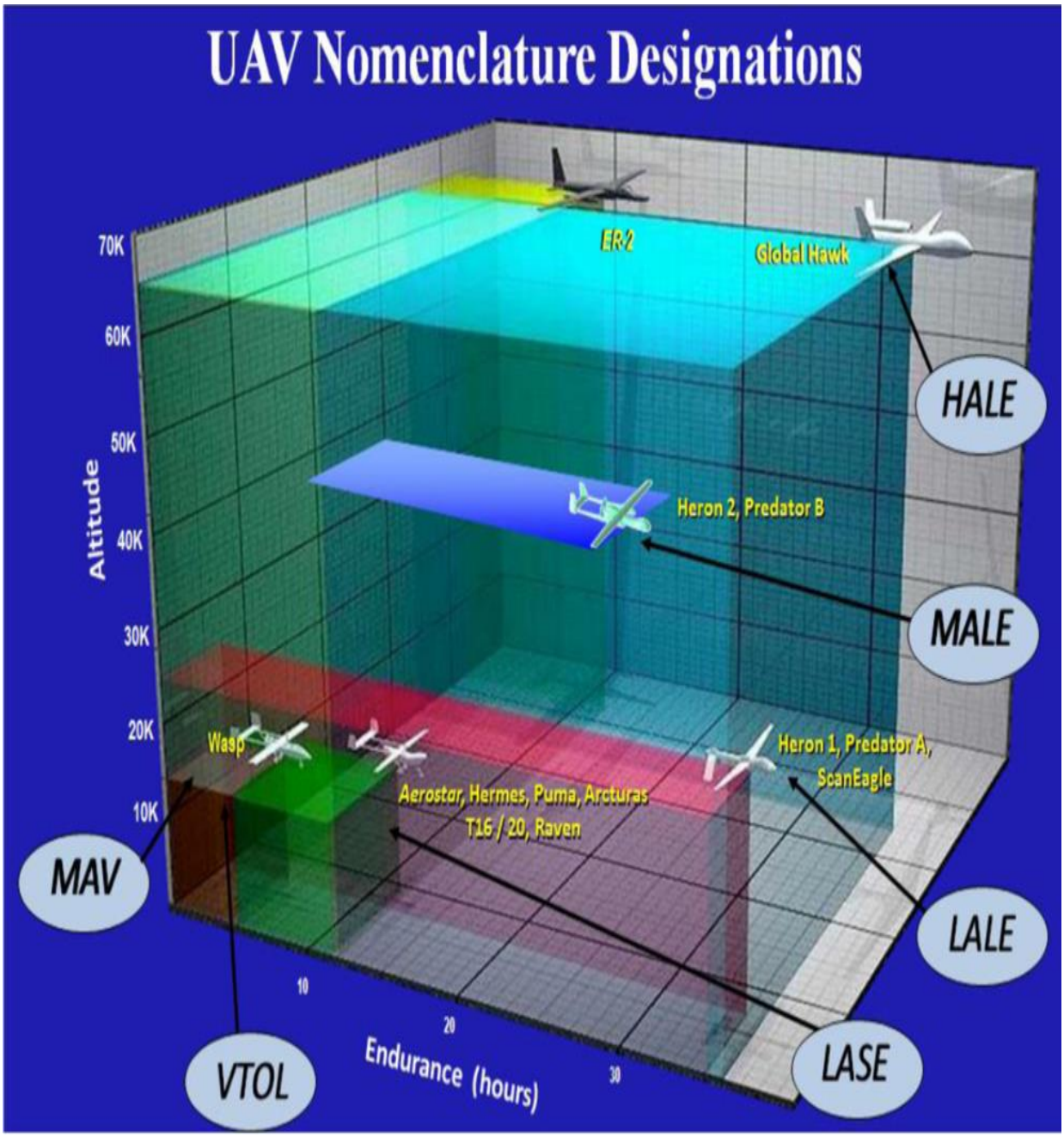

Figure 1. Image courtesy of US Department of Homeland Security

3.2: Drones versus Fighter Jets

The increasing prevalence of drones in modern warfare has sparked debate about their role compared to traditional fighter jets. While some argue that drones merely replicate the capabilities of fighter jets being that the drones are no different from what a regular fighter jet is abele to accomplish, the reality is that drones are being deployed more frequently due to their distinct advantages that they have much more to offer. These advantages are not just incremental improvements but represent a disruptive force that is fundamentally altering military strategies, tactics, and the overall character of war. The absence of an onboard pilot is a defining characteristic of drones, and this distinction underpins many of their advantages:

1. **Reduced Risk to Personnel:** One of the most significant advantages of drones over fighter jets is the elimination of risk to human pilots.[90] These pilotless machines are ideal for missions that are considered too dangerous or politically sensitive for manned aircraft, such as penetrating heavily defended airspace, conducting close air support in urban environments, or engaging in prolonged surveillance missions over hostile territory. In contrast, fighter jet pilots face inherent risks, including enemy fire, mechanical failure, and pilot error, which can lead to casualties and significant political repercussions. The use of drones can thus reduce the political cost of military interventions and allow for a more proactive use of force.

2. **Endurance and Persistence:** Drones possess a distinct advantage over fighter jets in terms of endurance and persistence. Unmanned aerial vehicles, unlike their manned counterparts, are not constrained by the physiological limitations of human pilots and can loiter over a target area for extended periods, providing persistent surveillance and the ability to strike

[90] Kunertova, Dominika. "Drones Have Boots: Learning from Russia's War in Ukraine." Contemporary Security Policy 44, no. 4 (2023): 582.

opportunistically. The MQ-9 Reaper, for instance, can stay airborne for over 24 hours,[91] while fighter jets typically have an endurance of a few hours. This enables drones to conduct continuous monitoring of targets, gather valuable real-time intelligence, and maintain a persistent presence over a given area, which is particularly valuable for missions such as border patrol, counterinsurgency operations, and maritime surveillance.

3. **Operational Reach:** Another advantage, that supports the role of drones in the contemporary warfare, is their ability to fly in high altitudes. Also due to the absence of pilot, who often cannot fly in these conditions. The combination of a high altitude and continuously improving camera lenses, makes drones an important warfare asset.[92] Especially, the fact that no ground-to-air missile can hit them, in the high altitudes, and also, they are not threatened by enemy fighter jets, again since the pilots are not able to reach the same altitude. In contrast to fighter jets, which fly in an altitude that can be easily deadly to them. Furthermore, UAVs are much easier to operate than fighter jets and do not require a skill of a highly trained pilot. However, in order to become a UAV pilot, one still must undergo a regular pilot training.

4. **Versatility and Adaptability:** Drones offer a greater degree of versatility and adaptability compared to fighter jets. They can be equipped with a wide range of payloads, from surveillance cameras and sensors to missiles and bombs, allowing them to be adapted to various mission types.[93] This modularity enables the rapid reconfiguration and customization of drones to meet evolving operational requirements, making them a valuable asset in a rapidly changing battlefield. Fighter jets, while capable of carrying a variety of weapons, are generally less adaptable and require more extensive modifications to switch between different mission profiles

[91] UK Ministry of Defence. Joint Doctrine Note 3/10: Unmanned Aircraft Systems: Terminology, Definitions and Classification. Joint Doctrine Note, UK Ministry of Defence, 2010.

[92] Magnuson, Stew. “The Future of Air Power: New Age of Autonomous Jet Fighters on Horizon.” National Defense 103, no. 778 (2018): 30. https://www.jstor.org/stable/27022315 .

[93] Miller, Jack. "Strategic Significance of Drone Operations for Warfare." E-International Relations, August 19, 2013, 6-7. https://www.e-ir.info/2013/08/19/strategic-significance-of-drone-operations-for-warfare/ .

5. **Cost-Effectiveness:** Drones offer a significant advantage over fighter jets in terms of cost-effectiveness. While the unit cost of a high-end drone like the MQ-9 Reaper[94] is estimated to be around $24 million, a modern fighter jet like the F-35[95] can cost upwards of $135 million. (as of 2012) and the operational costs vary from 40-60 million dollars per year. Yet it has to be clarified that the F-35 belongs to the higher class of fighter jets and is not commonly used. Other more vital example would be the A-10 Thunderbolt II65,[96] with the cost of 18,8 million dollars, this is a perfect alternative to the use of drones – also able to fly in lower altitudes and with manoeuvrability and often used to support the ground troops.

   The expensive part of building a drone is the research and development, due to the necessity of new technology to make the drones as efficient as possible. However, the operational costs of drones, including fuel, maintenance, and personnel, are considerably lower than those of fighter jets, which require highly trained pilots and extensive ground support. This disparity in cost makes drones an attractive option for militaries with limited budgets, allowing them to acquire and deploy a larger number of aerial assets at a fraction of the cost. Moreover, the loss of a drone, while undesirable, does not entail the same financial and human cost as the loss of a fighter jet and its pilot.

6. **Reduced Political and Diplomatic Constraints:** The use of drones can be less politically and diplomatically sensitive than deploying manned aircraft. The absence of pilots reduces the risk of escalation and retaliation, as the loss of a drone is less likely to trigger a major international incident compared to the downing of a manned aircraft and the potential capture or death of a pilot. This can provide greater flexibility for decision-makers in conducting military operations, particularly in contested airspace or against adversaries with robust air defence systems.

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[94] Vogel, Ryan J. “Drone Warfare and the Law of Armed Conflict.” Denver Journal of International Law and Policy 39, no. 1 (2011): 104.

[95] Shalal-Esa, Andrea. "Exclusive: U.S. Sees Lifetime Cost of F-35 Fighter to $1.45 Trillion." Reuters, March 29, 2012.

[96] https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104490/a-10c-thunderbolt-ii/

However, it is crucial to acknowledge that these advantages are not without their corresponding limitations. A balanced assessment of drone technology requires a critical examination of their vulnerabilities and the challenges they pose.

1. **Vulnerability to Countermeasures:** Unlike fighter jets, which possess robust electronic warfare suites and countermeasure systems, drones are relatively more susceptible to electronic warfare, jamming, and cyberattacks.[97] These can disrupt their communication and control systems, rendering them ineffective or even turning them against their operators. The ongoing conflict in Ukraine has highlighted the increasing importance of electronic countermeasures in modern warfare, with both sides actively employing tactics to neutralize enemy drones. The downing of several sophisticated drones, including the US-made MQ-9 Reaper,[98] by relatively inexpensive countermeasures underscores this vulnerability.

2. **Limited Situational Awareness:** In contrast to fighter jet pilots who have direct visual contact with the battlefield and can make split-second decisions based on real-time observations, drone operators rely on sensor data and video feeds transmitted over potentially vulnerable communication links. This reliance on remote piloting can result in delayed reactions, misidentification of targets, and unintended collateral damage, as tragically illustrated by the 2015 US drone strike in Afghanistan that mistakenly targeted a Doctors Without Borders hospital, resulting in the deaths of 42 civilians.[99]

3. **Psychological Impact:** The remote nature of drone warfare can create a psychological distance between operators and the consequences of their actions, potentially leading to desensitization and overuse of force. Unlike fighter jet pilots who directly experience the physical and emotional stresses of combat, drone operators may be more susceptible to the psychological toll of repeatedly engaging in lethal operations from afar. This raises concerns about the long-

[97] https://cove.army.gov.au/article/future-countermeasures-drones#_edn1

[98] https://www.airandspaceforces.com/houthis-shoot-down-third-mq-9/

[99] https://www.msf.org/kunduz-hospital-attack-depth

term well-being of drone operators and the potential erosion of ethical standards in warfare, as highlighted by studies on the psychological effects of drone operation.

4. **Technological Limitations:** Compared to fighter jets, which possess superior speed, agility, and payload capacity, drones are often constrained by technological limitations. They rely solely on the computer that controls them, without the control, they become uncontrollable and simply fall.[100] However, this issue is being dealt with by adding new and improved security measures – such as the back up battery and other software patches that prevent the system to crash. Fighter jets are no exception to a software or hardware failure, but they do have a pilot physically controlling them. Thus, they have a higher chance of being saved by the pilot, thought primarily it depends on the gravity of the failure. drones' susceptibility to adverse weather conditions, a factor that can ground entire fleets, can restrict their operational effectiveness in certain scenarios,[101] unlike fighter jets that are often equipped to handle diverse weather conditions.

Nonetheless, UAVs and similar technologies present a different case. There is an ongoing debate about whether UAVs should be classified as conventional or unconventional weapons. Proponents of the conventional classification argue that drones do not possess greater destructive power than fighter planes or long-range ballistic missiles. Given that missiles with nuclear warheads are prohibited, the destructive power of these aircraft is equivalent to the missiles they carry. On the other hand, advocates for the unconventional classification highlight that this technology is not universally accessible. While many states could potentially afford the development and training, the high costs make it unlikely that more states will incorporate such technologies into their military budgets in the near future.

[100] MAGNUSON, STEW. "THE FUTURE OF AIR POWER: NEW AGE OF AUTONOMOUS JET FIGHTERS ON HORIZON." *National Défense* 103, no. 778 (2018): 31. https://www.jstor.org/stable/27022315

[101] Rajawat, M. "Weather Conditions and Its Effets on UAS." International Research Journal of Modernization in Engineering Technology and Science 3, no. 12 (2021): 258.

In my opinion, the classification of the UAVs. should be context-dependent, considering their specific purpose and the capabilities of both sides in a conflict. A blanket classification of UAVs as either conventional or unconventional weapons is overly simplistic, we cannot simply classify the UAVs as a whole, due to the fact that the missions they are used for differing significantly. Thus, saying that the simple allocation to the conventional weapons would regard only the reconnaissance as it can be defended in front of the tribunal as simply more developed technology that does not affect the battlefield as such. On the other hand, the precise target elimination strategies for example might be regarded as unconventional. Arguing that this technology implies an asymmetric warfare, due to the fact that the opponent cannot use the same technique. Drones often create an asymmetry in warfare, when one side in a conflict has a significant technological advantage in drone technology, they can use drones in ways that their opponent cannot effectively counter. This asymmetry can be exploited through various tactics and capabilities, such as:

- **Standoff Strikes:** Drones enable attacks from a safe distance, minimizing risk to friendly forces while inflicting damage on the enemy.[102] This is particularly effective against high-value targets like command centres, air defence systems, or artillery positions.

- **Persistent Surveillance:** Drones can loiter for extended periods, providing continuous real-time intelligence on enemy movements, positions, and vulnerabilities.[103] This gives the user a significant informational advantage and allows for more effective targeting.

- **Swarm Attacks:** Coordinated attacks using multiple drones can overwhelm enemy defences and create chaos on the battlefield.[104] This tactic can be particularly effective against traditional air defence systems designed to counter individual threats.

- **Psychological Warfare:** The constant threat of drone surveillance and strikes can have a demoralizing effect on enemy forces, creating fear, uncertainty, and hesitancy.

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[102] https://www.airandspaceforces.com/article/stand-in-standoff/

[103] Ham, A., D. Similien, S. Baek, and G. York. "Unmanned Aerial Vehicles (UAVs): Persistent Surveillance for a Military Scenario." 2022 International Conference on Unmanned Aircraft Systems (ICUAS), Dubrovnik, Croatia, 2022, 1411-1413.

[104] Pledger, Thomas. "The Role of Drones in Future Terrorist Attacks." Land Warfare Paper 137. Association of the United States Army, February 2021, 4.

- **Specific Capabilities:**

- **Loitering Munitions:** These "kamikaze drones" can loiter for hours, waiting for a high-value target to appear before launching a suicide attack.[105] This capability is particularly effective against mobile targets like tanks and artillery.

- **Precision-Guided Munitions (PGMs):** Drones equipped with PGMs can deliver highly accurate strikes, minimizing collateral damage and maximizing the impact on specific targets.[106]

- **Electronic Warfare (EW):** Drones can be equipped with EW payloads to jam enemy communications, disrupt radar systems, and deceive air defences. This can create confusion and open windows of opportunity for other attacks.

- **Cyber Warfare:** While not a direct drone capability, drones can be used in conjunction with cyberattacks to gather intelligence, identify vulnerabilities, and even deliver malware or disrupt critical infrastructure.

In essence, tactical advantages are the "why" behind the use of drones, while specific capabilities are the "how." Here's a clearer way to understand the relationship between the two:

- **Tactical Advantage:** Standoff strikes (the "why")
    - **Specific Capability:** Precision-guided munitions (the "how")

Both terms are important for understanding the impact of drones on warfare. While tactical advantages focus on the strategic benefits, specific capabilities provide the technical details that explain how those benefits are achieved. Thus, the asymmetrical drone tactics and capabilities are those that provide a significant advantage to one side in a conflict, often due to

[105] Bode, Ingvild, and Tom Watts. "Loitering Munitions and Unpredictability: Autonomy in Weapon Systems and Challenges to Human Control." Center for War Studies, June 2023, 26.

[106] Esposito, Francesco. "Precision-Guided Munitions of the Future and the Related Challenges to NATO." Joint Air Power Competence Centre, December 2019. https://www.japcc.org/articles/precision-guided-munitions-of-the-future/ .

technological superiority, innovative employment, or the exploitation of vulnerabilities in the adversary's defences. Moreover, this asymmetry can be exploited through hybrid warfare tactics, where drones are integrated with other conventional and unconventional tools or being using in conventional and unconventional way at the same time to achieve a combined effect that is greater than the sum of its parts,[107] as drones have become a central tool in hybrid warfare, allowing actors to leverage their technological advantage in various ways. This includes using drones for[108]:

1. Surveillance and reconnaissance to gain information superiority.
2. Precision strikes against critical targets without risking ground troops.
3. Electronic warfare and cyberattacks to disrupt enemy communications and systems.
4. Propaganda and information operations to shape the narrative of the conflict.

Therefore, we can say asymmetrical warfare isn't a type of conflict but a set of tools and strategies. A stronger or weaker power may choose to use these tools alongside conventional tactics to maximize their effectiveness and exploit specific vulnerabilities or technological advantage. Modern conflicts rarely adhere to strict categories. Hybrid warfare, which blends conventional and unconventional tactics, is becoming the norm. Studying the asymmetric components within a hybrid war like the second Nagorno-Karabakh war, which demonstrates how state actors have leveraged a combination of conventional and unconventional asymmetrical drone tactics to achieve their objectives helps understand the full range of strategies at play.

To conclude, some might still argue that the UAVs are the same as regular fighter jets, as they have the same kind of weapons and pilot receive the same training. However, there are significant differences between using a UAV and a fighter jet. For one, UAV does not endanger the pilot; can be surrounding a specific area for longer periods of time; provide constant surveillance of the targets and as they are able to flight in high altitudes are less likely to be damages.

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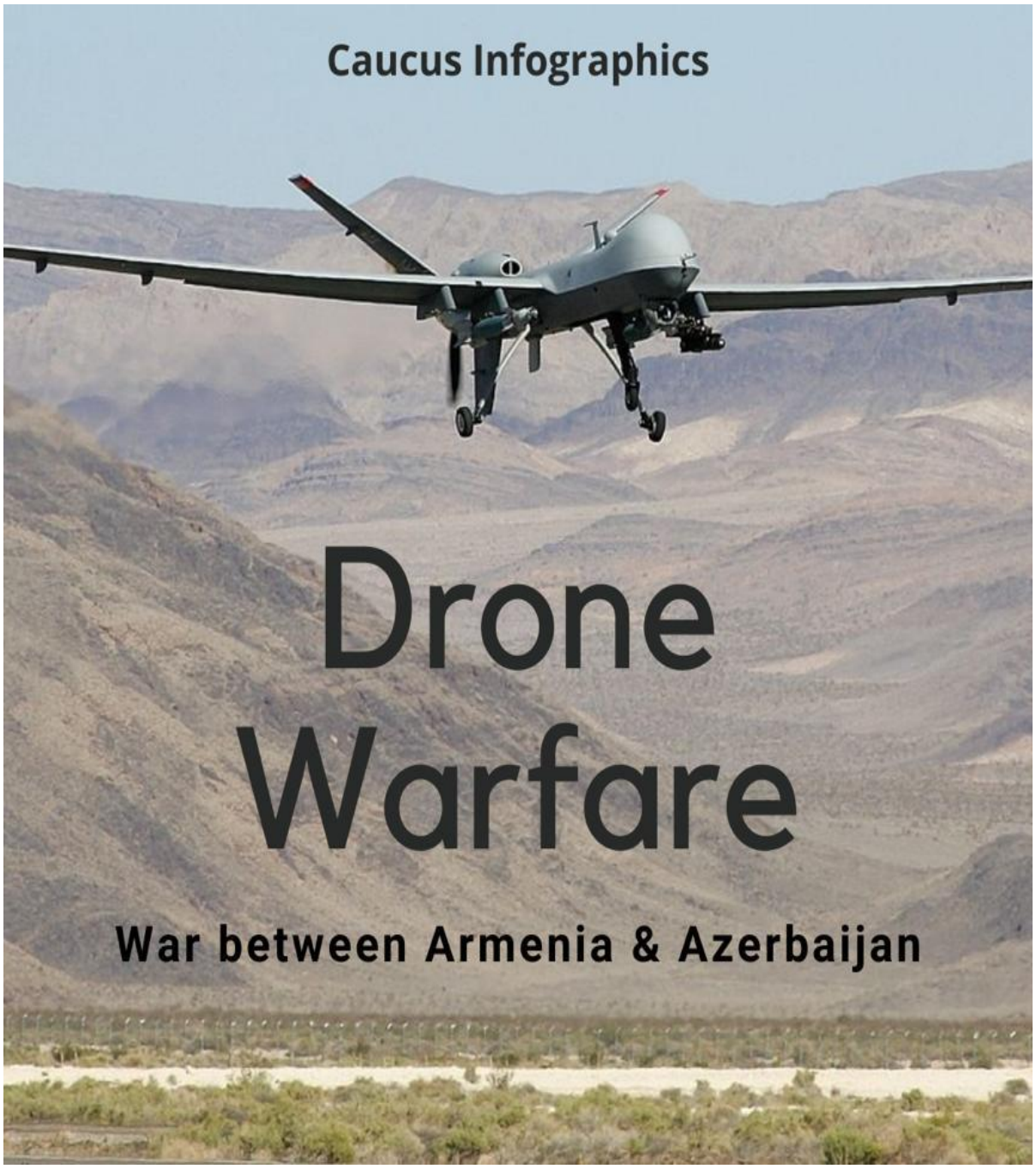
[107] Herța, Laura-Maria. "Hybrid Warfare - A Form of Asymmetric Conflict." International Conference KNOWLEDGE-BASED ORGANIZATION 23, no. 1 (2017): 140.

[108] Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." In "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12.

While the debate over the relative merits of drones versus fighter jets continues, the trajectory of military innovation suggests a clear trend. As Andrew Krepinevich, has identified, we are currently in the midst of what he terms the "eleventh Revolution in Military Affairs" (RMA). Throughout history, each RMA has been characterized by the introduction of disruptive technologies that fundamentally alter the conduct of warfare. In this context, the rise of drones aligns with historical patterns. Logic dictates that newer, more adaptable technologies tend to gain an advantage over older, less flexible systems. In the case of aerial warfare, drones, with their unique capabilities and rapidly evolving technology, appear poised to play an increasingly dominant role, gradually eclipsing the traditional fighter jet in many scenarios

Drones in Action

A Case Study Analysis



Chapter 4- Drones in Action

The Second Nagorno-Karabakh War in 2020 served as a stark demonstration of the transformative power of drone technology in modern conflict, with Azerbaijan's decisive victory widely attributed to its strategic use of drones. While the impact of drones on the outcome is undeniable, the extent of their influence and the specific mechanisms through which they reshaped the conflict remain subjects of debate. Some analyses portray the war as a one-sided affair, with Azerbaijani drones decimating Armenian forces with minimal ground engagement. This chapter delves beyond such simplistic narratives, seeking a more nuanced understanding of how drones functioned within the broader military context and fundamentally altered the way wars are fought and won, aligning with the core focus of this thesis.

By exploring Azerbaijan's diverse drone arsenal, ranging from loitering munitions to long-endurance surveillance platforms, this analysis will uncover how these capabilities were leveraged in conjunction with traditional military assets, electronic warfare, and information operations to create a multi-layered and adaptive approach to conflict that challenged traditional military doctrines. The conflict showcases a pivotal shift towards hybrid warfare, where the integration of conventional and unconventional tactics, facilitated by drones, enabled Azerbaijan to achieve decisive results. This chapter will examine how drones facilitated standoff engagement, minimizing troop risk, while simultaneously enhancing surveillance and targeting capabilities, providing Azerbaijan with real-time intelligence and long precision strike options.

Furthermore, this chapter will investigate the extent to which drones were a necessary condition for Azerbaijan's victory, or whether similar results could have been achieved through traditional means. By critically evaluating the available data and contrasting differing viewpoints, I will strive to offer a more balanced and comprehensive assessment of the role of drones in the Nagorno-Karabakh War. This examination will not only shed light on the specific dynamics of the conflict but also contribute to a broader understanding of the transformative potential of drone technology in shaping the future of military conflict, prompting further questions about their strategic, tactical, and ethical implications.

4-1- Conflict overview

The contested territory of Nagorno-Karabakh has served as a tinderbox of tension in the South Caucasus since the dissolution of the Soviet Union. A simmering territorial dispute between Armenia and Azerbaijan erupted into renewed warfare between September 27 and November 10, 2020, shattering a fragile peace established in 1994. This six-week conflict, fuelled by a complex interplay of historical grievances, ethnic tensions, and evolving military technologies, significantly altered the regional security landscape.

The roots of the Nagorno-Karabakh conflict extend far beyond mere territorial claims. Nationalist aspirations intertwined with religious differences fuelled the initial clashes that erupted in the late Soviet period.[109] Accusations of ethnic cleansing and forced migration further complicated the situation, highlighting the deep-seated animosity between the two sides[110]. Both Armenia and Azerbaijan constructed narratives justifying their claims to the territory, drawing upon historical associations, political realities, and future visions.[111] This divergence in perspectives made forging a mutually agreeable solution extremely challenging.

Despite ongoing mediation efforts by the OSCE Minsk Group, a permanent resolution remained elusive. The 1994 ceasefire brought a temporary halt to hostilities, but the "Four-Day War"[112] of 2016 underscored the precariousness of the situation. The Minsk Group proposed various solutions,[113] including a step-by-step approach or incorporation of Nagorno-Karabakh within Azerbaijan with a high degree of autonomy. However, none of these proposals gained traction.

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[109] De Waal, Thomas. Black Garden: Armenia and Azerbaijan Through Peace and War. New York: NYU Press, 2013.

[110] Gamaghelyan, Phil. "Rethinking the Nagorno-Karabakh Conflict: Identity, Politics, Scholarship." Imagine Center for Conflict Transformation, 2009, 4-6.

[111] Croissant, Michael P. The Armenia-Azerbaijan Conflict: Causes and Implications. Westport, CT: Praeger, 1998.

[112] Jarosiewicz, Aleksandra, and Maciej Falkowski. "The Four-Day War in Nagorno-Karabakh." OSW Ośrodek Studiów Wschodnich, 2016.

https://www.osw.waw.pl/en/publikacje/analyses/2016-04-06/four-day-war-nagorno-karabakh .

[113] Askerov, Ali. "The Nagorno Karabakh Conflict: The Beginning of the Soviet End." Chapter Three. ResearchGate, 2020, 62.

Notably, both sides continued to invest heavily in military hardware, seemingly anticipating a potential future conflict.

In September 2020, Azerbaijan launched a major offensive against Armenian forces in Nagorno-Karabakh. Emboldened by overt Turkish support and wielding a modernized military arsenal, Azerbaijan enjoyed a significant advantage. A critical factor in this disparity was the extensive use of Turkish-supplied drones. These drones, a potent symbol of contemporary warfare, proved devastatingly effective against Armenian defences with their Soviet-era military structure. The agility and precision of the UAVs disrupted Armenian command and control, inflicted heavy casualties, and crippled their ability to mount a sustained defence.[114] The capture of the strategically significant city of Shusha dealt a critical blow to Armenia,[115] ultimately forcing them to concede defeat and accept a Russian-brokered ceasefire agreement in November 2020. The November 2020 ceasefire agreement marked a turning point in the conflict.[116] Armenia, forced to withdraw from occupied territories surrounding Nagorno-Karabakh, conceded a significant territorial shift. Azerbaijan, on the other hand, reclaimed swathes of land lost in the earlier conflict. This decisive victory not only reshaped the territorial map but also heralded a new power dynamic in the region.

Several factors help explain Azerbaijan's military victory, but two stand out as 'magic bullets': the substantial role of UAVs supplied by Turkey and Israel, and Turkish senior military personnel's advisory role in Azerbaijan's operational plans and command.[117] The first war was between two armies built on a Soviet military legacy, but the second occurred between an army still reliant on outdated equipment and a modern army with Western standards, heavily reliant on drone

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[114] Postma, Joël. “Drones over Nagorno-Karabakh: Revolutionary Warfare.” Small Wars Journal (2020).

[115] Spencer, John, and Harshana Ghoorhoo. "The Battle of Shusha City and the Missed Lessons of the 2020 Nagorno-Karabakh War." Modern War Institute at West Point, 14 July 2021, Available at : mwi.westpoint.edu/the-battle-of-shusha-city-and-the-missed-lessons-of-the-2020-nagorno-karabakh-war/

[116] Margvelashvili, Zaal. "Ceasefire Agreement of the Nagorno-Karabakh Conflict." Levan Mikeladze Diplomatic Training and Research Institute, 14 Nov. 2020. Available at : https://di.gov.ge/wp-content/uploads/2021/02/14-november-2020-zaal-margvelashvili-ceasefire-agreement-of-the-nagorno-karabakh-conflict.pdf

[117] David Hambling, “The ‘Magic Bullet’ Drones behind Azerbaijan’s Victory over Armenia,” Forbes, November, 2020. Available at , https://www.forbes.com/sites/davidhambling/2020/11/10/the-magic-bullet-drones-behind--azerbaijans-victory-over-armenia/

technology. The second war was demonstrably different due to Turkey's more direct support, including these advanced UAVs, and the sheer scale of the fighting.

4-1-1- Technological drone Asymmetry

While both Armenia and Azerbaijan deployed drones, the conflict highlighted a stark disparity in their arsenals and tactical approaches, ultimately resulting in a decisive victory for Azerbaijan. This disparity was not merely a matter of numbers, but a reflection of Azerbaijan's strategic investment in a diverse and technologically advanced drone fleet, effectively leveraged to exploit vulnerabilities in Armenia's traditional military doctrine. This section will examine the drone capabilities of both sides, revealing how Azerbaijan's strategic use of diverse drone types and innovative tactics proved decisive in the conflict.

According to the Stockholm International Peace Research Institute, Azerbaijan entered the conflict with a clear qualitative advantage in drone technology, ranging from loitering munitions and reconnaissance drones to armed combat drones, showcasing a deliberate strategy to harness the full spectrum of drone capabilities.[118]

- **The Low Altitude Short Endurance (LASE):** Loitering munitions like the Israeli-made Harop (or IAI Harpy 2[119]) and the Orbiter 1K[120] were at the forefront of Azerbaijan's asymmetric strategy. These "kamikaze drones," with their ability to loiter for hours before autonomously striking radar emitters, proved instrumental in suppressing and destroying Armenian air defence systems.[121] The Harop, which is a loitering munition with a 16-kilogram mass of explosive warhead and an endurance of approximately 6 hours, specifically developed

[118] Shaan Shaikh and Wes Rumbaugh, "What missiles, drones, and rockets do Armenia and Azerbaijan have?," *The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense*, *Center for Strategic and International Studies (CSIS)*, December 8, 2020

[119] https://dimse.info/harpy-harop/

[120] https://aeronautics-sys.com/systems/orbiter-1k/

[121] Ancona Francesco, "AI in warfare: Loitering Munitions – Current Applications and Legal Challenges"' a. The Nagorno-Karabakh Conflict, Mondo Internazionale , 2024. Available at : https://mondointernazionale.org/en/focus-allegati/ai-in-warfare-loitering-munitions-current-applications-and-legal-challenges

for the Suppression/Destruction of Enemy Air Defences (SEAD/DEAD[122]) mission set.[123] It is an anti-radiation weapon that autonomously homes in on radar emitters. It also has a man in-the-loop mode which allows it to be manually targeted through an electro-optical sensor. in particular, became notorious for its devastating strikes against S-300 batteries, effectively neutralizing a key component of Armenia's defence apparatus.

- **The Medium Altitude Long Endurance (MALE):** The Turkish-made Bayraktar TB2[124], was perhaps the most surprising new asset on the battlefield, a medium-altitude, long-endurance (MALE) drone, emerged as the star of the conflict.[125] capable of carrying two anti-tank guided missiles and Roketsan MAM-L [126] or laser-guided MAM-C [127] sliding munitions, [128] it relentlessly targeted Armenian tanks, armoured vehicles, artillery, and other military assets, earning a reputation as a "tank killer" and showcasing the vulnerability of traditional ground forces to drone strikes. The TB2's success in the Nagorno-Karabakh conflict can be partly attributed to its prior combat experience in Libya and Syria, where it had proven its effectiveness against a range of Russian-made systems such as T-72 tanks,[129] BMP-1 IFVs[130],

[122] Northrop Grumman. "The Need for SEAD & DEAD." Accessed June 12, 2024. https://www.northropgrumman.com/what-we-do/advanced-weapons/the-need-for-sead-dead

[123] https://www.iai.co.il/p/harpy

[124] https://baykartech.com/en/uav/bayraktar-tb2/

[125] Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." Insight Turkey, vol. 23, no. 4, 2021, pp. 181

[126] https://www.roketsan.com.tr/en/products/mam-l-smart-micro-munition

[127] https://www.roketsan.com.tr/en/products/mam-c-smart-micro-munition

[128] Nikolov, Boyko. "Bayraktar TB2 MALE Unmanned Combat Aerial Vehicle (UCAV)." BULGARIANMILITARY, , 2022.

[129] https://tank-afv.com/coldwar/ussr/T-72.php

[130] https://tank-afv.com/coldwar/ussr/BMP-1.php

ZSU-23[131] and Pantsir-S1 [132]short-range air defence systems.[133] Purchase by Azerbaijan only in the summer of 2020.

- **High Altitude Long Endurance (HALE):** While the Harop and TB2 garnered much attention, Azerbaijan also leveraged HALE drones like the Israeli-made Hermes 900[134] and Heron[135] for persistent surveillance and reconnaissance. These platforms, capable of staying airborne up to 30 hours, provided a continuous stream of real-time intelligence on Armenian troop movements, artillery positions, and supply lines. This constant surveillance allowed Azerbaijani forces to maintain superior situational awareness, anticipate enemy actions, and strike with pinpoint accuracy, further amplifying their asymmetric advantage.

Azerbaijan also reportedly utilized smaller tactical drones like the Orbiter 3[136] and SkyStriker[137] for short-range reconnaissance and target acquisition, adding another layer to their comprehensive drone strategy.

- **Armenia's Limited Response**

In stark contrast to Azerbaijan's diverse and sophisticated drone fleet, Armenia primarily relied on indigenously developed systems like the Krunk and X-55 light reconnaissance drones, as well as the HRESH loitering munition.[138] These systems, while capable in their own right, lacked the

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[131] https://tank-afv.com/coldwar/ussr/ZSU-23-4-Shilka.php

[132] https://missilethreat.csis.org/defsys/pantsir-s-1/

[133] Postma, Joël. "Drones over Nagorno-Karabakh: A Glimpse at the Future of War?" *Atlantisch Perspectief* 45, no. 2 (2021): 16. https://www.jstor.org/stable/48638213.

[134] Egozi, Arie. "Why the Hermes 900 Is One of Elbit Systems' Most Popular MALE UAVs." Defence Procurement International Magazine, March 9, 2023. https://www.defenceprocurementinternational.com/feature.

[135] https://www.iai.co.il/p/heron

[136] https://aeronautics-sys.com/systems/orbiter-3/

[137] https://elbitsystems.com/media/SkyStriker.pdf

[138] Shaan Shaikh and Wes Rumbaugh, "What missiles, drones, and rockets do Armenia and Azerbaijan have?," *The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense*, *Center for Strategic and International Studies (CSIS)*, December 8, 2020

range, endurance, and firepower of their Azerbaijani counterparts. This technological disadvantage severely limited Armenia's ability to counter Azerbaijan's drone dominance, leaving them vulnerable to persistent surveillance, precision strikes, and the demoralizing psychological effects of a seemingly unstoppable aerial threat.

4-1-2- Azerbaijan's Conventional Disadvantages

Despite their technological advantage in drone warfare, Azerbaijan faced certain disadvantages in terms of conventional military capabilities. While Azerbaijan possessed a broader conventional military advantage in terms of overall numbers and modernized equipment,[139] it faced significant tactical and operational challenges in the Nagorno-Karabakh territory. Armenian forces had spent years fortifying their positions, constructing extensive defensive networks, and establishing well-prepared lines of defence throughout the region. Furthermore, Armenia's military had decades of experience in Nagorno-Karabakh, including combat experience from the first war, giving them a tactical advantage and a deep understanding of the local terrain that Azerbaijani forces lacked.[140] The mountainous terrain of Nagorno-Karabakh, with its remote mountains, forests, and valleys, posed a significant obstacle to traditional, ground-based military operations, making it difficult to manoeuvre heavy Armor and artillery effectively.[141] Additionally, Azerbaijan's air force, while undergoing modernization, was limited in size and capability compared to its ground forces, with only 127 aircraft in total at the onset of the conflict.[142]

These combined challenges—entrenched Armenian defences, difficult terrain, and a limited air force—represented specific vulnerabilities that Azerbaijan sought to overcome through the

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[139] Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War, Two Weeks In: The Military Balance." War on the Rocks, October 14, 2020. Accessed June 10, 2024 https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in/

[140] Anglim, Simon. "Azerbaijan's Victory: Initial Thoughts and Observations: Fighting the War – Was it the 'Drones'?" Military Strategy Magazine, Volume 7, Issue 3, Summer 2021, pages 13. https://www.militarystrategymagazine.com/article/azerbaijans-victory-initial-thoughts-and-observations-and-caveats-for-the-innovative/

[141] Erickson, Edward J. "The 44-Day War in Nagorno-Karabakh: Turkish Drone Success or Operational Art?" Army University Press, pp 7.

[142] Al Jazeera. "Infographic: Military Arsenals of Armenia and Azerbaijan." October 1, 2020. Accessed June 12, 2024. https://www.aljazeera.com/news/2020/10/1/infographic-military-arsenals-of-armenia-and-azerbaijan

asymmetrical use of drone technology. While Azerbaijan may have held an overall conventional advantage,[143] Asymmetrical Warfare is Relative: Asymmetrical warfare is not about absolute power, but rather about a relative imbalance in specific capabilities or domains of warfare.[144] A stronger military power might have a significant advantage in terms of tanks and aircraft, but if their opponent is inferior in drone technology or cyberwarfare, the stronger side can still employ asymmetrical drone tactics to exploit those specific vulnerabilities and at the same time exploiting their technological advantage,

While Azerbaijan was traditionally considered the weaker side in terms of holding territory in Nagorno-Karabakh, they were not necessarily weaker overall. They had a stronger economy, larger military, and access to advanced weaponry, including drones.[145] Azerbaijan specifically leveraged its technological advantage in drone warfare and cyber capabilities to overcome Armenia's entrenched positions and military assets. This was a deliberate strategy to exploit a specific strength, not just a general exploitation of weaknesses.

In this case, Azerbaijan leveraged its superior drone capabilities, including swarm attacks, loitering munitions, and electronic and informational warfare, to gain a decisive asymmetrical advantage over Armenia. By doing so, Azerbaijan's drones not only compensated for their conventional disadvantages but also created a psychological advantage through persistent surveillance and the threat of precise strikes. A stronger force might choose to employ asymmetrical tactics if they believe it will give them a decisive advantage in a particular area, even if they have superior conventional forces.[146]

The following tables provide a detailed breakdown of the military capabilities of both Armenia and Azerbaijan at the onset of the Second Nagorno-Karabakh War. Table 1 outlines Armenia's

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[143] Global Firepower. "Comparison of Armenia and Azerbaijan Military Strengths." 2024. Accessed June 12, 2024. https://www.globalfirepower.com/countries-comparison-detail.php?form=form&country1=armenia&country2=azerbaijan&Submit=COMPARE

[144] Makowski, Tadeusz. "The Nagorno-Karabakh Conflict as a Specific Example of Asymmetric Conflict: 2. Definition of the Asymmetric Conflict." Journal of Science of the Military Academy of Land Forces 49, no. 3 (185) (2017): pp 20. Accessed June 12, 2024. https://zeszyty-naukowe.awl.edu.pl/article/01.3001.0010.5119/en

[145] Makowski, "The Nagorno-Karabakh Conflict," pp 24.

[146] Deriglazova L., Minasyan S., Nagorno-Karabakh: the Paradoxes of Strangth and Weakness in an Asymmetric Conflict, [in:] “Caucasus Institute Research Papers”, no. 3, 2011

arsenal, highlighting its reliance on older equipment and a relative lack of advanced drone technology. Table 2, in contrast, illustrates Azerbaijan's significant military investments, particularly in its diverse and technologically advanced drone fleet, as well as its superior numbers in conventional weaponry such as missiles and rocket artillery.[147] This comparative analysis not only underscores the stark asymmetry in capabilities between the two sides but also serves as empirical evidence for the arguments presented in Part B (regarding the drone asymmetry) and Part C (regarding Azerbaijan's broader conventional advantage).

[147] Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh.

Table 1: Azerbaijan's Missiles, Drones, and Rocket Artillery

Weapon	Notes
LORA	• Ballistic missile purchased from Israel in 2017-2018. • 280-km range. • Accuracy of 10 meters circular error probability (CEP). • Estimated inventory of 4 launchers and 50 missiles.
9K79 Tochka-U (NATO: SS-21 Scarab)	• Ballistic missile inherited from the Soviet Union. • 120-km range. • Estimated inventory of 3-4 launchers.
EXTRA	• Guided-missile purchased from Israel in 2005-2009. • 150-km range with a 120-kilogram (kg) payload. • Paired with Azerbaijan's Lynx multiple rocket launcher system. • Estimated inventory of 6 launchers and 50 missiles.
Bayraktar TB2	• UAV purchased from Turkey as early as June 2020. • Commonly equipped with light munitions and can fly for 24 hours.
Harop	• Loitering munition purchased from Israel in 2014-2016. • Designed to destroy enemy radar in suppression of enemy air defenses (SEAD) missions. Also known as the Harpy 2, it can fly for up to 6 hours. • Estimated inventory of 50.
Orbiter 1K	• Loitering munition purchased from Israel in 2016-2019. • Estimated inventory of 80.
Orbiter-3	• Loitering munition purchased from Israeli in 2016-2017. • Estimated inventory of 10.
SkyStriker	• Loitering munition purchased from Israel in 2016-2019. • Two-hour flight endurance, 20-km range, equipped with a 5- or 10-kg warhead. • Estimated inventory of 100.
Hermes-900	• Medium-altitude, long-endurance (MALE) UAV purchased from Israel in 2017-2018. • Designed for intelligence, surveillance, and reconnaissance (ISR) missions. It can fly for up to 36 hours. • Estimated inventory of 2.
Hermes-450	• MALE UAV purchased from Israel in 2008-2013. • Estimated inventory of 10.
Heron	• MALE UAV purchased from Israel in 2011-2013. • Estimated inventory of 5.
Aerostar	• Surveillance UAV purchased from Israel in 2007-2012. • Estimated inventory of 14.
Searcher	• UAV purchased from Israel in 2011-2013. • Estimated inventory of 5.
Antonov An-2	• Soviet-era single-engine biplanes. • Repurposed as UAVs by equipping remote-control systems.
BM-30 Smerch	• 300mm MLRS purchased from Ukraine in 2003-2005 and Russia in 2011-2014. • 90-km range. • Estimated inventory of 30-40 launchers.
T-300 Kasirga/TRG-300 Tiger	• 300mm MLRS purchased from Turkey in 2015-2016. • 120-km range. • Estimated inventory of 20 launchers.
Belarusian Polonez	• 300mm MLRS purchased from Belarus in 2017-2019. • 200-km range. • Estimated inventory of 10 launchers.
TOS-1A	• 220mm MLRS purchased from Russia in 2011-2017. • 6-km range. • Estimated inventory of 36 launchers.
T-300	• 300mm MLRS purchased from Turkey in 2015-2016. • It can also equip TRG-300 guided rockets. • Estimated inventory of 20 launchers.
T-122	• 122mm MLRS purchased from Turkey in 2010-2014. • It can also equip TRG-300 guided rockets. • Estimated inventory of 40 launchers.
T-107	• 107mm MLRS purchased from Turkey in 2010-2013. • 11-km range. • Estimated inventory of 30 launchers.
RM-70	• 12mm MLRS purchased from the Czech Republic in 2016-2018. • Estimated inventory of 30 launchers.

Sources: Stockholm International Peace Research Institute, Ministry of Defence of Azerbaijan

Table 2: Armenia's Missiles, Drones, and Rocket Artillery

Weapon	Notes
9K79 Tochka-U (NATO: SS-21 Scarab)	• Ballistic missile inherited from the Soviet Union. • 120-kilometer (km) range. • Estimated inventory of 4 launchers.
Iskander-E (NATO: SS-26 Stone)	• Ballistic missile purchased from Russia in 2016. • Export variant of Russia's Iskander-M missile. • 280-300-km range. • Estimated inventory of around 8 launchers and 25 missiles.
SS-1C Scud B	• Ballistic missile inherited from the Soviet Union. • 300-km range. • Estimated inventory of around 8 launchers and 24 missiles.
X-55/Kh-55	• Indigenously produced reconnaissance UAV introduced in 2014.
HRESH	• Indigenously produced loitering munition introduced in 2018.
Krunk	• Indigenously produced reconnaissance UAV introduced in 2011.
Orlan-10	• Russian-made reconnaissance UAV. There is no record of Armenian acquisition, but reports suggest its use toward the end of the conflict.
BM-30 Smerch	• 300 millimeter (mm) MLRS purchased from Russia in 2015-2017. • 90-km range. • Estimated inventory of 6 launchers.
Norinco WM-80	• 273mm MLRS purchased from China in 1999. • 120 km range. • Estimated inventory of 4-8 launchers.
TOS-1A	• 220mm MLRS purchased from Russia in 2016. • 6-10 km range.
BM-21 Grad	• 122mm MLRS purchased from Russia in 1995-1996. • 20-km range.

Sources: Stockholm International Peace Research Institute, Ministry of Defence of Armenia.

4-1-3- The Hybrid Warfare Tactics of Azerbaijan

Azerbaijan's victory in the 2020 Nagorno-Karabakh War was not solely a testament to its technological superiority in drone warfare; it suggests a potential masterclass in hybrid warfare. This approach, characterized by the seamless integration of conventional and unconventional tactics, allowed Azerbaijan to maximize its strengths while potentially exploiting Armenian vulnerabilities across multiple domains.[148] The following analysis will examine the extent to which Azerbaijan's drone usage aligns with the characteristics of hybrid warfare, providing insights into the evolving nature of modern conflict.

One notable aspect of Azerbaijan's approach was the integration of drone strikes with traditional military manoeuvres. The war began with a series of drone attacks, targeting Armenian air defence systems, command centres, and artillery positions. These initial strikes, often carried out by loitering munitions like the Israeli-made IAI Harop, aimed to cripple Armenia's ability to respond effectively and create chaos in their ranks.[149] This approach, known as Suppression of Enemy Air Defences (SEAD) and Destruction of Enemy Air Defences (DEAD), combined with the innovative use of loitering munitions, can be seen as an unconventional tactic. Here's why:

1. **Innovation in Technology Application**: The use of loitering munitions represents a significant innovation in military tactics. Unlike traditional drones that return after their mission, loitering munitions hover over an area and strike targets of opportunity,[150] providing

[148] Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 9

[149] Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War, Two Weeks In: The Fighting Thus Far." War on the Rocks, October 14, 2020. Accessed June 10, 2024. https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in

[150] Melville, Aja, and Tom Freebairn. "The Evolving Landscape of Loitering Munitions." Forecast International, February 28, 2024. Accessed may 2024, https://dsm.forecastinternational.com/2024/02/28/the-evolving-landscape-of-loitering-munitions/

a flexible and responsive approach to targeting, which differs from conventional fixed-wing aircraft or traditional artillery.

2. **Surprise and Psychological Impact**: The unpredictability of loitering munitions disrupted Armenian plans and induced a psychological effect, as troops became more fearful and uncertain about when and where the next strike would occur. This unpredictability can create chaos and weaken the enemy's resolve.[151]

3. **Integration with Conventional Tactics**: Using drones for SEAD and DEAD missions reduces the risk to human pilots and allows for prolonged operations over enemy territory. This integration exemplifies an unconventional tactic that leverages modern technology to enhance traditional military strategies.[152]

4. **Asymmetric Advantages**: Drones are relatively inexpensive compared to manned aircraft, allowing for mass deployment that can overwhelm enemy defences. This cost-effectiveness is a hallmark of unconventional tactics, aiming to achieve significant results with minimal resources.[153]

Considering Azerbaijan's use of electronic warfare alongside drone operations could further elucidate their hybrid warfare strategy.[154] Electronic warfare encompasses various tactics aimed at disrupting or deceiving enemy communications, radar systems, and other electronic equipment. Incorporating electronic warfare elements into their operations could have further enhanced Azerbaijan's ability to gain a tactical advantage over Armenian forces.

Additionally, Azerbaijan's innovative use of drone technology extended beyond direct military applications. They reportedly employed converted Antonov-2 biplanes as decoys to trigger

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[151] Bode, Ingvild, and Tom Watts. "Loitering Munitions and Unpredictability: Autonomy in Weapon Systems and Challenges to Human Control." Published May 2023. Page 52. Available at: https://doi.org/10.5281/zenodo.7860762

[152] Horton, James C., Colonel, USAF. "Unmanned Combat Aerial Vehicles: SEAD and EW for the Future." Center for Strategy and Technology, Air War College, Air University, November 2005, p. 137

[153] Arreguin-Toft I., How the Weak Win Wars. A Theory of Asymmetric Conflict, “International Security” 2001, vol. 26, no 1

[154] Sprengel, *Drones in Hybrid Warfare*, p. 23

Armenian air defences,[155] demonstrating a creative and unconventional approach to warfare. This tactic not only diverted resources away from more critical targets but also highlighted Azerbaijan's willingness to utilize asymmetrical methods to gain an advantage.

Furthermore, Azerbaijan effectively utilized drones as a potential psychological weapon. By disseminating footage of successful drone strikes through social media and state-controlled media, they created a pervasive sense of fear and demoralization among Armenian troops and civilians alike.[156] This information warfare campaign, a hallmark of hybrid warfare, weakened the enemy's resolve and bolstered domestic support for Azerbaijan's military operations.

The culmination of this approach was the capture of Shusha, a strategically critical city in Nagorno-Karabakh. While the final assault involved traditional infantry operations, it was made possible by the preceding weeks of drone attacks that had systematically weakened Armenian defences and demoralized their troops.[157] The fall of Shusha, a turning point in the conflict, suggests the effectiveness of Azerbaijan's military strategy, where drones played a pivotal role as force multipliers, intelligence gatherers, and psychological weapons.

4-2- How Drones Redefined Warfare in Nagorno-Karabakh?

To answer this question, this section will analyse how Azerbaijan's strategic use of drone technology, facilitated by its ability to reduce troop risk and enhance surveillance and targeting capabilities, contributed to a significant shift towards hybrid warfare and transformed the character of the war. Building upon the exploration of Azerbaijan's drone arsenal, its integration into a broader hybrid warfare strategy, and the responses of Armenian forces, this analysis will now delve deeper into the heart of how these interconnected mechanisms transformed the character of the war. As the final dimension of the analytical framework, this section will meticulously examine

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[155] Fogel, Benjamin, and Andro Mathewson. "The Next Frontier in Drone Warfare? A Soviet-Era Crop Duster." Bulletin of the Atomic Scientists, February 10, 2021. Accessed June 10, 2024. https://thebulletin.org/2021/02/the-next-frontier-in-drone-warfare-a-soviet-era-crop-duster/.

[156] Postulart, Julian. "Death from Above: On the Propaganda Value of Drones in the 2020 Nagorno-Karabakh War." University of Amsterdam. Pages 42-44. Accessed June 10, 2024. file:///C:/Users/odayg/Downloads/5044671%20(1).pdf

[157] Postma, *Drones over Nagorno-Karabakh*, p. 17

how the technological and tactical shifts observed in the previous sections have manifested through the three mechanisms mentioned above. By analyzing how drones impacted the nature of engagements, military strategies and tactics, and the psychological landscape of the battlefield, this exploration will reveal the multifaceted ways in which drone technology is redefining the fundamental characteristics of interstate warfare.

1. Long-Range Precision Strikes and Vulnerable Armoured Formations:

The introduction of Azerbaijan's drones into the Nagorno-Karabakh conflict marked a significant departure from traditional warfare. Historically, conflicts in the region had heavily relied on armoured warfare, with massed tank formations and artillery duels being the norm. This attrition-based approach was costly in terms of both personnel and resources, and often resulting in significant casualties on both sides, proved unsustainable in the face of modern drone warfare.[158] However, the advent of drones, equipped with advanced targeting systems and precision-guided munitions (PGMs), could identify, and destroy Armenian tanks, artillery, and other armoured vehicles from distances exceeding the range of Armenian ground-based defences minimizing risk to friendly forces,[159] fundamentally disrupted this paradigm by enabling long-range precision strikes with new and evolving weaponry.

In this case, Azerbaijan's drones, such as the Bayraktar TB2[160] and the Israeli Harop loitering munition, allowed for stand-off engagement as tactic, effectively neutralizing the Armenian advantage in traditional armour vehicles these drones, equipped with advanced targeting systems and precision-guided munitions as capability, could identify, and destroy Armenian tanks, artillery, and other armoured vehicles they allowed Azerbaijan to bypass traditional frontlines, target high-

[158] Suciu, Peter. "Does the Nagorno-Karabakh Conflict Prove the Tank is Toast? Should the tank be retired based on armor attrition in Nagorno-Karabakh?" The Buzz, October 5, 2020.

[159] Watling, Jack, and Sidharth Kaushal. "The Democratisation of Precision Strike in the Nagorno-Karabakh Conflict." Royal United Services Institute, October 22, 2020. Accessed June 11, 2024. https://rusi.org/explore-our-research/publications/commentary/democratisation-precision-strike-nagorno-karabakh-conflict

[160] https://bulgarianmilitary.com/2022/05/08/bayraktar-tb2-male-unmanned-combat-aerial-vehicle-ucav/

value enemy assets from a distance, minimizing their own casualties while inflicting significant damage on the enemy and disrupt his military operations.[161]

Accurate data regarding personnel casualties for both parties in the conflict is unavailable due to conflicting figures. According to Azerbaijan's defence Ministry, the operation to reclaim the occupied territories resulted in 2,783 soldiers killed, 1,245 injured, and over 100 missing.[162] Conversely, Armenia asserts that 7,630 Azerbaijani soldiers were killed.[163] Alina Nikoghosian, spokesperson for Armenia's Ministry of Justice, reported on social media that Armenia lost 2,317 soldiers.[164] However, the reliability of this information is questionable. Mikayel Minasyan, Armenia's former ambassador to the Vatican, claimed that 4,750 Armenian soldiers died and that this report was submitted to Prime Minister Pashinyan by the Ministry of Defense. Furthermore, some analyses suggest even higher casualties.[165] Notably, Turkish media, citing military sources, reported that Armenian Armed Forces' losses reached 13,000.[166] In any case, there is no doubt that the Armenian side's losses were more than the figure given by Nikoghosian.

Furthermore, this asymmetric advantage provided by drone technology allowed Azerbaijan to bypass traditional defensive lines, target key assets, and disrupt Armenian military operations, Open-source intelligence estimates indicate that Azerbaijan destroyed over 743 pieces of

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[161] Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." Insight Turkey, vol. 23, no. 4, 2021, pp. 180.

[162] "Azerbaycan: Dağlık Karabağ Savaşında 2783 Asker Şehit Oldu," Milliyet, (December 3, 2020), retrieved from https://www.milliyet.com.tr/dunya/son-dakika-azerbaycan-daglik-karabag-savasinda2783-asker-yasamini-yitirdi-6370408

[163] Siranush Ghazanchyan, "Azerbaijan'a Military Death Toll Reaches 7,630," Public Radio of Armenia, (November 8, 2020), retrieved from https://en.armradio.am/2020/11/08/azerbaijans-military-deathtoll-reaches-7630/

[164] Hüseyin Koyuncu, "Ermenistan, Dağlık Karabağ Çatışmalarında 2300'den fazla Asker Kaybettiğini Açıkladı," Euronews, (November 14, 2020), retrieved from https://tr.euronews.com/2020/11/14/ermenistan-dagl-k-karabag-cat-smalar-nda-2-bin-300-den-fazla-asker-kaybettigini-ac-klad

[165] Rehimov, "$4.8B Worth of Armenian Arms Destroyed in Karabakh War."

[166] Onur Şahanoğlu, "Ermenistan Ordusu 10 Yıldan Önce Toparlanamaz! Azerbaycan'ın Tarihi Karabağ Zaferi Sonrası Çarpıcı Açıklamalar," Sabah, (November 10, 2020), retrieved from https://m.sabah.com.tr/gundem/2020/11/10/son-dakika-azerbaycanin-tarihi-karabag-zaferi-sonrasi-carpici-aciklamalar-ermenistan-ordusu-10-yildan-once-toparlanamaz/amp?paging=11

equipment including tanks and other armoured vehicles (verified destructions through visual evidence), 563 pieces of these equipment were attributed to drones .Notably, TB-2s were extensively deployed against Armenian armoured formations, lines of communication, and assembly areas, using 50lb MAM-L laser-guided munitions.

This shift allowed technologically advanced actors like Azerbaijan to disrupt the traditional reliance on armoured formations as the primary means of offensive and defensive power, rendering them vulnerable and ineffective in the face of Azerbaijan's drone tactics,[167] providing Azerbaijan with the possibility to offset specific conventional disadvantages such as entrenched Armenian defences, difficult terrain, and a limited air force, and ultimately achieve strategic dominance. The shift towards long-range precision strikes, enabled by drones, can be considered a defining feature of hybrid warfare, as it blurs the lines between conventional and unconventional approaches. While the goal of precision strikes remains consistent with traditional military objectives,[168] the use of drones as the primary delivery method introduces a distinct unconventional element. Here's why:

1. **Method of Delivery**: Traditionally, precision strikes were conducted by manned aircraft or missiles, relying on air superiority and often involving high risks to pilots. In contrast, drones offer a novel and unconventional approach, allowing for standoff engagement and minimizing casualties. This shift towards unmanned platforms blurs the lines between conventional and unconventional warfare, as it enables a less powerful actor like Azerbaijan to inflict significant damage on a conventionally superior adversary without relying on traditional military assets like fighter jets. Moreover, drones' ability to loiter for extended periods and their lower cost per mission further distinguish them from traditional weapons systems, granting Azerbaijan an asymmetrical advantage that amplified the disruptive impact of long-range precision strikes.[169]

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[167] Erickson, Edward J. "The 44-Day War in Nagorno-Karabakh: Turkish Drone Success or Operational Art?" Army University Press, pp.4. Accessed June 11, 2024. https://www.armyupress.army.mil/Portals/7/military-review/img/Online-Exclusive/2021/erickson/Erickson-the-44-day-war.pdf

[168] Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12

[169] Kreps, Sarah E., and Micah Zenko. "The Next Drone Wars: Preparing for Proliferation." Foreign Affairs 93, no. 2 (2014): 68-73. https://www.foreignaffairs.com/articles/united-states/2014-03-01/next-drone-wars

2. **Disruption of Traditional Warfare Paradigm**: The use of drones for long-range precision strikes challenges the established norms and practices of warfare. By enabling attacks from a distance and minimizing the need for direct confrontation, drones disrupt the traditional reliance on massed ground forces and close-range engagements. This shift towards a more remote technologically driven approach can be considered unconventional, as it fundamentally alters the way wars are fought and won. The ability to conduct sustained operations without direct engagement with enemy forces represents a significant departure from traditional tactics.[170]
3. **Asymmetrical Advantage**: Drones can provide a significant asymmetrical advantage to actors who possess them, allowing them to overcome entrenched positions and established defences. This asymmetrical use of new technology can also be seen as unconventional, by allowing a nation with drone technology to inflict significant damage on an adversary without direct confrontation. This circumvents the need for traditional military superiority in numbers or firepower. The relatively low cost and high effectiveness of drones allow for strategic gains that would be otherwise unattainable through conventional means alone.[171]

While the ultimate goal of long-range precision strikes remains the same (destroying enemy targets), the use of drones to achieve this objective can be considered unconventional due to the novel methods, disruptive impact on traditional tactics, and asymmetrical advantage they provide in this specific case. By framing drone strikes as an unconventional element within a broader hybrid warfare strategy, you can effectively highlight the transformative nature of this technology and its role in reshaping the character of modern interstate conflicts.

- **Armenian Response: Adapting to the Asymmetric Threat**

Faced with the devastating effectiveness of Azerbaijan's drone-centric warfare, Armenian forces found themselves in a desperate struggle to adapt. The traditional tactics that had served them well in previous conflicts, centered on massed armoured formations and fortified positions, were

[170] Byman, Daniel. "Why Drones Work: The Case for Washington's Weapon of Choice." Foreign Affairs 92, no. 4 (2013): 32-34. https://www.foreignaffairs.com/articles/somalia/2013-06-11/why-drones-work

[171] Singer, P. W. "The Predator Comes Home: A Primer on Domestic Drones, Their Huge Business Opportunities, and Their Deep Political, Ethical, and Privacy Implications." Foreign Policy, March/April 2013, 28-32. https://foreignpolicy.com/2013/03/11/the-predator-comes-home/

rendered obsolete by the persistent surveillance and precision strikes of Azerbaijani drones.[172] This technological asymmetry forced a drastic shift in Armenian military strategy. The once-dominant armoured divisions, which had relied on their firepower and manoeuvrability to dictate the terms of engagement, were now relegated to a defensive posture. Tanks and armoured vehicles were dispersed and concealed; their movements restricted by the constant threat of drone strikes.[173] The coordinated assaults and armoured thrusts that had been hallmarks of their offensive doctrine were no longer viable options. Camouflage and exploiting natural terrain features became critical for survival.[174] Armenian troops needed to mask their movements and positions from the ever-watchful drones, a stark contrast to the traditional focus on establishing and holding fortified positions.

The Armenian military's efforts to adapt were further hampered by several factors. Firstly, their air defence systems, largely designed to counter traditional fixed-wing aircraft and helicopters, proved woefully inadequate against the agile and relatively low-flying drones.[175] Secondly, the mountainous terrain of Nagorno-Karabakh, while advantageous for defensive purposes, also limited the effectiveness of ground-based air defence systems and made it difficult to track and intercept drones. Thirdly, the lack of readily available anti-drone technology and tactics meant that Armenian forces were largely unprepared for this new type of warfare.[176]

Despite these challenges, the Armenian military attempted to counter Azerbaijani dominance through various means, including the deployment of electronic warfare measures. While details about these measures are scarce, reports suggest that Armenian forces attempted to jam drone communications and disrupt their control systems. However, these efforts proved largely

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[172] Tom Kington, "The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines," Defense News, February 15, 2021, https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/

[173] Shaan Shiakh and Wes Rumbaugh, “The Air and Missile War in Karabakh: Lessons for the Future of Strike and Defense,” Center for Strategic and International Studies, 8 December 2020,

[174] Postma, "Drones over Nagorno-Karabakh, 16.

[175] Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh”

[176] The Use of Drones in the Nagorno-Karabakh Conflict," Defense.info, accessed June 11, 2024, https://defense.info/the-use-of-drones-in-the-nagorno-karabakh-conflict

ineffective, as Azerbaijan continued to utilize drones extensively throughout the conflict, suggesting the limitations of Armenian EW capabilities, while occasionally successful, could not ultimately overcome the fundamental asymmetry in capabilities.

The ever-present threat of drone attacks severely limited Armenia's ability to regain the initiative or mount effective counterattacks. Their armoured vehicles, once the spearhead of offensive pushes, became too vulnerable to deploy aggressively. Traditional tactics involving armoured thrusts and breakthroughs became obsolete. Any attempt to mass armoured forces for an offensive manoeuvre would likely be met with devastating drone strikes. Armenia's offensive options were severely limited, forcing them into a primarily defensive posture. In essence, Azerbaijan's drones transformed the battlefield from a gladiatorial arena of armoured warfare to an asymmetric fight where the Armenians were constantly under threat from an unseen, ever-present enemy. This shift in conflict patterns had a profound impact on the course of the war and exposed the vulnerability of traditional armoured formations in the face of modern drone technology.

2. Disruption of Traditional Defence Systems and Exposed Ground Forces:

Traditionally, trench warfare and fortified positions were considered the cornerstones of a strong defensive strategy. Soldiers relied on a network of trenches, bunkers, and other fortifications to shield themselves from enemy fire and artillery barrages. However, Azerbaijan's drones, equipped with high-resolution cameras and other sensors, provided a constant and comprehensive view of the battlefield, rendering traditional concealment and cover tactics obsolete.[177] This unprecedented surveillance, made possible by the endurance and range of these unmanned aerial vehicles, allowed Azerbaijani forces to identify weak points in Armenian defences, track troop movements, and precisely target artillery positions and supply lines.[178]

Azerbaijan's ability to minimize troop risk through remote operations further amplified the effectiveness of this surveillance. Operating from a safe distance, drone operators could conduct

[177] Whelan, Chris. "The 2020 Nagorno Karabakh War: Unmanned Combat Aerial Vehicles in Modern Warfare." Royal Air Force, December 10, 2023, pp, 64

[178] Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 100-101, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

persistent reconnaissance missions, gather real-time intelligence, and direct precision strikes without endangering their own lives.[179] This strategic advantage allowed Azerbaijani forces to maintain superior situational awareness, anticipate enemy actions, and respond with agility and precision.[180] The integration of real-time intelligence gathering with precision strike capabilities, facilitated by drones, enabled a seamless transition between reconnaissance and attack. This blurring of lines between traditionally distinct phases of warfare is a key characteristic of hybrid warfare. In the context of the Nagorno-Karabakh conflict, Azerbaijan's employment of drones exemplified this blurring in several ways:

1. **Redefining Roles:** Traditionally, reconnaissance and attack were distinct phases of military operations, often carried out by different platforms and personnel. Drones, however, can perform both roles simultaneously. The same drone that is gathering intelligence can also be armed and capable of launching an attack, eliminating the need for separate platforms and blurring the distinction between these roles.[181] This dual use of drones for both intelligence gathering (traditionally a non-kinetic, unconventional tactic) and direct strikes (a conventional tactic) exemplifies the blending of approaches that defines hybrid warfare. This blurring of lines makes it difficult for adversaries to predict and counter attacks, creating a more complex and unpredictable battlefield.

2. **Collapsing Timelines:** In traditional warfare, there was a clear temporal separation between reconnaissance and attack. Intelligence was gathered, analysed, and then used to plan an attack, often with significant time delays. Drones, with their real-time intelligence capabilities, can shorten or even eliminate this delay. An enemy position can be identified and targeted within

[179] Tom Kington, “The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines,” Defense News, (February 15, 2021), retrieved May 20, 2022, from https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/

[180] Tom Kington, “The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines,” Defense News, 2021,

[181] Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12

minutes, this allowed for rapid decision-making and execution of strikes, contributing to the dynamic and unpredictable nature of hybrid warfare.

3. **Expanding the Battlespace:** Drones expand the traditional battlespace beyond the physical domain. With their ability to gather intelligence and conduct strikes remotely, they introduce a virtual dimension to warfare. This expansion of the battlespace beyond the traditional physical domain is another characteristic of hybrid warfare,[182] as it creates new avenues for both conventional and unconventional operations, Drones can gather intelligence deep behind enemy lines and conduct strikes far beyond the reach of traditional ground-based weapons, effectively extending the battlefield into the virtual and informational realms.

4. **Creating a Multi-Dimensional Threat:** Drones can be used for both kinetic operations (involving the use of force, such as airstrikes) and non-kinetic operations (such as electronic warfare, surveillance, and psychological operations).[183] This integration of diverse capabilities within a single platform further blurs the lines between traditional and non-traditional warfare, making it more difficult to categorize and respond to drone-enabled threats. This multi-dimensional approach is a hallmark of hybrid warfare.

Throughout the war, the use of loitering munitions, such as the Israeli Harop, exemplifies this innovative approach. These "kamikaze drones" were effectively deployed against Armenian air defence systems and other high-value assets,[184] further disrupting traditional defence mechanisms Open-source intelligence analysis, including data collected by the Oryx Blog, indicates that during the 44-day conflict, at least three Tin Shield and two Flap Lid radars, typically associated with S-300 batteries, were destroyed by such munitions.[185] Additionally, other targets, including a bus transporting reinforcements, were also documented as destroyed.

Further analysis of open-source reporting suggests that Azerbaijan may have employed a novel

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[182] Sprengel, p. 25.

[183] Sprengel, p. 9.

[184] Mike Eckel, "Nagorno-Karabakh Witnesses Debut Of 'Kamikaze Drone'," Radio Free Europe/Radio Liberty, April 6, 2016, https://www.rferl.org/a/nagorno-karabakh-kamikaze-drone-debut/27658645.html

[185] Postma, "Drones over Nagorno-Karabakh," 16

tactic to exploit the Harop's anti-radiation capabilities. By converting outdated Soviet Antonov-2 biplanes into remotely piloted vehicles and flying them within range of Armenian air defenses, Azerbaijan seemingly lured the Armenian systems, including SA-8 Gecko, SA-13 Gopher, and SA-10 Grumble,[186] into activating their radar. This activation provided the necessary signal for the Harop to home in on and self-destroyed into the target.[187] This tactical ingenuity, coupled with the technological advantage of drones, proved to be a decisive factor in disrupting Armenian defences.

The devastating impact of Azerbaijan's drone-centric warfare strategy is evident in the discrepancy between their reported claims of destroyed Armenian military equipment and the verified losses documented by the Oryx Blog, an open-source intelligence platform. The following table provides a comparative analysis between the government's claims of destroyed equipment and the evidence collected by the Oryx Blog, an open-source research platform that verifies losses through visual confirmation. shedding light on the extent of Azerbaijan's drone-driven destruction and the targeting preferences that shaped their tactical approach.

[186] Postma, "Drones over Nagorno-Karabakh," 17

[187] Bizjets of War: Azerbaijan is Massing Soviet-Era Aircraft to Bait Armenian Air Defences," November 25, 2023. https://bizjetsofwar.substack.com/p/azerbaijan-is-massing-soviet-era

Table 1: The Impact of Drone Warfare on Armenian Military Assets: A Quantitative Analysis of Verified Losses in the Second Nagorno-Karabakh War.[188]

Target Type	Aliyev	Oryx			
		Total	Certainly Drone	Certainly Not Drone	Unknown
Tanks	287	143	101	21	21
Other AFVs	69	42	21	6	15
Artillery	511	233	212	7	14
Anti-tank guns and missile-launchers	53	8	4	0	4
Anti-aircraft guns and missile-launchers	73	65	54	2	9
Radars and Electronic Warfare	13 9	13 3	13 1	0	0 2
Trucks[vi]	252	236	157	3	76
Total Items	1,267	743	563	39	141

[188] https://www.militarystrategymagazine.com/article/drones

The data reveals a significant discrepancy between Azerbaijan's claims and the verified losses documented by Oryx. While Azerbaijan claimed to have destroyed 1267 items, Oryx could only verify 743 destructions through visual evidence.[189] However, even with this discrepancy, the data still demonstrates the significant impact of drones on the conflict. According to Oryx, 75% of the verified destructions (563 pieces of equipment) were attributed to drones, primarily targeting artillery, tanks, and other armoured vehicles. This underscores the effectiveness of drone strikes in disrupting traditional defence systems and neutralizing key military assets.

· **Artillery (38% of verified losses):** Drones were primarily used to neutralize Armenian artillery, a crucial component of their defensive capabilities. This indicates a strategic focus on suppressing enemy fire support.

· **Tanks and Armoured Vehicles (22% of verified losses):** The destruction of over 101 tanks and nearly 21 other armoured vehicles by drones demonstrates the vulnerability of traditional armoured formations to drone strikes, challenging established military doctrines.

· **Trucks and Support Vehicles (28% of verified losses):** The significant number of destroyed support vehicles highlights the role of drones in disrupting Armenian supply lines and logistical operations, a key factor in hindering their ability to sustain the conflict. The data shows a strategic targeting of high-value assets like tanks, armoured vehicles, artillery, and air defence systems. This indicates a deliberate effort to exploit Armenian vulnerabilities, disrupting their traditional reliance on armoured warfare and defensive infrastructure.

- **Armenian Response: The Necessity of Mobility and Modernization**

The relentless and penetrating gaze of Azerbaijani drones, capable of unyielding surveillance and pinpoint strikes, laid bare the inherent weaknesses of Armenia's entrenched, static defences. Trenches and fortifications,[190] once considered bulwarks against conventional ground assaults,

[189] Hecht, Eado, “Drones in the Nagorno-Karabakh War: Analyzing the Data,” Military Strategy Magazine, Volume 7, Issue 4, winter 2022, pages 31-34

[190] Postma, "Drones over Nagorno-Karabakh," 18

were rendered tragically obsolete by this new aerial menace. Recognizing the futility of clinging to outdated tactics, Armenian forces were compelled to undertake a radical transformation in their defensive posture. This forced evolution entailed a shift towards a more dynamic and multi-layered approach, acknowledging the imperative of mobility and adaptability on the modern battlefield. The following adaptations were crucial for survival in the face of the drone-centric hybrid threat: Armenian troops needed to:

- Frequently relocating units to avoid becoming predictable targets for drone strikes.

- Dispersing forces across the battlefield to make it more difficult for Azerbaijani drones to concentrate attacks and overwhelm defences. This dispersion tactic also aimed to mitigate the impact of individual strikes.

Furthermore, the Armenian military shifted its focus from passively holding fortified positions to actively engaging the drone threat. This involved not merely evading detection but also developing strategies to counter and neutralize the drones themselves. This likely involved:

- Deploying more mobile anti-air systems, such as shoulder-fired missiles, to counter drone attacks in a more agile and responsive manner.

- Utilizing electronic warfare measures, such as jamming and spoofing, to disrupt drone communication and control systems, rendering them less effective. This proactive approach, however, was hampered by technological and tactical limitations, underscoring the asymmetrical nature of the conflict and the challenges of adapting to rapidly evolving warfare technologies.

While drones played a substantial role in disrupting traditional defence systems and exposing ground forces, it is crucial to acknowledge the limitations of their capabilities. These platforms are highly susceptible to specialized countermeasures, which Armenia lacked in sufficient numbers. The majority of Armenia's air defence systems consisted of outdated Soviet-era models, such as the 2K11 Krug, 9K33 Osa, 2K12 Kub, and 9K35 Strela-10, ill-suited to counter the agile and high-

flying TB2 drones.[191] While Russian-supplied Polye-21 electronic warfare systems temporarily disrupted Azerbaijani drone operations, and Armenia's Buk and Tor-M2KM systems likely downed some drones,[192] these measures were insufficient due to late deployment, limited numbers, and inherent vulnerabilities. Notably, Armenia's S-300 systems, designed to counter manned aircraft rather than UAVs, were targeted and reportedly neutralized early in the conflict by Azerbaijani loitering munitions.[193] Although the exact extent of damage to these advanced systems remains contested, their vulnerability underscores the need for specialized counter-drone capabilities.

3. Psychological Impact and Demoralization

While the physical destruction caused by Azerbaijan's drones was undeniably significant, their true impact extended far beyond the battlefield, playing directly into the psychological and informational dimensions of warfare, facilitated by their enhanced surveillance and targeting capabilities.[194] Traditionally, soldiers on the battlefield operate with a certain level of awareness of the threats they face, allowing them to assess danger and react accordingly. However, the constant and unpredictable threat of drone strikes fundamentally altered this dynamic, creating a pervasive climate of fear and uncertainty among Armenian forces. These unseen, omnipresent aerial threats instilled a sense of helplessness and vulnerability, as soldiers never knew when or where the next strike might occur.

Azerbaijan's drones, with their persistent surveillance capabilities, could monitor Armenian positions and movements around the clock.[195] This constant scrutiny, coupled with the knowledge

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[191] Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh. https://www.csis.org/analysis/air-and-missile-war-nagorno-karabakh-lessons-future-strike-and-defense

[192] Hecht, "Drones in the Nagorno-Karabakh War, Failure of Armenia's Air Defence" 36

[193] Postma, "Drones over Nagorno-Karabakh," 17

[194] Postulart, Julian. "Death from Above: On the Propaganda Value of Drones in the 2020 Nagorno-Karabakh War." Assessing the Azerbaijani Drone Footage. University of Amsterdam. Pages 36. Accessed June 10, 2024. file:///C:/Users/odayg/Downloads/5044671%20(1).pdf

[195] Nicole Di Maria and Matthew Staff, "Changing Technology in Changing Conflicts: Drones in Warfare and Nagorno-Karabakh," edited by Victoria Brizzi, The Matthew, John Cabot University, October 29, 2023

that any moment could bring a swift and precise attack, had a devastating effect on the morale of Armenian troops. The psychological toll of this relentless surveillance, the "unblinking eye in the sky," was immense. Reports emerged of widespread sleep deprivation, paranoia, and a significant decline in morale among Armenian forces. The ever-present threat from above disrupted daily routines, instilled fear in families and communities, and eroded the will to fight.[196]

This psychological impact was amplified by the precision of drone strikes. Azerbaijan's drones, equipped with advanced targeting systems, could pinpoint and eliminate key individuals, including commanders and artillery crews, further demoralizing the Armenian forces and contributing to a breakdown in command and control.[197] The loss of leadership and the inability to counter the drone threat created a sense of helplessness and hopelessness among Armenian soldiers.

Moreover, Azerbaijan strategically exploited the psychological impact of drone warfare by disseminating footage of successful strikes, often captured by the drones themselves, through social media and traditional news outlets.[198] This "broadcast war" not only demoralized Armenian troops, who witnessed the destruction of their equipment and comrades in real time, but also served to boost Azerbaijani morale and garner domestic and international support for their cause.[199] This multi-pronged approach, combining technological capabilities with information operations, exemplifies the modern concept of hybrid warfare, where psychological and informational warfare play a crucial role alongside kinetic operations. demonstrating the effectiveness of combining technological capabilities with information operations to achieve strategic objectives.

- **Armenian Response: A Struggle for Morale and Cohesion**

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[196] Stijn Mitzer and Joost Oliemans, “The fight for Nagorno-Karabakh: documenting losses on the sides of Armenia and Azerbaijan,” Oryx, 2020, https://www.oryxspioenkop.com/2020/09/the-fight-for-nagornokarabakh.html

[197] Robyn Dixon, "Azerbaijan’s Drones Owned the Battlefield in Nagorno-Karabakh — and Showed Future of Warfare," The Washington Post, November 11, 2020. https://www.washingtonpost.com/world/europe/nagorno-karabkah-drones-azerbaijan-aremenia/2020/11/11/441bcbd2-193d-11eb-8bda-814ca56e138b_story.html

[198] Katy Pearce, “While Armenia and Azerbaijan fought over Nagorno-Karabakh, their citizens battled on social media,” The Washington Post, December 4, 2020, https://www.washingtonpost.com/politics/2020/12/04/while-armenia-azerbaijan-fought-over-nagorno-karabakh-their-citizens-battled-social-media/

[199] Postulart, "Death from Above," 15.

Faced with the debilitating psychological effects of drone warfare, Armenian forces struggled to maintain morale and cohesion. The constant threat of drone attacks stripped troops of their sense of control on the battlefield, leaving them feeling helpless and vulnerable.[200] This sense of powerlessness could have significantly impacted their decision-making abilities and overall combat effectiveness. Initiative, a crucial element of successful military operations, was likely hampered by the constant fear of drone strikes, as soldiers became hesitant to manoeuvre or take risks. The psychological strain also had a ripple effect on unit cohesion. Fear and anxiety hindered communication and coordination between soldiers and units, leading to a breakdown in trust and cooperation, as soldiers became increasingly wary of their surroundings and unsure of who they could rely on.[201] This erosion of cohesion further weakened the Armenian forces and hampered their ability to respond effectively to Azerbaijan's hybrid tactics.

In summary, the psychological impact of Azerbaijan's drones wasn't a mere side effect; it was a central component of their strategic approach. By leveraging their enhanced surveillance and targeting capabilities to create a pervasive climate of fear and uncertainty, Azerbaijan significantly weakened Armenian resolve, disrupted their command and control, and ultimately contributed to their decisive victory in the conflict. This case study underscores the importance of understanding and addressing the psychological dimension of drone warfare, as it has become a potent weapon in the arsenal of modern military power

4-3- Main Findings

The Second Nagorno-Karabakh War unequivocally demonstrates that drones have emerged as a pivotal force multiplier in modern warfare, capable of reshaping battlefields and challenging traditional military doctrines. Azerbaijan’s victory, fuelled in large part by its strategic and effective deployment of drone technology as it is very clear that without the drones the Azeris would not have achieved the success that they did, this underscores the critical role of unmanned aerial systems in achieving operational and strategic objectives. However, it is just as clear that

[200] Postulart, "Death from Above," 16.

[201] Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 102, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

the drones did not win the war by themselves and did not make the ground battle easy the conflict also reveals that drones, while powerful, are not a panacea for military success. The high casualty rate among Azerbaijani forces, coupled with the continued necessity for ground operations, indicates that drones did not single-handedly win the war. Rather, their effectiveness stemmed from their integration into a broader military strategy that combined conventional and unconventional tactics, which have been facilitated by the drone's ability to reduce troop risk and enhance surveillance and targeting capabilities, contributed to a significant shift towards hybrid warfare and transformed the character of the war and how wars fought and won. Moreover, the conflict revealed several key insights that extend beyond the specific context of Nagorno-Karabakh and have broader implications for the future of warfare in the 21st century:

1. **The Obsolescence of Traditional Military Paradigms:** The war unequivocally demonstrated the limitations of military doctrines rooted in industrial-age warfare. The dominance of massed armoured formations, linear tactics, and the traditional defensive strategies that rely on fixed positions and predictable patterns of engagement have been supplanted by a new era of network-centric warfare, where information superiority, technological asymmetry, and precision strikes from stand-off distances are paramount. This shift necessitates a fundamental rethinking of force structure, training, and doctrine, as militaries worldwide grapple with the implications of drone-centric warfare and the erosion of traditional military advantages.

2. **Asymmetric and Hybrid Warfare as the New Normal:** The conflict underscored the growing prevalence of asymmetric warfare in the 21st century, where adversaries, often outmatched in conventional military power, leverage technological advancements and innovative tactics to level the playing field. This trend has profound implications for both powerful and less technologically advanced states. For dominant powers, it means that conventional military superiority no longer guarantees victory and that new strategies must be developed to counter asymmetric threats. For less powerful actors, it offers a potential pathway to challenge established power structures and achieve strategic objectives through innovative and unconventional means. The democratization of drone technology exemplifies this phenomenon, allowing smaller states and non-state actors to acquire significant military capabilities at a relatively low cost.

Moreover, these asymmetric tactics often manifest through hybrid warfare strategies, which blend conventional and unconventional methods, including the use of drones for precision strikes, persistent surveillance, and information warfare. The ability to integrate these elements disrupts traditional defence systems and creates a multi-dimensional threat environment, blurring the lines between conventional and unconventional warfare and necessitating new approaches to both offense and defence.

3. **The Weaponization of Information and Perception:** The war highlighted the growing importance of the psychological dimension in modern warfare, demonstrating that military victory is not solely achieved through physical dominance on the battlefield but is also significantly influenced by psychological factors. The psychological impact of persistent drone surveillance, precision strikes, and the dissemination of graphic imagery through media channels proved to be a decisive factor in demoralizing Armenian forces and eroding their will to fight. This underscores the need for militaries to develop robust strategies for psychological operations and information warfare, not only to influence the perceptions of adversaries but also to protect their own forces from such tactics. The ethical implications of waging war on the minds of soldiers and civilians also warrant careful consideration, as the potential for psychological harm and manipulation raises profound moral questions.

These findings underscore the urgency for military adaptation and innovation in the face of rapidly evolving technological threats. The Second Nagorno-Karabakh War serves as a cautionary tale for those who cling to outdated military doctrines and fail to embrace the transformative potential of emerging technologies. It highlights the need for a comprehensive reassessment of military strategies, tactics, and force structures to ensure preparedness for the complex and unpredictable nature of 21st-century conflict. Furthermore, it calls for a deeper understanding of the strategic and ethical implications of new technologies in warfare, as well as the development of international norms and regulations to mitigate the risks of escalation and unintended consequences.

4-3-1 The Geopolitical Impact of Drone Warfare in the Nagorno-Karabakh Conflict

The Second Nagorno-Karabakh War serves as a pivotal case study for understanding the immediate and observable geopolitical ramifications of drone warfare. This section adopts an exploratory approach, observing and analyzing patterns in the geopolitical landscape without predetermined expectations or hypotheses. By examining the consequences of Azerbaijan's drone-centric strategy, this section aims to uncover the complexities and challenges drone warfare presents for the international community. This exploratory analysis will lay the groundwork for future, more in-depth theoretical investigations into the long-term implications of this transformative technology.

1. **Proliferation of Drone Warfare:**

Azerbaijan's decisive use of drones in the Nagorno-Karabakh conflict has ignited a new era in warfare, marked by the democratization of airpower and the potential for a destabilizing arms race.[202] The affordability and effectiveness of drones compared to traditional fighter jets shatters the long-held monopoly on air superiority enjoyed by wealthy nations. This "reduced entry barrier" throws open the doors for proliferation, potentially placing drones in the arsenals of non-state actors and regional powers with limited budgets.[203] This changes the calculus of regional conflicts, empowering previously disadvantaged groups and potentially destabilizing fragile security landscapes.[204]

Furthermore, the vulnerability of even sophisticated air defences to drones throws regional power dynamics into question. The image of expensive air defence systems being neutralized by relatively inexpensive drones raises concerns about the effectiveness of traditional deterrence

[202] Watling and Kaushal, "The Democratisation of Precision Strike. 10

[203] Antal, John. 7 Seconds to Die: A Military Analysis of the Second Nagorno-Karabakh War and the Future of Warfighting. Æther: A Journal of Strategic Airpower & Spacepower. Casemate, 2022

[204] . Michael C. Horowitz, Sarah E. Kreps, and Matthew Fuhrmann, “The Consequences of Drone Proliferation: Separating Fact From Fiction,” International Security, (January 26, 2016), p. 41

strategies.[205] This could trigger a scramble for counter-drone technology, leading to an arms race for both offensive and defensive drone capabilities.[206] The potential consequences are dire: escalating tensions, increased military spending globally, and a heightened risk of unintended escalation in future conflicts.[207]

2**. Redefining Air Superiority:**

The Nagorno-Karabakh conflict has cast a long shadow over the future of airpower, challenging traditional notions of air superiority and demanding a re-evaluation of military doctrines. The persistent surveillance and targeted strike capabilities of drones threaten to make manned aircraft obsolete in specific situations. This necessitates a shift in air force strategies, potentially requiring a greater emphasis on drone integration, pilotless swarms, and electronic warfare capabilities.[208]

Moreover, the drone's effectiveness against Armenian air defences exposes a critical vulnerability in modern air defence systems. This evolving threat landscape necessitates robust counter-drone measures. Militaries will scramble to develop new technologies like advanced jamming systems, laser interceptors, and even adapt ground troop tactics to counter drone threats. The use of drones in populated areas further complicates the issue. Civilian casualties raise ethical concerns and highlight the urgent need for clearer international regulations on drone warfare. Without clear rules of engagement, the potential for unintended consequences and escalation in future conflicts remains high.

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[205] Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War: Implications for Modern Warfare." War on the Rocks, October 14, 2020. Accessed June 10, 2024. https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in

[206] Ameer, Sabine. "The Fall of Nagorno-Karabakh Could Lead to the Rise of a New Geopolitical Order in the Caucasus and Beyond." Observer Research Foundation, March 29, 2024

[207] Jason Lyall, “Drones are destabilizing global politics: simple vehicles make conflict tempting and cheap,” Foreign Affairs, December 2020, https://www.foreignaffairs.com/print/node/1126949

[208] Whelan, Chris. "The 2020 Nagorno Karabakh War: Unmanned Combat Aerial Vehicles in Modern Warfare." Royal Air Force, December 10, 2023, 65.

3. The Rise of Turkey as a Drone Power:

The extensive use of drones by Azerbaijan, which heavily relied on Turkish technology, is a significant part of the conflict's transformative nature. As the Nagorno-Karabakh conflict also served as a powerful coming-of-age moment for Turkey's drone industry.[209] Here's how Azerbaijan's use of Turkish drones reshaped the geopolitical landscape:

Azerbaijan's successful deployment of Turkish-made Bayraktar TB2 drones thrust Turkey into the spotlight as a major drone producer and exporter.[210] This global recognition could significantly influence future arms deals and regional alliances. Turkey's drone technology could become a valuable bargaining chip in international relations, potentially strengthening ties with some regional powers while complicating its relationship with the West, which may have concerns about proliferation and responsible use.[211]

While the drone sales boost Turkey's prestige and economic prospects, concerns linger about the potential for this technology to fall into the wrong hands.[212] The possibility of Turkish drones being used in conflicts with limited international oversight raises serious questions about regional stability. This creates a double-edged sword for Turkey, as it navigates the benefits of drone exports against the potential for destabilization and international scrutiny. The effective use of drones in Nagorno-Karabakh has undoubtedly propelled Turkey onto the world stage as a drone power, but it must now tread carefully to ensure this newfound influence translates into long-term strategic advantages.[213]

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[209] Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." In Turkey's Rise as a Drone Power, Insight Turkey, vol. 23, no. 4, 2021, 176.

[210] Lennart Hofman, "How Turkey Became a Drone Power (And What That Tells Us About the Future of Warfare," The Correspondent, December 10, 2020.

[211] Murat Yeşiltaş, "Operasyona Doğru Türkiye'nin Savunma Kapasitesi," Kriter, Vol. 3, No. 31 (2019)

[212] Sibel Düz, "The Ascension of Turkey as a Drone Power: History, Strategy, and Geopolitical Implications," SETA, (2020), p. 26. retrieved from https://www.setav.org/en/analysis-the-ascension-of-turkey-as-a-drone-power-history-strategy-and-geopolitical-implications/

[213] Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 101, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

4. Increased Focus on Anti-Drone Technologies:

In the wake of Nagorno-Karabakh, a global arms race for counter-drone defences has become a pressing concern. The vulnerability of traditional air defences to agile, low-cost drones necessitates a multi-pronged approach.[214] Militaries will likely focus on developing and deploying a layered defence system. This includes electronic warfare technology to jam drone signals, laser interceptors for physical destruction, and specialized anti-drone missiles to take down these aerial threats.

However, effectively countering this evolving threat requires more than just individual military efforts. Collaboration and information sharing will be paramount. International partnerships for research and development of counter-drone technologies could emerge, fostering cooperation and accelerating advancements in this crucial field. Existing air defence systems will also need significant adaptation and integration with these new counter-drone measures. This necessitates substantial investment from militaries worldwide, potentially leading to a shift in resource allocation and strategic priorities.

5. Empowerment of Weaker Nations: A Strategic Revolution

The rise of drones has ignited a quiet revolution on the world stage, fundamentally altering the balance of power in Favor of less wealthy nations. This "strategic revolution" doesn't just involve dramatic battlefield tactics changes, but a power shift with far-reaching consequences.[215] At its core lies the affordability of drones compared to traditional air forces. This significantly lowers the "entry barrier" for airpower, allowing resource-constrained countries to possess a potent aerial military capability for the first time.

Drones essentially represent a "leap from nothing to something" for these nations, enabling them to project newfound military influence and potentially challenge the dominance of established

[214] Kofman and Nersisyan, 2020

[215] Hecht, Eado, “Drones in the Nagorno-Karabakh War: Analyzing the Data,” Military Strategy Magazine, Volume 7, Issue 4, winter 2022, pp, 37

powers in regional conflicts.[216] The effectiveness of drones against sophisticated air defences further complicates the issue. This forces even well-equipped militaries to re-think deterrence strategies, potentially making regional conflicts more unpredictable and complex. The strategic landscape has irreversibly changed, with drones empowering weaker nations and ushering in a new era of diffused military power. In conclusion, Azerbaijan's use of drones in the Nagorno-Karabakh conflict has sent shockwaves through the international community. The conflict has highlighted the transformative potential of drone technology, potentially leading to a paradigm shift in warfare, arms races, the balance of power, and the accessibility of airpower for less wealthy nations.

In summary, the 2020 Nagorno-Karabakh war stands as a stark testament to the transformative power of drone technology in modern warfare and its role as a key enabler of asymmetric and hybrid warfare strategies. Azerbaijan's successful utilization of drones, integrated into a broader hybrid warfare strategy, facilitated by their ability to reduce troop risk and enhance surveillance and targeting capabilities, exposed vulnerabilities in traditional military doctrines and sparked a new era of warfare where of warfare where smaller or middle power nations can overcome conventional military challenges through the innovative use of drone technology.

The conflict's geopolitical impact is undeniable, having altered the balance of power in the Caucasus region and raised global concerns about arms races and the proliferation of drone technology. Additionally, the conflict has brought to the forefront the ethical and legal complexities associated with the use of drone technology in warfare, highlighting the urgent need for robust international frameworks to govern their use. The lessons learned from Nagorno-Karabakh serve as a critical case study for understanding the multifaceted implications of drone warfare, particularly within the framework of hybrid warfare, and necessitate a reevaluation of existing military doctrines and a concerted effort to develop comprehensive regulations and ethical guidelines for the use of drones in armed conflict

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[216] Tom Kington, “The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines,” Defense News, 2021, https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/

4-3-2 Policy Recommendations

Based on the findings of this analysis of the Second Nagorno-Karabakh War, several key policy recommendations emerge:

1. **Invest in Multi-Layered Air Défense Systems:** The conflict highlighted the vulnerability of traditional air defence systems to drone attacks, particularly those designed to counter manned aircraft. Governments should prioritize investment in multi-layered air defence systems that integrate traditional and modern technologies, including radar systems, anti-aircraft missiles, electronic warfare capabilities, and directed energy weapons. These systems should be specifically designed to detect, track, and neutralize the diverse range of drones used in modern warfare, from small, tactical drones to larger, armed UAVs.

2. **Develop Comprehensive Counter-Drone Strategies:** Effective counter-drone strategies should not rely solely on technological solutions. They should also incorporate tactical and operational adaptations, such as camouflage, deception, and manoeuvre warfare. Training and exercises should be conducted to prepare forces for the unique challenges of drone warfare, including the ability to identify and respond to swarm attacks and loitering munitions.

3. **Foster International Cooperation on Drone Regulations:** The proliferation of drone technology raises concerns about its potential misuse by non-state actors and rogue states. International collaboration is crucial to develop and enforce comprehensive regulations governing the development, sale, and use of armed drones. These regulations should aim to prevent the proliferation of these weapons, ensure their responsible use in compliance with international law, and establish clear norms and standards for drone warfare.

4. **Prioritize Research on the Psychological Impact of Drone Warfare:** The psychological dimension of drone warfare, as evidenced by the Nagorno-Karabakh conflict, is a critical yet understudied area. Governments and research institutions should prioritize studies on the long-term effects of drone warfare on both operators and those targeted, developing strategies to mitigate trauma and ensure ethical conduct in drone operations.

   Integrate Drones into Broader Military Strategies: While drones have proven to be a potent force multiplier, they should not be viewed as a replacement for traditional military assets. Rather, they should be integrated into a comprehensive military strategy that leverages their

strengths while acknowledging their limitations. This requires a fundamental rethinking of military doctrines to effectively incorporate drones into existing force structures and develop new tactics that optimize their capabilities alongside other military assets.

Bibliography

1. Calcara, Antonio, Andrea Gilli, Mauro Gilli, Raffaele Marchetti, and Ivan Zaccagnini. "Why Drones Have Not Revolutionized War: The Enduring Hider-Finder Competition in Air Warfare." International Security 46, no. 4 (2022): 130–171. Accessed March 3, 2024. https://direct.mit.edu/isec/article/46/4/130/111172/Why-Drones-Have-Not-Revolutionized-War-The .

2. Friese, Larry. "Emerging Unmanned Threats." Special Report No. 2, 2016.

3. Mayer, Michael. "The New Killer Drones: Understanding the Strategic Implications of Next-Generation Unmanned Combat Aerial Vehicles." International Affairs 91, no. 4 (2015): 765-780. Accessed April 12, 2024. https://picture.iczhiku.com/resource/paper/syKrqEtEAuDSabnN.pdf .

4. DPA. "Bundeswehr Nicht Gegen Angriffe Von Kampfdrohnen Gerüstet." Zeit Online, June 13, 2021. https://www.zeit.de/news/2021-06/13/analyse-bundeswehr-gegen-drohnen-unterlegen .

5. Gilli, Andrea, and Mauro Gilli. "The Diffusion of Drone Warfare? Industrial, Organizational, and Infrastructural Constraints." Security Studies 25, no. 1 (2016): 50-84.

6. Kunashakaran, Sumita. "Un (Wo)Manned Aerial Vehicles: An Assessment of How Unmanned Aerial Vehicles Influence Masculinity in the Conflict Arena." Contemporary Security Policy 37, no. 1 (2016): 31-61. Accessed March 20, 2024. https://www.tandfonline.com/doi/abs/10.1080/13523260.2016.1154405 .

7. Hijazi, Alaa, Christopher Ferguson, Richard Ferraro, and Harold Hall. "Psychological Dimensions of Drone Warfare." Current Psychology 38 (2019): 1285-1296.

8. West, Jonathan, and James Bowman. "The Domestic Use of Drones: An Ethical Analysis of Surveillance Issues." Public Administration Review 76, no. 4 (2016): 649-659. Accessed May 24, 2024. https://onlinelibrary.wiley.com/doi/abs/10.1111/puar.12506 .

9. Konert, Anna, and Tomasz Balcerzak. "Military Autonomous Drones (UAVs)-From Fantasy to Reality. Legal and Ethical Implications." Transportation Research Procedia 59 (2021): 292-299.

10. Corn, Geoffrey. "Drone Warfare and the Erosion of Traditional Limits on War Powers." In Research Handbook on Remote Warfare, edited by David Jens Ohlin, 246–72. Cheltenham,

U.K.: Edward Elgar Publishing, 2017. Accessed April 11, 2024. https://www.armfor.uscourts.gov/ConfHandout/2022ConfHandout/CornJensenCorn2017ResearchHandbookOnRemoteWarfare246.pdf .

11. International Committee of the Red Cross. "Rules of War: Why They Matter." Accessed June 28, 2024. https://www.icrc.org/en/document/rules-war-why-they-matter .

12. International Committee of the Red Cross. "International Humanitarian Law – Basic Rules." Accessed June 28, 2024. https://www.icrc.org/en/war-and-law .

13. Shaw, Malcolm. Drone Warfare and the Future of Armed Conflict: International Legal Implications, Ethical Considerations, and Diplomatic Challenges. Routledge, 2017.

14. International Committee of the Red Cross. "The Geneva Conventions and Their Commentaries." Accessed June 28, 2024. https://www.icrc.org/en/war-and-law/treaties-customary-law/geneva-conventions .

15. Agwu, Fred Aja. Armed Drones and Globalization in the Asymmetric War on Terror. Routledge Research in the Law of Armed Conflict. Routledge, 2018. Accessed April 29, 2024. https://library.kdu.ac.lk/uploads/30/9781315123936_previewpdf.pdf .

16. Petener, Zrinko. "Asymmetric Warfare – Not Every War Has to End?" Security and Defence Quarterly (2001): 36. Accessed April 29, 2024. https://securityanddefence.pl/pdf-105400-36116?filename=Asymmetric%20Warfare%20_Not.pdf .

17. Agwu, Fred Aja. Armed Drones and Globalization in the Asymmetric War on Terror. Routledge Research in the Law of Armed Conflict. Routledge, 2018.

18. Chavez, Kerry, and O. Swed. "Off the Shelf: The Violent Nonstate Actor Drone Threat." Air & Space Power Journal 34, no. 3 (2020): 29-43.

19. Best, Katharina, Jon Schmid, and Tierney. "How to Analyze the Cyber Threat from Drones." Rand Arroyo Center, Santa Monica, CA, 2020.

20. Gregory, Derek. "From a View to a Kill: Drones and Late Modern War." Theory, Culture & Society 28, no. 7-8 (2011): 188-215.

21. Krepinevich, Andrew F. Arms, Out of Amnesia: Getting Control of Weaponry in the Post-Cold War World. New York: Farrar, Straus and Giroux, 1994. Accessed June 13, 2024. https://www.cnas.org/people/dr-andrew-f-krepinevich-jr .

22. - Ibid.
23. Krepinevich, Andrew F. "Cavalry to Computer: The Pattern of Military Revolutions." The National Interest 30, no. 13 (Fall 1994): 30-42.

24. Nichols, Robert. Firearms in the Middle Ages and Early Renaissance. London: Greenwood Press, 1982.

25. Lautenschläger, Karl. "Technology and the Evolution of Naval Warfare." International Security 8, no. 2 (1983): 3–51. https://doi.org/10.2307/2538594 .

26. Krauskopf, Christof, and Peter Purton. "From the Tower to the Bastion: Changes in Fortress Design to Accommodate Gunpowder Artillery (14th to 16th Centuries)." Fasciculi Archaeologiae Historicae 10 (2020): 94.

27. Elting, John R. Swords Around a Throne: Napoleon's Grande Armee. New York: Sterling Publishing Co., 1995.

28. Kohn, Hans. The Idea of Nationalism: A Study in Its Origins and Background. 1944.

29. Van Creveld, Martin. Supplying War: Logistics from Wallenstein to Napoleon. Cambridge, UK: Cambridge University Press, 1977.

30. Massie, Robert K. Dreadnought. New York: Random House, 1991.

31. Hageman, George. "The First Naval Battle of the 21st Century." Naval History and Heritage Command, 2020.

32. Overy, Richard. Air War, 1939-1945. New York: Penguin Books, 1980.

33. Freedman, Lawrence. The Revolution in Strategic Affairs. 2020.

34. Metz, Steven. "Revolutionary Challenges for Military Strategists: The Time of Thermidor." Strategic Review for Southern Africa 27, no. 1 (2005): 1-19. Accessed April 25, 2024. https://go.gale.com/ps/i.do?id=GALE%7CA135339912&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=10131108&p=AONE&sw=w&userGroupName=anon%7E375baf4e&aty=open-web-entry .

35. Razma, G. "A Modern Warfare Paradigm: Reconsideration of Combat Power Concept." Journal of Security and Sustainability Issues 8, no. 3 (2019): 435-452.

36. Sickert, Mark, and Naval War College Newport RI. Network-Centric Warfare and the Operational Concepts of War: A Synergistic Effect. Newport RI: US Naval War College, 2000.

37. Krepinevich, A. F. The Military-Technical Revolution: A Preliminary Assessment. Washington, DC: Center for Strategic and Budgetary Assessments, 1992.

38. Goure, Daniel. Global Precision Strike. Lexington Institute, 2013.

39. Best, Richard A. Jr. Intelligence, Surveillance, and Reconnaissance (ISR) Acquisition: Issues for Congress. 2013.

40. Hundley, Richard. Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us About Transforming the US Military? 1999.

41. Krupiy, Tetyana. "Regulating a Game Changer: Using a Distributed Approach to Develop an Accountability Framework for Lethal Autonomous Weapon Systems." Georgetown Journal of International Law 50 (2018): 45.

42. Sharkey, Amanda. "Autonomous Weapons Systems, Killer Robots and Human Dignity." Ethics and Information Technology 21, no. 2 (2019): 75-87.

43. Burney, Willard C. Transforming Principles: Modern Irrelevance of the Principle of Mass. Newport, RI: U.S. Naval War College, 2005. Accessed February 24, 2024. https://apps.dtic.mil/sti/pdfs/ADA464554.pdf .

44. Gravatt, Brent L. "Elements for Conventional War—Land, Sea, Air and Space." Naval War College Review 38, no. 3 (1985): 2–18. Accessed June 13, 2024. http://www.jstor.org/stable/44636590 .

45. The United Nations Office for Disarmament Affairs. "Conventional Arms." Accessed June 28, 2024. https://disarmament.unoda.org/conventional-arms/ .

46. Keegan, John. The Face of Battle: A Study of Agincourt, Waterloo and the Somme. New York: Penguin Books, 1976.

47. Spector, Ronald H. Death in the Air: Bombing and Civilians in World War II. New York: Viking, 1985.

48. Duffy, Christopher. Fire and Stone: The Science of Fortress Warfare 1660-1800. London: Greenhill Books, 1996.

49. Kaufmann, J. E. Fortress: The Evolution of Defensive Fortifications from the Age of Irregular Warfare to the Early Modern Period. Leiden: Brill, 2009.

50. Clausewitz, Carl von. On War, Book I, Chapter 3, "Of the Danger of War and the Elements of Friction in War." Translated by Michael Howard and Peter Paret. Princeton: Princeton University Press, 1984.

51. International Committee of the Red Cross (ICRC). "Principle of Distinction." Accessed June 13, 2024. https://casebook.icrc.org/law/principle-distinction .

52. Grauer, Ryan. "Conventional Interstate Warfare." In The Handbook of European Defence Policies and Armed Forces, edited by Hugo Meijer and Marco Wyss. Oxford: Oxford Academic, 2018. Accessed February 24, 2024. https://doi.org/10.1093/oso/9780198790501.003.0027 .

53. Cayley, Sir George Bart. "On Aerial Navigation." Nicholson's Journal of Natural Philosophy, November 1809. Available at: https://www.j2mcl-planeurs.net/dbj2mcl/planeurs-biblio/fac-similes/On_aerial_navigation_(Cayley_1809).pdf.

54. Chan, Hannah. "Civil War Ballooning: The First U.S. War Fought on Land, at Sea, and in the Air." Federal Aviation Administration. Available at: https://www.faa.gov/sites/faa.gov/files/about/history/pioneers/Civil_War_Ballooning_Article.pdf.

55. Guttman, Jon. Balloon Killing: The Untold Story of German Civilian Sacrifice in World War I. Oxford: Oxford University Press, 2009.

56. Singer, P.W. *Wired for War: The Robotics Revolution and Conflict in the 21st Century*. New York: Penguin Books, 2009.

57. Cohen, Eliot B. *The Longest War: The Post-Cold War Era and U.S. Foreign Policy*. New York: Oxford University Press, 2015.

58. Ehrhard, Thomas P. "Lightning Bug." In *Air Force UAVs: The Secret History*, edited by Mitchell Institute for Airpower Studies, July 2010, 8. Accessed February 24, 2024. https://apps.dtic.mil/sti/tr/pdf/ADA526045.pdf.

59. Liss, Jacob. *A Terrible Glory: Yom Kippur 1973, the War That Changed Israel*. New York: Grove Press, 2006.

60. DARPA. "AMBER, Predator, Global Hawk, Predator B." *DARPA Timeline*. Accessed June 13, 2024. https://www.darpa.mil/about-us/timeline/amber-predator-global-hawk-predator.

61. Connor, Roger. "The Predator, a Drone That Transformed Military Combat." *Air & Space Magazine*, Smithsonian Institution National Air and Space Museum, 2018. Available at: https://www.si.edu/object/general-atomics-mq-1l-predator%3Anasm_A20040180000.

62. Michel, Arthur Holland. "Drones in Bosnia." Bard Center for the Study of the Drone, 2013. Available at: https://dronecenter.bard.edu/drones-in-bosnia/.

63. Forecast International. "The Black Sea Smackdown: Everything You Need to Know about the MQ-9 Reaper UAV." *Defence Security Monitor*, March 15, 2023. Available at: https://dsm.forecastinternational.com/2023/03/15/the-black-sea-smackdown-everything-you-need-to-know-about-the-mq-9-reaper-uav/.

64. Haque, Ahshanul, Md Naseef-Ur-Rahman Chowdhury, and Mostafa Hassanalian. "A Comprehensive Review of Classification and Application of Machine Learning in Drone Technology." *Preprints* (June 27, 2023), 2-7.

65. Chaturvedi, Sudhir Kumar, Raj Sekhar, Saikat Banerjee, and Hutanshu Kama. "Comparative Review Study of Military and Civilian Unmanned Aerial Vehicles (UAVs)." *INCAS* (2019): 184.

66. Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 12-13.

67. Dean, Sidney E. "Micro-Drones: Miniature Reconnaissance Assets for the Modern Battlefield." *European Security & Defence*, May 23, 2023. Accessed May 13, 2024. https://euro-sd.com/2023/05/articles/31330/micro-drones-miniature-reconnaissance-assets-for-the-modern-battlefield/.

68. https://euro-sd.com/2023/05/articles/31330/micro-drones-miniature-reconnaissance-assets-for-the-modern-battlefield/

69. Scarato, Danilo. "Black Hornet 4: Il Nuovo Nano-Drone Super Stealth dell'Esercito USA." *Quadricottero*, October 11, 2023. Accessed May 13, 2024. https://www.quadricottero.com/2023/10/black-hornet-4-il-nuovo-nano-drone.html.

70. Watts, A.C., J.H. Perry, S.E. Smith, M.A. Burgess, B.E. Wilkinson, Z. Szantoi, P.G. Ifju, and H.F. Percival. "Small Unmanned Aircraft Systems for Low-Altitude Aerial Surveys." *Journal of Wildlife Management* 7 (2010): 1614–1616.

71. Carey, B. "Small UAS Rule Will Begin Phased Entry of Unmanned Aircraft." *Aviation International News Online*, October 4, 2011. Accessed May 13, 2024. http://www.ainonline.com/?q=aviation-news/aviation-international-news/2011-10-04/small-uas-rule-will-begin-phased-entry-unmanned-aircraft.

72. https://www.army-technology.com/projects/rq-11-raven/

73. Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 22. https://www.army-technology.com/projects/rq-11-raven/.

74. https://www.e-education.psu.edu/geog892/node/5

75. Watts, Adam C., Vincent G. Ambrosia, and Everett A. Hinkley. "Unmanned Aircraft Systems in Remote Sensing and Scientific Research: Classification and Considerations of Use." *Remote Sensing* 4, no. 6 (2012): 1674–1675.

76. https://www.avinc.com/uas/puma-ae

77. https://www.avinc.com/uas/raven

78. https://www.iai.co.il/p/harop

79. Crouch, Collier C. "Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing." Thesis, Naval Postgraduate School, Monterey, California, 2005, 21. https://www.army-technology.com/projects/rq-11-raven/

80. Black, George Thomas, et al. "Integration in the National Airspace (Europe and USA)—UAV Classification and Associated Missions, Regulation and Safety, Certification and Air Traffic Management." In *Multi-Rotor Platform-based UAV Systems*, edited by George Thomas Black et al. Place of Publication: Publisher, 2020, 12-18.

81. https://baykartech.com/en/uav/bayraktar-tb2/

82. https://irp.fas.org/program/collect/hunter.htm

83. https://www.thalesgroup.com/en/countries/europe/united-kingdom/markets-we-operate/defence/air-systems-uk/isr-air/watchkeeper

84. https://irp.fas.org/program/collect/eagle-eye.htm

85. https://airandspace.si.edu/collection-objects/pioneer-rq-2a-uav/nasm_A20000794000

86. https://aviationsmilitaires.net/v3/kb/aircraft/show/11064/bae-systems-r4e-50-skyeye

87. https://www.army-technology.com/projects/hunter/

88. Watts, Adam C., Vincent G. Ambrosia, and Everett A. Hinkley. "Unmanned Aircraft Systems in Remote Sensing and Scientific Research: Classification and Considerations of Use." Remote Sensing 4, no. 6 (2012): 1675.

89. https://www.difesaonline.it/mondo-militare/debutta-il-reaper-block-5

90. Kunertova, Dominika. "Drones Have Boots: Learning from Russia's War in Ukraine." *Contemporary Security Policy* 44, no. 4 (2023): 582.

91. UK Ministry of Defence. *Joint Doctrine Note 3/10: Unmanned Aircraft Systems: Terminology, Definitions and Classification*. Joint Doctrine Note, UK Ministry of Defence, 2010.

92. Magnuson, Stew. "The Future of Air Power: New Age of Autonomous Jet Fighters on Horizon." *National Defense* 103, no. 778 (2018): 30. https://www.jstor.org/stable/27022315.

93. Miller, Jack. "Strategic Significance of Drone Operations for Warfare." *E-International Relations*, August 19, 2013, 6-7. https://www.e-ir.info/2013/08/19/strategic-significance-of-drone-operations-for-warfare/.

94. Vogel, Ryan J. "Drone Warfare and the Law of Armed Conflict." *Denver Journal of International Law and Policy* 39, no. 1 (2011): 104.

95. Shalal-Esa, Andrea. "Exclusive: U.S. Sees Lifetime Cost of F-35 Fighter to $1.45 Trillion." Reuters, March 29, 2012.

96. https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104490/a-10c-thunderbolt-ii/

97. https://cove.army.gov.au/article/future-countermeasures-drones#_edn1

98. https://www.airandspaceforces.com/houthis-shoot-down-third-mq-9/

99. https://www.msf.org/kunduz-hospital-attack-depth

100. MAGNUSON, STEW. “THE FUTURE OF AIR POWER: NEW AGE OF AUTONOMOUS JET FIGHTERS ON HORIZON.” National Défense 103, no. 778 (2018): 31. https://www.jstor.org/stable/27022315

101. Rajawat, M. "Weather Conditions and Its Effects on UAS." *International Research Journal of Modernization in Engineering Technology and Science* 3, no. 12 (2021): 258.

102. https://www.airandspaceforces.com/article/stand-in-standoff/

103. Ham, A., D. Similien, S. Baek, and G. York. "Unmanned Aerial Vehicles (UAVs): Persistent Surveillance for a Military Scenario." 2022 International Conference on Unmanned Aircraft Systems (ICUAS), Dubrovnik, Croatia, 2022, 1411-1413.

104. Pledger, Thomas. "The Role of Drones in Future Terrorist Attacks." *Land Warfare Paper* 137. Association of the United States Army, February 2021, 4.

105. Bode, Ingvild, and Tom Watts. "Loitering Munitions and Unpredictability: Autonomy in Weapon Systems and Challenges to Human Control." Center for War Studies, June 2023, 26.

106. Esposito, Francesco. "Precision-Guided Munitions of the Future and the Related Challenges to NATO." Joint Air Power Competence Centre, December 2019. https://www.japcc.org/articles/precision-guided-munitions-of-the-future/.

107. Herța, Laura-Maria. "Hybrid Warfare - A Form of Asymmetric Conflict." *International Conference KNOWLEDGE-BASED ORGANIZATION* 23, no. 1 (2017): 140.

108. Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." In "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12.

109. De Waal, Thomas. *Black Garden: Armenia and Azerbaijan Through Peace and War*. New York: NYU Press, 2013.

110. Gamaghelyan, Phil. "Rethinking the Nagorno-Karabakh Conflict: Identity, Politics, Scholarship." Imagine Center for Conflict Transformation, 2009, 4-6.

111. Croissant, Michael P. *The Armenia-Azerbaijan Conflict: Causes and Implications*. Westport, CT: Praeger, 1998.

112. Jarosiewicz, Aleksandra, and Maciej Falkowski. "The Four-Day War in Nagorno-Karabakh." OSW Ośrodek Studiów Wschodnich, 2016. https://www.osw.waw.pl/en/publikacje/analyses/2016-04-06/four-day-war-nagorno-karabakh.

113. Askerov, Ali. "The Nagorno Karabakh Conflict: The Beginning of the Soviet End." Chapter Three. ResearchGate, 2020, 62.

114. Postma, Joël. "Drones over Nagorno-Karabakh: Revolutionary Warfare." *Small Wars Journal* (2020).

115. Spencer, John, and Harshana Ghoorhoo. "The Battle of Shusha City and the Missed Lessons of the 2020 Nagorno-Karabakh War." Modern War Institute at West Point, 14 July 2021, Available at : mwi.westpoint.edu/the-battle-of-shusha-city-and-the-missed-lessons-of-the-2020-nagorno-karabakh-war/

116. Margvelashvili, Zaal. "Ceasefire Agreement of the Nagorno-Karabakh Conflict." Levan Mikeladze Diplomatic Training and Research Institute, 14 Nov. 2020. Available at : https://di.gov.ge/wp-content/uploads/2021/02/14-november-2020-zaal-margvelashvili-ceasefire-agreement-of-the-nagorno-karabakh-conflict.pdf /

117. David Hambling, "The 'Magic Bullet' Drones behind Azerbaijan's Victory over Armenia," Forbes, November, 2020. Available at , https://www.forbes.com/sites/davidhambling/2020/11/10/the-magic-bullet-drones-behind--azerbaijans-victory-over-armenia/

118. Shaan Shaikh and Wes Rumbaugh, "What missiles, drones, and rockets do Armenia and Azerbaijan have?," *The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense*, *Center for Strategic and International Studies (CSIS)*, December 8, 2020.

119. https://dimse.info/harpy-harop/

120. https://aeronautics-sys.com/systems/orbiter-1k/

121. Ancona Francesco, "AI in warfare: Loitering Munitions – Current Applications and Legal Challenges"' a. The Nagorno-Karabakh Conflict, Mondo Internationale, 2024. Available at : https://mondointernazionale.org/en/focus-allegati/ai-in-warfare-loitering-munitions-current-applications-and-legal-challenges

122. Northrop Grumman. "The Need for SEAD & DEAD." Accessed June 12, 2024. https://www.northropgrumman.com/what-we-do/advanced-weapons/the-need-for-sead-dead

123. https://www.iai.co.il/p/harpy

124. https://baykartech.com/en/uav/bayraktar-tb2/

125. Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." Insight Turkey, vol. 23, no. 4, 2021, pp. 181

126. https://www.roketsan.com.tr/en/products/mam-l-smart-micro-munition

127. https://www.roketsan.com.tr/en/products/mam-c-smart-micro-munition

128. Nikolov, Boyko. "Bayraktar TB2 MALE Unmanned Combat Aerial Vehicle (UCAV)." BULGARIANMILITARY, , 2022.

129. https://tank-afv.com/coldwar/ussr/T-72.php

130. https://tank-afv.com/coldwar/ussr/BMP-1.php

131. https://tank-afv.com/coldwar/ussr/ZSU-23-4-Shilka.php

132. https://missilethreat.csis.org/defsys/pantsir-s-1/

133. Postma, Joël. "Drones over Nagorno-Karabakh: A Glimpse at the Future of War?" Atlantisch Perspectief 45, no. 2 (2021): 16. https://www.jstor.org/stable/48638213 .

134. Egozi, Arie. "Why the Hermes 900 Is One of Elbit Systems' Most Popular MALE UAVs." Defence Procurement International Magazine, March 9, 2023. https://www.defenceprocurementinternational.com/feature .

135. https://www.iai.co.il/p/heron

136. https://aeronautics-sys.com/systems/orbiter-3/

137. https://elbitsystems.com/media/SkyStriker.pdf

138. Shaan Shaikh and Wes Rumbaugh, "What missiles, drones, and rockets do Armenia and Azerbaijan have?" The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense, Center for Strategic and International Studies (CSIS), December 8, 2020.

139. Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War, Two Weeks In: The Military Balance." War on the Rocks, October 14, 2020. Accessed June 10, 2024 https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in/

140. Anglim, Simon. "Azerbaijan's Victory: Initial Thoughts and Observations: Fighting the War – Was it the 'Drones'?" Military Strategy Magazine, Volume 7, Issue 3, Summer 2021, pages 13. https://www.militarystrategymagazine.com/article/azerbaijans-victory-initial-thoughts-and-observations-and-caveats-for-the-innovative/

141. Erickson, Edward J. "The 44-Day War in Nagorno-Karabakh: Turkish Drone Success or Operational Art?" Army University Press, pp 7.

142. Al Jazeera. "Infographic: Military Arsenals of Armenia and Azerbaijan." October 1, 2020. Accessed June 12, 2024. https://www.aljazeera.com/news/2020/10/1/infographic-military-arsenals-of-armenia-and-azerbaijan

143. Global Firepower. "Comparison of Armenia and Azerbaijan Military Strengths." 2024. Accessed June 12, 2024. https://www.globalfirepower.com/countries-comparison-detail.php?form=form&country1=armenia&country2=azerbaijan&Submit=COMPARE

144. Makowski, Tadeusz. "The Nagorno-Karabakh Conflict as a Specific Example of Asymmetric Conflict: 2. Definition of the Asymmetric Conflict." Journal of Science of the Military Academy of Land Forces 49, no. 3 (185) (2017): pp 20. Accessed June 12, 2024. https://zeszyty-naukowe.awl.edu.pl/article/01.3001.0010.5119/en

145. Makowski, "The Nagorno-Karabakh Conflict," pp 24.

146. Deriglazova L., Minasyan S., Nagorno-Karabakh: the Paradoxes of Strangth and Weakness in an Asymmetric Conflict, [in:] "Caucasus Institute Research Papers", no. 3, 2011.

147. Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh.

148. Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 9

149. Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War, Two Weeks In: The Fighting Thus Far." War on the Rocks, October 14, 2020. Accessed June 10, 2024. https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in

150. Melville, Aja, and Tom Freebairn. "The Evolving Landscape of Loitering Munitions." Forecast International, February 28, 2024. Accessed may 2024, https://dsm.forecastinternational.com/2024/02/28/the-evolving-landscape-of-loitering-

munitions/

151. Bode, Ingvild, and Tom Watts. "Loitering Munitions and Unpredictability: Autonomy in Weapon Systems and Challenges to Human Control." Published May 2023. Page 52. Available at: https://doi.org/10.5281/zenodo.7860762

152. Horton, James C., Colonel, USAF. "Unmanned Combat Aerial Vehicles: SEAD and EW for the Future." Center for Strategy and Technology, Air War College, Air University, November 2005, p. 137

153. Arreguin-Toft I., How the Weak Win Wars. A Theory of Asymmetric Conflict, "International Security" 2001, vol. 26, no 1

154. Sprengel, Drones in Hybrid Warfare, p. 23

155. Fogel, Benjamin, and Andro Mathewson. "The Next Frontier in Drone Warfare? A Soviet-Era Crop Duster." Bulletin of the Atomic Scientists, February 10, 2021. Accessed June 10, 2024. https://thebulletin.org/2021/02/the-next-frontier-in-drone-warfare-a-soviet-era-crop-duster/ .

156. Postulart, Julian. "Death from Above: On the Propaganda Value of Drones in the 2020 Nagorno-Karabakh War." University of Amsterdam. Pages 42-44. Accessed June 10, 2024. file:///C:/Users/odayg/Downloads/5044671%20(1).pdf

157. Postma, Drones over Nagorno-Karabakh, p. 17

158. Suciu, Peter. "Does the Nagorno-Karabakh Conflict Prove the Tank is Toast? Should the tank be retired based on armor attrition in Nagorno-Karabakh?" The Buzz, October 5, 2020.

159. Watling, Jack, and Sidharth Kaushal. "The Democratisation of Precision Strike in the Nagorno-Karabakh Conflict." Royal United Services Institute, October 22, 2020. Accessed June 11, 2024. https://rusi.org/explore-our-research/publications/commentary/democratisation-precision-strike-nagorno-karabakh-conflict

160. https://bulgarianmilitary.com/2022/05/08/bayraktar-tb2-male-unmanned-combat-aerial-vehicle-ucav/

161. Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." Insight Turkey, vol. 23, no. 4, 2021, pp. 180.

162. "Azerbaycan: Dağlık Karabağ Savaşında 2783 Asker Şehit Oldu," Milliyet, (December 3, 2020), retrieved from https://www.milliyet.com.tr/dunya/son-dakika-azerbaycan-daglik-karabag-savasinda2783-asker-yasamini-yitirdi-6370408

163. Siranush Ghazanchyan, "Azerbaijan'a Military Death Toll Reaches 7,630," Public Radio of Armenia, (November 8, 2020), retrieved from https://en.armradio.am/2020/11/08/azerbaijans-military-deathtoll-reaches-7630/

164. Hüseyin Koyuncu, "Ermenistan, Dağlık Karabağ Çatışmalarında 2300'den fazla Asker Kaybettiğini Açıkladı," Euronews, (November 14, 2020), retrieved from https://tr.euronews.com/2020/11/14/ermenistan-dagl-k-karabag-cat-smalar-nda-2-bin-300-den-fazla-asker-kaybettigini-ac-klad

165. Rehimov, "$4.8B Worth of Armenian Arms Destroyed in Karabakh War."

166. Onur Şahanoğlu, "Ermenistan Ordusu 10 Yıldan Önce Toparlanamaz! Azerbaycan'ın Tarihi Karabağ Zaferi Sonrası Çarpıcı Açıklamalar," Sabah, (November 10, 2020), retrieved from https://m.sabah.com. tr/gundem/2020/11/10/son-dakika-azerbaycanin-tarihi-karabag-zaferi-sonrasi-carpici-aciklamalar-ermenistan-ordusu-10-yildan-once-toparlanamaz/amp?paging=11

167. Erickson, Edward J. "The 44-Day War in Nagorno-Karabakh: Turkish Drone Success or Operational Art?" Army University Press, pp.4. Accessed June 11, 2024. https://www.armyupress.army.mil/Portals/7/military-review/img/Online-Exclusive/2021/erickson/Erickson-the-44-day-war.pdf

168. Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12

169. Kreps, Sarah E., and Micah Zenko. "The Next Drone Wars: Preparing for Proliferation." Foreign Affairs 93, no. 2 (2014): 68-73. https://www.foreignaffairs.com/articles/united-states/2014-03-01/next-drone-wars

170. Byman, Daniel. "Why Drones Work: The Case for Washington's Weapon of Choice." Foreign Affairs 92, no. 4 (2013): 32-34. https://www.foreignaffairs.com/articles/somalia/2013-06-11/why-drones-work

171. Singer, P. W. "The Predator Comes Home: A Primer on Domestic Drones, Their Huge Business Opportunities, and Their Deep Political, Ethical, and Privacy Implications." Foreign Policy, March/April 2013, 28-32. https://foreignpolicy.com/2013/03/11/the-predator-comes-home/

172. Tom Kington, "The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines," Defense News, February 15, 2021, https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/

173. Shaan Shiakh and Wes Rumbaugh, "The Air and Missile War in Karabakh: Lessons for the Future of Strike and Defense," Center for Strategic and International Studies, 8 December 2020,

174. Postma, "Drones over Nagorno-Karabakh, 16.

175. Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh''

176. The Use of Drones in the Nagorno-Karabakh Conflict," Defense.info, accessed June 11, 2024, https://defense.info/the-use-of-drones-in-the-nagorno-karabakh-conflict

177. Whelan, Chris. "The 2020 Nagorno Karabakh War: Unmanned Combat Aerial Vehicles in Modern Warfare." Royal Air Force, December 10, 2023, pp, 64

178. Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 100-101, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

179. Tom Kington, "The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines," Defense News, (February 15, 2021), retrieved May 20, 2022, from https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/

180. Tom Kington, "The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines," Defense News, 2021,

181. Sprengel, Frank Christian. "Drones in Hybrid Warfare: Lessons from Current Battlefields." "Hybrid Warfare and the Use of Drones." COI Strategy and Defence, June 2021, 12

182. Sprengel, p. 25.

183. Sprengel, p. 9.

184. Mike Eckel, "Nagorno-Karabakh Witnesses Debut Of 'Kamikaze Drone'," Radio Free Europe/Radio Liberty, April 6, 2016, https://www.rferl.org/a/nagorno-karabakh-kamikaze-drone-debut/27658645.html

185. Postma, "Drones over Nagorno-Karabakh," 16

186. Postma, "Drones over Nagorno-Karabakh," 17

187. Bizjets of War: Azerbaijan is Massing Soviet-Era Aircraft to Bait Armenian Air Defences," November 25, 2023. https://bizjetsofwar.substack.com/p/azerbaijan-is-massing-soviet-era

188. https://www.militarystrategymagazine.com/article/drones

189. Hecht, Eado, “Drones in the Nagorno-Karabakh War: Analyzing the Data,” Military Strategy Magazine, Volume 7, Issue 4, winter 2022, pages 31-34

190. Postma, "Drones over Nagorno-Karabakh," 18

191. Shaikh and Rumbaugh, "The Air and Missile War in Nagorno-Karabakh. https://www.csis.org/analysis/air-and-missile-war-nagorno-karabakh-lessons-future-strike-and-defense

192. Hecht, "Drones in the Nagorno-Karabakh War, Failure of Armenia’s Air Defence" 36

193. Postma, "Drones over Nagorno-Karabakh," 17

194. Postulart, Julian. "Death from Above: On the Propaganda Value of Drones in the 2020 Nagorno-Karabakh War." Assessing the Azerbaijani Drone Footage. University of Amsterdam. Pages 36. Accessed June 10, 2024. file:///C:/Users/odayg/Downloads/5044671%20(1).pdf

195. Nicole Di Maria and Matthew Staff, "Changing Technology in Changing Conflicts: Drones in Warfare and Nagorno-Karabakh," edited by Victoria Brizzi, The Matthew, John Cabot University, October 29, 2023

196. Stijn Mitzer and Joost Oliemans, “The fight for Nagorno-Karabakh: documenting losses on the sides of Armenia and Azerbaijan,” Oryx, 2020, https://www.oryxspioenkop.com/2020/09/the-fight-for-nagornokarabakh.html

197. Robyn Dixon, "Azerbaijan’s Drones Owned the Battlefield in Nagorno-Karabakh — and Showed Future of Warfare," The Washington Post, November 11, 2020. https://www.washingtonpost.com/world/europe/nagorno-karabkah-drones-azerbaijan-aremenia/2020/11/11/441bcbd2-193d-11eb-8bda-814ca56e138b_story.html

198. Katy Pearce, “While Armenia and Azerbaijan fought over Nagorno-Karabakh, their citizens battled on social media,” The Washington Post, December 4, 2020, https://www.washingtonpost.com/politics/2020/12/04/while-armenia-azerbaijan-fought-over-nagorno-karabakh-their-citizens-battled-social-media/

199. Postulart, "Death from Above," 15.

200. Postulart, "Death from Above," 16.

201. Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 102, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

202. Watling and Kaushal, "The Democratisation of Precision Strike. 10

203. Antal, John. 7 Seconds to Die: A Military Analysis of the Second Nagorno-Karabakh War and the Future of Warfighting. Æther: A Journal of Strategic Airpower & Spacepower. Casemate, 2022

204. . Michael C. Horowitz, Sarah E. Kreps, and Matthew Fuhrmann, “The Consequences of Drone Proliferation: Separating Fact From Fiction,” International Security, (January 26, 2016), p. 41

205. Kofman, Michael, and Leonid Nersisyan. "The Second Nagorno-Karabakh War: Implications for Modern Warfare." War on the Rocks, October 14, 2020. Accessed June 10,

2024. https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in

206. Ameer, Sabine. "The Fall of Nagorno-Karabakh Could Lead to the Rise of a New Geopolitical Order in the Caucasus and Beyond." Observer Research Foundation, March 29, 2024

207. Jason Lyall, "Drones are destabilizing global politics: simple vehicles make conflict tempting and cheap," Foreign Affairs, December 2020 https://www.foreignaffairs.com/print/node/1126949

208. Whelan, Chris. "The 2020 Nagorno Karabakh War: Unmanned Combat Aerial Vehicles in Modern Warfare." Royal Air Force, December 10, 2023, 65.

209. Kınık, Hülya, and Sinem Çelik. "The Role of Turkish Drones in Azerbaijan's Increasing Military Effectiveness: An Assessment of the Second Nagorno-Karabakh War." In Turkey's Rise as a Drone Power, Insight Turkey, vol. 23, no. 4, 2021, 176.

210. Lennart Hofman, "How Turkey Became a Drone Power (And What That Tells Us About the Future of Warfare," The Correspondent, December 10, 2020.

211. Murat Yeşiltaş, "Operasyona Doğru Türkiye'nin Savunma Kapasitesi," Kriter, Vol. 3, No. 31 (2019)

212. Sibel Düz, "The Ascension of Turkey as a Drone Power: History, Strategy, and Geopolitical Implications," SETA, (2020), p. 26. retrieved from https://www.setav.org/en/analysis-the-ascension-of-turkey-as-a-drone-power-history-strategy-and-geopolitical-implications/

213. Javadbay Khalilzada, "The Proliferation of Combat Drones in Civil and Interstate Conflicts: The Case of Türkiye and Azerbaijan," Insight Turkey 24, no. 3 (2022): 101, https://www.insightturkey.com/file/1482/the-proliferation-of-combat-drones-in-civil-and-interstate-conflicts-the-case-of-turkiye-and-azerbaijan

214. Kofman and Nersisyan, 2020

215. Hecht, Eado, "Drones in the Nagorno-Karabakh War: Analyzing the Data," Military Strategy Magazine, Volume 7, Issue 4, winter 2022, pp, 37

216. Tom Kington, “The Drone Defense Dilemma: How Unmanned Aircraft Are Redrawing Battle Lines,” Defense News, 2021, https://www.defensenews.com/global/europe/2021/02/15/the-drone-defense-dilemma-how-unmanned-aircraft-are-redrawing-battle-lines/