

COCKPITS TO CODES: UNCREWED (UNMANNED) AERIAL VEHICLES (UAVS) AND REVOLUTION IN MILITARY AFFAIRS

Isma Naseem¹, Zia Ul Haque Shamsi^{*2}

DOI: <https://doi.org/10.5281/zenodo.18950954>

Keywords

Drones, UAVs, Revolution in Military Affairs (RMA), Warfare

Article History

Received: 29 January 2026

Accepted: 05 March 2026

Published: 11 March 2026

Copyright @Author

Corresponding Author: *

ziashamsi@ndu.edu.pk

Abstract

Uncrewed Aerial Vehicles (UAVs) have revolutionised the traditional concept of human-operated machines, bringing the idea of semi-autonomous, or centrally controlled, aircraft far from the target areas. The character and conduct of war have been fundamentally changed. The contemporary era of military warfare is reliant on advanced computational power, advanced sensing software, and stealth technology, which has led to the development of these UAVs. The proponents of UAVs argue that military forces have become smaller yet more effective and lethal, with enhanced projection capabilities that enable better Intelligence, Surveillance, and Reconnaissance (ISR). UAVs such as MQ-9 Reaper support ground soldiers in carrying out special operations with real-time monitoring. This paper aims to enhance the understanding of UAVs, examine their contributions in the military realm, and determine how they have altered warfare.

INTRODUCTION

Uncrewed Aerial Vehicles (UAVs), commonly known as drones, are aircraft capable of operating without a pilot and crew. They function autonomously based on commands and codes, instructions given before the flight, and instructions from humans on the ground. UAVs possess the features necessary for victory in warfare. They have revolutionised military affairs, particularly the information realm. In this era of information, computers, software, robots, and autonomous systems are pertinent to discuss, as military affairs today are heavily dependent on these technological advancements. Before delving deep into what UAVs are and how they have revolutionised military affairs, it is necessary to understand what they are. Andrew Marshall stated RMA as “A major change like warfare, driven by innovative technology, combined with dramatic changes in military doctrine and operational concepts, fundamentally altering the character and conduct of military operations.” This revolution

has resulted in “enhanced force projection and efficiency of armed forces.”

UAVs have revolutionised military affairs by enabling smaller, more effective, and more lethal forces. This kind of revolution is also known as the Military-Technical Revolution. The first time a UAV was used was in the form of a hot air balloon in 1849. But as other technologies advanced during the Cold War, UAVs acquired capabilities such as high-resolution imaging, real-time intelligence, and surveillance and reconnaissance. Precision and accuracy are the most dominant features of UAVs, as seen in “Operation Enduring Freedom and Operation Desert Storm.”

Research Methodology:

This work uses a qualitative research approach; scholarly articles, peer-reviewed research publications, and other published sources, such as books and reports, have been used to provide background knowledge and deeper context. The

research is based solely on the synthesis and interpretation of existing literature to create a consistent narrative. This methodological selection aligns with the qualitative, exploratory approach of the inquiry, which focuses on interpretation, contextual comprehension, and critical synthesis rather than quantification. Moreover, all citations and references have been carefully adhered to the Chicago Manual of Style (17th edition).

Theoretical Framework

The RMA theory was introduced by Andrew Krepinevich, Richard Betts, and Michael O'Hanlon. It describes the transformation in military affairs through the use of advanced technologies and organisational and doctrinal changes. It describes the "RMA moment" as the tipping point at which the introduction of new doctrine, weaponry, and war practices culminates in an irreversible transformation that defines new ways of fighting wars. UAVs represent a watershed moment in the RMA as they provide better C4ISR, greater precision, real-time surveillance to reduce the fog of war, operate more autonomously, integrate multiple sensor systems, and provide precision strike capabilities and persistent surveillance cost-effectively.

Revolution in Military Affairs (RMA) Paradigm and UAVs

Advances in Computational Power, Decreased Physical Size of Computer Components and Lower Costs

The significant elements of RMA are "Great advances in computational power, decrease in the physical size of computer components, and lower costs leading to dramatic progress in military technology" which is explained in terms of UAV technology.

- **Advances in Computational Power:**

UAVs have advanced in computational power, enabling military operations with improved capabilities and proficiency. It includes integration of advanced cameras, navigation systems, AI and multiple sensor systems. Using these features, UAVs can be programmed to autonomously

execute mission profiles, including surveillance, reconnaissance, and strike missions. It allows the execution of complex flight patterns and missions without constant direct human control. For example, the USA's MQ-9 Reaper can fly autonomously for approximately 27 hours and can carry a 3750 lb. payload, reaching an altitude of up to 50,000 ft at 240 knots.

- **Artificial Intelligence (AI) and UAVs:**

Using AI systems in a UAV enables it to perform advanced functions such as object detection, target tracking, threat assessment, and processing and analysing large amounts of data in real time. The Predator drone, used widely in Afghanistan, Iraq and the Global War on Terror, uses AI technology for military operations. The Turkish Kargu-2 drone used by the government in Tripoli against Libyan militants, also described as a "Lethal autonomous weapon system," is an AI-powered drone that can autonomously fly pre-programmed flight patterns, adjust its altitude and speed, and find and attack the intended target. By developing Perdix UAV, a micro drone capable of operating in swarms of up to 1,000 cooperating, AI-equipped drones, the US has been able to conduct surveillance, reconnaissance, target acquisition, and other missions. These tiny drones are powered by AI, advanced communication systems, and onboard computers, enabling them to coordinate and execute complex missions. However, there are many legal and ethical concerns associated with AI in military operations.

- **Multiple Sensor Systems and UAVs:**

Multiple sensor systems have been integrated with UAVs to paint images of the operational area or enemy terrain, giving them "dominance over battle space knowledge." UAVs have high-resolution cameras and thermal imaging systems. It can combine these sensor inputs to provide a comprehensive, accurate view of the area being surveilled. The Global Hawk, developed and used by the USA in the Iraq and Afghanistan wars, has been extensively utilised for military reconnaissance missions. Block 30 has electro-optical and infrared (EO/IR) cameras, synthetic aperture radar (SAR), and a multi-spectral

targeting system (MTS) that combines the capabilities of an EO/IR camera and a laser designator. A comprehensive picture of the battlefield, including the locations of enemy troops, vehicles, and other assets, is created, providing the military commander with a sketch of the operational environment.

- **Smaller Physical Size:**

UAVs have become smaller, lighter, and more agile due to the compact physical size of computer components. By reducing the size of computer components such as processors, memory, and storage devices, UAVs can be made smaller and lighter, enabling them to be deployed in a wider range of environments. For example, the Black Hornet Nano is a tiny, lightweight UAV that gave the British an edge in surveillance during Operation Herrick. Reconnaissance missions, situational awareness and safety for troops, even Zoom face can be done through this UAV. It reduces the cost of the operation, as soldiers were typically sent forward for reconnaissance, while Black Hornet performs ISR missions at low cost and without risk. The AeroVironment Switchblade UAV is a small and lightweight UAV that can be launched from a tube, making it highly mobile and agile. Switchblade UAVs are “suicide UAVs” that hit their targets to destroy them.

- **Lower Costs:**

The utilisation of UAVs has significantly cut the typical cost of military operations. One of the primary advantages is the cost-effectiveness of UAVs, as they are less costly to operate and maintain than traditional manned aircraft. The risk to human life is reduced because there is no pilot on board; hence, no expensive pilot training is required. UAVs can also be used for logistics supply in hard, inaccessible and remote areas, and they can perform this task at a lower cost than traditional methods. MQ-9 Reaper can be used for a variety of missions, including ISR and attack. This was done at a lower cost than the multirole surveillance aircraft. UAVs also facilitate logistic support to troops in remote, hard and inaccessible areas. This reduces the relevance of traditional costly methods.

Joint Service Command & Data Fusion:

Joint Service Command and Data fusion by the latest technologies is becoming a critical element in the thinking of modern-day military strategists. Historically, national armies have been organised into specialised branches such as armies, navies, air forces, and Marine Corps, and each branch worked with the others when necessary but otherwise pursued its own internal aims. The advent of technology and sophisticated communication platforms accelerated the integration of coordinated actions. Additionally, the emergence of "stand-off" armaments that can be launched from an array of military platforms, including ships, aircraft, both unmanned and manned and land-based vehicles, has made inter-service cooperation essential.

- **Joint Service Command and UAVs:**

UAVs have exacerbated coordination and joint command in two ways:

First, UAVs depend heavily on coordinated command for their operation. This element of dependence lies in the operational responsibilities of drones, which require an array of pre-information, from ground-based intelligence to an associated task force of land, air, and sea to ground-based launch crews, and finally the control centre, where a pilot further uses live, coordinated communications to carry out a strike. All this procedure is subject to a coordinated decision undertaken by joint military service personnel. The most efficient UAV system structure of the U.S. is considered to be operated by the joint service commands, such as Central Command in Asia and the Middle East. Central Command uses its task forces, operating primarily in Air and sea, to assist with UAV launches and provide other operational support.

Second, apart from the operational dependency of UAVs on joint service commands, they also serve to reinforce them. The integration of UAVs with joint service commands has enabled greater collaboration and coordination among military branches and more efficient application of UAVs in military operations. UAVs can now capture real-time data and imagery, which can be combined with information from other sources to

provide a more comprehensive depiction of a targeted location. This also helps commanders make better-informed decisions and respond more quickly to changing situations.

- **Data Fusion and UAVs**

The drone's operational application results from extensive data fusion. A drone is remotely piloted from a station after being launched by a ground crew operating at a far-off base. Before the launch, the control is transferred by the ground crew members to a designated pilot. This involves a huge amount of data fusion. Specifically, the US Reaper drone is equipped with two communication systems: a ground-control antenna that enables the ground crew to control takeoff and landing, and a satellite communications system that enables remote control by the pilot. These involve sophisticated sensors that receive real-time data and thus have great potential for use on smaller platforms, such as drones and other UAVs.

The Role of UAVs in Eliminating the Fog of War:

The entire concept of Fog of War boils down to the idea that it represents a situation on the battlefield where commanders have limited intelligence. In this scenario, the commanders are unsure or uncertain about: 1) what the enemy is doing at the exact moment in time, where the enemy's troops and logistics are located, what is the strength of the enemy's troops and what weapons are in the enemy's possession? 2) What does the battlefield look like in terms of terrain and weather during daytime and nighttime? What are the possible plans of the enemy? Are there any civilians in the area? Etc. These probable questions essentially require answers so commanders can be certain and make prudent decisions (this information was previously provided by manned aircraft, which later proved costly and susceptible to causing pilot deaths). UAVs or drones are an important component of the joint command system, and have been able to answer these questions and thus have been able to eliminate the fog of war by performing the following functions:

Surveillance and Reconnaissance: UAVs fly over and near the areas of interest and gather intelligence and real-time, reliable data regarding the location and activities of adversary troops on the battlefield with the help of cameras and different types of enhanced sensors installed on them, such as electro-optical (EO) cameras, Acoustic sensors, infrared cameras, Synthetic Aperture Radar (SAR), etc.

Targeting: A UAV is used by the commander to conduct target killing; the drone provides sensory and visual data to the commander, and, using this data, the commander launches missiles after being "certain" of the target's position, location, and movement. The drones thus reduce uncertainty and enable commanders to conduct precise attacks. This also limits the risk of collateral damage.

Communication: Drones also serve as relays between troops on the battlefield and commanders, helping reduce uncertainty when communication is cut off.

Post-mission Analysis: With the help of information attained through the means of UAVs, the commanders carry out "post-mission analysis" by reevaluating the information obtained during the mission. This feature also helps reduce the fog of war, as military commanders can analyse the efficiency and effectiveness of their own forces and the enemy's plans and capabilities. This reduces uncertainty about future planned operations.

UAVs as Agile Weapons Platforms that Can Deploy Zero CEP

CEP (Circular Error Probability) is the measure of the accuracy of the weapon platform. UAVs offer greater accuracy without risking the lives of pilots, while their manoeuvrability can be controlled or guided from control centres far from the target area. The margin of error is reduced by the ability to gather real-time intelligence and surveillance on enemy movement and positions. However, they cost less than other weapons designed to perform similar tasks or missions. The purpose of UAVs may include surveillance, attack, or delivery. The

following are the ways that contribute to lower costs, greater agility, and reduced error margins.

- UAVs can be armed with Precision Guided Munitions (PGMs), and these can be launched from a safer distance with a higher degree of accuracy. This reduces the risk to the operator's life and enables greater efficiency and effectiveness during any strike mission.
- The agility of UAVs makes them multipurpose with a wider range of tasks, i.e., ISR, target acquisition, and precision attacks.
- The use of UAVs in conducting ISR missions, equipped with a range of sensors, cameras, and radars, to track and detect targets. This helps with information collection and data gathering.
- They can be rapidly deployed due to their lower cost in the target area and allow for swift response against changing situations.
- They are less expensive than manned aircraft or ground-based platforms, which makes them an ideal option for limited budgets.

The ability of UAVs to quickly adapt to changing environmental and operational situations makes them agile weapon platforms. This includes manoeuvrability, flexibility, remote control, real-time information gathering, and stealthy operating capabilities. Manoeuvrability enables UAVs to hover and fly at high speed, with directional control to adjust their position and respond rapidly during any mission. Flexibility enables UAVs to perform a wide variety of missions and adapt to different scenarios. A remote control enables UAVs to be remotely piloted and operated from a safer distance. Real-time information gathering enables UAVs to make decisions and respond more quickly. UAVs can avoid detection and operate with a low visual and acoustic signature.

The CEP of UAVs depends on the specific UAVs and the assigned mission. Unlike missiles, UAVs are not typically designed to be precision-guided; however, some are equipped with GPS for accuracy. The MQ-9 Reaper costs \$32 million and has a CEP of less than 5 m, making it highly accurate. They are also highly agile and can be

armed with PGMs. Others may vary depending on their weight and mission requirements.

UAVs as Fast, Deadly, and Small Unit Forces:

UAVs refer to the miniaturisation of technologies in one device or vehicle that require a "small unit force structure to carry out their desired operation/target. "Fast, deadly, and smaller unit forces" are explained in the context of UAVs. Fast refers to the rapid responses carried out by UAVs, enabled by advanced communication, ISR, target acquisition, and precision strike capabilities. Few UAVs are equipped with weapons like lethal PGMs, which make them deadly to the target. All the aforementioned technologies integrated into UAVs have replaced the cumbersome, demanding logistics requirements and sluggish movement of large military forces with fast, deadly, agile, and smaller unit forces. RMA mainly transformed the military into "smaller and more lethal forces".

FAST (Enhanced Speed of Forces)

The "small size, less weight, minimised consumption and robust communication link" of UAVs has increased the speed and effectiveness of military operations and reduced the timeframes and number of armed personnel required for specialised operations. Hence, they complete assigned tasks faster than crewed traditional aircraft. The requirement for boots on the ground and logistical needs has been replaced by UAVs, enabling small forces to carry out designated tasks more quickly and effectively. Instead of waiting months to receive information about the enemy from designated forces, UAVs provide real-time intelligence in seconds, enabling rapid responses.

Small Force Structures

In the contemporary era, special operations are common worldwide. Special operations are basically an offshoot of warfare, encompassing "the unique set of objectives, weapons and forces." For such operations, Special Forces are trained; they are small, specialised units that acquire unconventional combat skills through innovation, improvisation, and self-reliance. They are small and self-sufficient, making them fast, agile and very effective forces. The mode of conducting SOF

operations is to conduct rapid surgical operations from supported bases in any country, using “sophisticated communication and air vehicles”. Sometimes, they play the role of pop-up forces in which SOFs identify the target and pass the command to UCAVs to launch PGMs or any other lethal weapon.

Intelligence is a prerequisite for successful special operations. Apart from intelligence, SOFs require “portable, lightweight communication equipment”. As per the report of the Federation of American Scientists, “Already overburdened with equipment, weapons and 'ammunition', the average team member carries a 72-hour supply of food and water. Air Force Special Tactics Team members are typically loaded with transceivers, navigational aids, weapons, ammunition, and food weighing 70-80 pounds. Hence, UAVs acquire features that help small forces become agile, effective, and deadly.

UAVs and Contemporary Dynamics

UAVs have become one of the most revolutionary tools of war in the 21st century, changing the way military power is produced, projected, and used, and originally limited to intelligence, surveillance, and reconnaissance (ISR) in conflicts such as Afghanistan and Iraq. UAVs have evolved to take on multiple roles, including precision strikes, loitering attacks, electronic warfare support, and real-time battlefield coordination. This change can be seen in the expanding use of UAVs, which has led to near-constant surveillance, disrupting the classic conditions of operations and shortening the decision-making cycle. As an example, Azerbaijan used Turkish Bayraktar TB2 drones during the Nagorno-Karabakh conflict in 2020 to destroy the Armenian armoured groups in targeted strikes, which proves the capabilities of UAVs to achieve air superiority without exposing pilots and at a small fraction of the cost of manned aircraft.

In the same way, low-cost commercial drones adapted for military applications have democratised higher-end capabilities, empowering non-state actors and smaller militaries to confront larger ones, thereby blurring the distinction between asymmetric and symmetric warfare. The

development of these technologies indicates a transition from platform-based, pilot-reliant air operations to networked, unmanned systems that will improve situational awareness and minimise human risk throughout the battle space.

The recent conflicts underscore the importance of UAVs to operational planning and execution, transforming the nature of warfare through mass deployment and the incorporation of new technologies. Such a case is the Russia-Ukraine war, which is said to be the first complete drone war with inexpensive commercial and military drones being used in large numbers to target artillery, surveillance of the battlefield, infrastructure attacks, and saturation attacks with loitering munitions. Ukraine rolled out the "Army of Drones" program, which provided UAVs to company-level units, making it possible to strike enemy targets with real-time ISR, FPV (first-person view) drone attacks, disrupting Russian logistics and armour. Russia also adapted the Iranian Shahed-136 to swarm attacks and demonstrated the strategic value of attrition warfare. In the India-Pakistan military standoff of May 2025, known as Operation Sindoor, both parties were using UAVs to survey, communicate and engage in limited precision strikes; India made use of its drone attacks to turn off Pakistani radar and infrastructure, whilst Pakistan used anti-drone systems to deal with the escalation in a nuclear environment. The Iran-Israel conflict is another example of this development, where waves of long-range UAVs and loitering munitions coordinated by Iran are meant to saturate the air defences as observed during the April 2024 salvo of more than 300 UAVs and loitering missiles, which were countered by a multi-layered Israeli defence system that has incorporated electronic warfare and intelligence-led operations. Such instances reveal the compression of kill chains by UAVs, the development of hybrid tactics by UAVs, and the necessity of establishing counter-UAV ecosystems. All of these conflicts point to the fact that warfare is moving into a period in which algorithms are replacing cockpits, autonomy is augmenting human decision-making, and technological adaptation is becoming decisive, as numerical superiority once was. The increasing use of UAVs

is leading to an evolutionary change in the world of military affairs, one of continuous surveillance, lower risk to human life, accelerated kill-chain, and the increasing prominence of artificial intelligence and swarm technology, which promises a radical change in the future manifestation of warfare, its organisation, and its control. There are ethical issues, such as the possibility of reduced conflict thresholds because of remote actions and the problem of accountability in autonomous systems. Besides, the mass effect of inexpensive drones undermines the conventional precept of force concentration, where the systematic operation of AI-powerful drones to invent the battlefield is observed in Ukraine. Not only does this shift in paradigm expand coercion in asymmetric environments, but it also prompts the world's militaries to invest in adaptive doctrines, underscoring the importance of UAVs in redefining strategic stability and international security standards.

Sun Tzu's Maxims and Their Contemporary Relevance

Sun Tzu wrote a timeless masterpiece, "The Art of War", a thousand years ago, that is still relevant in current dynamics. Many dictums relate to RMA and UAVs, but only a few will be discussed here. "The Supreme art of war is to subdue the enemy without fighting," and "Every battle is won before it is fought" Sun Tzu says that UAVs provide real-time ISR, providing credible information about the enemy, and that a state may win a war before it happens. It also applies in "if you know enemies and know yourself, you will not be imperilled in a hundred battles." UAV swarms deceive and overwhelm the enemy's defences, which manifests "All warfare is based on deception." Thus, the UAVs and the revolution they brought can be explained through Sun Tzu's Art of War in contemporary times as well.

Limitations of UAVs:

UAVs have significant limitations that hinder many operations that manned aircraft can perform. Payload and power supply weight restrict the capacity of UAVs with limited range or endurance.. The reliance on batteries limits flight

distance and operational range. UAVs are vulnerable to various network attacks, which reduces communication reliability.. Communication security is at stake due to possible breaches and eavesdropping. Any sudden changes in the environment or weather make them vulnerable. There are multiple Smart detection technologies for anti-drone measures, such as jamming, nets, and lasers. Singaporean TRD (tiny red dots) is a drone slayer that interferes with drones' navigation systems, either dropping them or veering them off course. Also, regulatory restrictions are absent, as UAVs have repeatedly trespassed military sites or airports, disrupting services. These limitations need to be addressed to make UAVs more efficient, weather-friendly, and immune to anti-drone systems.

Anti-Drone Systems:

The emergence of anti-drone systems has enabled drone interception through laser beams, radio frequency sensors, and other kinetic means. The U.S. has made VAMPIRE (Vehicle Agnostic Modular Palletised ISR Rocket Equipment), which uses rockets and other countermeasures to engage and kill drones. Singapore's TRD Tiny Red Dots has produced various drone slayers that also target drones for interception.

Recommendations:

The limitations described above can be mitigated through a range of measures, such as advancing battery technology and increasing payload capacity to improve range and endurance. Communication reliability can be improved through clustering of multiple UAVs. Distributed functioning of UAVs must be ensured to overcome the anti-drone measures. UAVs must be autonomous in performing effective, safe missions despite environmental changes and sudden weather shifts. Last but not least, reducing Radar Cross Section (RCS) can also help. RCS is a function of the size of UAVs and the reflective materials they contain. It helps UAVs evade interception and identification by enemy radars and other defence systems.

Conclusion:

In a nutshell, by incorporating innovative technologies and altering military doctrine, uncrewed aerial vehicles (drones) have revolutionised military operations. They have made military powers more effective, modest, and deadly, with their high-quality imaging, constant surveillance, reconnaissance, and intellectual capacities. UAVs likewise offer accuracy and precision on the battlefield and can provide continuous situational awareness to the leader, making them a significant asset in special and sensitive missions. Overall, drones have enabled a wider range of missions, reduced the fog of war, and provided cost-effective solutions for surveillance and precision strikes. This can be stated in the form of a mnemonic as well:

D "Dynamic Intelligence, Surveillance, and Reconnaissance"

R "Resilient Networking"

O "Offensive Cyber Capabilities"

N "Navigational Superiority"

E Electronic Warfare Integration"

BIBLIOGRAPHY

"7 Pros & Cons of Drones and Unmanned Aerial Vehicles." *Ohio University* (blog). May 11, 2021. Accessed April 2, 2025. <https://onlinemasters.ohio.edu/blog/the-pros-and-cons-of-unmanned-aerial-vehicles-uavs/>.

Alsuhli, Ghada, Ahmed Fahim, and Yasser Gadallah. "A survey on the role of UAVs in the communication process: A technological perspective." *Computer Communications* 194 (2022), 86-123. Accessed May 1, 2025. doi: 10.1016/j.comcom.2022.07.021.

Bernardini, Andrea, Federica Mangiatordi, Emiliano Pallotti e Licia Capodiferro. "Drone detection by acoustic signature identification." *Electronic Imaging* 29, no. 10 (2017), 60-64. doi: 10.2352/issn.2470-1173.2017.10.imawm-168.

Bledsoe, Everett. How Much Does a Military Drone Cost? *The Soldiers Project*. Accessed

April 1, 2025. <https://www.thesoldiersproject.org/how-much-does-a-military-drone-cost/>.

Boone, Jon. "Pakistani Army Claims It Has Killed Three Militants Using Its Burraq Drone." *The Guardian*. September 7, 2015. Accessed May 5, 2025. <https://www.theguardian.com/world/2015/sep/07/pakistan-army-burraq-drone-strike-kills-three-militants-shawal-reports>.

Bousquet, Antoine. "A revolution in military affairs?" *Technology and World Politics*, 2017, 165-181. Accessed April 25, 2025. doi:10.4324/9781317353836-9.

Buckley, John. *Air Power in the Age of Total War*. London: Routledge, 2006.

Chapman, Gary. "An Introduction to the Revolution in Military Affairs." In *Changing Threats to Global Security: Peace Or Turmoil: XV International Amaldi Conference 2003*, 2-21. Helsinki: Finnish Institute of International Affairs, 2004.

Chapple, Amos. "The Drones Of The Ukraine War." *RadioFreeEurope/RadioLiberty*. November 17, 2022. Accessed May 1, 2025. <https://www.rferl.org/a/ukraine-russia-invasion-drones-war-types-list/32132833.html>.

Cheddar. "How A Drone Strike Works - Cheddar Explains." *YouTube*. January 22, 2022. Accessed May 1, 2025. <https://www.youtube.com/>

Clausewitz, Carl v. *On War*. Edited by Michael Howard and Peter Paret. New Jersey: Princeton University Press, 1989.

Cramer, Maria. "A.I. Drone May Have Acted on Its Own in Attacking Fighters, U.N. Says." *The New York Times* (New York), June 3, 2021.

Crowley, Michael, Falih Hassan, and Eric Schmitt. "U.S. Strike in Iraq Kills Qassim Suleimani, Commander of Iranian Forces." *The New York Times - Breaking News, US News, World News and Videos*. January 2, 2020. Accessed May 5, 2025. <https://www.nytimes.com/2020/01/02/>

- world/middleeast/qassem-soleimani-iraq-iran-attack.html.
Defence update. "AeroVironment Switchblade 600." *YouTube*. October 2, 2022. Accessed May 5, 2025. https://www.youtube.com/watch?v=QJ5C1zTc2Ac&t=4s&ab_channel=defenseupdate.
- Department of Defence. "Operations and Exercises." *United States Central Command*. Accessed May 2, 2025. <https://www.centcom.mil/OPERATIONS-AND-EXERCISES/>.
- Edwards, Bill. "Revolution in Military Affairs Vs Military Revolution: The Emergence of Drones and Robotics As a Driver in Societal Change." *Small Wars Journal*. November 11, 2022. Accessed May 1, 2025. <https://smallwarsjournal.com/jrnal/art/revolution-military-affairs-vs-military-revolution-emergence-drones-and-robotics-driver>.
- Epazz, Iqra. "How Will Drones Impact the Future of Military Warfare?" *ZenaDrone*. July 20, 2022. Accessed May 1, 2025. <https://www.zenadrone.com/drones-impact-the-future-of-military-warfare/>.
- Field, Matt. "Meet the Future Weapon of Mass Destruction, the Drone Swarm." *Bulletin of the Atomic Scientists*. April 22, 2021. Accessed May 5, 2025. <https://thebulletin.org/2021/04/meet-the-future-weapon-of-mass-destruction-the-drone-swarm/>.
- Frackiewicz, Marcin. "The Advantages of Military Drones for Surveillance and Reconnaissance Operations - TS2 SPACE." *TS2 SPACE - Global Satellite Services*. March 10, 2025. Accessed May 1, 2023. <https://ts2.space/en/the-advantages-of-military-drones-for-surveillance-and-reconnaissance-operations/>.
- Gordon, Chris. "Cutting-Edge Drones Headed to Ukraine in Latest US Aid." *Air & Space Forces Magazine*. February 26, 2023. Accessed May 1, 2025. <https://www.airandspaceforces.com/cutting-edge-drones-headed-to-ukraine-in-latest-us-aid/>.
- Gross, Oren. "The New Way of War: Is There A Duty to Use Drones?" *Florida Law Review* 67, no. 1 (January 2016). Accessed April 28, 2025. <https://scholarship.law.ufl.edu/cgi/viewcontent.cgi?article=1219&context=flr>.
- Gunzinger, Mark, and Lukas Autenreid. "The Promise of Skyborg." *Air and Space Forces Magazine*, November 1, 2020.
- Harper, Jon. "US Central Command's New Task Force 99 Begins Drone Operations in Middle East." *DefenseScoop*. Accessed May 1, 2025. <https://defensescoop.com/2023/02/13/us-central-commands-new-task-force-99-begins-drone-operations-in-middle-east/>.
- Hoehn, John R., Kelley M. Sayler, and Michael E. DeVine. "Unmanned Aircraft Systems: Roles, Missions, and Future Concepts." *Congressional Research Service*, July 2022. Accessed April 20, 2025. <https://sgp.fas.org/crs/weapons/R47188.pdf>.
- Hoehn, John R., Kelley M. Sayler, and Michael E. DeVine. *Unmanned Aircraft Systems: Roles, Missions, and Future Concepts*. Washington, D.C.: Congressional Research Service, 2022. Accessed May 2, 2025. <https://sgp.fas.org/crs/weapons/R47188.pdf>.
- Howard, Stephen P. "SPECIAL OPERATIONS FORCES AND UNMANNED AERIAL VEHICLES: SOONER OR LATER?" Master's thesis, THE SCHOOL OF ADVANCED AIRPOWER STUDIES, 2000. <https://irp.fas.org/eprint/howard.htm>.
- <https://www.davidmurrin.co.uk/blog-entry/drones-at-war-ukraines-revolution-in-military-affairs>.
JFCOM-UAS-Pocket Guide. United States: Joint Unmanned Aircraft System Centre of

- Excellence, 2010.
<https://info.publicintelligence.net/JFCO-M-UAS-PocketGuide.pdf>.
- Koubaa, Anis, and Ahmad T. Azar. *Unmanned Aerial Systems: Theoretical Foundation and Applications*, 1st ed. Cambridge: Academic Press, 2021.
Kratos Defence & Security Solutions. "Tactical UAVs." *Technology Innovation for National Security | Kratos*. Accessed May 4, 2025.
<https://www.kratosdefense.com/systems-and-platforms/unmanned-systems/aerial/tactical-uavs>.
- Lutkevich, Ben. "Drone(UAV)." *TechTarget*. Accessed March 28, 2025.
<https://www.techtarget.com/iotagenda/definition/drone#:~:text=Drones%20have%20two%20basic%20functions,reduce%20weight%20and%20increase%20maneuverability>.
- MacAskill, Ewen. "US drones hacked by Iraqi insurgents." *The Guardian* (Washington), December 17, 2009.
- Marcus, Jonathan. "Combat Drones: We Are in a New Era of Warfare - Here's Why." *BBC News*. February 4, 2022. Accessed May 4, 2025. <https://www.bbc.com/news/world-60047328>.
- Marshall, Jamie. "Exclusive: The Technology Empowering Military and Police Services." *International Security Journal*. Accessed May 1, 2025.
<https://internationalsecurityjournal.com/technology-military-police-ecs/>.
- Miller, Jack. "Strategic Significance of Drone Operations for Warfare." *E-International Relations*. Accessed May 2, 2025.
<https://www.e-ir.info/2013/08/19/strategic-significance-of-drone-operations-for-warfare/>.
- "MQ-1B Predator." *Air Force*. September 1, 2015. Accessed May 5, 2025.
<https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104469/mq-1b-predator/>.
- "MQ-9 Reaper." *Air Force*. March 1, 2021. Accessed May 5, 2025.
<https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/>.
- Munro, Daniel. "SOARING COST OF MQ-9 REAPER EXPLORED AS RUSSIAN JET DOWNS US DRONE." *HITC*. March 14, 2023. Accessed May 5, 2025.
<https://www.hitc.com/en-gb/2023/03/14/soaring-cost-of-mq-9-reaper-explored-as-russian-jet-downs-us-drone/>.
- Murrin, David. "Drones At War: Ukraine's Revolution In Military Affairs." *Official Website of David Murrin - Global Forecaster*. May 21, 2022. Accessed May 4, 2025.
- Nurkin, Tate. "The Importance of Advancing Loyal Wingman Technology." *Defence News*. August 18, 2022. Accessed May 5, 2025.
<https://www.defensenews.com/opinion/commentary/2020/12/21/the-importance-of-advancing-loyal-wingman-technology/>.
- Pace, Peter. *UAS Roadmap 2005*. US, 2005.
https://irp.fas.org/program/collect/uav_roadmap2005.pdf.
- Patil, Sameer. "Ayman al-Zawahiri's killing and the US' over-the-horizon counterterrorism capability." *ORF Observer Research Foundation*. August 30, 2022. Accessed May 1, 2025.
<https://www.orfonline.org/expert-speak/ayman-al-zawahiris-killing-and-the-us-over-the-horizon/>.
- "RQ-4 Global Hawk." *Air Force*. October 3, 2014. Accessed May 5, 2025.
<https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104516/rq-4-global-hawk/>.
- SAE Media Group. "Deceiving the Enemy: These Are the Drones You Are Looking For." *Mobility Engineering Technology*. May 1, 2021. Accessed May 4, 2025.
<https://www.mobilityengineeringtech.com/component/content/article/adt/pub/briefs/unmanned-vehicles-robotics/>.

Spencer, Maj. J. "How Drone Swarms Could Change Urban Warfare." *C4ISRNet*. August 19, 2022. Accessed May 1, 2025. <https://www.c4isrnet.com/opinion/the-compass/net-defense-blogs/2017/12/11/how-drone-swarms-could-change-urban-warfare-commentary/>.

"Surveillance Radar Systems for Drone Tracking & Detection." *Unmanned System Technology*. Accessed March 28, 2025. <https://www.unmannedsystemstechnology.com/expo/surveillance-radar/>

U.S. Naval Forces Central Command. "Task Force 59 Launches Aerial Drone from Coast Guard Ship in the Middle East." *U.S. Central Command*. Accessed May 1, 2023. <https://www.centcom.mil/MEDIA/NEWS-ARTICLES/News-Article-View/Article/3239932/task-force-59-launches-aerial-drone-from-coast-guard-ship-in-middle-east/>.

Urban, Mark. *Task Force Black: The Explosive True Story of the Secret Special Forces War in Iraq*. New York: St. Martin's Griffin, 2012. PDF.

US Air Force. *MQ-1B Predator*. Virginia, 2015. <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104469/mq-1b-predator/>.

US Air Force. *RQ-4 Global Hawk*. Virginia, 2014. <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104516/rq-4-global-hawk/>.

Zhu, Zhengyu, and Xingwang Li. *Intelligent Sensing and Communications for Internet of Everything*, 1st ed. Amsterdam: Elsevier, 2022.

