



## Implementation of Revolution in Military Affairs in the Russian and Ukrainian Wars

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### ABSTRACT

This research examines the implementation of the Revolution in Military Affairs (RMA) concept in the Russian-Ukrainian War, focusing on its impact on military strategies and operational tactics. RMA involves transformative changes in military technology, doctrine, and organization, reshaping modern warfare. In this conflict, elements such as drone technology, cyber warfare, and network-based weapon systems have been pivotal. Using a descriptive analysis method, the study collected data from military reports, journal articles, and news sources to identify how RMA was applied by both sides and evaluate the influence of modern technology on the conflict's outcomes. The analysis focused on Unmanned Aerial Vehicles (UAVs), electronic warfare systems, and network-based defenses, which intensified the complexity and pace of operations. The findings reveal that both Russia and Ukraine adopted RMA elements, albeit with varying capabilities and effectiveness.

## **INTRODUCTION**

The conflict between Russia and Ukraine that began in 2014 and has escalated since 2022 has brought new dynamics to modern warfare. One important aspect of this conflict is the application of the Revolution in Military Affairs (RMA) concept, which refers to the radical changes in military technology, doctrine and organization that have transformed the way war is conducted in the 21st century (Knox & Murray, 2001). RMA involves the application of advanced technologies such as precision weapon systems, Unmanned Aerial Vehicles (UAVs), network warfare and cyber warfare, all of which have significantly affected the way warfare is conducted in this conflict.

RMA began to emerge as an important concept in military studies from the end of the Cold War, when technological advances, particularly in the fields of information, communications and precision weapons, introduced new dimensions to military tactics (Cohen, 2010). On the modern battlefield, RMA technologies enable faster, more accurate and more lethal military operations, changing the characteristics of combat from conventional warfare to more complex and focused on information control and technological superiority. The Russian and Ukrainian conflicts have shown that elements of RMA not only impact the military power of a large state like Russia, but can also be utilized by smaller state actors, such as Ukraine, to balance power in an asymmetric war (Murray & Knox, 2020).

In this conflict, the use of UAV or drone technology, air defense systems, and cyber operations have stood out as key elements in both sides' military strategies. Ukraine, for example, has utilized drones in reconnaissance and precision strike roles against Russian military targets, providing a significant advantage in ground combat and tactical attacks (Watt & Johnson, 2022). Meanwhile, Russia, which has more advanced military technological capacity, has also utilized cyber and Electronic Warfare (EW) capabilities to disrupt Ukrainian military communications and command, as well as conduct precision strikes with guided missiles and artillery based on RMA technology (Clark et al., 2022).

In addition, this war also underscored the importance of network operations and information dominance, two key pillars in RMA. Information has become a strategic weapon no less important than conventional weapons. Both Russia and Ukraine used social media, digital propaganda, and cyberattacks to influence public perception and the morale of opposing forces (Buchanan & Denning, 2022). These operations are not only conducted by the military, but also involve non-state actors such as hacker groups and technology companies, expanding the reach and impact of RMA on the battlefield.

Thus, the implementation of RMA in the Russian and Ukrainian wars not only changed military tactics, but also had a far-reaching impact on the overall strategy of both sides. It blurred the lines between military and civilian, and created a new dynamic in warfare that was increasingly complex and difficult to predict (Freedman, 2022). This war serves as a clear example of how RMA plays a role in increasing the intensity and complexity of modern conflicts, as well as how smaller actors can utilize advanced technology to counter larger and more powerful military forces.

## **LITERATURE REVIEW**

### **Definition and Concept of RMA**

RMA refers to radical changes in military technology that alter the character and dynamics of warfare (Knox & Murray, 2001). According to Cohen (2010), RMA involves the integration of information technology, communications and precision weapons to create more efficient and effective military operations. These technologies enable network-based operations, which not only accelerate the tempo of combat but also increase the accuracy of attacks through the use of real-time data-based surveillance and control systems. This is relevant in the Russia-Ukraine war, where Russia and Ukraine's ability to integrate advanced technologies into their military operations demonstrates the key characteristics of RMA.

In a historical context, RMA first emerged during the Gulf War (1990-1991), where the US military used advanced technologies such as GPS systems and guided missiles to execute precision strikes against enemy targets (Murray, 2010). Since then, major countries such as Russia have begun to develop similar strategies that utilize advanced technology to change their military tactics. Freedman (2022) notes that while Russia is often associated with conventional forces, it has also invested in cutting-edge technologies that enabled the use of cyber warfare and UAVs in its operations in Ukraine.

### **UAV Technology in the RMA**

One important element of RMA that stands out in the Russian and Ukrainian wars is the use of Unmanned Aerial Vehicles (UAVs) or drones. According to Buchanan and Denning (2022), drones have become a strategic weapon in this conflict, used by both sides for reconnaissance, precision strikes and battlefield control. Ukraine, for example, has used drones such as the Bayraktar TB2 to attack Russian military targets with a high degree of precision, providing a significant advantage in tactical combat (Watt & Johnson, 2022). The use of these drones allows Ukraine to offset Russia's military superiority in terms of numbers of military personnel and equipment.

On the other hand, Russia also used drones in this war, although its approach was more integrated with advanced electronic warfare (EW) systems (Clark et al., 2022). Russian drones were used not only to attack enemy targets, but also to disrupt Ukrainian military communications and command systems. Freedman (2022) states that Russia's use of UAVs demonstrates how RMA enables the integration of various elements of modern technology to create more effective and efficient military operations. The strategic environment is a condition, factor, or force that is outside the organization or country, but can affect the achievement of the strategic goals of the organization or country, (David, 2017). Furthermore, according to the Government of Indonesia in Government Regulation Number 41 of 2010 concerning Regional Apparatus Organizations, the strategic environment is defined as "conditions, situations, and developments that occur inside and outside the local government that affect the implementation of local government". Thus, it can be concluded that the strategic environment can be understood as conditions, factors, or forces outside the organization or country that can affect the achievement of their strategic goals.

### **Cyber and Electronic Warfare**

RMA includes not only physical technologies such as UAVs and precision weapons, but also non-physical dimensions such as cyber and electronic warfare. In the context of the Russia and Ukraine wars, cyberattacks have become an important element in both sides' military strategies. Buchanan and Denning (2022) note that Russia has aggressively used cyberattacks to cripple critical infrastructure in Ukraine, including power, communications and transportation networks. These attacks aim to undermine Ukraine's ability to coordinate its operations on the battlefield. In addition, electronic warfare (EW) also plays a key role in Russia's military strategy. According to Clark et al. (2022), Russia has used EW technology to disrupt Ukrainian military communications and radars, hindering their ability to detect attacks and respond quickly. This shows how RMA is changing the character of modern warfare by utilizing new dimensions not previously explored in traditional military strategies.

### **Network and Information-Based Operations**

One of the most significant aspects of RMA is the emergence of network-based military operations, which enable real-time integration of information on the battlefield. According to Freedman (2022), information technology has become central to the changes in military strategy, where speed, accuracy, and connectedness are key elements in determining the outcome of battles. In the Russia and Ukraine war, both sides are using information networks to coordinate attacks and responses more quickly and efficiently. Russia, for example, has utilized network-based command and control systems to integrate various elements of warfare, including UAVs, precision weapon systems and electronic warfare (Watt & Johnson, 2022). This allows them to respond more quickly and effectively to changes on the battlefield. Ukraine has also utilized similar technologies, especially with technological support from international allies, to

enhance their combat capabilities in the face of Russian military superiority (Buchanan & Denning, 2022).

### **Asymmetric Warfare Strategy and the Impact of RMA**

RMA also plays an important role in asymmetric warfare strategies, where smaller state actors can use advanced technologies to confront larger military powers. Murray and Knox (2020) state that RMA technology enables conventionally weaker states to remain competitive on the battlefield through the use of UAV technology, cyberattacks, and information-based operations. In the context of the Russia and Ukraine war, Ukraine has utilized these elements to offset Russia's military superiority, especially in terms of superiority in numbers and equipment. Watt and Johnson (2022) note that Ukraine's strategy of combining precision strikes using UAVs, as well as coordinated network operations, has had a significant impact on Russia's ability to achieve a quick victory. This suggests that RMA is not only relevant to a large state like Russia, but can also be used by smaller states to defend themselves in asymmetric conflicts.

### **Implications of RMA for the Future of Modern Warfare**

The Russian and Ukrainian wars provide a clear example of how RMA will shape the future of modern warfare. Freedman (2022) notes that the technological changes brought about by RMA will continue to evolve, with a greater focus on precision weapons, information-based operations, and non-physical warfare such as cyber and electronic. These conflicts mark the beginning of a new era in military strategy, where technological superiority becomes more important than the number of personnel or conventional forces.

In this context, an understanding of RMA is crucial for future military studies. States that want to remain relevant on the modern battlefield must invest in advanced technologies and integrate elements of RMA into their military doctrine and strategy (Clark et al., 2022). The Russian and Ukrainian conflicts, in all their complexity, show that modern warfare is not only defined by physical strength, but also by the ability to adapt advanced technologies in military operations.

### **METHODOLOGY**

This article is compiled based on the literature study method by collecting data through searching for appropriate keywords in search engines, books, journals, or other scientific sources, which are then analyzed and the results are outlined in writing, Zed in (Ningsih et al., 2022). The data used in this writing is secondary data, where secondary data is generally in the form of evidence, records, or historical reports that have been compiled in archives/documentary data, both published and unpublished, Alawiyah in (Rehardiningtyas et al., 2022).

## RESEARCH RESULTS

### Warfare Transformation through Advanced Technology

#### 1. The Role of Unmanned Aerial Vehicles (UAVs) in the Conflict

The Russia-Ukraine war has become a significant example of how Unmanned Aerial Vehicles (UAVs) or drones influence and transform the dynamics of modern warfare. Within the framework of the Revolution in Military Affairs (RMA), UAVs play a crucial role in enhancing military effectiveness through reconnaissance, surveillance, and precision strikes. UAV technology not only allows forces to minimize the risk to military personnel but also improves operational efficiency in complex battlefield conditions. Both Russia and Ukraine actively utilize UAVs in their military operations, reflecting the importance of this technology in modern warfare.

Ukraine has extensively employed UAVs in the war against Russia, primarily for reconnaissance and tactical strikes. One of the most notable UAVs used by Ukraine is the Bayraktar TB2, a Turkish-made drone capable of monitoring and striking targets from long distances. The Bayraktar TB2 played a key role in disrupting Russian ground operations, particularly at the start of the conflict, by destroying Russian convoys and command posts (Buchanan & Denning, 2022). The use of the Bayraktar TB2 by Ukraine demonstrates how UAVs can provide significant tactical advantages in asymmetric conflicts, where a smaller military can precisely target larger, more powerful forces. In addition to the Bayraktar TB2, Ukraine also utilizes modified commercial drones for military missions. These drones are used for reconnaissance and gathering intelligence data, which is then used to plan attacks or monitor Russian troop movements. These UAVs also play an important role in enhancing the situational awareness of Ukrainian forces, allowing them to respond quickly to threats or changes on the battlefield (Clark et al., 2022).

On the other side, Russia has also employed UAVs as part of its military strategy, particularly in reconnaissance and airstrike operations. The Orlan-10 UAV, frequently used by Russian forces, has been involved in battlefield surveillance and artillery targeting. This drone helps Russia coordinate precise artillery strikes by providing real-time information about the positions of Ukrainian forces (Freedman, 2022). The Orlan-10 also has the capability to disrupt enemy communication signals, enhancing the effectiveness of Russia's electronic warfare operations (Watt & Johnson, 2022).

In addition to the Orlan-10, Russia uses the ZALA Lancet drone, which is a loitering munition or suicide UAV. This UAV is launched to directly strike targets such as combat vehicles, air defense systems, and critical Ukrainian military infrastructure. The use of these drones highlights the importance of UAVs in conducting precision strikes on targets that are difficult to reach with conventional weapons, while also minimizing losses for the attacker (Freedman, 2022).

The role of Unmanned Aerial Vehicles (UAVs) in the Russia-Ukraine war demonstrates that this technology has a significant impact on enhancing modern military strategies. UAVs provide strategic advantages through their ability to conduct precision strikes without risking military personnel. Additionally, drones play a crucial role in intelligence gathering and reconnaissance, which are essential in modern operations that increasingly rely on real-time data and information. Within the framework of the *Revolution in Military Affairs* (RMA), UAVs represent one of the most important elements of the transformation in warfare methods and approaches. This technology allows nations with limited resources to remain competitive in asymmetric conflicts through technological superiority. Ukraine, despite having a smaller military force than Russia, has been able to utilize UAV technology to maintain its position and even damage Russian military capabilities (Buchanan & Denning, 2022). This demonstrates that UAVs are not only effective war tools but also symbols of a fundamental shift in the dynamics of modern warfare driven by RMA.

The use of UAVs in the Russia-Ukraine war reflects a major shift in military strategy driven by the RMA. UAV technology enables military operations to become more effective and precise, while also reducing risks to military personnel. This conflict shows that nations that can effectively employ UAV technology will gain a strategic advantage in modern conflicts. Both Russia and Ukraine have demonstrated that UAVs play a critical role in intelligence gathering, battlefield surveillance, and precision strikes, making them key elements in the RMA.

## 2. Precision-guided munitions (PGM)

The use of precision-guided munitions (PGMs) has been a key factor in the implementation of Revolution in Military Affairs (RMA) in various modern conflicts, including the Russian and Ukrainian wars. PGMs are advanced weapons designed to target objects with high accuracy, minimizing civilian damage and ensuring pinpoint destruction. In the context of the Russian and Ukrainian wars, the use of PGMs not only reflects a shift in the way warfare is conducted, but also demonstrates the role of high technology in winning battlefield dominance.

Russia has relied on PGMs to strengthen its strategic advantage in this conflict. Some examples of Russia's use of precision weapons include Kalibr cruise missiles and Iskander short-range ballistic missiles, which were used to attack strategic targets such as ammunition depots, military command centers, and Ukraine's energy and transportation infrastructure. These attacks aim to disrupt Ukraine's logistics and chain of command, reducing their ability to defend controlled territory (Freedman, 2022). Russia also uses these systems to cripple energy infrastructure, creating pressure on civilian populations, especially during the winter. Meanwhile, Ukraine, while more limited in military capabilities, also utilizes PGMs supplied by Western allies. Weapons such as Javelin and NLAW anti-tank missiles, provided by the United States and the United Kingdom, have proven effective in destroying Russian armored vehicles across multiple battlefields (Buchanan & Denning, 2022). The effectiveness of

these precision missiles allows Ukraine to confront larger Russian mechanized forces with fewer military losses, thus providing an important tactical advantage.

The advantage of PGMs in this war is their ability to accurately destroy high-priority targets without the need for large military forces. The accuracy offered by PGMs allowed Russia and Ukraine to achieve strategic objectives without sacrificing significant numbers of military personnel. In addition, PGMs also play an important role in long-range strike operations that avoid direct risk to troops on the front lines. This is particularly relevant in modern warfare that is increasingly dependent on high technology and reduced risk to personnel (Clark, 2022). However, the effectiveness of PGMs is not free from challenges. One of the main obstacles is the technology's dependence on satellite navigation systems such as GPS. In the Russian and Ukrainian wars, both sides have engaged in electronic warfare aimed at disrupting satellite signals and reducing the effectiveness of PGMs (Lanoszka, 2022). In addition, the high development and maintenance costs of PGMs limit their use, especially for Ukraine which relies heavily on supplies from other countries.

### **Implications of Asymmetric Strategy in RMA**

#### **1. Cyber Warfare in Asymmetric War**

Cyber warfare has also become an important component in asymmetric conflicts, especially in the Russia and Ukraine wars. Cyberattacks are used to undermine an adversary's critical infrastructure, such as communications networks, energy systems and military facilities. Russia has used cyber tactics aggressively against Ukraine, launching attacks targeting Ukraine's energy and communications networks, with the aim of disrupting the country's ability to defend and operate effectively. However, Ukraine has also counterattacked through defensive cyberattacks, with help from the international community, including cyber volunteer groups. In asymmetric warfare, cyber warfare provides an opportunity for a country with limited resources to capitalize on technological advantages and hit a larger adversary in critical areas. Cyberattacks allow Ukraine to counterbalance Russian forces on the digital battlefield, creating a new form of resistance that does not rely on physical force.

Electronic warfare also plays a key role in asymmetric warfare. Electronic warfare allows both sides to disrupt the enemy's communication and navigation systems, especially in the context of PGMs and drones that rely heavily on GPS and satellite communication networks. Russia and Ukraine have used electronic warfare tactics to limit the effectiveness of the opponent's precision strikes, with the aim of lowering reliance on technology used for military superiority (Biddle, 2022).

The use of technology in asymmetric warfare has been an important element in the implementation of Revolution in Military Affairs (RMA) in the Russian and Ukrainian wars. Technologies such as drones, PGMs, cyber warfare and electronic warfare have enabled countries with limited resources to remain competitive in the face of larger military forces. The use of these advanced technologies in asymmetric warfare demonstrates a fundamental shift in modern military strategy, where technology, rather than numbers of personnel and equipment, becomes a key determinant in the outcome of conflict.

## 2. Electronic Warfare

Electronic Warfare (EW) has become an important strategic component of modern warfare, and the Russia-Ukraine conflict is a clear example of how this technology is being widely used in the context of Revolution in Military Affairs (RMA). EW encompasses actions taken to control the electromagnetic spectrum, such as disrupting, controlling or exploiting an adversary's communication signals, as well as protecting the same spectrum for one's own use (Biddle, 2022). In the Russia-Ukraine conflict, EW has been used by both sides to gain military advantages, both in terms of defense and attack. Russia has long been considered one of the countries with the strongest EW capabilities in the world. In this conflict, Russia has made intensive use of EW technology to disrupt Ukraine's communications, navigation and reconnaissance. One of the main systems used is the Krasukha-4, a jammer system designed to disable enemy radar and satellite-based UAVs (Giles, 2018). Russia also uses EW technology to counter the Global Positioning System (GPS) used by Ukrainian troops and drones for navigation and precision targeting. By disrupting GPS signals, Russia has managed to degrade the effectiveness of Ukrainian precision strikes, which rely heavily on satellite-based technology.

Russian EW attacks also aim to disrupt Ukrainian military communication systems, directly affecting the coordination of troops on the ground. For example, Russian EW systems are used to target Ukrainian radio and satellite communications, as well as other critical infrastructure connected through electronic networks, thus degrading Ukraine's ability to respond quickly to attacks (Mick, 2022). Despite facing more advanced Russian EW capabilities, Ukraine has also successfully utilized EW technology to counter Russian electronic attacks. Ukraine, with support from Western countries, has developed and deployed electronic countermeasures (ECM) systems to counter Russian EW operations. One of the main forms of response is Ukraine's ability to detect and avoid Russian jamming signals, allowing the use of drones and precision strikes to continue despite electromagnetic spectrum interference (Buchanan & Denning, 2022). In addition, Ukraine also uses EW technology to protect its critical infrastructure, such as civilian and military communications networks, which are targeted by Russian attacks. With the help of advanced anti-jamming software and hardware, Ukraine can maintain the flow of information necessary for its military operations, as well as mitigate the effects of Russian EW attacks.

In the context of Revolution in Military Affairs, EW represents a shift from conventional land-based warfare to more high-tech warfare. The use of EW in the Russia-Ukraine war shows how modern warfare increasingly relies on control over the electromagnetic spectrum to dominate the battlefield. EW has also become an important tool to limit the use of advanced technologies such as Unmanned Aerial Vehicles (UAVs) and precision-guided munitions (PGMs), which require satellite signals and electronic communications to operate effectively (Biddle, 2022). EW in this conflict demonstrates how technology plays a key role in redefining military strategy and tactics in the 21st century. Ukraine has been able to utilize EW capabilities to offset Russia's military superiority, while Russia used this technology to cripple Ukraine's communications and reconnaissance systems. Therefore, EW is not only part of the RMA but also a defining element in modern warfare strategy.

Electronic Warfare in the Russia and Ukraine conflict highlights the importance of the electromagnetic spectrum in modern warfare. Russia's use of EW to disrupt Ukrainian communications and navigation, as well as Ukraine's counter-response through countermeasures systems, shows how this technology can change the course of a conflict. Within the RMA framework, EW represents a non-kinetic dimension of warfare that can have a strategic impact as important as the use of kinetic weapons on the battlefield.

## **CONCLUSIONS AND RECOMMENDATIONS**

The implementation of Revolution in Military Affairs (RMA) in the Russian and Ukrainian wars has shown how technological change, especially in the fields of precision weapons, UAVs and electronic warfare (EW), has changed the dynamics of modern conflict. These technologies enable more precise, rapid and coordinated military operations, capable of counterbalancing larger conventional military forces. UAVs play an important role in intelligence gathering, reconnaissance and precision strikes, while EW is becoming a strategic tool for controlling and manipulating the electromagnetic spectrum, which greatly affects troop communications and navigation. Both technologies demonstrate that modern warfare is increasingly reliant on non-kinetic and digital technologies, and these changes are a hallmark of the RMA.

The conflict also highlights how actors with limited resources, such as Ukraine, are able to utilize modern technologies to defend and even undermine larger military powers, such as Russia (Giles, 2018; Buchanan & Denning, 2022). Conversely, Russia has shown how large traditional military powers can remain relevant by investing in cutting-edge technologies such as EW and UAVs to maintain dominance on the modern battlefield.

**Technology Capacity Building:** States need to develop UAV, EW and precision weapons capabilities to remain competitive on the modern battlefield. Investment in research and development of these technologies should be prioritized. **International Cooperation:** International cooperation is needed to improve defense capacity in the face of modern technological threats. Ukraine, for example, can continue to strengthen its defenses through alliances with countries that have high technological capabilities. **Adaptation of Military Doctrine:** Traditional military doctrine must be adapted to include the use of

digital and non-kinetic technologies such as EW and UAVs in military strategy. The use of these technologies should be thoroughly integrated into modern military tactics and operations.

### **ADVANCED RESEARCH**

Further research on the implementation of Revolution in Military Affairs (RMA) in the Russian and Ukrainian wars could further explore how new technologies, such as artificial intelligence (AI) and autonomous systems, affect future conflict dynamics. In addition, further studies could analyze the long-term impact of electronic warfare (EW) and Unmanned Aerial Vehicles (UAVs) on asymmetric warfare strategies and the development of modern military doctrine. It could also evaluate how the adaptation of these technologies is reshaping global military alliances and the readiness of states to face increasingly complex modern security challenges.

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