ASSESSING MILITARY NECESSITY OF AUTONOMOUS WEAPONS SYSTEMS (AWS) IN ARMED CONFLICTS: A CASE STUDY OF IRAN-ISRAEL

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Abstract

Rapid technological advancement has revolutionised the concept of modern warfare. The deployment of AWS has become a new high for military forces around the globe to get a comparative advantage over an adversary in any combat mission. This research aims to explain the military necessity of the Autonomous Weapons Systems (AWS) in an armed conflict. This study adopted the qualitative explanatory approach, whereas the data was collected from structured interviews, official reports, and journals. On the other hand, the case study Iran-Israel Missile Exchange has been considered to support the thematic analysis. Moreover, the study utilised the Revolution in Military Affairs (RMA) theory, which explains the dual impacts of using AWS in combat missions. However, the study's findings reveal that the deployment of the AWS ensures military necessity for the forces in an armed conflict based on the tactical and strategic advantages. The deployment of the AWS enhances the overall operational effectiveness and gives forces leverage over their foes.

Keywords: Autonomous Weapons Systems, Semiautonomous Systems, Military Necessity, Armed Conflict.

Introduction

The rapid evolution of artificial intelligence in recent years has impacted every walk of life, and the military is no exception. The military is heading towards deployment of autonomous weapons systems (AWS) in armed conflicts. The advancement of AI-based AWS has revolutionised warfare techniques. General Robert Cone, head of the US Army Training and Doctrine Command (TRADOC), said in an interview that the US Army will send robots instead of humans to the battlefield by 2030. He added that one-quarter of the soldiers will be replaced with robots and drones.[1] This development is driven by the expectation of various benefits, including minimum human casualties, increased accuracy, expanded operational adequacy, and enhanced cost efficiency.[2] Moreover, weapons based on advanced technology are being deployed in armed conflict to get a comparative advantage over the adversary.

The development and deployment of AWS marks a paradigm shift in strategies and techniques in modern warfare. There is a need to evaluate the impacts

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of autonomous weapons compared to conventional weapons. A thorough review of the existing literature highlights the evolution of AWS and its benefits. As technology advances, new AWS are increasingly being used in combat for advancements in sensor and analytical capabilities, integration into military operations to defend civilians and property, and to surge the pace of military operations.[3] Automation will be present in weapon systems and battlefields, but genuine autonomy in weaponry will likely remain rare due to unique considerations like tempo and speed requirements for specific operations.[4]

The exacerbating usage of these weapons is now gaining recognition at the global level; many states are using these weapons to get a comparative advantage over their adversaries. AWS are used during armed conflict and are considered a symbol of deterrence among major and emerging powers. For a better understanding of this technology, it is pertinent to recognise the existing level of autonomy in military robots and the limitations they face in the form of control by human administrators. Semi-autonomous systems have been in use for quite some time now. There have been long-standing aspirations to move towards higher autonomy, where AWS can make choices autonomously, including target discovery and engagement.[5] Therefore, the main objective of this study is to comprehensively assess the military advantage of AWS in armed conflict with their status on the global stage.

Theoretical Explanation

RMA provides a framework for analysing and understanding the transformation in military affairs.[6] This theory explains the potential impact of technology integration, changes in organisational structures, and transformation of operational concepts in the military. Andrew Marshall defines RMA as fundamental, far-reaching changes in how advanced militaries either plan to conduct or prosecute military operations; he later added that the term revolutionise does not incorporate rapid or sudden change but the change that must be profound and gives way to new methods of the warfare that would be more powerful.[7] Similarly, in the past, it is evident that innovation in military technology has revolutionised the concept of war. However, this revolution occurs only when new innovative technologies emerge, new methods of operations or warfare develop, and new military organisations are created.[8]

Andrew F. Krepinevich also explained this theory. Interestingly, he says RMA occurs when the integration or use of emerging technologies are seen in many military systems along with new innovative operational and organisational concepts and adaptation, respectively, change the nature of the conduct of war.[9] He further says four factors do not necessarily but still play significant roles in military revolution: technological advancement, system development, operational innovation, and organisational adaptation.[10] Later, he added two more elements: the degree of state competition in the international realm and strategies the opponents opt to pursue to exploit the hidden potential of military revolution.[11]

Another scholar, Richard O. Hundley, explained RMA. He says it is a paradigm shift in military operations and war. Similarly, Theodor Galdi maintained another explanation of the RMA theory that needed to be fully quoted.

> *"A revolution in military affairs takes place when one of the participants in a conflict incorporates new technology, organisation, and doctrine to the extent that victory is attained in the immediate instance, but more importantly, that any other actor who might wish to deal with that participant or that activity must match, or counter the new combination of technology, organisation, and doctrine to prevail. The accomplishments of the victor become the necessary foundation for any future military activities in that area of conflict."*[12]

To sum up, the discourse surrounding the theoretical explanation of RMA provides that this theory is all about the advancement of military technology and transition in operational and organisational concepts and structures to ensure decisive victory in the war.

In the context of this study, RMA provides valuable knowledge for the potential implications of integrating these advanced technological weapons at the operational and strategic level for the military in terms of military necessity. This theory emphasises the transformative effect of innovative technology on military capabilities. AWS is a form of advanced-innovative technology that dramatically increases military effectiveness by ensuring rapid decision-making, precision, and fewer human casualties in the war zone.[13] Therefore, this theoretical framework aims to check how the usage of AWS brings technological revolution in the military and increases the effectiveness of operations.

Methodology

The study adopted a qualitative interview-based case study approach to explore the military necessity of utilising AWS in armed conflict. A purposive sampling technique was adopted for data collection from officers and experts on armed conflict law, ensuring the selection of participants with direct and relevant experience. Structured interviews were conducted with 13 participants to get in-depth insights on the subject matter. The interviews were transcribed, then specific themes and patterns were identified using thematic analysis. The thematic analysis provided a comprehensive understanding of the subject matter with the further utilisation of the Iran-Israel missile exchange case study.

Current Status of Autonomous Weapons Systems (AWS)

Recent technological advancements have led to debate over AWS's operational capabilities and legal/ethical implications. This section provides a significant understanding of the current status of AWS based on the degree of human involvement and different types of AWS being deployed by states in armed conflict, such as defence systems, UAVs, etc.

General Understanding of Autonomous Weapons Systems

Automation and autonomous are two terms used interchangeably but have different meanings. Marra and Macneil say the more the system works without human involvement, the greater the autonomy.[14] Currently, technologies have been deployed in armed conflicts with a certain level of autonomy to track, identify, decide, and target; these systems fall under the spectrum of autonomy. On the other hand, autonomy in weapons is only active when the human response is limited, or there are circumstances where the human engagement time is narrow.[15] From this definition, it can be said that autonomy is best characterised by the discrete property of any system and an association between a system and its operator. This can vary across weapon systems based on the degree of the system's autonomy.[16] For a broader understanding, the definitions of the International Committee of the Red Cross (ICRC) and the US Department of Defence (DOD) are considered to explain the concept better.

According to the DOD:

> *"A weapon system that, once activated, can select and engage targets without further intervention by a human operator. This includes human-supervised autonomous weapons systems designed to allow human operators[17] to override the operation of the weapon system but can select and engage targets without further human input after activation."*[18]

On the other hand, ICRC says:

> *"Any weapon system with autonomy as a key function, that can select, detect, identify, track or select, and attack, neutralise, damage, or destroy a target without human intervention."*

However, when lethality is added to these systems, they become Lethal AWS.[19] Therefore, based on these two statements, this study defines AWS as "a system that can accomplish its mission with limited or without human intervention". Hence, AWS is a system whose selecting and targeting functions are autonomous but directed by other agents for all its purposes of operability and mobility. Further explanation of the AWS is given in the succeeding paragraphs.

Types of Autonomous Weapons Systems

There is no internationally agreed definition of AWS. However, the US Department of Defense divides AWS into three main categories (Semiautonomous weapons, human-supervised weapons, and autonomous weapons) based on its level of autonomy.[20] Furthermore, Human Rights Watch applied the loop theory to these categories with the addition of a degree of control and defines AWS as human-in-the-loop, human-on-the-loop, human-out-of-the-loop.[21] Based on this categorisation, the study illustrates types of AWS in the Table below, and each type is explained in the succeeding paragraphs.

Autonomous Weapons based on Level of Autonomy and Degree of Control

Type of AWS	Loop	Definition	Example
Semiautonomous Weapons	In	Systems capable of operating with limited human intervention for the selection of the target	Reaper and Predator Drones
Human-supervised Weapons	On	Systems can operate with human intervention, especially in case of termination or to avoid excessive damage	Global Hawk Surveillance drone
Lethal Autonomous Weapons	Out	Systems can operate (once activated, select and target independently) without human intervention	Kamikaze Drones, Taranis Drones, SGR A1 Sentry Robots, Aegis Combat System

Source: Authors, Based on Information Available on Secondary Source of Data

Semiautonomous Weapons

This type of AWS is also referred to as a human-in-the-loop weapon system. Once activated, it is a weapon system that requires limited human intervention. In other words, A type of autonomous weapon only intended to engage targets (individuals or groups) preprogrammed by the human operator. Paul Scharre rightfully says that in a weapon system, if a human remains when the system (observes, orients, decides, and acts) to target the object or individual – this system is considered an autonomous weapon system.[22] In this situation, the search and target of the object or individual may be autonomous, but only the human operator decides to engage or target. Drones' technology in modern warfare falls under this type of AWS category.

Human-Supervised Weapons

Human-supervised AWS is also known as a human-on-the-loops weapon. These are types of autonomous weapons that require full human intervention from activation to termination. The human operator in this weapon system acts as a supervisor to intervene and terminate the target even in case of system failure or when there are chances of unacceptable destruction.[23] These weapons autonomously select and attack the individual or object based on a pre-programming nature. However, they retain continuous human supervision for their operability and, if necessary, override the system within a narrow time frame. An example of this weapon system includes the missile defence system of the contemporary world.

Lethal Autonomous Weapons (LAWS)

The type of AWS is also referred to as a human-out-of-the-loop weapon. This one is the most typical type of AWS and has yet to be developed fully. Once activated, it is a weapon that selects or engages an individual or object without any human intervention by any human agent. This type of AWS works fully autonomously without further human involvement; they have an element of autonomous decision-making regarding selecting a target or using force against it. Robert Sparrow claims that fully autonomous weapons or lethal autonomous become self-aware and may act rogue because of their level of autonomy without human intervention.[24] Due to their self-awareness, these weapons systems are equipped with the ability to make decisions. Moreover, a genuinely lethal autonomous system can learn and adapt its functioning to change circumstances or according to the evolving battlefield conditions.[25] Based on this, they are often called 'killer robots' or 'robotic weapons.'[26] Examples of this type of weapons include loitering munitions.

Classification of Autonomous Weapons Systems (AWS)

AWS emerged as a significant advancement in military technology and revolutionised warfare. These weapons are characterised by their capability to operate with limited or without human intervention. Based on their operational environment, these weapons are classified into fixed positions, ground, air, and maritime, and have loitering capabilities. Furthermore, this classification has a diverse transformative impact on contemporary warfare. Understanding this classification is essential for analysing their military necessity and ethical/legal implications. Therefore, this section examines the classification of AWS already being used in armed conflicts and some under development.

Fixed Position Weapons Systems

The current AWS with the highest autonomy level are fixed-position weapons systems. As opposed to remote unmanned systems, these weapons operate in stationary positions. These systems include land-and-sea-based defensive systems and fixed gun systems or sentry guns, which have different levels of human intervention. Many countries around the globe are currently using fixed-position AWS for defence against rockets, missiles, drones, aircraft, and high-speed boats.[27] These weapons are primarily semi-autonomous and human-supervised and require human supervision. However, a few of these weapons are being developed; they can perform their operations without human intervention. The table illustrated gives the names of a few weapons that fall under this category

Fixed Position Autonomous Weapons Systems with Brief Description

	Name	Usage	Autonomy	Country	Year
Classification: Fixed Position AWS	Patriot (PAC-3) MSE	Hit-to-kill technology with improved range and accuracy	Semiautonomous	USA, Germany, Israel, UAE	2015
	Phalanx (CIWS) SeaRAM	Hybrid missile system for more excellent capability	Semiautonomous	USA, Germany, Japan, South Korea	2008
	Iron Dome	Air defence for intercepting missiles	Semiautonomous	Israel	2011
	NBS MANTIS	Air defence system	Semiautonomous	Germany	2011
	Samsung SGR A-1	Sentry Robot system, deployed along borders and military installations	Semiautonomous	South Korea	2007
	C-RAM	Air defence system that detects and tracks incoming missiles	Semiautonomous	USA, Germany, UK, Israel. Netherlands, Australia	2004

Source: Authors, Based on Information Available on Secondary Source of Data

Ground Weapons Systems

Unmanned ground AWS have been developed with fitted weapons to perform remote operations and have the potential to perform autonomously. According to the DOD, these weapons are designed with two potential uses: reaching out to inaccessible or dangerous areas for humans and use as a weapon system.[28] This type of

weapon provides force multiplication benefits to the troops. Also, these weapons are used for bomb disposal purposes. Even the US is testing and developing ground combat systems to fight with enemy combat systems instead of human soldiers.[29] Still, these systems are not yet developed, but they have the potential to be realised shortly. Based on the currently developed ground weapons, the table illustrates some of their examples below.

Ground-Based Autonomous Weapons Systems with Brief Description

	Name	Usage	Autonomy	Country	Year
Classification: Ground-based AWS	THeMIS	For the role of transport, logistics, and support	Semiautonomous	Estonia	2015
	DOGO	For close-quarter combat, and IRS	Semiautonomous	Israel	2016
	Uran-9	For reconnaissance and fire support	Semiautonomous	Russia	2016
	Milrem Robotics type-X	For support, IRS, and direct engagement	Semiautonomous	Estonia	2020

Source: Authors, Based on Information Available on Secondary Source of Data

Maritime Weapons Systems

Maritime AWS have also been developed in various sizes and functions. Based on their operations, these weapons are further categorised into antisubmarine warfare or surface warfare and underwater vehicles for using lying mines and underwater attacks.[30] These weapons have revolutionised the concept of maritime warfare; they can deal underwater, especially in case of communication difficulties. Furthermore, they can perform several operations with autonomy underwater for days without human intervention. The table gives names of developed maritime autonomous weapons.

Maritime Autonomous Weapons Systems with Brief Description

	Name	Usage	Autonomy	Country	Year
Classification: Ground Based AWS	Sea Hunter	Antisubmarine warfare and surveillance system	Autonomous	US Navy	2016
	ACTUV	For warfare and surveillance	Autonomous	US Navy	2016
	Black Fish UUV	Under water UV for ISR	Autonomous	China	2015

Source: Authors, Based on Information Available on Secondary Source of Data

Aerial Weapons Systems

The Aerial AWS among all AWS stand out. These weapons have the most advanced technology and strategic importance in contemporary warfare regarding speed, precision, accuracy, and operational efficiency. Aerial AWS encompasses a broad range of systems, from Aircraft to loitering munitions, that require varying degrees of human involvement. These weapons are further categorised into various types:

Aircraft

Autonomous fighter jets are yet to be developed with high autonomy. Older fighter jets require full human supervision for carrying out operations such as pinpoint accuracy to shoot down enemy jets, but modern fighter jets include advanced technology tools to assist in combat operations based on inbuilt sensors, radar, and guided missiles. However, various semiautonomous jets have been developed, which have laid the foundation for future autonomous combat air jets. With the successful test flight of X-47B, Northrop Grumman demonstrated that the stage is set for developing a more permanent fleet of uncrewed Aircraft in the future.[31]

Aerial Autonomous Weapons Systems with Brief Description

		Name	Usage	Autonomy	Country	Year
Classi-fication: Air AWS	**Aircraft**	X-47B	Combat Aircraft	Autonomous	US	2011
		Taranis	For IRS and direct engagement	Semiautonomous	UK	2013
	UAVs	Kamikaze Drones	For precision strikes and tactical operations	Semiautonomous and Autonomous	USA, Russia	Multiple Years
		Heron TP	For IRS and strike operations	Semiautonomous	Israel	2010
		Harpy	Targeting enemy radar system	Semiautonomous	Israel	1990
	Loitering Munitions	KUB-BLA	Suicide drones for precision strikes	Autonomous	Russia	2019

Source: Authors, Based on Information Available on Secondary Source of Data

Uncrewed Air Vehicles (UAVs)

Uncrewed Air Vehicles (UAVs) are one of the most significant revolutionary inventions in the military field. They are also known as drones commonly. These systems can be operated remotely or autonomously without any human pilot onboard. Since the beginning of the 21st century, UAVs have been extensively used in military operations.[32] UAVs are used for ISR, precision strikes, situational awareness, and logistic support. They come in various sizes and shapes based on their functioning and operability. Tactical UAVs are used for gathering intelligence at intermediate range; on the other hand, strategic UAVs are large-fixed-wing resembling conventional Airplanes, used to perform long-range, high altitude, and high-speed missions.[33] The advanced models of UAVs have decision-making capabilities for target identification and engagement with limited human intervention.

Loitering Munitions

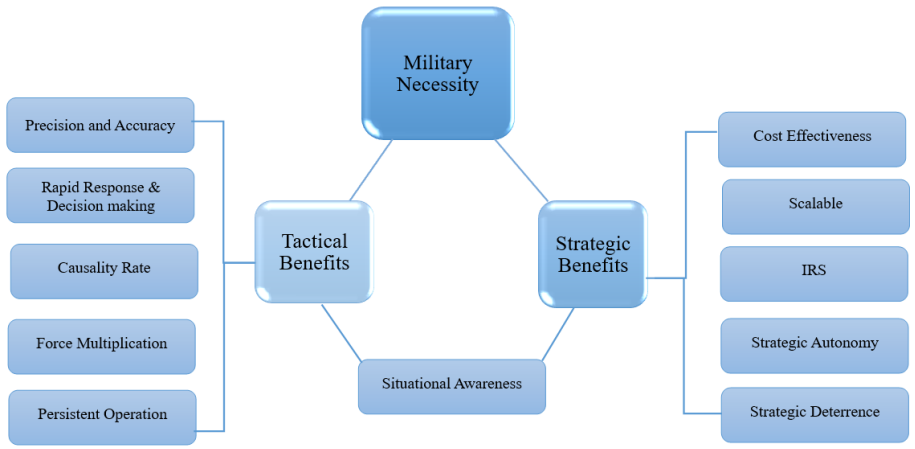
Loitering munitions are a new generation of UAVs that aim to provide next-level value precision and flexibility in contemporary warfare. Unlike UAVs, they are

designed to be operated in warfare for direct targeting as they have fire capability due to built-in warheads. It loiters in the Air for extended periods to carry out their autonomous missions. This munition is becoming a critical tool for modern militaries as it has been extensively used in the Russia-Ukraine war.[34] Examples of such munitions are a kamikaze drone or a suicide drone.

Military Necessity of Autonomous Weapons Systems

This section provides a complete analysis and findings of the first dependent variable, Military Necessity. The analysis presented here is based on the themes extracted from the data collected from structured interviews. The detailed structured interviews of respondents from the selected sample size provided a significant understanding of the military necessity or advantages of using autonomous weapons in armed conflict. The research incorporates thematic analysis to elaborate on the perspectives of the military and legal experts on the given topic, focusing on the theme of military necessity. The sub-themes of the primary variable are elaborated below in Figure.

Identified Sub-themes of Military Necessity



Source: Authors, Based on Information from Primary Data

Military Necessity is the fundamental principle in the justification of any warfare. It is a principle of the law of armed conflicts that justifies using force during any armed conflict only to achieve the military objective. The indispensable measures for securing the goals/ends of wars are known as military necessity.[35] Similarly, Michael N. Schmitt argues that military necessity ensures the complete submission of the enemy with the least resources—time, life, and cost.[36] However, the recent revolution in military affairs has advanced the conduct of war. In the past, the states used various war tactics to achieve their military objectives. These military objectives

have been achieved by introducing gun powders, firearms, mechanisation, railroads, aircraft, etc. The development of nuclear weapons and advancement in computing and information technology revolutionised the concept of war. Nevertheless, in contemporary warfare, the RMAs are driven by artificial intelligence and autonomous systems to achieve military necessity. One of the respondents said, "The evolution of AWS has advanced the strategies of war".[37] The AWS is transforming changes in the conduct of warfare with critical significance in enhancing efficiency, precision, accuracy, and strategic capabilities.[38] As one respondent stated, "Throughout my military career, I have seen advancement in the tactics of war, but the recent advent of AWS has taken armed conflicts to another level."[39] This section aims to explain the deployment of the AWS in any armed conflict meeting the criteria of military necessity by analysing the operational effectiveness of the AWS incorporating both tactical and strategic benefits to bring advancement into the conduct of war.

Operational Effectiveness

Operational effectiveness in any armed conflict is essential for the military forces to achieve their tactical and strategic goals while reducing the threats and risks with evolving situations of the battlefield and manifesting the desired impact. Similarly, the operational effectiveness of the AWS is deeply rooted in their capability of deployment in armed conflict with greater precision, persistency, and efficiency than conventional weapons. In this regard, the advancement of the AWS proved to be revolutionary in military affairs. As Ajey Lele says, AWS offer ample advantages for the militaries, and these weapons systems have the potential to be 'faster, better and cheaper.'[40] The tactical and strategic benefits of the AWS for any armed conflict are discussed in the succeeding paragraphs.

Tactical Benefits

AWS can provide significant tactical benefits to the military forces by enhancing operational effectiveness in armed conflict. These systems provide precision with persistence on the battlefield. The AWS can be operated autonomously or with little human intervention to give soldiers rapid response time and effective decision-making. Furthermore, integrating advanced sensors and pre-programming allows AWS to perform tasks in complex missions, as it is said that robots are intelligent like humans and can operate in all domains, whether they are trained for it or not.[41] This uniqueness of AWS has enabled the forces to engage with the adversary more strategically while maintaining superiority in an evolving battlefield environment. AWS provide several tactical advantages to the military in an armed conflict.

Precision and Accuracy

To begin with, AWS significantly enhance the precision and accuracy of targeting enemy positions or objects in combat operations. With advanced integrated sensors, AWS can accurately identify, locate, and engage enemy targets. This further

ensures minimum collateral damage and exacerbates the mission's success rate in an armed conflict. Andrew Salerno says one area that can benefit military goals with AWS is precision targeting with minimum collateral damage.[42] These weapon systems use vast amounts of data in real-time for rapid response to target positions that surpass human capabilities. Also, the high accuracy provided by the data analysis in real-time ensures that the weapons deliver munitions with pinpoint precision, reducing the threat of unintended damage and leading to achieving the military objective. One of the respondents reported, "AWS can increase accuracy and precision in any armed conflict with minimum loss of life and collateral damage due to its ability to pinpoint targeting."[43] For instance, Iran launched drones toward Israel to target their bases or military infrastructure with precision to avoid civilian or collateral damage. This cutting-edge technology not only provides efficiency in the mission but also allows strategic manoeuvres within the changing conditions of the battlefield. Another respondent says AWS allows strategic manoeuvres in evolving battlefield conditions with continuous speed, accuracy, and precision operation.[44] The precision and accuracy provided by AWS ensure advancement in armed conflict driven by Revolutionising Military Affairs (RMA). As these weapons enhance operational effectiveness, they are a central component of RMA.

Rapid Response and Decision Making

In addition to this, AWS also offer rapid response and decision-making capabilities to the military forces in an armed conflict. The battlefield environment in any armed conflict is supposed to be complex. It requires swift reaction in minimum time, especially when there is a high-stake operational situation, and time is considered crucial to determine the impact of the outcome of the target. AWS can analyse vast amounts of data to assess threats in the given environment further and make rapid, precise decisions using data processing ability. Marko Kovic acknowledges the positive outcomes of autonomous weapons on the battlefield; in essence, these weapons can make complex decisions like humans, either soldiers on the grounds or commanders-in-chief in the decision-making chain of the military.[45] AWS can provide a comparative advantage over the adversary in this case by utilising a rapid decision-making process, enabling forces to neutralise the emerging threats effectively and further adapt to the evolving circumstances of the battlefield.

One of the respondents stated:[46]

> *"AWS has exceptional decision-making abilities; these weapons can identify, track, and pinpoint targets by showing the exact image of the target and suggesting the type of weapon to use. AWS also assists commanders in making decisions by showing a Common Operating Picture (COP)."*

Thereby, AWS enhance the success of the combat mission in an armed conflict with a decisive edge. Also, in situations where there are communication gaps or disruptions within the command center. These weapons ensure continuity in the

mission and maintain operational momentum even when the enemy forces employ a communication breakdown or electronic warfare. Another respondent argues, "I believe that even during communication breakdown, AWS can make faster decisions with a complete evaluation of risks and opportunities to gain comparative advantage on the battlefield."[47] Likewise, rapid response and decision-making given by AWS are considered the primary outcomes of RMA theory. These weapons shift war tactics by enabling instant responses and giving leverage to forces in a rapidly changing operational environment. In the case of the Iran-Israel missile stand-off, the Iron Dome instantly detected the incoming missiles and intercepted them to ensure no harm to civilian population or objects.

Reduction in Causality Rate of Soldiers

Another crucial tactical benefit of AWS in armed conflicts is reducing the casualty rate of the soldiers. Technological advancement driven by RMA is ensured with the use of AWS in armed conflicts to reduce the number of casualties among soldiers. The AWS can perform high-risk missions in the most dangerous environments where deploying humans is risky due to threatening conditions. Marchant posits that AWS can reduce the casualty rate by reducing the involvement of soldiers in threatening environments.[48] As already discussed, AWS provide high-precision and rapid response even without soldiers ensuring the safety of human lives. AWS can replace human soldiers in dull and dangerous environments, especially in missions/areas of long sorties, bomb disposal, high radioactive materials, and operating in nuclear clouds. The reduction of the involvement of humans directly in the mission not only lowers the rate of casualties but also enables the strategic deployment of soldiers to achieve military advantage in an armed conflict.

A respondent provides several ways how AWS can reduce the loss of human soldiers in any armed conflict:[49]

> *"The AWS can reduce the casualty rate of soldiers in several ways. First, these weapons can provide troops with convoy protection during their mobility from one place to another by avoiding surprise attacks. Second, AWS now allow us to strike enemy hideouts without deploying the troops on the ground. Third, these weapons loiter over a target area for long durations for surveillance and assist in identifying potential threats before they become menaces for the soldiers. Fourth, these provide direct force protection while operating in environments requiring soldiers to be deployed and conduct patrols, especially in troubled areas. Last, AWS can now help us identify potential Improvised Explosive Devices (IEDs) in operational areas, resulting in significantly reducing the casualties of soldiers in any conflict."*

However, the engagement of the AWS increases the casualties for adversaries. It can inflict harm to the forces of foes at an exceptional level to have a comparative advantage over them. In this regard, another respondent stated, "AWS can maximise the casualty rate of enemy forces if they are a counterattack target; the attack would be directly on the military installations or objects, where there is the possibility of the

availability of enemy forces. In this case, direct harm can be inflicted, which increases the human loss of adversary forces."[50]

Force Multiplier

Similarly, one of the most essential advantages of AWS in tactical operations is enabling itself to act as a force multiplier. These weapon systems can perform their role traditionally with double impact power. AWS, as force multiplier, amplify the effectiveness of the small forces.[51] These weapon systems cover more areas to execute complex operations simultaneously while allowing soldiers to be strategically deployed to more critical areas on the battlefield. This capability of the AWS allows military forces to get a higher operational impact with the involvement of fewer human resources. The RMA theory underscores the importance of AWS technology in amplifying the military's capabilities by acting as force multipliers. One of the respondents suggested, "AWS allow military units to achieve greater operational impact with fewer personnel, increasing overall combat efficiency and enabling more strategic allocation of human resources to critical areas, ultimately enhancing the military's operational reach and effectiveness."[52] In the case of the Iran-Israel Missile Standoff, Semi-AWS allowed both rivals to extend their combat reach without enhancing or compromising the workforce.

Persistent Operation

Moreover, AWS can be operated continuously in armed conflicts because of their zero-fatigue ability compared to humans, which leads to persistent missions. AWS do not require sleep and rest as compared to human soldiers. Michal Klincewicz claims AWS cannot feel stress, fatigue, or pain; they also obey orders and come back home from war with Post Traumatic Stress Disorder (PTSD).[53] Similarly, RMA theory posits that continuous operational capability is the critical advancement of the military. The AWS can also be operated over extended periods to support the mission. A US Air Force Captain, Michael Byrnes, demonstrates that a single UAV with complete autonomy and accuracy can perform a few hundred rounds of ammunition with sufficient fuel reserves compared to human pilots who cannot perform long-duration operations.[54] This continuity of their operation further allows them to monitor vast areas to assess the threats, gather intelligence, and surveillance without any disruption. A respondent asserted, "The continuous operational capability of AWS increases situational awareness and rapid response capability, which enable commanders to utilise the real-time data for effective decision making."[55] For example, Iron Dome – performed consistent operations during the Iran-Israel missile crisis to detect and intercept the missiles.

Strategic Benefits

AWS allow forces to achieve military objectives by providing strategic advantages and the ability to transform complex operations through advanced

autonomation in any armed conflict. Integrating cutting-edge technology in the AWS increases the agility and response capabilities, resulting in operational effectiveness on the battlefield. According to Christian Trotti, Assistant Director of Forward Defense at the Atlantic Council, AWS integrated with AI have implications for the conduct of war and deterrence in future conflicts. These weapons can bring revolution to military affairs and potentially shape future warfare.[56] AWS assist militaries in operations with less reliance on human intervention and more focus on providing situational awareness and optimising military utility in armed conflict. These weapons systems strategically provide an adaptable military posture crucial for engaging in the dynamic security environment.

Cost-effectiveness

AWS are cheaper than conventional weapons. The cost-effectiveness element of the AWS allows the military to get a strategic advantage in armed conflict. Nowadays, cheaper UAVs and swarms are being manufactured to provide the power of force multiplier during any operation compared to conventional weapons. Masood and Baid say AWS are cost-effective and can be produced faster than conventional weapons.[57] Similarly, a respondent for this study illustrates an example of a single Kamikaze drone that is cheaper to acquire but can destroy expensive tanks or radar systems.[58] In addition to manufacturing costs, AWS require a smaller workforce for deployment, further reducing the logistic burden. This capability of AWS results in lower operational costs, enabling the defence budget to be used in other critical areas. Likewise, another respondent asserted, "If we do a cost-benefit analysis of both conventional weapons and AWS (drones), the latter is cheaper to acquire than the F-16, a conventional weapon."[59] He added, "AWS' operational and maintenance cost is half the cost used to maintain conventional fighter jets and helicopters like Cobras."[60] As RMA theory says, technological integration in the military brings advancement and further reduces the budget; the technological advancement driven by AWS not only ensures this stance. Additionally, AWS provide high precision and accuracy with doubled impact, reducing the number of weapons deployed as a single weapon fulfils the requirement.

One of the Respondents gave an overview of the cost-effectiveness of AWS:[61]

> *"Indeed, they are more cost-effective than conventional weapons; first and foremost, AWS have reduced personnel costs, with minimal human supervision, reducing the need for large numbers of personnel to operate and maintain them; also, using AWS can reduce overall operational costs as well, and they have long service lives, hence saving the national exchequer. Moreover, they have reduced maintenance costs; apart from all these, they also reduce battle damage, including personnel casualties, saving costs for medical care, rehabilitation, and replacing personnel and assets."*

Intelligence, Reconnaissance, and Surveillance (IRS)

Moreover, AWS can provide intelligence, reconnaissance, and surveillance (IRS) to streamline operations in any armed conflict. These weapon systems are equipped with advanced sensors that enable them to conduct persistent IRS in vast areas without human intervention. Major Andrew William Sanders says that swarming drone units that disperse and then vigilantly concentrate critical moments allow the IRS to destroy the target and transform tactical benefits into strategic advantage in the long run.[62] The AWS can be operated in hazardous or remote environments where it is challenging to deploy human soldiers or where the involvement of human resources is impractical. These systems, especially in those environments, can identify, track, and assess activities rapidly, target them with high precision and reliability, and provide continuous situational awareness to the commanders. A respondent stated, "AWS, with its ease and speed of operation, stealth, and robustness, would increase freedom of action in acquiring intelligence pre and post-action (battle damage assessment), reinforce the protection of the group, and enhance the effect of deception manoeuvres against enemy forces."[63] The militaries can further monitor the enemies' movements by utilising these weapons and enhancing their quick decision-making, resulting in the mission's ultimate success. For instance, recent drones like kamikaze have gained situational awareness before engaging targets.

Another respondent said:[64]

> *"With AI algorithms, AWS can process and analyse vast amounts of data from various sources, including sensors, satellites, drones, and reconnaissance platforms. Fusing information from multiple sources can generate a comprehensive picture of the battlefield, including enemy positions, terrain features, and potential threats. AWS's Pattern Recognition (PR) and Anomaly Detection (AD) capability enables early detection of potential threats, such as enemy movements or suspicious activities, allowing commanders to take proactive measures to mitigate risks."*

Scalability

Furthermore, AWS, due to their capability to adapt to dynamic operational requirements, provide scalable benefits to the military. The pre-programmed nature of the AWS allows them to be deployed in diverse environments to perform varying tasks from surveillance to direct combat operation and logistical support as compared to conventional weapons. Scalability is a crucial aspect of transformation, and this transformation ensures the advancement of the military, which is the main point of RMA theory. This scalability means that AWS can be redeployed quickly to deal with emerging threats or adjust to varying strategic priorities. Scholars argue that AWS exhibit advanced autonomy, scalability, coordination, and redundancy features.[65] This capability ensures that the military operation must be responsive and effective. A respondent claimed, "AWS can scale operations efficiently as needed."[66] These weapon

systems are manufactured to be deployed in layered missions or across multi-domain operations (MDOs) where integrated forces or capabilities exist. The AWS multi-domain operability allows forces to leverage the power of each domain (land, Air, sea) to get operational outcomes with coordination and comprehensive strategies. AWS can help create data fusion, data coming from different sides (land, Air, sea), and ensures data mining techniques. For instance, one of the respondents said, "AWS can support Multi-Domain Operations (MDOs) with surveillance in the Air to transfer critical information to the land forces to execute cyber operations by disrupting the communication lines of the enemy simultaneously – providing a unified operational response to the military forces to get a comparative advantage over the adversary."[67] For example, during an integrated operation, drones can be used for air surveillance and strikes; meanwhile, ground AWS can provide logistic support to military forces, or an automated defence system can detect and intercept incoming missiles. This integration ensures operational flexibility with evolving battlefield conditions.

Strategic Autonomy

Strategic autonomy is another significant benefit of AWS. AWS enable military forces to enhance the mission's success rate by reducing reliance on human operators. RMA theory posits that the military can execute its operations with real-time adaptability to ensure advancement. However, it can be done by integrating AWS to execute a mission with minimum human oversight. Scholars argue that AWS are the best invention as they can limit the involvement of humans in war.[68] Similarly, General Robert Cone suggested that by relying on support robots, the military can reduce the size of a brigade in terms of human resources without compromising the effectiveness of the operation.[69] With AWS, soldiers can only pay attention to take rapid and decisive actions on the battlefield despite fully engaging in the war. A respondent reported, "With the usage of AWS, strategic autonomy can be achieved in contested environments with a probability of a high success rate. Meanwhile, soldiers can be deployed to less dangerous areas."[70] An example of strategic autonomy is the usage of drones by the US in counterterrorism operations; these drones were used to perform surveillance, and conduct strikes precisely with limited human involvement.

Deterrence Capability

Another advantage of AWS at the strategic level is their ability to bolster deterrence capabilities. These capabilities can be achieved by strengthening the ability of the military to manifest its power and responsive nature in the theatre to potential threats. AWS offer formidable strategic deterrence because of their rapid deployment, precision, accuracy, and persistence in operations. In addition, AWS can be deployed strategically to enforce the policies of deterrence that are to be realised by the enemy. This further demonstrates a credible response capability against adversary forces. According to Michael C. Horowitz, AWS increase deterrence stability through active signalling.[71] [72] Due to their independent operability nature, the AWS allow swift response against aggression or coercion while maintaining deterrence by manifesting

forces' ability to protect their national interests. One of the respondents states "that deploying AWS in armed conflict offers strategic benefits such as integrating battlefield information for enhanced Command, Control, Communications, Computers, Intelligence, Surveillance, Target Acquisition, and Reconnaissance (C2ISTAR), based on their active monitoring and predictable response. They further ensure any aggressive response the enemy takes will be swiftly countered, enhancing deterrence capabilities."[73] Besides this, a credible deterrent posture reduces the likelihood of retaliation by the adversary to escalate the conflict, thus ensuring stability in a contested environment. RMA theory underscores the innovative technology for military advancement – this advancement in military technology improves the deterrence posture. AWS are advanced technology demonstrating their ability to respond rapidly to aggression.

Iran-Israel Missile Exchange: A Case Study

The recent Iran-Israel missile exchange incident involved extensive use of both autonomous and semiautonomous weapons. This incident highlights the exacerbating significance of AWS in modern armed conflict. The missile exchange started on April 13, 2024, when Iran launched a layered onslaught attack against Israel with more than 300 drones and 120 missiles, including both ballistic and cruise missiles.[74] This attack was a retaliatory strike under "Operation True Promise" for Israel's attack on the Iranian diplomatic Base on April 18 in Damascus, killing seven key figures of the Islamic Revolutionary Guard Corps (IRGC).[75] In response to this attack, Israel again conducted Airstrikes inside Iranian territory, targeting several areas, including Isfahan and Tabriz. The aim of using this case study is to examine how AWS were deployed by both states, ensuring military necessity.

Iran used a significant number of drones, including Shahed-131 and Shahed-136 variants that have the capability of autonomous flight and precision targeting with built-in warheads – a relatively cheaper to manufacture.[76] [77] Along with these drones, Iran deployed Paveh cruise missiles with semiautonomous features for navigating and targeting, further allowing them to follow a flight path that assisted them in evading the defences of a hostile state. On the other hand, Israel used its' state-of-the-art Iron Dome, a semiautonomous defence system. Nimran says Israel's Iron Dome has been operational for over a decade and now uses significant AI Algorithms to improve system accuracy."[78] Moreover, an Arrow missile defence system should be used to defend against the attack of Iran on its territory.[79] Likewise, the retaliatory strikes conducted by Israel involved precision-guided missiles with the ability to target autonomously with high accuracy.

Regarding the strategic benefits, fully autonomous and semiautonomous systems allowed Tehran to launch a coordinated large-scale attack with precision and accuracy while ensuring no collateral damage or damage to any civilian object. Furthermore, these weapons allowed Iran to execute complex attacks with limited human intervention. This strategy ensured no risk to soldiers while surging

operational flexibility. Also, using many of these weapons demonstrated Iran's credible deterrence capability at the international level, showcasing advanced military technology. Similarly, Tel Aviv also gained strategic benefits by deploying fully and semiautonomous weapons systems. These systems enabled Israel to effectively and efficiently defend its territory. Only the Iron Dome system intercepted and neutralised a significant number of Iranian drones and missiles in the air, further protected the civilian objects, and ensured no collateral damage. Nimran states that Iron Dome's success rate is more than 90 per cent and has low operating costs.[80] They were giving the upper hand to Israel, as with the usage of these weapons for defence, it gained strategic control over conflict to avoid unnecessary escalation.

The usage of AWS in the Iran-Israel missile exchange has broader implications. The deployment of the AWS stabilised deterrence dynamics for both states. Each state's ability to carry out offensive and defensive attacks ensured de-escalation. Also, this missile crisis highlighted the significance of acquiring AWS to maintain a technological edge in case of a conflict. In this regard, both Tehran and Tel Aviv demonstrated that having AWS is crucial for strategic superiority and territorial security. In addition, using AWS in this incident enhanced the operational efficiency with no direct involvement of humans in any combat missions or armed conflicts. However, every invention has pros and cons, and AWS are no exception.

Recommendations

Based on the analysis, the study provides pragmatic and practical recommendations for the utilisation of autonomous weapons systems in armed conflicts:

- One of the most crucial points is to integrate human oversight to ensure ethical and legal accountability of individuals. Human commanders should retain control over AWS while making critical decisions about life and death.
- Rapid deployment protocols should be developed to effectively utilise AWS to respond to evolving battlefield conditions with human oversight.
- The latest AWS must be equipped with an 'integrated robotic system' to ensure synchronised efforts that enhance the capabilities of both man and machine.
- AWS should be programmed to fully comply with the fundamental principles of IHL, especially distinction and proportionality. It will ensure force multiplication with minimum collateral damage, and their deployment will align with ethical warfare standards.
- There should be a focus on refining targeting systems to avoid discrimination between civilian or military targets.
- Governments and international organisations should collaborate to establish a clear legal framework for governing AWS in armed conflicts. The framework must ensure proper accountability, prevent misuse, and clarify liability when these systems are employed in unintended incidents.

Conclusion

The study discussed comprehensively the key advancements in different military domains. The study presented two main definitions of AWS, which the DOD and ICRC gave. Based on these definitions, the study derived its definition and incorporated it throughout the study to further explain the variables by considering the theoretical framework. Moreover, the study provided three main types of AWS based on autonomy and human control: semiautonomous weapons, human-supervised weapons, and (lethal) autonomous weapons. In addition to this, the classification of AWS has also been discussed based on its transformative impact on the conduct of warfare. Each type or classification has a unique point that overall increases the operational effectiveness in combat missions. Regarding military necessity, primary data collected from military officers and legal experts suggest that AWS enhance operational effectiveness by discussing the critical tactical and strategic advantages that enable the system, compared to conventional weapons, to provide a more significant comparative advantage to forces over their adversaries. Likewise, the theoretical framework adopted for this variable is 'Military Revolutionary Affairs', which posits that technological advancement brings revolution or transition in military tactics and strategies. In the context of the theoretical framework, it can be said that AWS can potentially transform military capability. The strategic importance of the AWS is recognised by data analysis. These weapons provide significant decision-making and rapid action even in specific operating environments and battlefields. These weapons give the upper hand in mobilising assets and dominance in terms of escalation when the opponent still relies on conventional weapons. Furthermore, a case study of the Iran-Israel Missile Exchange has also been discussed in the context of this variable. This case study also illustrated a crucial role played by the AWS in achieving military advantages. All this highlights that the advent of AWS is changing the landscape of warfare by conferring notable military advantages. However, for ethical and lawful utilisation of AWS, there must be apparent human oversight, adherence to IHL, and an established accountability mechanism. Similarly, there is a need to develop rapid deployment protocols through the integrated robotic system to use AWS as force multiplier for the forces with limited collateral damage. International organisations and governments can establish a clear legal framework to regulate these weapons to ensure accountability and prevent their misuse, further paving the way for the ethical use of AWS in armed conflicts.

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