# Lethal Autonomous Weapon Systems

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## Introduction

Warfare is as old as human history. Throughout that history, weapons development has focused on gaining an advantage over the enemy for victory and reducing potential risk to friendly forces. Progress towards this goal has marched on with the development of long spears, bows and arrows, firearms, and combat aircraft. Over the recent years, the world's militaries have been adopting and integrating unmanned aerial vehicles, UASs for short, into their arsenals. At the same time, the leading technology companies, along with the defense industry, have been making advancements in artificial intelligence for applications across a multitude of industries. The combination of UASs and artificial intelligence will totally remove humans from the equation on the battlefield. These Lethal Aerial Weapon Systems, LAWS, will have the ability to kill or destroy at their own discretion. Ethical and moral concerns will need to be addressed by the international communities as these systems are developed and employed. Here, a history of LAWs and their evolution, the current trends, issues, and societal concerns will be presented.

#### **Evolution**

During Operation Desert Storm in the early 1990s, the coalition forces faced a formidable enemy. The Iraqi Army was the fifth largest in the world, and their air force had over 600 combat-ready aircraft. Conventional thinking as that the war would be long and arduous due to the size and capabilities of Iraqi forces (Stewart, 2016). However, in the decade leading up to the war, the coalition forces had been developing multi-role fighter aircraft from the lessons learned in Vietnam. When these advanced fighters took to the skies over Iraq, they quickly established air superiority with their utilization of smart weapons to eliminate enemy aircraft and conduct precision strikes on ground targets. High-Speed Anti-Radiation Missiles effectively suppressed enemy air defense systems. They forced the enemy into turning them off during engagements, leaving them even more vulnerable to air attacks (Stewart, 2016). Also, their advanced sensors gave allowed them to conduct night operations that caught the enemy off guard. Due to their effects, the coalition ground forces were able to conduct offensive operations with little resistance. A war that was supposed to take years ended in six weeks. The integral role of airpower was on full display.

Fast forward to the early 2000s, when the War on Terror is in full swing. Coalition forces again looked to airpower to gain an advantage on the battlefield. Using Effects-Based Operations, strategic targets were eliminated with precision-guided munitions and enabled another swift defeat of the Saddam Regime (Stubbs, 2022). Nation-building was next on the agenda, with the end goal of Iraq being a beacon of democracy in the Middle East. However, it the war eventually turned into a 20-year quagmire as the coalition forces were constantly dealing with insurgents trying to destabilize the region. The insurgents were not a traditional national army but guerilla forces that blended into the local population. Due to this, the United States Air Force deployed drones to conduct surveillance operations and strikes only after solid confirmation of enemy combatants was obtained. Remote Piloted Aircraft not only increased safety by not putting a pilot in harm's way but also permitted extended duration sorties since the pilot could swap out at the ground control facility. This capability allowed for coalition forces to continue the years-long process of battling the insurgents for the long haul.

Both abilities were showcased in January 2020, when a Quds Force leader thought to be the architect of the insurgent tactics used in Iraq against United States forces was eliminated. According to The Journal of International Law, Iranian General Qasem Soleimani was tracked at the Baghdad International Airport and eliminated by a lethal precision strike from an MQ-9 Reaper (U.S. Drone Strike in Iraq kills Iranian Military Leader Qasem Soleimani, 2020). The conflicts throughout history have always sought the exact outcome of eliminating one's enemy. While the outcome has remained the same, the means has drastically changed with the advent of new technologies. It is only reasonable to assume that instruments used on the battlefield will continue progressing towards more advanced capabilities to achieve strategic military goals.

## Trends

As remote-piloted aircraft showed their effectiveness throughout the War on Terror and other significant conflicts, other countries have quickly developed their own for integration into their armed forces. Now, over 70 countries use remotely piloted aircraft globally (Franke, 2014). Today, as more conflicts continue to arise across multiple continents, the advantage of eliminating the risk of harm to pilots and the need for cheaper, more expendable options has spurred countries to turn to smaller drones, autonomous drones. These drones are being used to attack enemy personnel and equipment. The Current price for an MQ-9 Reaper is thirty-two million dollars, while the cost of a LAW is one-hundred thousand dollars. With the dramatic reduction in cost, the widespread use of drones is increasing (Javorsky et al, 2019).

At the same time, artificial intelligence (AI) development in the private sector has sparked interest from governments looking for a military advantage (Verbruggen, 2019). AI initially started with the ability to perform basic text recognition, but with advancements in machine-learning and microprocessors, task-complexity has increased. Today, AI can perform predictive analysis, image recognition, and person profiling. This allows computers to simulate the human learning experience and improve their processes through accumulated experience (Jai, 2021). Infusing AI into machines has yielded spectacular results. Machines have been able to play soccer, drive cars on congested city roads, and drone-deliver packages to customers. The melding of drones with artificial intelligence will be the natural progression with the development of LAWs. Given AI as a tool, drones will be able to interpret the surroundings and perform pre-programmed actions based on the interpretation. If the drone identifies a subject and the subject is wielding a weapon, it can label that subject a target. Then, it can predict when the weapon is going to be used for hostile actions and neutralize the threat. The United States Air Force is using this combination of drones and AI to develop Skyborg. Skyborg is a fleet of autonomous drones that will be the wingman of fighter aircraft (Bollino & Shankar, 2019). The pilot will be able to direct the drones to tasks or mission objectives while continuing to engage or evade the enemy as needed. With the drones operating independently of human inputs to achieve its goal, the Air Force will effectively multiply its forces on the battlefield. Additionally, it will be able to lower the number of trained pilots it will need in the force and reduce training costs for pilot replacement. These advantages will continue to push the development and adoption of LAWs.

### **Issues and Impacts**

While LAWs will provide a unique capability to the battlefield and advantages to the armed forces that integrate them, AI development is still in the early stages. Developers have a hard time understanding the choices an AI computer makes due to the complexity of the neural networks and algorithms used for the cognitive decision-making process (Filgueiras, 2022). Without the ability to understand the processes, engineers and governments may not be able to verify if the neural networks or algorithms have any inherent flaws or biases. Employment of machines with the ability to make life-or-death choices without fully understanding the methodology behind the choices could be irresponsible. A LAW might not know the impact its attack may have in the geopolitical sphere. If a drone were on a routine surveillance mission and identified a political leader as a threat and attacks,

the situation might escalate to a full-scale war.

A fundamental shift could also occur in a nation's understanding of engaging in military conflicts. The choice to engage in conflicts could become easier due to the reduced cost. One deterrent to starting a conflict is the losses that might be incurred to the nation's military personnel and equipment. LAWs will increase the distances between armed forces and the battlefield, thus reducing the human costs of engaging in conflicts (Dumouchel, 2021). Politicians may be more willing to choose military engagements over other options since they wouldn't have to worry about public backlash. Also, the public may push politicians to choose military options knowing that their troops won't be in harm's way on the battlefield. This feedback loop could lead to more conflicts around the globe as more countries develop LAWs.

# **Societal Concerns**

The current international governance of armed conflict does not address the use of LAWs. Current governance spells out actions or weapons that are prohibited from use in war. One prohibited action is attacking unlawful targets, such as churches, schools, and hospitals. If a LAW attacked one of them, it would clearly violate of international treaties. However, the nation that employed the LAW might not be legally responsible if the command's intent was not to attack the unlawful target (Payne, 2017). Without revisions international laws to address the employment of LAWs, commanders of warring nations may utilize this loophole for immoral actions to cause extreme suffering to their enemy.

In addition, there are ethical concerns about allowing a LAW to kill humans. LAWs cannot feel empathy or understand the meaning of life and death. The lack of empathy removes the human capacity to show mercy or feel pity during hostile actions (Schwarz, 2021). During an attack, a LAW won't be able to understand the suffering being caused by its actions. It won't be able to determine when the target's ability to fight has been eliminated. Without human involvement, LAWs themselves could cause unnecessary suffering during conflicts.

The Morality of war will always be an issue for society. Employment of LAWs will be no different. Soldiers deal with many issues after war, such as Post-traumatic stress disorder (PTSD). When dealing with PTSD, soldiers may turn to acts of violence as a coping mechanism. These acts can lead to suffering within society as more soldiers return home after a conflict. LAWs could be a way to remove soldiers from the battlefield and prevent them and society from suffering.

## Application

While the military pursuit of LAWs will continue, the engineers designing them must remain moral and ethical. A step that could be taken is for LAW software to specialize in military applications and not repurposed private sector software. By specializing the software, engineers can build-in the rules that govern international conflicts. Programming in the ability for LAWs to specify what is and is not an unlaw target would meet the principle of distinction, which would prevent the LAW from attacking schools, churches, or hospitals. Building in proportionality could also ensure that the LAWs only use the necessary amount of force to achieve its goal. Additionally, a failsafe should be programmed into the software that activates if the LAW's computations result in ambiguous solutions. If the LAW cannot confirm a target, or the proportioned force needed, it will not perform any hostile actions on its own. It will flag itself to a human operator, who can assess the situation and take the appropriate actions. Implementing specialized software could prevent unnecessary human suffering and ensure LAWs comply with established international treaties governing armed conflicts.

While specialized software is a way to ensure LAWs are more ethical, the safest thing to

do is to always build in meaningful human control. Allowing a human to determine targets in real-time and the force required to engage the target will prevent LAWs from acting immorally or causing more suffering than necessary. During the engagement, the human can adjust the LAWs use of force to an appropriate level as events unfold. Also, the human will be able to adhere to the Laws of Armed Conflict and the Rule on Engagement set forward by the battlefield commanders (Santoni de Soi & Van den Hoven, 2018). The human will also be able to determine if a target is a military necessity before engaging to prevent unnecessary suffering. Legal responsibility can be assigned by having a human directly involved in the process if an unlawful action takes place. These actions would ensure that militaries employ LAWs morally and ethically.

LAWs cannot bear criminality on their own. Commanders and individuals involved with the employment of LAWs need to be legally bound to the lawful or unlawful actions they commit (Egeland, 2016). Current international treatises should be updated to define LAWs as weapons capable of employing ordinance through their computations with the intent to harm, destroy, or kill. Once defined, it needs to be written in the treaty that commanders or individuals that employ a LAW are legally responsible for its actions during conflict. This governance revision will ensure LAWs are employed sensibly. Furthermore, companies that develop and manufacture LAWs should be open to legal liability. Like how car manufacturers are held liable for design characteristics that make their vehicles unsafe or cause injury, defense companies should carry the same burden. LAWs would need data recording capabilities to capture the inputs given by the commander or soldier on the battlefield and the sensory from the battlefield. In the event of an unlawful act, an investigator can analyze the data to determine if it was employed correctly or if there was a malfunction with the system. If the system malfunctions due to poor design of the hardware or software, the manufacturer should be held liable. With this revision, LAW development might slow down as development companies ensure they take necessary steps to produce reliable products that minimize their legal impacts. By ensuring safe designs are necessary through software and hardware, along with governances that establish legal responsibility from manufacturing to employment, the adoption of LAWs into a nation's armed forces may slow. With the extra time, society will have chance to assess if LAWs belong on the battlefield.

# Conclusion

Warfare has continued to evolve as technology advances. The goal has been to remove soldiers from harm's way while achieving military objectives. The melding of drones with artificial intelligence will be the next leap of technological advancement on the battlefield as lethal autonomous weapons. Nations will quickly adopt LAWs for their cost efficiency, reduction of casualties endured by friendly forces, and force-multiplying effects. While effective on the battlefield, the AI that will power their autonomy is still poorly understood and requires further development and testing. Also, due to the cost reduction and effectiveness, countries may choose military engagements over diplomacy.

Current international governance does not legally account for LAWs, and that they may inadvertently attack unlawful targets. Governments need to define LAWs and establish legal responsibility for their actions on the battlefield to deter their misuse. Additionally, manufacturers need to be held accountable if LAWs performance leads to unlawful attacks that are not user ordered. To ensure unnecessary suffering is not the result of LAW employment, these issues need to be addressed before LAWs are allowed to be used in warfare.

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