

## REVIEW OF THE RISKS OF AUTONOMOUS WEAPONS

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**Abstract:** *Weapon autonomy is an imperative for the development of the arms industry. The introduction of autonomous weapons into military conflicts is one of the most current topics in modern warfare. This type of weapon represents a significant advance in the development of technology, but at the same time it also represents a serious risk for the security and stability of states, as well as the global community. This paper analyzes the risks of autonomous weapons. Through problem analysis, this work contributes to understanding the risk of autonomous weapons and finding effective solutions to manage this risk.*

**Keywords:** *risk, ethics, law, autonomous weapons, artificial intelligence*

### 1. INTRODUCTION

Acknowledging the weaknesses of artificial intelligence does not diminish its advantages. Artificial intelligence is neither good nor bad; it represents a powerful tool. The key question that arises is how humans should use this technology.

Delegating a task to a weapon implies accepting the consequences if the weapon makes a mistake. When discussing the use of autonomous weapons, it is essential to carefully consider the risks that arise. Weapons designed to harm the enemy can become a danger to one's own units (users) if they go out of control. The significant difference between semi-autonomous (supervised) and fully autonomous weapons is the degree of harm the system can cause before there is an opportunity for human intervention.

In supervised autonomous weapons, humans play the role of a "natural failsafe" who can intervene if problems arise. Humans can override the rigid rules of the system and make decisions. Removing humans diminishes the system's flexibility. In fully autonomous

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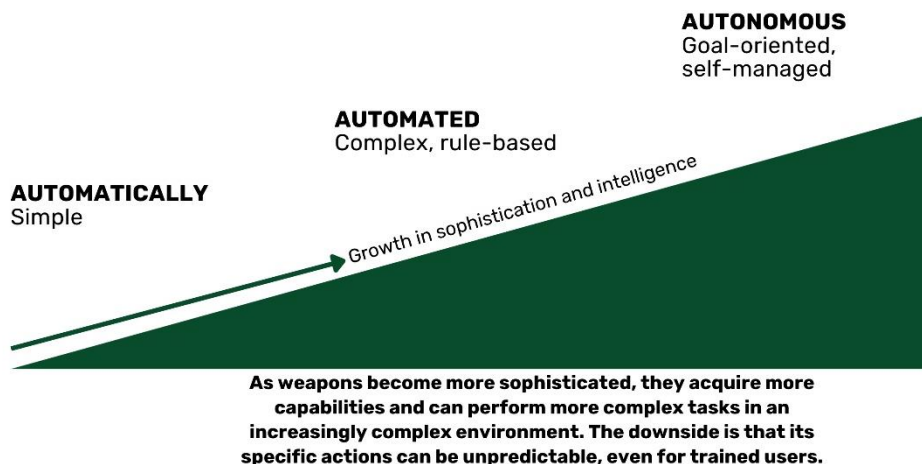
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weapons, there is no human to intervene and stop the system's operation. This issue raises ethical questions about the future of military technology and how to use it in a way that best serves humanity's interests.

Considering the risks of autonomous weapons extends beyond technical aspects and encompasses broader implications for society, diplomatic relations, and international law. Autonomous weapons present challenges that require careful thought about ethics, security, and the long-term consequences of their use. It also raises the question of how to protect against the misuse of this technology. By examining these issues, a foundation is laid for analyzing how autonomous weapons will shape the future and ways in which society can work together to minimize risks and protect fundamental human values.

## 2. AUTONOMOUS WEAPONS

Modern weaponry has undergone significant changes in recent years, and one of the most intriguing evolutions is the development of autonomous weapons. Although the concept of autonomous weapons may seem clear, there is actually a considerable level of confusion and ambiguity surrounding its definition. This ambiguity often accompanies questions about the differences between automatic, automated, and autonomous weapons (Figure 1), further complicating the understanding of this technological revolution.



**Figure 1.** Automatic, automated and autonomous weapons

*Source: Created by the authors based on Scharee, 2020*

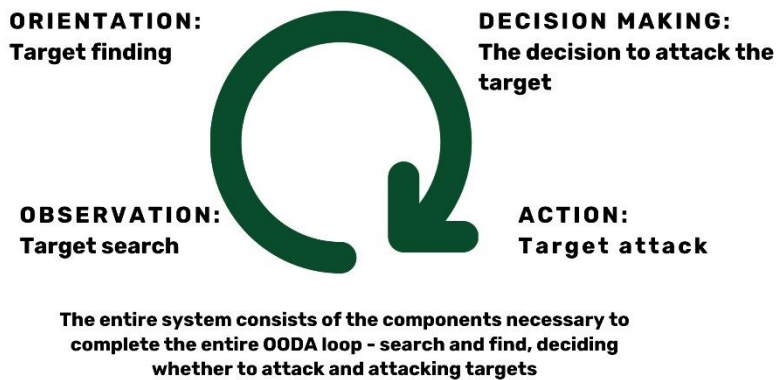
To better understand autonomous weapons, it is necessary to consider a wide range of terms used in relation to modern weaponry. The terminology is often blended, and there seems to be no firmly defined boundary between various categories of weapons. Current terms that emphasize significant characteristics of weapons include: automatic, automated, and autonomous weapons.

Automatic systems are simple and do not exhibit much decision-making. Automatic weapons have evolved gradually, with inventors building upon the work of their predecessors and refining it (e.g., automatic weapons refer to a type of firearm that can continuously fire ammunition as long as the trigger is held down and there is ammunition in the magazine). Automated systems are more complex and can take into account a range of input information and assess multiple variables before taking action (e.g., automated weapons refer to firearms equipped with technology or devices for automating the firing process. This type of weapon

can encompass various types of technological enhancements, including electronic targeting and sensors).

Autonomy is the ability of a machine to independently perform a task. There is no internationally agreed-upon definition of autonomous weapons. One definition, used in the working meetings of the International Committee of the Red Cross, states, „Autonomous weapon systems are weapons that can independently select and engage targets, i.e., with autonomy in „critical functions” to acquire, track, select, and attack targets” (International Committee of the Red Cross, 2014).

For ease of use, the terms „autonomous weapon system” and „autonomous weapon” are used interchangeably in this work. Figure 2 illustrates what this entails.



**Figure 2.** Components of an autonomous weapon  
*Source: Created by the authors based on Scharee, 2020*

However, depending on the decision-making process for targeting, we differentiate between **supervised autonomous weapons** (human in the loop - Figure 3) and **fully autonomous weapons** (human out of the loop - Figure 4).



**Figure 3.** Supervised autonomous weapons (human in the loop)  
*Source: Scharee, 2020*



**Figure 4.** Fully autonomous weapons (human out of the loop)  
*Source: Scharee, 2020*

If there is a person in the loop deciding which target to engage, it is referred to as supervised autonomous weaponry, as shown in Figure 3 (Scharee, 2020).

In the case of fully autonomous weaponry, as depicted in Figure 4, the entire engagement loop (search, detection, decision, and attack) is automated. Such weaponry can search, make attack decisions, and act independently, with no human intervention possible (Scharee, 2020).

These characteristics create a significant distinction between these two groups of weaponry and determine their purpose.

### 3. AUTONOMOUS WEAPONS AND ETHICAL CHALLENGES

The use of autonomous weapons may be legal in some situations, but it may not necessarily be morally acceptable. The question of ethical challenges related to autonomous weapons becomes increasingly significant as this technology develops and is applied in military conflicts (Thomas & Mittal 2019). Based on an analysis of relevant literature that examines the ethical challenges of using autonomous weapons, the authors highlight the most significant ones:

**Responsibility:** One of the primary ethical challenges of autonomous weapons relates to the issue of responsibility. When a machine makes targeting decisions and carries out attacks without human intervention, who is responsible for any unintended consequences? This transfer of responsibility can result in difficulties in establishing blame and ensuring justice in cases of errors or misuse (as the person who activated it may claim not to be responsible for the actions of a system that did not do what the person intended) (Mirkovic, 2007). In contrast, when autonomous weapons correctly execute someone's intent, responsibility is clear: the person who set the autonomous weapon in motion is responsible for it.

**Precision and Collateral Damage:** Autonomous weapons may be programmed to be precise, but there is a risk of errors occurring in the target identification process. This can lead to "accidental" harm and civilian casualties.

**Human Interaction and Decision-Making:** With increasing automation in military operations, questions arise about the role of humans in decision-making. Is it morally

acceptable for people to delegate such responsibility to machines, especially in situations involving the use of lethal force? A particular aspect of this element pertains to the use of weapons that are not under the control of organized military or police forces but rather in the hands of terrorists and similar groups.

**Lack of Empathy:** Autonomous weapons lack the ability to empathize, meaning they cannot understand human emotions and the situations in which people find themselves.

**War Crimes and Ethics:** The use of autonomous weapons in the context of war crimes poses a unique ethical challenge. How can one identify and sanction those responsible if it is machines that have committed the crimes? This raises questions about justice and moral accountability for such actions.

In light of these ethical challenges, the question arises of how to reconcile technological advancements in the military sector with moral and ethical principles. The international community should continue to address these challenges to ensure that the use of autonomous weapons aligns with the values and principles of humanity.

#### **4. AUTONOMOUS WEAPONS AND LEGAL FRAMEWORK**

There have been many attempts in the past to control or ban certain types of weapons, as seen in some examples provided in Table 1. Bans on weapons target different phases of weapon production, preventing access to technology, prohibiting states from developing weapons, restricting production, or regulating use. The legality of autonomous combat systems, like any newly developed weapon, must be assessed based on their design and intended use, as well as their effect on targets (Joncic, 2021).

The laws of war should protect humanity from the worst consequences of war. Modern laws of war were created in the late 19th and early 20th centuries (Scharee, 2020). Today, a series of agreements, such as the Geneva Conventions, constitute the law of armed conflict or international humanitarian law. International humanitarian law (IHL) is the fundamental legal framework for the use of weapons in armed conflicts. IHL applies to all armed conflicts and imposes an obligation to protect civilians, prisoners of war, and the wounded.

IHL has three fundamental principles: the principle of distinction means that armed forces must distinguish between enemy combatants and civilians on the battlefield. IHL recognizes cases where civilians may accidentally suffer harm when targeting enemy combatants, which is known as collateral damage. However, the principle of proportionality states that collateral civilian casualties must not be disproportionate to the military necessity of the attack on a specific target. The principle of avoiding unnecessary suffering prohibits the use of weapons that cause excessive injuries. IHL also includes other rules, such as the protection of combatants who are hors de combat - taken out of action because they have surrendered or are incapacitated (Scharee, 2020).

However, IHL does not explicitly regulate the use of autonomous weapons. IHL principles such as distinction and proportionality apply to the consequences on the battlefield but not to the decision-making process. Historically, soldiers have made the decision to open fire, but nothing in the laws of war prohibits a machine from doing so. Nevertheless, there is a general consensus that IHL can be applied to autonomous weapons, and they should comply with existing norms (Joncic, 1996).

**Table 1.** Overview of Weapon Bans (Source: (Scharee, 2020; Joncic, 2021; Filipovic, 2023; Mirkovic, 2007)

Red. br.	YEAR	YEAR	REGULATION OR ARGUEMENT	LEGALLY BINDING?	TYPE OF REGULATION	SUCCESS	CONSEQUENCES
1	Serrated bayonets	the first World War	Silent cooperation on the battlefield	Without explicit agreement	Norm against possession	Successful	Unnecessary suffering
2	Submarines	1899. 1921 – 1922.	Hague Convention of 1899 Washington Naval Conference of 1921-1922.	Never ratified	Attempted bans - never ratified	Unsuccessful	Unnecessary suffering
3	Ballistic missile defense	1972.	Ballistic Missile Defense Agreement	Legally binding	Limited deployment	Successful during the Cold War, failed in a multipolar world	Strategic stability
4	Conventional weapons	1996.	Vassenar Arrangement	Legally non-binding	Limited proliferation	Partially successful	Political control
5	Cluster munitions	2008.	Convention on Cluster Munitions	Legally binding	Prohibited development, production, accumulation, and use	Generally successful, with exceptions	Civilian casualties
6	X-ray transparent fragments	1980.	Convention on Certain Conventional Weapons (CCW) Protocol I	Legally binding	Prohibited use	Successful	Unnecessary suffering
7	Incendiary weapons	1980.	CCW Protocol III	Legally binding	Regulated use	Variable success	Civilian casualties
8	Chemical and biological weapons	1985.	Australia Group	Legally non-binding	Prohibited dissemination	Variable success	Civilian casualties, unnecessary suffering
9	Ballistic and cruise missiles	1987. 2002.	Missile Technology Control Regime, Hague Code of Conduct	Legally non-binding	Limited dissemination	There was some success	Strategic stability
10	Intermediate-range missiles	1987.	Intermediate-Range Nuclear Forces Treaty (INF Treaty)	Legally binding	Prohibited possession	Successful but currently threatened in a multipolar world	Strategic stability
11	Nuclear weapons and launcher numbers	1979. 1991. 2002. 2011.	SALT I, SALT II START, SORT New START	Legally binding	Limited quantities	Successful	Limiting the arms race

The United Nations Convention on Certain Conventional Weapons contains some restrictions on the use of weapons that could be applied to autonomous weapons (Joncic, 2021). For example, Protocol III prohibits the use of weapons that may be of little use for targeted destruction or have harmful effects that can spread to the civilian population. However, the application of any form of prohibition is complicated due to the lack of a definition of autonomous weapons.

Despite the unclear regulation in international humanitarian law, the use of autonomous weapons is a reality in armed conflicts. Conflicts in the Gaza Strip have led to serious violations of the rules of international humanitarian law, often due to the use of autonomous and automated weapons. A report by Human Rights Watch documented six incidents in which 29 civilians, including six children, were killed (Joncic, 2021).

In the conflict in Nagorno-Karabakh, Azerbaijan gained a military advantage and victory thanks to the use of such weapons. Armenia did not have a sufficient number of these means and faced limitations, especially in areas where the terrain did not allow the use of conventional weapons.

Managing the risks of autonomous weapons is a challenge for society and requires cooperation between states to establish adequate regulations. Clear legal frameworks are needed to regulate the use of autonomous weapons to prevent unintended consequences and protect human rights. These legal frameworks should cover all aspects of the use of autonomous weapons, including programming, testing, monitoring, and control. International cooperation is also necessary to avoid an arms race in autonomous weapons and to work together to manage the risks posed by this technology. In conclusion, the evolution of the law does not keep pace with the evolution and development of autonomous weapons.

## **5. AUTONOMOUS WEAPONS IN PRACTICE**

In this section, several unwanted incidents related to autonomous weapons are mentioned to better understand the risks associated with this technology that have occurred. Various situations in which autonomous weapons played a role, whether accidents, unwanted events, or serious problems in their use, have been explored. Some of the most well-known examples include (research by the author based on publicly available data):

1. In June 2021, an autonomous howitzer produced by Hanwha Defense suddenly fired a projectile on a cargo ship in the South China Sea while parked on the deck. There were no injuries, but this incident highlights the dangers of unintended activation of autonomous weapons and the need for better control and safety systems.
2. In August 2021, an autonomous mortar produced by Milrem Robotics suddenly activated and fired a mine at a weapons demonstration in Estonia, causing minor damage. This incident highlighted potential dangers of autonomous weapons that are not adequately tested and verified before use.
3. In 2018, an autonomous rocket launcher of Turkish production, KARGU, designed to seek and destroy targets autonomously, fired several rockets at the wrong targets during a military exercise in Turkey.
4. In December 2020, an autonomous combat vehicle produced by General Dynamics Land Systems lost control during testing in the US state of Texas and overturned, killing a worker. This incident highlighted the challenges in developing safe autonomous systems for military use.

5. In March 2020, Turkish Bayraktar TB2 drones, used in the Nagorno-Karabakh conflict, accidentally killed Turkish soldiers. Several such incidents were reported during the conflict.

6. In June 2020, the Iranian anti-aircraft system "Mersad" accidentally shot down a Ukrainian passenger plane after misidentifying it as an enemy aircraft. 176 people were killed.

7. In February 2021, autonomous drones were used in an attack on oil installations in Saudi Arabia. However, the attacks by these drones were unsuccessful, leading to reduced damage that could have been caused but also highlighting the shortcomings in the reliability of this technology.

8. In February 2021, an autonomous rifle produced by TrackingPoint suddenly activated and injured a worker in a Texas warehouse during maintenance. The worker survived, but this incident highlighted potential dangers of autonomously activating weapons.

9. In September 2020, an autonomous border surveillance unmanned system produced by Anduril Industries crashed in Mexican territory, causing a diplomatic incident between the United States and Mexico. This incident highlighted the difficulties in developing reliable autonomous monitoring and security systems.

By reviewing a series of unwanted events related to autonomous weapons from different parts of the world, it is clear that there are significant risks associated with this technology. These events illustrate the potential dangers of unintended activation, target misidentification, accidents during testing, and potential misuse of autonomous weapons.

Such events emphasize the need for stricter safety, reliability standards, and testing rules in the development and use of autonomous weapons. They also point to the importance of adequate training for personnel handling this technology and the need for international regulations that will effectively address ethical and legal dilemmas arising from autonomous weapons.

## **6. CONCLUSION**

Introducing autonomous weapons into armed conflicts brings significant advantages in terms of technological advancement and increasing the efficiency of military operations. However, it also carries serious risks related to safety, ethics, and long-term consequences. The paper has analyzed various aspects of autonomous weapons risks to better understand the implications of their use.

Autonomous weapons can be fully autonomous or semi-autonomous, with or without human intervention. Risks associated with fully autonomous weapons include a lack of human control, accountability for machine errors and decisions, a lack of empathy, and moral dilemmas. Questions about accuracy and collateral damage are also important because autonomous weapons can inadvertently harm civilians or other individuals who are not the intended targets on the opposing side.

Ethical challenges related to autonomous weapons include questions of responsibility, moral dilemmas regarding delegating decisions to machines, and a lack of empathy. It is also emphasized that international humanitarian law, which regulates the use of weapons in armed conflicts, needs to better adapt to autonomous weapons to be applicable.

The legal framework for regulating autonomous weapons is currently unclear, but there are initiatives trying to align existing agreements with new technological challenges. However, more effort is needed to establish clear legal frameworks that will regulate the programming, testing, monitoring, and control of autonomous weapons.

Examples of unwanted events related to autonomous weapons, such as cases of weapons activation during military exercises or unintended attacks on the wrong targets, highlight the need for better safety and control systems.

The future development of autonomous weapons requires strict control. The question of the feasibility of controlling their production and use brings a new dilemma, given that there is now production of highly sophisticated weapons outside of state control. Various cases involve the production of this weapon in controlled state conditions but also abuse by individual states for humanitarian purposes.

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