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ROBOTIC WARFARE, LAW OF ARMED CONFLICT, AND LAW OF ROBOTIC ARMED CONFLICT

Kadir Alpaslan DEMIR*
Ebru CAYMAZ**

* Ph.D., Associate Professor, Program Manager, Turkish Naval Research Center Command, Istanbul, Turkey
** Marmara University, Department of Organization and Management, Istanbul, Turkey

Abstract:
Robotic technology offers great benefits to humanity. However, one of the first uses of this technology is for war. We already have seen the actual use of armed unmanned aerial vehicles to destroy enemy targets in war zones. Some experts believe that robots will change the nature of wars. Even with the current artificial intelligence technology, it is possible to task a robot to kill a human without human intervention. There are many ethical issues surrounding robotic warfare. Current warfare ethics is shaped by the principles of Law of Armed Conflict (LOAC). These principles are formed based on the experiences of earlier wars. These wars were fought only by humans. However, in the robotic warfare era, there are new types of combatants. Therefore, we may need a new set of principles for LOAC. Currently, there are international campaigns for a ban on Lethal Autonomous Weapon Systems (LAWS), in other words, killer robots. Some experts advocate regulating the use of military robots rather than calling for an international ban. In this study, we discuss the current developments regarding the call for a ban and the arguments for a regulation on killer robots. In addition, we introduce a set of principles to guide the development of a Law of Robotic Armed Conflict (LORAC).

Keywords: Robotic Warfare, Law of Armed Conflict, Law of Robotic Armed Conflict, International Humanitarian Law, Warfare Ethics, Robot Technology, Robots, Robot Wars, Ethics, Warfare, LOAC, LORAC

1. Introduction

We are using industrial robots for quite some time now. With the recent developments in the robotics field, the use of robots is expanding. Robots are becoming a part of our lives [1, 35]. While robots offer great benefits to humanity, unfortunately, we are also eager to use this technology for war. There are many robotic technology studies funded by the military [35, 36]. There are even studies to build ethical robots for warfare [2-4]. The use of military drones with lethal intent is increasing [5]. It is also creating concern among public [6-9]. Various experts and robotic scientists are calling for a ban on the use of lethal autonomous weapon systems (LAWS) – also called killer robots [8, 9]. A campaign, called "The Campaign to Stop Killer Robots" was launched in 2013 [6]. The United Nations started to regulate the use of armed military drones. In March 2014, the UN Human Rights Council adopts a resolution (A/HRC/25/L.32) [10] regarding drone transparency and accountability [11]. 27 countries were in favor of the resolution, *"Ensuring use of remotely piloted aircraft or armed drones in counter-terrorism and military operations in accordance with international law, including international human rights and humanitarian law."* Six countries including France, Japan, Republic of Korea,

The former Yugoslav Republic of Macedonia, United Kingdom, and United States of America were against the resolution. As in the case of this resolution, some of the countries are unwilling to support such resolutions yet. They have the technology on their side. Countries are expressing their positions on the use of killer robots.

Recently, in the opening of the 2017 academic year, Russian president Vladimir Putin expressed his opinion on artificial intelligence (AI) [12]. Putin believes that the country with the most advanced AI technology will dominate the world. Furthermore, he predicts that wars will be fought by drones. The ones whose drones are eliminated will have no choice but surrender. Some call the robotic warfare is the third revolution in warfare [9]. The first revolution was due to gunpowder and the second one is due to the development of nuclear weapons [13]. There are supporting and opposing arguments on the use of lethal autonomous systems [6-23]. All these arguments point toward an increasing and urgent need for a regulation on the use of lethal autonomous weapon systems.

The Law of Armed Conflict (LOAC) sets the principles for conducting warfare. It is developed based on the experiences of earlier wars in history. Now, we are entering the robotic warfare era. In this era, there are new types of combatants in the battlefield: Humans, drones, and robots. In the robotic warfare, we need to discuss the applicability of the principles of LOAC. Sterio states that newly developed weapons such as drones may require better-suited rules of armed conflict [22]. We believe there is a need for a new law of armed conflict. In the robotic warfare era, we may call this new law - the Law of Robotic Armed Conflict (LORAC). However, before that, we need to develop a set of principles to guide the development of this new law. Therefore, the goal of this study is to identify a set of principles guiding the development of Law of Robotic Armed Conflict.

In the second section, we discuss the types of combatants in the robotic warfare era. We briefly discuss the basic principles of law of armed conflict in the third section. Next, we present the current international discussions on the use of killer robots. In the fifth section, we identify a set of principles guiding the development of a Law of Robotic Armed Conflict (LORAC). Finally, we conclude the paper.

2. Types of Combatants in the Robotic Warfare Era

Robotic technology is advancing fast. Today, there are many drones in the battlefield. Soon, we will also see robots in the battlefield. In the robotic warfare era, there will be three types of combatants: humans, drones, and robots. We briefly discuss each type of combatant.

2.1. Humans

Until recent years, wars were fought only by humans. Historically, mankind utilized technology to build weaponry and machinery. These weapons and machines were not smart therefore humans were using or operating them in the battlefield. In recent years, technology enabled us to incorporate artificial intelligence in weaponry and machinery. The weapons and other instruments of war become smart. We started to use these smart weapons and machinery. However, presently, humans are still the main combatants in war. There is an enormous amount of literature focusing on humans in battle. Thus, we are not going to detail humans as a type of combatant.

2.2. Drones

A remotely operated unmanned aircraft is commonly called a drone. For the purposes of this study, we extend this definition of a drone. All types of remotely operated military unmanned systems will be called drones. In addition, drones may be armed or not. Not all military uses of unmanned systems require weaponry. However, when we talk about combatants, the discussion naturally revolves around armed drones.

The use of military drones in war zones is increasing remarkably [5, 14, 17]. There are many supportive arguments for the use of military drones. One of the most important arguments is moving human warfighters out of harm's way [3]. In addition, we can use drones in dangerous zones such as biological hazardous zones. There are also counter arguments for the use of military drones [24]. A "*PlayStation mentality*" is dangerous for operators [18]. Since the operators of armed drones are generally far away from the battle zone, they do not have the fear of getting injured or killed. Inflicting harm may feel easier. Therefore, some experts claim that the use of drones may increase ethical violations [19]. As the human life losses increase due to military drone strikes, there will be more debates and an increase in negative public opinions [25]. As a result, there are many ethical discussions for the use of armed military drones [3, 24, 26].

2.3. Robots

Contrary to popular belief, we do not have a universally accepted definition for a robot [1, 27]. The definition of a robot is the subject of many studies, especially in relation to law, ethics, and philosophy [28].

A robot may be defined as "*a machine that senses, thinks, and acts*" [29]. According to the Oxford dictionary definition, a robot is "*a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer*". The Merriam-Webster dictionary defines a robot as "*a machine that looks like a human being and performs various complex acts (such as walking or talking) of a human being*". All these definitions have problems such as "What do we mean by a machine thinking?" or "What does acting involve?". While all these definitions classify robots as machines, people have different views regarding robots [30]:

- Robots are nothing but machines.
- Robots have ethical dimensions.
- Robots are moral agents.
- Robots, the evolution of a new species.

Note that some drones also have certain autonomous behavior. For example, some medium altitude long endurance (MALE) UAVs have autonomous takeoff and landing capability [24]. We distinguish robots from drones in terms of their autonomous capability in selecting and engaging targets without a human in the loop. An open letter [8] from AI & robotics researchers was announced at the opening of the International Joint Conferences on Artificial Intelligence (IJCAI) 2015 conference. According to the letter, "*Autonomous weapons select and engage targets without human intervention. They might include, for example, armed quadcopters that can search for and eliminate people meeting certain pre-defined criteria, but do not include cruise missiles or remotely piloted drones for which humans make all targeting decisions.*"

Note the important difference between a drone and a robot in terms of war ethics. A drone requires a human operator in the loop to harm or kill a human target. A robot autonomously makes the decision to harm or kill a human target. As a result, in the context of robotic warfare, the distinction between a robot and a drone is the answer to the following question:

Who makes the decision to harm or kill a – human – target?

3. The Basic Principles of the Law of the Armed Conflict (LOAC)

There are certain basic principles that all warfighters should abide by. Law of Armed Conflict (LOAC) or Law of War (LOW) is based on these principles. Law of Armed Conflict is also known as International Humanitarian Law (IHL). The essentials of LOAC come from The Geneva Conventions of 1949. The Geneva Conventions consist of four separate international treaties. The main purpose of these treaties is to protect combatants and noncombatants from unnecessary suffering. They also aim to protect civilians and private property. These principles are explained briefly.

3.1. Principle of Military Necessity

A dominant notion within the framework of IHL is "military necessity" and it clashes generally with humanitarian protection. The basis of this principle can be seen in Saint Petersburg Declaration (1868) which states that "*the only legitimate object which States should endeavor to accomplish during war is to weaken the military forces of the enemy*" and that "*for this purpose, it is sufficient to disable the greatest possible number of men*". It also includes women today.

Military necessity requires combat forces to engage in only necessary acts to accomplish a legitimate military objective. This principle is entirely practical and it accepts the realities of battle. It becomes acceptable when reasonable force is necessary and lawful and can be operationally justified in combat to make the opponent submit. However, the concept of military necessity does not give the armed forces the freedom to ignore humanitarian considerations altogether. It must be interpreted in accordance with the principles of IHL.

3.2. Principle of Discrimination or Distinction

The principle of discrimination or distinction requires discrimination between lawful combatant targets and noncombatant targets such as civilians, civilian property, prisoners of war (POWs), and wounded personnel unable to fight.

The essential idea of distinction is to only engage valid military targets. It requires warfighters to separate military targets from civilian objects to the maximum extent feasible. The prohibition to attack any person "hors de combat" (those who are sick and wounded, prisoners of wars) is a fundamental rule under IHL. Additionally, they may be entitled to additional protections if they meet the criteria of being a POW.

While IHL permits violence, it prohibits the infliction of unnecessary suffering. However, the meaning of these terms is unclear and the protection may be limited. Therefore, it would be highly inappropriate to take risks by locating a hospital or POW camp next to an ammunition factory.

3.3. Principle of Proportionality

According to the U.S. Army Field Manual for Law of Land Warfare [31], "*Loss of life and damage to property incidental to attacks must not be excessive in relation to the concrete and direct military advantage expected to be gained.*"

The principle of proportionality limits potential harms to civilians by demanding that the least amount of harm is caused to civilians. When harm to civilians must occur, it needs to be proportional to the military advantage. Excessive use of force is not permitted during war.

The article where proportionality is most prevalent is in Article 51 (5) of API concerning the conduct of hostilities which prohibits attacks when the civilian harm would

be excessive in relation to the military advantage sought. In this area of "hostilities", we often come across with the term of "collateral damage". Proportionality is only applied when a strike is made against a lawful military target. When a military target is attacked, incidental or collateral damage to civilians and civilian objects should be avoided as much as possible.

3.4. Principle of Unnecessary Suffering or Humanity

In any armed conflict, the right of the parties involved to choose methods and means of warfare is not limited. However, weapons and tactics which cause unnecessary suffering or superfluous injury are prohibited.

The principle of humanity and its absence during the battle of Solferino of 1859 is the central notion which inspired Henry Dunant, the founder of the International Committee of the Red Cross (ICRC). This principle stipulates that all humans have the capacity and ability to show respect and even care for their enemies. The notion of humanity is the fact that separates humans from animals. Therefore all people must be treated humanely and without discrimination based on sex, nationality, race, religion, or politic beliefs.

4. International Discussions on Robotic Warfare

Noel Sharkey, a professor of artificial intelligence and robotics at the University of Sheffield, wrote an article titled "*Robot wars are a reality*" in the Guardian in 2007 [21]. He concluded the military opinion article with a call for an international legislation and a code of ethics for autonomous robots at war [21]. Sharkey is also the chair and one of the co-founders of the International Committee for Robot Arms Control (ICRAC) [7]. According to the committee's website, ICRAC is an international not-for-profit association committed to the peaceful use of robotics in the service of humanity and the regulation of robot weapons. ICRAC was founded in September 2009 by a group of scientists and experts. The committee members research, publish, discuss, and work to establish an effective limitation on the use military robotics. In their founding mission statement, they urge for an arms control regime on military robotics: "*Given the rapid pace of development of military robotics and the pressing dangers that these pose to peace and international security and to civilians in war, we call upon the international community to urgently commence a discussion about an arms control regime to reduce the threat posed by these systems.*"

In 2013, "The Campaign to Stop Killer Robots (https://www.stopkillerrobots.org/)" was launched in London, UK. The campaign calls for "*a pre-emptive and comprehensive ban on the development, production, and use of fully autonomous weapons, also known as lethal autonomous weapons systems or killer robots"* [6]. The supporters of the campaign warn the United Nations, governments, and the public about the threats posed by killer robots.

In 2015, an open letter [8], "Autonomous Weapons: An Open Letter from AI & Robotics Researchers", was announced at the opening of the International Joint Conferences on Artificial Intelligence (IJCAI) 2015 conference. According to the website (https://futureoflife.org/open-letter-autonomous-weapons/), the letter was signed by more than twenty thousand people and more than three thousand of them are artificial intelligence and robotics researchers. The letter [8] concludes with "*In summary, we believe that AI has great potential to benefit humanity in many ways, and that the goal of the field should be to do so. Starting a military AI arms race is a bad idea, and should be prevented by a ban on offensive autonomous weapons beyond meaningful human control.*"

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Recently, at the opening of a major AI conference (IJCAI 2017), an open letter [9] signed by 126 founders and directors of more than 100 companies from 28 countries was presented. This open letter, "An Open Letter to the United Nations Convention on Certain Conventional Weapons", was part of The Campaign to Stop Killer Robots [6]. The letter concludes with the following words: "*Lethal autonomous weapons threaten to become the third revolution in warfare. Once developed, they will permit armed conflict to be fought at a scale greater than ever, and at timescales faster than humans can comprehend. These can be weapons of terror, weapons that despots and terrorists use against innocent populations, and weapons hacked to behave in undesirable ways. We do not have long to act. Once this Pandora's box is opened, it will be hard to close. We, therefore, implore the High Contracting Parties to find a way to protect us all from these dangers*."

There are also recent discussions regarding the use of Lethal Autonomous Weapons Systems (LAWS) [32] within the United Nations. At the 2013 United Nations Convention on Certain Conventional Weapons (CCW) Meeting of States Parties, it was decided to act upon the developments regarding the use of LAWS. Between 2014 and 2016, there were meetings of experts on LAWS. At the 2016 Fifth CCW Review Conference, UN decided to establish a Group of Governmental Experts (GGE) on Lethal Autonomous Weapons Systems. The experts are expected to meet regularly to discuss the developments regarding LAWS.

China presented their position on LAWS at the Fifth Review Conference of the Convention on Certain Conventional Weapons (CCW) in December 2016 [33]. Their position is based on 3 main arguments. First, they argue that the definition and scope of LAWS should be carefully discussed and agreed upon with a consensus. Note that there are many issues related to the definition and scope especially when phrases such as "human judgment" and "meaningful human control" cloud the discussions. Second, use of LAWS should be regulated with international agreements such as humanitarian laws. Third, robotic warfare decreases the cost of war especially in terms of human lives. Therefore, waging wars may become easier. China urges that until an appropriate solution is found, states should exercise caution in the use of LAWS and avoid harming civilians.

As of 23 May 2017, 19 countries are calling for a ban on lethal autonomous weapon systems. Table 1 presents these countries.

Table 1. Countries Calling for a Ban on Lethal Autonomous Weapon Systems (LAWS)

Algeria	Cuba	Holy See	Peru
Argentina	Ecuador	Mexico	State of Palestine
Bolivia	Egypt	Nicaragua	Venezuela
Chile	Ghana	Pakistan	Zimbabwe
Costa Rica	Guatemala	Panama	

There are 81 countries expressing concerns regarding lethal autonomous weapon systems. However, currently, only a handful of countries actually called for a ban on the use of LAWS. Note that the countries calling for a ban on LAWS are the frontiers in robotic technology. Frontier countries in robotic technology would naturally be reluctant to accept a ban on LAWS. Since LAWS provide them a significant advantage in warfare over the ones not able to utilize or afford this technology.

These developments indicate the heating debate on the use of killer robots. We shall expect wide-spread global discussions across many international organizations such as United Nations.

5. Law of Robotic Armed Conflict (LORAC)

The basic principles of the Law of Armed Conflict (LOAC) were developed based on the experiences of earlier wars. In those wars, the only warfighters were humans. Therefore, currently, LOAC basically sets the principles for the wars between human combatants. As we enter the robotic warfare era and drones and robots become combatants in wars, we shall reevaluate the applicability of the basic principles of LOAC. This reevaluation may result in a new Law of Armed Conflict. In the robotic warfare era, we may call this new law, **Law of Robotic Armed Conflict (LORAC)**. The following principles may guide the development of LORAC.

5.1. LORAC shall seek worldwide acceptance and approval.

Regardless of what really happens in wars, LOAC is a universally accepted set of principles. Violating the principles of LOAC may result in international consequences. Just like LOAC, Law of Robotic Armed Conflict (LORAC) requires worldwide acceptance and approval. Note that the countries with robotic technology advantage will naturally want to benefit from their advantage. Therefore, achieving worldwide common ground will not be easy.

5.2. LORAC shall enforce the design of ethical behavior in military robots.

The discipline of roboethics deals with the ethical issues surrounding robotics [1, 28, 34]. The literature on roboethics is already building up. Based on these studies, we can predict that robots may exhibit ethical behavior in due time. Furthermore, they can even act as a moral agent [30]. Arkin hypothesize that robots can be better soldiers in certain circumstances and more humane combatants than humans in the battlefield [2]. There are already studies on governing lethal behavior and embedding ethics in robot architectures [3]. Some experts claim robots may exhibit more ethical behavior in the battlefield [2].

5.3. LORAC shall aim for removing humans out of battle.

While robotic warfare era poses many dangers to humanity, it may also present opportunities. Maybe not in the near future, but a later time, we may have the opportunity to be able to remove humans out of war. In the robotic warfare era, we may accomplish wars without human combatants and let the robots fight our wars. Killing humans in wars may be banned forever. These ideas may seem as naïve and wishful thinking. But consider the current campaigns such as “the Campaign to Stop Killer Robots”. The public opinion is gaining momentum for a ban on killer robots. On the other hand, it is not easy for a country to abandon a technological advantage for warfare. Therefore, we may accomplish wars without humans quicker than expected. Russian president Vladimir Putin predicts that future wars would be fought by drones and the winner is determined by drone supremacy. Putin said "*When one party's drones are destroyed by drones of another, it will have no other choice but to surrender*" [12].

5.4. LORAC shall aim for reducing violence on humans.

There will be a transitioning period until we reach wars without human combatants. During this period, we will experience wars between humans and robots or drones. Therefore, while LORAC shall aim for removing humans out of battle, during the transitioning period, we may at least achieve reducing violence on humans. Rather than killing or harming humans, we may only aim for temporarily disabling the human combatant. We may develop weapons that are not lethal and arm robots with these weapons. In addition, we may design high precision military robots those are very careful

in preventing collateral civilian losses. The use of surveillance drones may help to protect civilians in UN peacekeeping missions [37]. Bomb squads use robots to eliminate explosive threats [5]. Therefore, there are already various uses of drones for reducing violence on humans.

5.5. LORAC shall aim for reducing human suffering due to war.

The principles of LOAC include distinction, proportionality, military necessity, limitation, good faith, humane treatment, and non-discrimination. All these principles are a means to reduce human suffering of civilians and warfighters during war. We may redefine these principles and do better with LORAC. For example, we may redefine distinction. In LORAC, we may ban targeting humans and only allow targeting robots. Basically, we may discriminate between humans and robots. In addition, with smart high precision weapons, we might reduce or completely eliminate collateral civilian losses.

5.6. LORAC shall aim for limiting harm on the environment during war.

In the last couple of decades, there were many discussions related to environmental protection. Various scientists are warning the public about the dangers of not caring for our environmental sustainability. Earth is the only habitable planet that we know of and we are not treating our planet well. With LORAC, we may at least aim for limiting harm on the environment during war.

5.7. LORAC shall aim for limiting cyber damage to critical civilian cyber infrastructure.

Information technology is everywhere. We heavily rely on IT for both civilian and military purposes. In the last 50 years or so, IT infrastructure becomes an essential part of a nation's critical infrastructure such as power lines or waterworks. Our financial systems rely on IT. Even social networks may be a considered an important way of communication. Today, disruptions on these services may cause human suffering. Cyber warfare is an emerging type of war. Cyber warfare aims at defending and attacking information technology - cyber assets. In cyber warfare, we try to protect our own cyber assets, while attacking the cyber assets of an opponent. In the future, robotic warfare may couple with cyber warfare. Cyberattacks on killer robots and military cyber assets may very well be considered a part of war, therefore, legitimate. However, cyberattacks on civilian cyber assets may lead to human suffering. As a result, LORAC shall aim for limiting cyber damage to critical civilian cyber infrastructure.

6. Conclusions

Artificial intelligence (AI) and robotic technology are advancing at an enormous speed. We need laws, regulations, and related ethics both on the civilian and military use of robotics. Unmanned aerial vehicles (UAVs) are occupying our skies. The national, federal, and international aviation administrations are trying to come up with adequate regulations to govern UAVs in skies. Autonomous cars are being tested on highways and roads. We have yet to see regulations for autonomous cars. Social robots are entering our lives. There are no regulations for them as well. Unfortunately, we are also using robots for war. Regulating the use of killer robots will be a challenge and may take a long time before we reach an international consensus on what the regulations should be. Before that, we need more studies and research on the use of robots in warfare. We have to study how the rules of *"jus ad bellum"* and *"jus in bello"* apply to robotic warfare. In this new era, we need to develop a new Law of Armed Conflict (LOAC). We may call this law – Law of Robotic

Armed Conflict (LORAC). In this study, we identified a set of guiding principles for the development of a Law of Robotic Armed Conflict.

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