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Autonomous weapon system: Law of armed conflict (LOAC) and other legal challenges

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ABSTRACT

The legality of autonomous weapon systems (AWS) under international law is a swiftly growing issue of importance as technology advances and machines acquire the capacity to operate without human control. This paper argues that the existing laws are ineffective and that a different set of laws are needed. This paper examines several issues that are critical for the development and use of AWS in warfare. It argues that a preemptive ban on AWS is irrelevant at this point and urges the appropriate authorities to develop a modern legal framework that is tailored to embrace these state-of-the-art weapons as the Law of Armed Conflict (LOAC) develops. First, this paper explores the myriad of laws designed to govern the potential future development and deployment of artificial intelligence and AWS in the context of International Humanitarian Law or LAOC. Second, the paper argues that it will be challenging for AWS to fulfill the requirements laid out under the International Committee of the Red Cross and LOAC for the rules of humanity, military necessity, distinction, proportionality and precaution, especially as it is related to noncombatants. Third, the paper discusses command responsibility and argues that states should establish accountability for wrongful acts committed by the AWS. Finally, this paper contends that there is an urgent need for a new legal framework to regulate these AWS and presents different solutions for the legal framework of AWS.

1. Introduction

The legality under international law of autonomous weapon systems (AWS) is an issue that is growing swiftly in importance as technology advances and machines acquire the capacity to operate without human control.[1] This paper addresses several issues that are critical for the development and use of AWS in warfare and urges appropriate authorities to develop a modern legal framework that is tailored to embrace these state-of-the-art weapons as LOAC develops. Throughout human existence, humans have developed and continually progressed their use of tools and technology. Transhumanism, or the human desire to acquire new capacities, is as ancient as our species itself.[2] Humans have always sought to expand the boundaries of their existence, be it socially, geographically,

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[1] Nathalie Weizmann, *Autonomous Weapon System under International Law*, Academy Briefing No. 8, Nov. 2014, at 3,3.

[2] Nick Bostrom, *A History of Transhumanist Thought*, 14 J. of Evol. & Tech. 1, 1 (2005), *reprinted in* Michael Rectenwald & Lisa Carl, Academic Writing Across the Disciplines (2011).

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or mentally.[3] Human beings share a common tendency to search for a way around every obstacle and limitation to life and happiness.[4] Humans want their gadgets to cook, clean, read, dictate, count, and solve problems for them.[5] Now, humans must decide if they want gadgets to fight for them as well.[6]

Imagine a world where soldiers no longer return home in flag-draped caskets to heartbroken families, parents no longer grieve the loss of their children, and children no longer grieve the loss of their parents.[7] This is a world where warfare is fought with autonomous robotics.[8] Autonomous robots – mobile machines that can make decisions, such as to fire upon a target, without human intervention – can replace the human soldier.[9] Robots can take the place of soldiers in dangerous missions, like tunneling through dark caves in search for terrorists, securing urban streets rife with sniper fire, patrolling the skies and waterways where there is little cover from attacks, clearing roads and seas of improvised explosive devices (IEDs), surveying damage from biochemical weapons, guarding borders and buildings, controlling potentially-hostile crowds, and even as frontline infantry.[10] Weapon systems are becoming increasingly automated, and arguably some autonomous military systems have been deployed for years.[11] Recent advances in automated systems and the possibilities they portend have generated interest and anxiety within some militaries and defense ministries, and have also generated a movement of non-governmental activists seeking to ban fully autonomous weapons.[12]

This struggle between the interest in technological advancement and anxiety is not new to the world of warfare. The human desire for better and more powerful weapons has been driving human beings since the beginning of time. It may have started with replacement of fists with clubs, arrows with swords, and eventually bullets with cannons and other heavy artillery, but the outcome has not eliminated wars. Technological advancements created enthusiasm for war simultaneously with fear and dread of the destruction war will bring. The resulting carnage and killing is far beyond what any club bearing ancestor could have imagined. These technological advancements included tanks and air attacks, which kill hundreds or thousands in one strike. From these advancements, cities were destroyed and masses were killed. Technology advancements brought about the creation of nuclear weapons, which can reduce an entire city and wipe out its population with only one bomb. Whole cities have disappeared, affecting present and future generations. All these modern methods of fighting wars, at all levels of conflict, have required active human participation and involvement. In the wake of the September 11, 2001 terrorist attacks, there has been a dramatic upsurge in the presence and use of unmanned aerial vehicles, commonly identified by the media and the public as "drones."[13] This marks the beginning of the shift in human participation, as drones began replacing humans in the battlefield; however, they still require humans to operate them. The drone's rapid combat application not only gave rise to various legal issues and implications, but also set the stage for the development and eventual use of fully AWS.[14] Professor Stuart Russell from the University of California at Berkeley said that these deadly drones could be the final stage of the ongoing technological march toward the AWS.[15] Some scientists say arm makers have crossed into troubling territory; they are developing weapons that solely rely on artificial intelligence without benefit of human intuition and experience.[16] This concern is growing as Artificial Intelligence (A.I.) installed in robotic drones will soon allow drones to perform targeted killing without the consultation of their human masters, working autonomously, coldly responding to a set of predetermined criteria.[17]

Unfortunately, International Humanitarian Law (IHL) or Law of Armed Conflict (LOAC) does not currently have provisions for this kind of technology, and it remains to be seen whether the international community would be supportive of a treaty that would limit or ban laws.[18] However, the Convention on Conventional Weapons, which is grounded in IHL, provides an important framework to further understanding of the technical, legal, ethical and policy questions raised by the development and use of AWS in armed conflicts.[19] Clearly, it is not too late to do this as the systems are already in widespread use by our military. Currently, technology is outpacing the extent of our laws. Our current system permits the creation of and use of technology where no laws have been enacted to address the concerns created by the new technologies. Thus, the current system is to create laws and regulations after the fact, when the technology is already in use in the public sphere. Militarized

[3] *Id.*

[4] *Id.*

[5] Cadet Allyson Hauptman, *Autonomous Weapons and the Law of Armed Conflict*, 218 Mil. L. Rev. 170, 170 (2013).

[6] *Id.*

[7] Patrick Lin, George Bekey & Keith Abney, *Autonomous Military Robotics: Risk, Ethics and Design*, Cali. Polytech. State U., version 1.0.9, Dec. 20, 2008, at 1.

[8] *See generally Id.*

[9] *Id.*

[10] *Id.*

[11] Kenneth Anderson, Daniel Reisner & Matthew Waxman, *Adapting the Law of Armed Conflict to Autonomous Weapon Systems*, 90 Int'l L. Stud. 386, 386 (2014) (discussing how Israel's anti-radar loitering missile, the Harpy, patrols the sky until enemy radar is turned on. It then attacks and destroys the radar installation on its own. It patrols the assigned area, and will attack any hostile radar activated in its vicinity).

[12] *Id.*

[13] Braden T. Thomas, *Autonomous Weapon Systems: The Anatomy of Autonomy and the Legality of Lethality*, 37 Hous. J. Int'l L. 235, 235 (2015).

[14] *Id.*

[15] Rhodi Lee, *Killer Drones and Artificial Intelligence is a Recipe for Disaster for Humans*, Tech Times (May 28, 2015, 9:32 AM), http://www.techtimes.com/articles/56187/20150528/killer-drones-and-artificial-intelligence-is-a-recipe-for-disaster-for-humans.htm.

[16] John Markoff, *Fearing Bombs that Can Pick Whom to Kill*, N.Y. Times, Nov. 12, 2014, at A1.

[17] Shawn Helton, *Hollywood Comes Real: The Future of Warfare Will be 'Decided by Drones' Not Humans*, 21st Century Wire (Oct. 8, 2013), http://21stcenturywire.com/2013/10/08/death-by-drones-the-future-of-warfare-will-be-decided-by-drones-not-humans/.

[18] Lee, *supra* note 15.

[19] *Autonomous Weapon Systems: Is it Morally Acceptable for a Machine to Make Life and Death Decisions?* Int'l Comm. of the Red Cross (April 15, 2015), https://www.icrc.org/en/document/lethal-autonomous-weapons-systems-LAWS (meeting of Experts on Lethal Autonomous Weapons Systems (LAWS) Statement of the ICRC).

drones are no exception to this system. For example, drones were developed first, and then the laws and regulations were discussed. Accordingly, drones affected privacy laws, surveillance laws, and international laws regarding the killing of suspected terrorists and the LOAC in actual warfare. Rather than continue a reactive approach, societies need to be proactive and use careful thought out direction to legislate the laws and regulations required for the AWS before employment by nation states.

This paper argues that the existing laws are ineffective and a different set of laws are needed. In addition, this paper addresses several issues that are critical for the development and use of AWS in warfare. First, this paper explores the myriad of laws designed to govern the potential future development and deployment of A.I. and AWS in the context of LOAC. Second, this paper examines the challenges for AWS to fulfill the requirements laid out under the ICRC and LOAC for the preservation of human life, especially as it relates to noncombat. The paper argues that states should establish accountability for wrongful acts committed by the AWS. Fourth, the paper contends that all the nations involved in the development of A.I. and AWS must be party to the convention that sets the rules to govern autonomous machines. These four goals are accomplished in two parts of this paper. Part I offers definitions and a detailed overview of the technology used in AWS; this helps in determining whether or not AWS can fit under the current standards of LOAC rules and weapon laws. Part II argues that the autonomous weapons developed or intended for use in armed conflict must be capable of being used in accordance with LOAC. The paper discusses just war theory that includes jus in bello for the use of AWS in warfare. Further, this paper discusses the rules of distinction, proportionality, unnecessary suffering and military necessity in attack. This section is followed by discussion about prohibition on conventional weapons and customary law, which governs the law of weapons. It also evaluates the propriety of evaluating AWS by those standards, addresses potential shortcomings of such application, and proffers alternative avenues to refine current weapons laws. This paper explores that there is an urgent need for a new legal framework to regulate AWS and presents different solutions for the legal framework of AWS. The conclusion argues that a preemptive ban is irrelevant at this point and urges the appropriate authorities to develop a modern legal framework that is tailored to embrace these state-of-the-art weapons as LOAC develops.

2. Definitions

To the extent that there are no standard, universally accepted definitions of some of the key terms employed in this paper, there is need to stipulate those working definitions here since it is important to ensure the same basic understanding of those terms at the outset.[20] It will help in addressing the legal issues that underlie the use of AWS. For the purpose of this paper, these terms have these assigned meanings.

[20] Lin, Bekey & Abney, *supra* note 7, at 4.

2.1. *Artificial intelligence*

Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs.[21] A.I. is usually defined as the science of making computers do things that require intelligence when done by humans.[22] But A.I. does not have to confine itself to methods that are biologically observable.[23] A.I. has had some success in limited, or simplified, domains.[24] However, the five decades since the inception of A.I. have brought only very slow progress, and early optimism concerning the attainment of human-level intelligence has given way to an appreciation of the profound difficulty of the problem.[25]

2.2. *Autonomous weapon system*

An AWS is, according to the International Committee of the Red Cross, one that has autonomy in its "critical functions," meaning a weapon that can select (i.e. search for or detect, identify, track) and attack (i.e. intercept, use force against, neutralize, damage or destroy) targets without human intervention.[26] For example, Israel's anti-radar loitering missile, the Harpy, patrols the sky until enemy radar is turned on.[27] It then attacks and destroys the radar installation on its own.[28] It patrols the assigned area and will attack any hostile radar activated in its vicinity.[29] As another example, Norway plans to equip its fleet of advanced jet fighters with the Joint Strike Missile, which according to the *New York Times*, can hunt, recognize, and detect a target without human intervention.[30] For the last example, Britain's "fire and forget" Brimstone missiles can distinguish among tanks, cars and buses without human input or control.[31] The foray into autonomous aircraft is a move that conjures images of killer drones, capable of choosing targets and hunting them down without human oversight.[32]

[21] John McCarthy, *What is Artificial Intelligence?* Stanford Univ. Computer Sci. Dept. (revised Nov. 12, 2007), http://www-formal.stanford.edu/jmc/whatisai/.

[22] Jack Copeland, *What is Artificial Intelligence?* Alan Turing (May 2000) http://www.alanturing.net/turing_archive/pages/reference%20articles/what%20is%20ai.html, (last visited Feb. 27, 2016).

[23] McCarthy, *supra* note 21.

[24] Copeland, *supra* note 22.

[25] *Id.*

[26] *Autonomous Weapon Systems: Is it Morally Acceptable for a Machine to Make Life and Death Decisions? supra* note 19.

[27] *Autonomous Weapons Which Select, Destroy Targets without Human Intervention Proliferate*, Homeland Sec. News Wire (Nov. 13, 2014), http://www.homelandsecuritynewswire.com/dr20141113-autonomous-weapons-which-select-destroy-targets-without-human-intervention-proliferate.

[28] *Id.*

[29] *Harpy Air Defense Suppression System*, Def. Update Int'l Online Def. Mag., http://defense-update.com/directory/harpy.htm (last visited Feb. 27, 2016).

[30] *Autonomous Weapons Which Select, Destroy Targets without Human Intervention Proliferate*, *supra* note 27.

[31] *Id.*

[32] *Navy Unveils New Program to Create Drone-Like Autonomous Aircraft*, Fox News (April 6, 2014), http://www.foxnews.com/us/2014/04/06/new-technology-to-enable-navy-drones-to-choose-flight-paths-landing-sites/.

This paper will cover both A.I. and AWS, not just philosophical questions or ethical theory, with the goal of providing some legal relevance if not actionable insights at this stage.

3. Autonomy of AWS

Before learning about the legal aspects and governing of AWS, it is important to discuss the relevant technology used in AWS for a better understanding of its legality. The key difference between human soldiers and AWS is that humans have the capability to distinguish between a legitimate target and a non-legitimate target. Humans use their biological senses for the distinction; whereas, AWS make the decision based on their human created technological components. This ability to decide which targets are military or non-military, and combatant or non-combatant, is known as the principle of distinction and is required by the LOAC. The principle of distinction will be discussed in detail later in this paper. Some of the key components in AWS that directly impact the principle of distinction are sophisticated sensors, sensor fusion, communication and motion planning, a description of which will follow this section. Autonomy is a characteristic of the technology, attached to a function or functions, not an object in itself.[33] There are currently discussions in a variety of national and international fora about autonomy and AWS.[34] Yet, governments are unsure of what they need to know in order to make responsible policy choices.[35] It is suggested that it would be useful to focus on how autonomy is developed in autonomous weapons to perform "critical functions" (such as a weapon that can select i.e. search for or detect, identify, track and attack i.e. intercept, use force against, neutralize, damage or destroy) because these are the functions most relevant to 'targeting decision-making', and therefore most relevant to compliance with LOAC, in particular its rules on distinction, proportionality and precautions in attack.[36] It is hard to imagine a computer program sophisticated enough to make such complex value judgments required by the LOAC.[37] Not all autonomous functions are of equal concern: some might be uncontroversial while others raise significant legal, ethical and strategic questions.[38] Also, understanding the autonomy of AWS will be helpful in concluding whether or not present laws of LOAC are sufficient. Some experts contend that it is simply too difficult to design a machine that can distinguish between a combatant and a non-combatant, as required for the Law Of War and Rule Of Engagement, particularly as insurgents pose as civilians.[39] The following framework includes a discussion of the major technological design of AWS, such as sophisticated sensors, communication and motion planning, in context with law of war.

3.1. Sophisticated sensors

AWS consist of sophisticated sensors. Sensors help AWS in distinguishing important targets during the warfare. AWS have new types of radar, laser and infrared sensors, which are helping missiles and drones calculate more accurately and define more clearly their position and orientation.[40] "Machine vision," resembling and exceeding that of human capability, identifies patterns in images and helps weapons distinguish important targets.[41] This nuanced sensory information can be quickly interpreted by sophisticated artificial intelligence systems, enabling a missile or drone to carry out its own analysis in flight.[42] Additionally, computer hardware hosting has become relatively inexpensive and expendable.[43] The ability of a computer or other machine to perform actions formerly thought to require intelligence is a game changer. Among these actions and capabilities are logical deduction and inference, creativity, the ability to make decisions based on past experience, the absence of sufficient information or the presence of conflicting information, together with the ability to understand spoken language.[44] With the help of sophisticated sensors, A.I. tries to perform the acts required according to the standards of principle of distinction.

3.2. Sensor fusion

"Sensor fusion is a process by which data from several different sensors are 'fused' to compute something more than could be determined by any one sensor alone. An example is computing the orientation of a device in three-dimensional space."[45] The peak of AWS might be combining information from different fusion sensors for use on board a drone equipped with heavy armaments. Sensor fusion is coming very close to mimicking the function of the human brain with its ability to fuse what it sees, hears, smells, thinks and feels to reach a decision. It is challenging to create AWS with the help of sensor fusion that will calculate and perform in compliance with the principle of distinction. Moreover, a challenge exists for AWS without any survival instinct to learn from its mistakes. It is unknown if these AWS can comply with the principle of distinction without making grave and deadly mistakes.

3.3. Communications

To implement strategies and to impart orders, efficient communication is required during battle to minimize unnecessary

[33] *Framing Discussions on the Weaponization of Increasingly Autonomous Technologies*, United Nations Inst. for Disarm. Rsrch., 4 (2014), http://www.unidir.org/files/publications/pdfs/framing-discussions-on-the-weaponization-of-increasingly-autonomous-technologies-en-606.pdf.

[34] *Id.* at 1.

[35] *Id.*

[36] *Autonomous Weapon Systems: Is it Morally Acceptable for a Machine to Make Life and Death Decisions? supra* note 19.

[37] Josh Dzieza, *The Pros and Cons of Killer Robots*, The daily Beast (May 30, 2013, 11:31 AM), http://www.thedailybeast.com/articles/2013/05/30/the-pros-and-cons-of-killer-robots.html.

[38] *Framing Discussions on the Weaponization of Increasingly Autonomous Technologies*, *supra* note 33, at 4.

[39] Lin, Bekey & Abney, *supra* note 7, at 76.

[40] Markoff, *supra* note 16.

[41] *Id.*

[42] *Id.*

[43] *Id.*

[44] *Artificial Intelligence Definition*, Dictionary.com, http://dictionary.reference.com/browse/artificial+intelligence (last visited Feb. 28, 2016).

[45] Sensor Fusion, http://www.nxp.com/products/sensors/nxp-sensor-fusion:XTRSICSNSTLBOX (last visited Feb. 28, 2016).

damage to life and property. Before preparing to send AWS into warfare, more thought and planning about communication between AWS and humans, and between AWS and AWS, is needed. Handling communication and coordination between multiple agents, each with the ability to act and react in the presence of incomplete and imperfect information, can be an enormous challenge.[46] Dr. Peter Asaro, a philosopher of science at the New School and co-founder of the International Committee on Robot Arms Control says, "Autonomous systems interacting with each other competitively can escalate quickly and unpredictably."[47] While acting quickly and unpredictably, AWS may miscommunicate, which might lead to a violation of the principle of distinction by attacking the non-military targets and non-combats.

3.4. *Motion planning (also called path planning)*

Motion planning controls the movement of AWS. Recent advances in computational capabilities, in terms of hardware and algorithms, communication architectures, and sensing and navigation devices, have made it possible to develop autonomous, single or multi-agent systems that exhibit a high degree of reliability in their operation in the face of dynamic and uncertain environments, operating conditions, and goals.[48] AWS must be able to construct a proper representation of the environment and of their own state from the available sensory data and/or knowledge base and must be able to make timely decisions aiming at interacting with the environment in an optimal way.[49] Trajectory planning determines an optimal control maneuver to take to follow a given path or to go from one location to another. It is a highly specialized field involving creating mobile platforms, using holograms[50] and non-holonomic constraints,[51] while calculating steering angles and curves.[52] It will be challenging for AWS to calculate angles and curves, and distinguish between military targets and non-military targets, during fast paced warfare situations. A military target might keep changing according to the movement of enemy. For example, a group of terrorists could hide inside a factory and then escape to a mosque.

The discussion of AWS components above lay out both the challenges and the potential problems they might cause in combat zone. Determining an optimal path for an autonomous vehicle traveling at high speeds or through crowded terrain while calculating shapes, distances, and densities of the various objectives and obstacles in its path requires both sensor-fusion and agility of communication between the sensors together with a high degree of reliability. In a city with pedestrians, cars, buses, delivery drones and other constraints, such as an evasive or moving target, the complications compound. Principle of distinction of LOAC cannot be satisfied because AWS will commit mistakes and the lives of civilians and their properties would be accidentally destroyed. In the preceding discussion, the current state of some of the robotic hardware and systems being used and/or being developed by the military services for AWS are presented.[53]

Technology and science have dramatically advanced warfare and improved the capabilities of weapons throughout history, but the emergence of autonomous technology may well represent a revolution for modern warfare.[54] Accordingly, the use of AWS in warfare will pose a large number of legal as well as ethical challenges with the above technological features, which do not satisfy the requirement of LOAC. In the following sections, the background of LOAC will be discussed followed by general principle, weapon law and weapon review to expand on the various legal challenges raised by AWS.

4. The Law of Armed Conflict (LOAC)

Currently, there are no treaties that specifically address or govern the use of AWS.[55] However, there is universal consensus that the LOAC applies to AWS.[56] All warfare is governed by IHL, also known as the LOAC.[57] Therefore, in the absence of specific treaty prohibitions, parties can look to LOAC to sufficiently address the issue of AWS employment.[58] In particular, in order to evaluate the overall lawfulness of AWS, one must review two discrete areas of LOAC: General principle of LOAC and weapons law.[59] This area of analysis is generally

[46] THE UAV, http://www.theuav.com/ (last visited Feb. 28, 2016).
[47] Dzieza, *supra* note 37.
[48] Emilio Frazzoli, Munther Dahleh, & Eric Feron, *Real-Time Motion Planning for Agile Autonomous Vehicles*, 25 J. OF GUID., CONTROL, & DYN. 116, 116 (2002), *available at* http://web.mit.edu/dahleh/www/pubs/frazzoli_gcd_02.pdf.
[49] *Id.*
[50] *Hologram Definition*, WhatIs.com, http://whatis.techtarget.com/definition/hologram (last visited Feb. 28, 2016) (A hologram is a three-dimensional image, created with photographic projection).
[51] Mattias Flygare, *Nonholonomic Constraints*, KAU DEP'T OF PHYSICS & ELEC. ENG'G, 1 (Jan. 15, 2012), http://www.ingvet.kau.se/juerfuch/kurs/amek/prst/11_nhco.pdf. (A nonholonomic system is a system whose state depends on the path taken to achieve it. These types of constraints often arise in mechanical systems with rolling or sliding contact, but can also occur in less obvious ways).
[52] Francois G. Pin & Hubert A. Vasseur, *Autonomous Trajectory Generation for Mobile Robots with Non-Holonomic and Steering Angle Constraints*, INT'L ATOMIC ENERGY CTR. Aug. 20–22, 1990), http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/21/094/21094449.pdf.
[53] Lin, Bekey & Abney, *supra* note 7, at 19.
[54] Jeffrey S. Thurnher, *Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective*, NEW TECH. AND THE LAW OF ARMED CONFLICT (forthcoming) (manuscript at 2), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2271158.
[55] Christopher P. Toscano, *"Friend of Humans": An Argument for Developing Autonomous Weapons Systems*, 8 J. NAT'L SEC. L. & POL'Y 189, 205 (2015).
[56] Michael N. Schmitt, Jeffrey S. Thurnher, *"Out of the Loop": Autonomous Weapon Systems and the Law of Armed Conflict*, 4 HARV. NAT'L SEC. J. 231, 243 (2013).
[57] James Foy, *Autonomous Weapons Systems Taking the Human Out of International Humanitarian Law*, 23 DAL. J. LEGAL STUD. 47, 53 (2014).
[58] Toscano, *supra* note 55.
[59] *Id.* (in particular, in order to evaluate the overall lawfulness of AWS, one must review two discrete areas of IHL: weapons law and targeting law); *see also* Jeffrey S. Thumher, *The Law That Applies to Autonomous Weapon Systems*, ASIL INSIGHTS (Jan. 18, 2013), https://www.asil.org/insights/volume/17/issue/4/law-applies-autonomous-weapon-systems; *see also* Anderson, Reisner & Waxman, *supra* note 11, at 8–11.

accepted among scholars, and these two areas become the legal litmus test for AWS.[60] First, a weapon may be incapable of adhering to the principles of IHL, rendering it illegal per se; even when it is deployed against a lawful target, the weapon would be illegal.[61] Second, the IHL's weapons law evaluates the AWS's lawfulness in and of itself (the means).[62] The ICRC similarly requires that new weapons should be evaluated through the lens of "means" and "methods."[63] AWS is, as all weapons and weapon systems are, a means of warfare (whereas a method of warfare involves deployment and tactics).[64]

The LOAC comes from both customary international law and treaties.[65] Customary international law, based on practices that nations have come to accept as legally required, establishes the traditional rules that govern the conduct of military operations in armed conflict.[66] LOAC arises from a desire among civilized nations to prevent unnecessary suffering and destruction while not impeding the effective waging of war.[67] Simple humanitarian concerns should limit battlefield conduct.[68] War is not a contest to see who can most effectively injure one's opponent.[69] War cannot be simple blood sport.[70] Indeed, modern LOAC has been largely driven out by humanitarian concerns.[71] LOAC regulates, among other things, the means and methods of warfare – the weapons used and the tactics employed.[72] Also, a part of public international law, LOAC regulates the conduct of armed hostilities, but only among consenting nations.[73] It also aims to protect civilians, prisoners of war, the wounded, sick, and shipwrecked.[74] LOAC applies to international armed conflicts and in the conduct of military operations and related activities in armed conflict.[75] As some experts argue, it may simply be fantasy to think humans can design a machine that can distinguish between a combatant and a non-combatant as required by the LOAC, particularly when insurgents often pose as civilians.[76] On the other hand, humans also cannot always distinguish valid targets from illegal ones.[77] Does it make sense to hold robots to a higher standard than humans are able to achieve ourselves?[78] Some autonomous weapons systems permit humans to override their decisions, but some weapons move so quickly that human monitors may not be able to take control.[79] The LOAC generally demands there to be human "eyes on target," authorizing strikes and ensuring non-combatants are not being targeted. Furthermore, even if a specific type of weapon is not unlawful per se or is not specifically prohibited by particular treaties, governments may use it improperly, in a manner that would result in unnecessary suffering or in the targeting of civilian population.[80] Such use is also unlawful under the relevant rules of LOAC.[81] At its foundation, LOAC is based on four key principles, which undergird the spirit and purpose of the law and drive determinations in areas such as targeting, detention, and treatment of persons.[82] The overarching principle that pertains to weapons systems is the prohibition of superfluous injury or unnecessary suffering.[83] Weapons that cannot be directed at specific military objectives and that by their very nature violate the principle of distinction are also unlawful per se.[84] Therefore, this section gives an idea about the requirements to use weapon under LOAC.

4.1. *The Just War Theory*

The Just War Theory is a broadly accepted theoretical framework for regulating conduct in war that has been embraced by such esteemed and influential institutions as academia, the US military establishment (including the military academies) and the Catholic Church.[85] It is also compatible with, if not actually a formulation of, the principles underlying most of the international laws regulating warfare, such as the Geneva and Hague Conventions.[86] This section aims to illuminate the challenges to Just War Theory posed by AWS. Just War Theory formalizes the moral justifications for war.[87] From the start, Just War theorists have been occupied with two central questions: when it is appropriate to go to war (*jus ad bellum*) and how war should be fought (jus in bello).[88] Remote warfare, such as drone strikes, presents several ethical challenges to national governments because their use contradicts principles within the Just War tradition; their advancement disconnects society from war, and their proliferation risks devaluing the

[60] *Id.*
[61] Foy, *supra* note 57.
[62] Toscano, *supra* note 55.
[63] *Id.*
[64] Gregory P. Noone and Diana C. Noone, *The Debate over Autonomous Weapons Systems*, 47 Case W. Res. J. Int'l L. 25, 29 (2015).
[65] Rod Powers, *Law of Armed Conflict (LOAC)*, About, http://usmilitary.about.com/cs/wars/a/loac.htm (last updated Dec. 15, 2014).
[66] *Id.*
[67] *Id.*
[68] Gray D. Solis, *The Law of Armed Conflict: International Humanitarian Law in War*, 7 (2010).
[69] *Id.*
[70] *Id.*
[71] *Id.*
[72] Oren Gross, *The New Way of War: Is There A Duty to Use Drones?* 67 Fla. L. Rev. 1, 26 (2015).
[73] Powers, *supra* note 65.
[74] *Id.*
[75] *Id.*
[76] Patrick Lin, *The Ethical War Machine*, Forbes (June 22, 2009, 6:00 PM), http://www.forbes.com/2009/06/18/military-robots-ethics-opinions-contributors-artificial-intelligence-09-patrick-lin.html.
[77] *Id.*
[78] *Id.*
[79] *Autonomous Weapons Which Select, Destroy Targets without Human Intervention Proliferate*, *supra* note 27.
[80] Gross, *supra* note 72, at 27.
[81] *Id.*
[82] Laurie R. Blank, *After "Top Gun": How Drone Strikes Impact the Law of War*, 33 U. Pa. J. Int'l L. 675–681, (2012).
[83] Gross, *supra* note 72, at 27.
[84] *Id.*
[85] Peter M. Asaro, *How Just Could a Robot War Be?* Umed University Center for Cultural Analysis, Rutgers University, 1 (2008) http://peterasaro.org/writing/Asaro%20Just%20Robot%20War.pdf.
[86] *Id.*
[87] Ethan A. Wright, *Of Drones and Justice: A Just War Theory Analysis of the Unite States' Drone Campaigns*, Ursinus College 12 (2015), http://digitalcommons.ursinus.edu/cgi/viewcontent.cgi?article=1003&context=ethics_essay.
[88] Erich Freiberger, *Just War Theory and the Ethics of Drone Warfare*, E-International Relations (Jul. 18, 2013), http://www.e-ir.info/2013/07/18/just-war-theory-and-the-ethics-of-drone-warfare/.

significance of ethics in autonomous technology.[89] The principles of Just War Theory (or the Just War Tradition) are the basis of ethics and laws that govern armed conflict, and they accommodate autonomous technologies used in drone warfare.[90] Under the laws of war, appropriate use of force is judged not only by assessing the results of force, but also by the proportionality of employing that force.[91] For example, a drone might kill a non-combatant on the battlefield.[92] However, if such force had been deemed proportional according to the situation and threat, the tragic death would be both legally and morally acceptable.[93] Considering that it is possible to program the laws of war into AWS, they will pose no new ethical dilemma if sent to the battlefield; they are extensions of human operators and are subject to the same ethical standards.[94]

Many researchers are as concerned with the moral hazards raised by such technology as they are with the threat of its use by terrorists.[95] "Should a machine be making life and death decisions on the battle field?"[96] Bonnie Docherty, an arms researcher with Human Rights Watch (HRW) told MSNBC,[97] "If a killer robot unlawfully killed a civilian, it would be extremely difficult to hold anyone accountable because it was the robot that made the decision to kill. By contrast, a drone or other weapon is merely a tool in the hand of a human who can then be held responsible."[98]

4.1.1. *Jus in bello*

Most of jus in bello analysis references to whom one is allowed to kill and who is off limits. The typical distinction is between "combatants," who may be the targets of wartime operations, and "non-combatants," who are exempt from being targets of such attacks.[99]

Most scholarly arguments focus on whether AWS are capable of upholding jus in bello principles, particularly the principles of distinction and proportionality.[100] Proponents often cite that machines will be better able to distinguish between combatants and noncombatants than human soldiers.[101] Furthermore, since machines are not affected by emotions, they will refrain from engaging in retributive acts against civilian populations.[102] Detractors argue it is too difficult to distinguish between combatants and noncombatants, particularly in counterinsurgency wars. They argue that such AWS will be unable to fight proportionately because the judgment required for such calculations is beyond the programming and learning capacities of these systems.[103]

4.1.2. Jus ad bellum

This discussion has been directed almost entirely to considerations of law derived from the principle of jus in bello.[104] *Jus ad bellum* appears to be overlooked, or excluded, considerations of *jus ad bellum* that arise from the use of AWS. It is in this context that those considerations, also typically discussed as matters of international peace and security, may be considered to have implications under the law of armed conflict.[105] The traditional emphasis of Just War Theory concerns when it is morally acceptable for a state to begin or participate in the coercion that is war, that is, *jus ad bellum*.[106] *Jus ad bellum* attempts to spell out when beginning the coercion of war is morally legitimate and when it is not.[107] Also, this law is acceptable for the justifications to use armed force and declare war.[108] Questions arise regarding whether AWS is compatible with *jus ad bellum*.[109] *Jus ad bellum* traditionally comprise six principles: just cause, right intention, proper authority, last resort, probability of success and proportionality.[110] *Jus ad bellum* governs the use of force between states.[111] The potential impact of AWS on international peace and security should not be underestimated.[112] One concern is that because the forces of a state that deployed AWS would be at lower immediate risk, states might more easily resort to force.[113] Thus, possession of such weapons might prompt states to lower the threshold for using force and consequently increase the incidence of attacks.[114] This in turn could cause an escalation in armed violence between states that can deploy such weapons.[115]

As a threshold matter, the *jus ad bellum* inquiry depends on whether the territorial State has consented to the attack.[116]

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[89] David Redekop, *How Remote Warfare Poses an Ethical Challenge for National Governments*, Academia 1, http://www.academia.edu/7997208/How_Remote_Warfare_Poses_an_Ethical_Challenge_for_National_Governments (last visited Feb. 28, 2016).

[90] James J. Carafano, *Autonomous Military Technology: Opportunities and Challenges for Policy and Law*, The Heritage Foundation (Aug. 6, 2014), http://www.heritage.org/research/reports/2014/08/autonomous-military-technology-opportunities-and-challenges-for-policy-and-law.

[91] *Id.*

[92] *Id.*

[93] *Id.*

[94] *Id.*

[95] Eric Levitz, *Elon Musk and Stephen Hawking call for a ban on autonomous weapons*, MSNBC (Jul. 28, 2015) http://www.msnbc.com/msnbc/elon-musk-and-stephen-hawk-call-ban-autonomous-weapons.

[96] *Id.*

[97] *Id.*

[98] *Id.*

[99] *Id.*

[100] Heather M. Roff, *Lethal Autonomous Weapons and Jus Ad Bellum Proportionality*, 47 Case W. Res. J. Int'l L.24, 38 (2015) *available at* http://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1006&context=jil.

[101] *Id.*

[102] *Id.*

[103] *Id.*

[104] Mark Gubrud, *Killer robots, international law, and just war theory*, The New Atlantis (Apr. 17, 2015) http://futurisms.thenewatlantis.com/search/label/LAWS2015.

[105] *Id.*

[106] Lin, Bekey & Abney, *supra* note 7, at 45.

[107] *Id.* at 44.

[108] *Id.*

[109] P. Noone and C. Noone, *supra* note 64, at 39.

[110] *Id.* at 40.

[111] Weizmann, *supra* note 1, at 9.

[112] *Id.*

[113] *Id.*

[114] *Id.*

[115] *Id.*

[116] Laurence Shore et al, *The Legality Under International Law Of Targeted Killings by Drones Launched by the United States*, Comm. on int'l l., N. Y. City Bar Ass, 8 (Jun. 2014) http://www2.nycbar.org/pdf/report/uploads/20072625-TheLegalityofTargetedInternationalKillingsbyUS-LaunchedDrones.pdf.

Article 2(4) of the UN Charter is properly interpreted as prohibiting all uses of force above a certain minimal level.[117] Under Article 24 of the UN Charter, the UN Security Council is responsible for the 'maintenance of international peace and security.'[118] Under Chapter VII, it may authorize 'action by air, sea or land forces as may be necessary to maintain or restore international peace and security.'[119]

With respect to the right of self-defense, because Article 51 of the Charter does not describe the nature of the party launching an armed attack, it does not necessarily limit the right to self-defense to armed attacks by states.[120] The threshold for the occurrence of an armed attack by another state thus appears to be relatively high, going beyond a mere frontier incident between members of the armed forces of two states (or armed groups operating in one state with limited support from another state).[121] It might even be argued by some that a very limited and targeted strike by one state against individuals located in another state would not constitute an armed attack in the sense of the UN Charter or customary law, with the argument being based on the highly contested concept of anticipatory self-defense.[122] If there is consent, there is no infringement on sovereignty.[123] After all, nobody had ever had to consider before that a weapon itself might decide to start a war unjustly.[124] In sum, any state that deployed AWS on the territory of another state would need to comply fully with *jus ad bellum*, the international legal framework that governs the use of force by one state against another.[125]

4.2. *General principles of IHL/LOAC*

In this section, it will be analyzed how the weapons system will be used (the methods). This analysis falls squarely within LOAC principles. The LOAC revolves around core principles: distinction, proportionality, military necessity, unnecessary suffering and precaution in attack. Application of any weapon depends upon these four general principles of LOAC. Additionally, targeting law governs the circumstances of the use of lawful weapons and includes general rules of IHL/LOAC. This section will help in developing the conclusion that LOAC rules are ineffective to regulate AWS.

4.2.1. *Distinction*

"Distinction" means persons employing force must distinguish between lawful military targets (e.g. opposing combatants, equipment, or facilities), protected persons (e.g. civilians, medical personnel, chaplains, or persons who are hors de combat) and property.[126] Distinction requires that a combatant, using reasonable judgment in the circumstances, distinguish between combatants and civilians, as well as between military and civilian objects.[127] According to Article 48 of Additional Protocol I "In order to ensure respect for and protection of the civilian population and civilian objects, the parties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives."[128] Additional Protocol I also prohibits the use of weapons which are "of a nature to strike military objectives and civilians or civilian objects without distinction."[129]

Can a robot distinguish between a soldier and a civilian, or between a combatant who is raising his rifle to fire and one who is raising it above his head to surrender?[130] LOAC requires that it do so.[131] Humans sometimes cannot make the distinction between a soldier and a civilian, it will be challenging for the machines to exceed the capability of their makers. Alarmingly, non-governmental organizations and independent media sources have discovered that "In Pakistan, there have been 346 drone strikes between 2004 and 2012, which have killed between 2570 and 3337 people; it is estimated that 26 percent of those killed were civilians. . ." and that "an additional 1300 have been injured."[132] This data is from drones that are operated by humans. There is no available data of decisions taken by autonomous machines. In the past, drones failed to distinguish between the high volume target and civilians at least 26% of the time. When it comes to taking the life of human beings, 26% inaccuracy fails to meet the LOAC standard of distinction. It is unknown if drones and artificial intelligence will ever be so refined and so accurate that they can make the kinds of distinctions necessary to avoid the gross injustice following from a 26% civilian casualty rate.

4.2.2. *Proportionality*

The LOAC principle of proportionality requires that the expected loss of civilian life and damage to civilian property incidental to attack not be excessive in relation to the concrete and direct military advantage anticipated from striking

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[117] Mary Ellen O'Connell, *Unlawful Killing with Combat Drones, A Case Study of Pakistan*, The U. of N. D. Sch. of L. 13 (2004–2009) also available via SSRN http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1501144.

[118] *Autonomous Weapon System under International Law*, Geneva Academy, at 9, November 2014, https://www.geneva-academy.ch/joomlatools-files/docman-files/Publications/Academy%20Briefings/Autonomous%20Weapon%20Systems%20under%20International%20Law_Academy%20Briefing%20No%208.pdf.

[119] *Id*.

[120] *Id*.

[121] Stuart Casey-Maslen, *Pandora's box? Drone strikes under jus ad bellum, jus in bello, and international human rights law*, 94 Int'l R. of the Red Cross, N. 886, 602 (summer 2012), https://www.icrc.org/eng/assets/files/review/2012/irrc-886-casey-maslen.pdf.

[122] *Id*.

[123] Laurence Shore et al, *supra* note 116, at 8–9.

[124] Gubrud, *supra* note 104.

[125] Weizmann, *supra* note 1, at 10.

[126] Toscano, *supra* note 55, at 210.

[127] Anderson, Reisner & Waxman, *supra* note 11, at 401.

[128] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, Treaties, St., Parties & Comment. (Int'l Comm. of the Red Cross), *available at* https://www.icrc.org/ihl/4e473c7bc8854f2ec12563f60039c738/8a9e7e14c63c7f30c12563cd0051dc5c?OpenDocument.

[129] *Rule 71, Weapons that by Nature Indiscriminate*, Int'l Comm. of the Red Cross, https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule71 (last visited Feb. 28, 2016).

[130] Dzieza, *supra* note 37.

[131] *Id*.

[132] Almantas Vainauskas, *The Strategic Costs and Consequences of the U.S. Drone Warfare (DRAFT)*, Academia, 14, http://www.academia.edu/7532477/The_Strategic_Costs_and_Consequences_of_the_U.S._Drone_Warfare_DRAFT_ (last visited Feb. 28, 2016).

the target.[133] According to U.S. Army Field Manual FM27-10, proportionality is described as "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."[134] The key here is the word "incidental," meaning outside of the military target.[135] This means that when considering a target, the damage to civilians and their property cannot be excessive in relation to the military advantage gained.[136] Proportionality is a necessary consideration in attacks on civilian targets that it includes, not on combatants.[137] This is a venerable concept. Grotius writes, "one must take care of, so far as is possible, to prevent the death of innocent persons, even by accident."[138] Proportionality is not a requirement if the target is purely military.[139] This principle brings with it an obligation to consider all options when making targeting decisions: verification of the target, timing of attack, choice of weapons used, warnings and evacuations for civilian populations.[140] The operators of drone, after duly considering all options and taking all mitigating maneuvers, must do everything possible to minimize the damage to the life and property. Yet, the above data shows that in 26% of cases, drones have failed to hit military targets without great loss of civilian lives. These drones are operated by humans. At present, the burden of proportionality is on the operators. As drones become more autonomous, the operators' control is reduced and the burden of proportionality is shifted to the drones. However, in case of AWS, it is unknown if AWS can consider all other options of war. The AWS are usually one-strike tools that do not have the ability to consider other options. It is unknown if AWS can be programmed to estimate the collateral damage before an attack. The ability of AWS will be questioned when it has to distinguish between a building full of terrorists and a factory full of workers. If AWS focuses on a building consisting of people, not terrorists, it might attack the factory and kill all the workers. Hence, AWS do not satisfy the requirement of proportionality principle.

4.2.3. *Unnecessary suffering*

The LOAC concept of unnecessary suffering that limits unnecessary suffering to civilians and combatants is codified in Additional Protocol I, Article 35(2), which specifies "It is prohibited to employ weapons, projectiles and materials and methods of warfare of a nature to cause superfluous injury or unnecessary suffering."[141] AWS are, quite simply, not designed to "cause unnecessary suffering." Therefore, they would meet the per se requirements of the humanity principle.[142] A weapon is not banned on the ground of superfluous injury or unnecessary suffering merely because it causes great or even horrendous suffering or injury.[143] The effects of certain weapons may be repulsive, but this is not in and of itself enough to render these weapons illegal.[144] An example of this would be napalm, which was used extensively in WWII and the Vietnam Conflict.

Compliance with the principle of unnecessary suffering depends upon the kind of weapon used and the kind of suffering it might cause. Weapons can be chosen to satisfy this principle; however, the real success or failure depends upon the features of the used weapons and their competency to carry out missions.

4.2.4. *Military necessity*

"Military necessity" means combatants may only employ force against legitimate military objectives.[145] The principle of military necessity states that a combatant is justified in using those measures, not forbidden by international law, which are indispensable for securing complete submission of an enemy at the earliest possible moment.[146] Military necessity requires combat forces to engage in only those acts that are necessary to accomplish a legitimate military objective.[147] Napoleon Bonaparte said "Every injury done to the enemy, even though permitted by the rules, is excusable only so far as it is absolutely necessary; everything beyond that is criminal."[148] The principal of military necessity prohibits things such as wounding or permanently injuring an opponent except during the fight, torture to exact confessions and other activities simply used to inflict additional damage on the enemy that does not further the military objective.[149] To decide whether an AWS could obey the mandate of military necessity, one must ask whether it can identify military targets and then assess whether the destruction of the target "offers a definite military advantage."[150] The destruction of enemy forces and materiel generally would meet this test; therefore, the question of whether an AWS could meet the requirements of military necessity becomes a question of whether it can meet the requirements of discrimination.[151] If the AWS cannot identify whether a target is military or civilian, including whether a target is a cultural object or medical facility, it cannot determine whether a target's destruction would be militarily necessary.[152] Assuming that sensor technology and software improves to the point that an AWS could identify a target as military or civilian, it could probably meet the strict legal requirements of military necessity.[153] The AWS, however, would still have to be under the control of a human

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[133] *Basic Principles of LOAC and their Targeting Implications*, Curtis E. Lemay Center, https://doctrine.af.mil/download.jsp?filename=3-60-D33-Target-LOAC.pdf (last updated Jan. 10, 2014).
[134] Travis Normand & Jessica Poarch, 4 *Basic Principles*, The Law of Armed Conflict (LOAC), http://loacblog.com/loac-basics/4-basic-principles/.
[135] *Id.*
[136] *Id.*
[137] Solis, *supra* note 68, at 274.
[138] *Id.* at 275.
[139] Normand & Poarch, *supra* note 134.
[140] *Id.*
[141] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, at Article 35, *available at* https://www.icrc.org/ihl/WebART/470-750044?OpenDocument.
[142] Benjamin Kastan, *Autonomous Weapons Systems: A Coming Legal "Singularity"?* U. Ill. J.L. Tech. & Pol'y 45, 62 (2013).
[143] Solis, *supra* note 68, at 270.
[144] *Id.*
[145] Toscano, *supra* note 55, at 209.
[146] Anthony Finn & Steve Scheding, *Developments and Challenges for Autonomous Unmanned Vehicles: A Compendium* 172, (2010).
[147] *Id.*
[148] Solis, *supra* note 68, at 258.
[149] Normand & Poarch, *supra* note 134.
[150] Kastan, *supra* note 142, at 58.
[151] *Id.*
[152] *Id.*
[153] *Id.*

commander.[154] Military necessity is a context-dependent, value-based judgment of a commander (within certain reasonableness restraints) applied through the targeting process.[155]

Thus, military commanders must act in a manner necessary for advancing military objectives and must ensure that their actions are not otherwise prohibited by the LOAC.[156] Accordingly, AWS may only target legitimate military objectives which result in a military advantage, and they cannot engage in wanton or unnecessary killing or destruction.[157] To satisfy this principle, combatants would program an AWS to engage only lawful military targets.[158]As with many complex weapon systems like drones, an AWS will likely fail at one point or another.[159]

4.2.5. *Rule of precaution in the attack*

Lastly, it is customary under LOAC principles to take all feasible precautions in an attack.[160] In the conduct of hostilities, LOAC requires the parties to armed conflicts to take constant care to spare the civilian population, civilians and civilian objects.[161] The feasibility of precautions is what would be feasible for the operator of the machine, not to the options available to the machine.[162]

The rule of precaution is reflected in Article 57(1) & (4) of Additional Protocol I of Geneva Convention 1949, which requires parties to an armed conflict to exercise "constant care" and to "take all reasonable precautions" to spare the civilian population and avoid damage to civilian objects. Article 57(3) further requires that when given the option, parties must select the military objective most likely to "cause the least danger to civilian lives and to civilian objects."[163] LOAC requires parties in an armed conflict to take 'feasible' precautions when they carry out attacks to avoid and minimize incidental loss of civilian life, injury to civilians, and damage to civilian objects.[164] Listed below are some of the fundamental precautions required by the rule and set out in Article 57(2) of Additional Protocol I to Geneva Convention 1949:

- Those who plan or decide upon an attack must:
  - (I) Do everything feasible to verify that the objectives to be attacked are lawful military objectives and that it is not prohibited to attack them.
  - (II) Take all feasible precautions, when they choose the means and methods of attack, to avoid and in any event to minimize incidental loss of civilian life, injury to civilians, and damage to civilian objects.
  - (III) Refrain from deciding to launch an attack that may be expected to cause incidental loss of civilian life, injury to civilians, or damage to civilian objects (or a combination of these harms), which is excessive in relation to the concrete and direct military advantage anticipated.
- (b) An attack shall be cancelled or suspended if it becomes apparent that the objective is not a military one or is subject to special protection or that the attack may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.[165]

The challenge in using AWS is meeting the requirement to do everything feasible to verify that a target is a military one.[166] Feasible in this context generally means that which is practicable or practically possible, taking into account all circumstances prevailing at the time, including humanitarian and military considerations.[167] There may be instances where the robust recognition capabilities of an AWS will be more precise (and, thus, more reliable) than a human in fulfilling this requirement.[168] In other cases, depending on the circumstances (and what is practically possible), the AWS may have to be augmented with other sensors to help verify the target.[169] With all of the required precautions in attack, there is inherently a value judgment about whether all feasible steps have been taken.[170] How AWS will reasonably make this value judgment may prove to be one of the biggest challenges in terms of compliance.[171] Even if humans take feasible planning precautions with respect to an AWS, the plans need to remain relevant when the AWS makes the decision to launch an attack.[172] Programming a weapon system to perform such qualitative evaluations reliably and at speed is manifestly challenging, not least because technological limitations do not constitute an excuse for failure to comply with LOAC.[173] Ultimately if a country intends to use an AWS on a battlefield, it must ensure that the system can adequately take these feasible precautions.[174]

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[154] *Id*. at 59.
[155] *Id*.
[156] Toscano, *supra* note 55, at 209.
[157] *Id*.
[158] *Id*.
[159] Kastan, *supra* note 142, at 59.
[160] Toscano, *supra* note 55, at 212.
[161] *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, Int'l Comm. of the Red Cross, 84 (March 2014), *available at* https://www.icrc.org/en/document/report-icrc-meeting-autonomous-weapon-systems-26-28-march-2014 (summary report of an expert meeting in Geneva, Switzerland, with selected presentations given by independent experts).
[162] *Id*. at 42.
[163] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, Article 57, *available at* https://www.icrc.org/applic/ihl/ihl.nsf/Article.xsp?action=openDocument&documentId=50FB5579FB098FAAC12563CD0051DD7C.
[164] Weizmann, *supra* note 1, at 15.
[165] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, Article 57, *available at* https://www.icrc.org/applic/ihl/ihl.nsf/9ac284404d38ed2bc1256311002afd89/50fb5579fb098faac12563cd0051dd7c.
[166] Jeffrey S. Thurnher, *The Law That Applies to Autonomous Weapon Systems*, Insights (Jan. 18, 2013), https://www.asil.org/insights/volume/17/issue/4/law-applies-autonomous-weapon-systems.
[167] *Id*.
[168] *Id*.
[169] *Id*.
[170] *Id*.
[171] *Id*.
[172] Weizmann, *supra* note 1, at 17.
[173] *Id*.
[174] Thurnher, *supra* note 166.

5. Weapon laws

AWS are subject to a two-part LOAC test, applicable to all weapons, under Article 51(4) and Article 36 (weapon review will be discussed in the following section) of Additional Protocol I (AP I) to the Geneva Convention.[175] This section of this paper is intended to help in determining if present weapon laws are sufficient to regulate AWS. There are two rules to be satisfied for the lawfulness of weapon laws. First, Article 51(4) of Additional Protocol I to the Geneva Conventions, which states that:

> Indiscriminate attacks are prohibited. Indiscriminate attacks are:
>
> (a) those which are not directed at a specific military objective;
>
> (b) those which employ a method or means of combat which cannot be directed at a specific military objective;
>
> (c) those which employ a method or means of combat the effects of which cannot be limited as required by this Protocol; and consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction.[176]

Under this rule it is irrelevant that an AWS, as opposed to a human-controlled system, may make the final targeting decision.[177] So long as the autonomous weapon can be supplied with sufficiently reliable and accurate data to enable it to be directed at a specific military target, the weapon system would not be indiscriminate by nature and thus not unlawful per se.[178] Attacks against civilian objects are banned not only when they are direct and deliberate, but also when they are indiscriminate.[179] Examples of indiscriminate attacks and indiscriminate targeting are second World War Nazi "Buzz bombs" and V1 and V2 rockets aimed at London with no specific target, just the city of London, as well as Iraqi SCUD missiles fired at Israel and Saudi Arabia during Gulf War.[180]

Similarly, it seems a tough task for AWS to figure out the difference between London and Israel efficiently. Yet, with the help of sensor-fusion technology and GPS, it can. This accuracy is limited by hackers or even natural phenomena. However, an attack on London or Israel will still be an indiscriminate attack because they are attacking heavily populated civilian targets. This endangers the preservation of human life as it has been laid out under the ICRC and LOAC rules.

According to Additional Protocol to Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflict (Protocol I), 8 June 1977, "it is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering."[181] Also, "It is prohibited to employ methods or means of warfare, which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment."[182] AWS could cause superfluous injury, including long-term suffering to those exposed and not killed as well as incalculable damage to the environment because it can be equipped with nuclear warheads.

5.1. *Weapons review*

Second, Additional Protocol I Article 36 codifies a customary international law obligation to conduct a legal review of new means of warfare before introducing it into warfare.[183] It is important to carry out rigorous legal reviews of new technologies of warfare to ensure that it may be used lawfully.[184] Weapons law and weapons review have both been affected by military necessity since the 4th century when Augustine of Hippo tried to reconcile his Christian faith with the need for self-defense and the resulting warfare.[185] The need to carry out legal reviews of new weapons, means and methods of warfare is found in Article 36 of Additional Protocol I of 1977. The rule provides that:

> In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party (a party to any international agreement which has both signed and ratified the treaty) is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party (HCP).[186]

According to Additional Protocol I Article 36, "new" weapons are subject to review.[187] There are two ways to determine whether a weapon is "new" or not. First, one may look to the

[175] Toscano, *supra* note 55, at 206 (AWS are subject to a two-part LOAC test, applicable to all weapons, under Article 36 of Additional Protocol I (AP I) to the Geneva Convention.).
[176] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, at Article 51.
[177] Thurnher, *supra* note 68, at 5 (Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective).
[178] *Id.*
[179] Solis, *supra* note 68, at 536.
[180] *Id.* at 537.
[181] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, at Article 51.
[182] *Id.* Article 35 (3), https://www.icrc.org/ihl/WebART/470-750044?OpenDocument.
[183] Toscano, *supra* note 55, at 206.
[184] *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, *supra* note 161, at 74.
[185] Thomas W. Pittman, & Linda S. Murnane, *The Law of Armed Conflict in Modern Warfare*, HEIN ONLINE, http://heinonline.org/HOL/LandingPage?handle=hein.journals/judgej42&div=18&id=&page=.
[186] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977*, *supra* note 128, at Article 35, *available at* https://www.icrc.org/ihl/WebART/470-750044?OpenDocument.
[187] Justin McClelland, *The review of weapons in accordance with Article 36 of Additional Protocol I*, 85 INT'L COMM. OF THE RED CROSS, 404 (June 2003) No. 850 (revised) https://www.icrc.org/eng/assets/files/other/irrc_850_mcclelland.pdf.

State intending to use it.[188] The fact that a weapon has been in service with one State for some time before being sold to another State would not prevent the receiving State from considering the weapon as "new" for the purposes of Article 36.[189] Second, new weapons are determined by reference to the date upon which the weapons came into service.[190] On ratification by a State of Additional Protocol I, those weapons already in service could not be considered "new" within the terms of Article 36.[191] The aim of Article 36 is to prevent the use of weapons that would violate international law in all circumstances and to impose restrictions on the use of weapons that would violate international law in some circumstances by determining their lawfulness before they are developed, acquired or otherwise incorporated into a State's arsenal.[192] These reviews ensure the United States complies with its international obligations, especially those relating to the LOAC, and it helps military planners ensure military personnel do not use weapons or weapons systems that violate international law.[193] Legal reviews should equally consider all of a state's treaty and customary obligations under international law, including LOAC and international human rights law.[194] If a technology can only distinguish between civilian and military objects in certain circumstances, the legal review must "draw attention to the restricted circumstances in which its employment would be legitimate and should set out the actions that will be required in order to seek to ensure that when the weapon system is used the discrimination principle will be complied with."[195] If the weapon system is incapable of implementing precautions in attack as required by LOAC, a legal review should set out the consequent limitations on its lawful use.[196] However, "it is true that some AWS might violate LOAC norms, it is categorically not the case that all such systems will do so. Instead, and as with most other weapon systems, their lawfulness as such, as well as the lawfulness of their use, must be judged on a case-by-case basis."[197] In reality, however, it may be arduous to review the legality of a complex AWS whose functioning is difficult to test and therefore unpredictable.[198] Therefore, there is need for new set of weapon laws that can deal with the complex AWS.

6. Legal challenges

The advent of AWS creates new challenges that need to be addressed.[199] In this section, full view of the challenges faced in the field of AWS will be addressed and organized.[200] These challenges are organized in thematic sub-groups: Asimov's laws of Robotics, risk of cyber attack, prohibition of AWS, and positive aspects of the use of A.I. in warfare and other future challenges. The first challenge of ensuring the accountability for acts of an AWS poses some significant challenges.[201]

6.1. *Accountability for the war crimes and command responsibility*

Under LOAC and international criminal law, individuals are criminally responsible for any war crimes they commit.[202] They may also be held responsible under different modes of liability: for attempting, assisting in, facilitating, aiding, abetting, planning or instigating the commission of a war crime.[203] But who can be held liable for the war crimes committed by autonomous weapons? People demand accountability. In the case of AWS, some of the individuals in the chain of command or production might also be considered criminally liable, including commanders, programmers or manufacturers.[204] It would nevertheless be hard to prosecute such individuals successfully because it would be necessary to prove that they intended to commit the crimes in question or knew that they would be committed.[205] According to Rule 153 of Customary IHL:

> Commanders and other superiors are criminally responsible for war crimes committed by their subordinates if they knew, or had reason to know, that the subordinates were about to commit or were committing such crimes and did not take all necessary and reasonable measures in their power to prevent their commission, or if such crimes had been committed, to punish the persons responsible.[206]

Under LOAC, commanders have been entrusted with the task of ensuring respect for that body of law by their subordinates.[207] This responsibility includes not only the training in LOAC of

[188] *Id.* at 397.
[189] *Id.*
[190] *Id.*
[191] *Id.*
[192] Kathleen Lawand, *A Guide to Legal Review of New Weapons, Means and Methods of Warfare, Measure to implement article 36 of Additional Protocol I of 1977*, revised, https://www.icrc.org/eng/assets/files/other/icrc_002_0902.pdf.
[193] Powers, *supra* note 65.
[194] Weizmann, *supra* note 1, at 17.
[195] *Id.* at 18.
[196] *Id.*
[197] Michael N. Schmitt, *Autonomous Weapon Systems and International Humanitarian Law: A Reply to the Critics*, Harv. Nat'l. Sec. J. Features, 8 (2013), http://harvardnsj.org/wp-content/uploads/2013/02/Schmitt-Autonomous-Weapon-Systems-and-IHL-Final.pdf, also available http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2184826.
[198] Weizmann, *supra* note 1, at 18.
[199] Anderson, Reisner and Waxman, *supra* note 11, at 406.
[200] Lin, Bekey & Abney, *supra* note 7, at 73.
[201] *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, *supra* note 161, at 87.
[202] Weizmann, *supra* note 1, at 21 (Rule 151, ICRC, Customary IHL Study. At: https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule151).
[203] *Id.* (See for instance, 1998 Statute of the International Criminal Court, Art. 25; ICTY Statute, Art. 7; Statute of the International Criminal Tribunal for Rwanda (ICTR), Art. 6; Statute of the Special Court for Sierra Leone (SCSL), Art. 6.).
[204] *Id.* (revised).
[205] *Id.*
[206] *Rule 153*, Customary IHL, https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule153.
[207] Jamie A. Williamson, *Some considerations on command responsibility and criminal liability*, 90 Int'l R. of the Red Cross, N. 870, 303 (June 2008) https://www.icrc.org/eng/assets/files/other/irrc-870_williamson.pdf.

those under their command, but also the taking of necessary measures to prevent or punish subordinates committing violations of LOAC.[208] Failure by a commander to do so will give rise to criminal liability, often termed superior responsibility.[209] The principle of individual responsibility and punishment for crimes under international law is the enduring legacy of Nuremberg and has been described as the "cornerstone of international criminal law."[210] Contemporary international criminal tribunals and courts, such as the International Criminal Tribunal for the former Yugoslavia (ICTY), the International Criminal Tribunal for Rwanda (ICTR), the Special Court for Sierra Leone and the International Criminal Court (ICC), all demonstrate the continuing importance of establishing individual criminal responsibility for war crimes and crimes against humanity.[211]

A January 2012 report by the Congressional Research Service notes, "Drone crashes get a lot of attention; 38 Predators and Reapers have crashed in Iraq and Afghanistan thus far. . .."[212] Also, drones have human control. Who should be blamed and punished for improper robotic conduct, such as illegal or accidental killings, if a robot can make its own attack decisions? This question would trigger an intense effort to recreate every facet of the attack and the equipment failures involved and would no doubt rival those enquiries that ensue after an airliner goes down.

Arguably, AWS fusion sensors, sophisticated cameras, communications and networking ability could give a robotic warrior better situational awareness than its human counterparts possess.[213] In that case, robots should be permitted to refuse orders, for instance, to attack a suspected hideout in which it detects mostly children and unarmed adults.[214] The LOAC prohibits targeting non-combatants, so an ethical commander would have been obliged to cancel the order and cease action if he is notified in time about the civilian nature of those inside.[215] Robots should have the ability to assume the proper course of action, at the risk of subverting the chain of command.[216] There will be times when this is desirable. Since every member of a country is required to conform to the LOAC, robots, their operators and their commanders should also follow the highest standard of LOAC. Highly informed and sophisticated A.I.s should not be exempted from obeying laws that even the least informed citizen must obey.

6.2. *Asimov's Laws of Robotics*

A deontological approach often comes to mind in investigating robotic ethics: Asimov's Three Laws of Robotics (he later added a fourth or 'Zeroth Law') are intuitively appealing in their simple demand to not harm or allow humans to be harmed, to obey humans, and to engage in self-preservation.[217] Furthermore, the laws are prioritized to minimize conflicts.[218] Thus, doing no harm to humans takes precedence over obeying a human, and obeying trumps self-preservation.[219] However, in story after story, Asimov demonstrated that three simple hierarchically-arranged rules could lead to deadlocks when, for example, the robot received conflicting instructions from two people or when protecting one person might cause harm to others.[220]

Asimov's laws of robotics were fused into the neural networks of the robots' "positronic" brains.[221] The "Three Laws of Robotics" state that a robot may not injure a human being or, through inaction, allow a human being to come to harm.[222] Second, a robot must obey orders given it by human beings except where such orders would conflict with the First Law.[223] Third, a robot must protect its own existence as long as such protection does not conflict with the First or Second Law.[224]

Asimov's fiction explored the implications and difficulties of the "Three Laws of Robotics".[225] It established that the first law was incomplete as stated due to the problem of ignorance: a robot was fully capable of harming a human being as long as it did not know that its actions would result in (a risk of) harm, i.e. the harm was unintended.[226] For example, a robot, in response to a request for water, could serve a human a glass of water teeming with bacterial contagion, or throw a human down a well, or drown a human in a lake, ad infinitum, as long as the robot was unaware of the risk of harm.[227]

As unclear and contradictory as Asimov's laws are when humans try to apply them to lethal drones involved in military use, these laws are most often cited in the attempt to codify our future relationship with intelligent machines.[228] Asimov's laws never anticipated the widespread military usage of heavily armed robots and drones. However, Asimov later introduced a fourth or zeroth law that outranked the others: A robot may not harm humanity, or, by inaction, allow humanity to come to harm.[229]

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[208] *Id.*
[209] *Id.*
[210] Jack M. Beard, *Autonomous Weapons and Human Responsibilities*, 45 GEO. J. INT'L L. 642 (2013–14) https://www.law.georgetown.edu/academics/law-journals/gjil/recent/upload/zsx00314000617.PDF (original, Prosecutor v. Tadic, Case No. IT-94-1-T, Judgment, ¶¶ 664–66 (Int'l Crim. Trib. for the Former Yugoslavia) May 7, 1997.)
[211] *Id.*
[212] Spencer Ackerman and Noah Shachtman, *Almost 1 in 3 U.S. Warplanes is a Robot*, WIRED, (Jan. 9, 2012) http://www.wired.com/2012/01/drone-report/.
[213] Patrick Lin, *supra* note 76.
[214] *Id.*
[215] *Id.*
[216] *Id.*
[217] Lin, Bekey & Abney, *supra* note 7, at 30.
[218] *Id.*
[219] *Id.*
[220] *Id.*
[221] James Barrat, *Our Final Invention (Excerpt)*, TOR (Sept. 20, 2013) http://www.tor.com/stories/2013/09/our-final-invention-excerpt.
[222] *Id.*
[223] *Id.*
[224] Lin, Bekey & Abney, *supra* note 7, at 30.
[225] *Id.*
[226] *Id.*
[227] *Id.*
[228] Barrat, *supra* note 221 (revised).
[229] *Do we need Asimov's laws?* MIT TECH. R. (May 16, 2014) https://www.technologyreview.com/s/527336/do-we-need-asimovs-laws/.

It only gets worse from there. Semi-autonomous robotic drones are already killing hundreds and perhaps thousands of people each year.[230] Fifty-six countries have or are developing battlefield robots.[231] The race is on to make them autonomous and intelligent. For the most part, discussions of ethics in the use of artificial intelligence and the rapid technological advances regarding A.I.s and their use in warfare and counter-terrorism seem to be taking place in different worlds, each uninformed by the other.[232] It is suggested that to regulate AWS, Asimov's laws should be implemented in a pragmatic way by the international legislative community. Asimov's laws helped to make [fictional] robots acceptable to people.[233] It is suggested that to regulate AWS, Asimov's laws should be implemented in a pragmatic way by the international legislative community. Other authors have attempted to fix other ambiguities and loopholes in the rules Asimov devised in order to prevent disastrous scenarios that nonetheless satisfied laws numbered 0–3.[234] For example, Lyuben Dilov [1974] introduced a Fourth Law of Robotics to avoid misunderstandings about what counts as a human and as a robot: (4) a robot must establish its identity as a robot in all cases.[235] This law is sometimes stated as: (4). A robot must know it is a robot.[236] Others [e.g. Harrison, 1989] have also argued for a Fourth Law that requires robots to reproduce, as long as such reproduction does not interfere with laws 1–3.[237]

6.2.1. *A few hypothetical examples with different scenarios may help illustrate the preeminent issues of AWS*

Hypothetical examples will help in concluding that it is impractical to replace human control from the battlefield and act according to the rules of ICRC and LOAC.

6.2.1.1. First case scenario. An AWS in Afghanistan identifies a high-level Taliban target within Afghanistan, and the target is determined through the telephonic conversation. With the help of biometrics intelligence sources, the AWS determines the target is entering his home and the operation would meet the laws of proportionality, necessity, and humanity required under the law of armed conflict, and it employs itself to conduct the kill operation. Later on, it is determined that the drone attack killed several other family members present inside the house.

There are a number of issues that become apparent in the above example: lack of human consent for the attack, meaning no human operator with an attorney at his side would parse the possible scenarios and their consequences. Also, there would be a lack of proof that the person entering was indeed the suspected terrorist. There has been a great deal of research done on how difficult it is for members of one culture to accurately identify members of another culture. The American Psychological Association web site says, "The greater difficulty of other-race relative to own-race facial recognition is one of the most researched issues in eyewitness identification."[238] Thus, if human beings struggle to recognize faces of other human beings, then it seems a tough task for humanly designed machines to recognize human targets. In short, the principle of distinction is violated. Surely, this lack of discrimination could not be overcome by robots programmed by non-discriminating human beings.

6.2.1.2. Second case scenario. AWS might misunderstand the situation because of lack of experience or training. Its audio sensors might not be able to interpret the language correctly. Two friends might be using humorous language with idioms a robot cannot understand or interpret accurately.

6.2.1.3. Third case scenario. AWS can also be used to set up scenarios that could threaten human existence. For example, Oxford University philosopher Nick Bostrom believes that super-intelligences will retain the same goals they began with, even after they have increased astronomically in intelligence.[239] "Once unfriendly super-intelligence exists," he warns, "it would prevent us from replacing it or changing its preferences."[240] This assumption that super-intelligences will do whatever is necessary to maintain their "goal-content integrity" undergirds his analysis of what, if anything, can be done to prevent artificial intelligence from destroying humanity.[241]

6.3. *Risk of cyber attack and LOAC*

In this paper, the legality of AWS has been challenged at numerous points. Another challenge for AWS is to apply LOAC to cyberwarfare.[242] The term used here refers to the means and methods of warfare that consist of cyber operations amounting to, or conducted in the context of, an armed conflict, within the meaning of LOAC.[243] Further, to regulate AWS includes the issue of whether to create new laws regarding both domains.[244] These two issues have a direct relationship with one another that lawyers and policymakers should acknowledge.[245] Mostly, cyber attacks are carried out by hackers. In armed conflict, most hackers would be civilians who remain protected by LOAC against direct attack, although they would remain subject to law enforcement and possible criminal prosecution depending

[230] *See generally*, Barrat, *supra* note 221.
[231] *Id.*
[232] *Id.*
[233] Jennifer Baker, *Drones need their own version of Asimov's laws of robotics-MEPs*, The Register (Sept. 4, 2015) http://www.theregister.co.uk/2015/09/04/watch_out_for_the_drones_surveillance_is_a_real_risk_warn_meps/.
[234] Lin, Bekey & Abney, *supra* note 7, at 31.
[235] *Id.*
[236] *Id.*
[237] *Id.*
[238] Gary L. Wells & Elizabeth Olson, *The other-race effect in eyewitness identification: What do we do about it?* Vol 7(1) Psych. Public Pol'y & L. 230–246 (Mar. 2001) http://psycnet.apa.org/journals/law/7/1/230/.
[239] Edward M. Geist, *Is Artificial Intelligence Really an Existential Threat to Humanity?* Bulletin of the Atomic Scientists (August 9, 2015), http://thebulletin.org/artificial-intelligence-really-existential-threat-humanity8577.
[240] *Id.*
[241] *Id.*
[242] Eric Messinger, *Is it Possible to Ban Autonomous Weapons in Cyberwar?* Just Security (Jan. 15, 2015) https://www.justsecurity.org/19119/ban-autonomous-weapons-cyberwar/.
[243] *What limits does the law of war impose on cyber attacks?* Int'l Comm. of the Red Cross (Jun. 28, 2013) https://www.icrc.org/eng/resources/documents/faq/130628-cyber-warfare-q-and-a-eng.htm.
[244] Messinger, *supra* note 242.
[245] *Id.*

on whether their activities violated other bodies of law.[246] According to an annual report by the Pentagon's chief weapons tester, nearly every U.S. weapons program tested in fiscal year 2014 showed "significant vulnerabilities" to cyber attacks, including misconfigured, unpatched and outdated software.[247] A number of high profile developments have pushed the issue of cyber security into the spotlight.[248] Revelations regarding the Stuxnet program, a cyber weapon that targeted Iranian uranium enrichment centrifuges, emerged in early June along with reports regarding Flame, an alleged effort to extract data from the computers of Iranian nuclear scientists.[249]

Cyber attacks might be one of the major concerns with the artificial intelligence. Michael Gilmore, Director of Operational Test and Evaluation (DOT&E) said, "Cyber adversaries have become as serious a threat to U.S. military forces as the air, land, sea and undersea threats represented in operational testing for decades."[250] Recent reports indicate that Russian forces used hacking to intercept a U.S. surveillance drone flying over the Crimea region of Ukraine in March.[251] Allegedly, hackers were able to sever the connection between the drone and its operator using "complex radio-electronic technology."[252] One of the major challenges in the development of software for autonomous systems in general will be protecting it from cyber-attacks, both during development and during operations.[253] If an AWS were to be hacked and diverted from its normal functioning, then the potential consequences could be disastrous.[254] It is fine to develop machines with the amazing ability to wage war on behalf of humans, but humans must somehow build manageable limitations into those machines that cannot be taken over by malware, other machines, or the enemy. It seems challenging for the AWS to deal with the vulnerabilities of cyber attack under the ICRC and LOAC.

6.4. *Call for prohibiting autonomous weapons systems*

Despite the fact that AWS will not likely be making fire/no fire decisions in the near to medium term, there are already some groups calling for international accords to ban such systems.[255] The most prominent of these groups is called the International Committee for Robot Arms Control (ICRAC).[256] In 2009, the issue of fully AWS picked up by the international community at the United Nations Convention on Conventional Weapon in Geneva, ICRAC and the Campaign to Stop Killer Robots.[257] These restrictions are concerned with where and for what purpose robotic weapons are deployed.[258] ICRAC proposes a complete prohibition of deploying robotic weapons in space.[259] Presumably, this is meant to cover both autonomous and semi-autonomous machines.[260] In addition, they propose a ban on the deployment of all autonomous unmanned systems regardless of the theater of operation.[261] Yet, they do seem to tolerate some minimal use of tele-operated systems as long as they are not space based.[262] More than 30 states and five groups of states have included autonomous weapons in their statements during First Committee, in addition to the International Committee of the Red Cross and Campaign to Stop Killer Robots.[263] A total of 62 states have spoken on this topic since 2013.[264] Almost all states that spoke on the matter have expressed support for more discussions on autonomous weapons in 2016 at the Convention on Conventional Weapons.[265] However, certain weapons are prohibited under the Convention on Certain Conventional Weapons which builds upon long-established customary rules regulating the conduct of hostilities. These include: (1) the requirement that a distinction be made at all times between civilians and combatants; and (2) the prohibition of the use of weapons which inflict excessive injury or suffering on combatants or render their death inevitable.[266] While these general principles apply to all weapons used in armed conflict, the Convention imposes specific prohibitions or restrictions on the use of conventional weapons about which there is widespread concern.[267]

Moreover, Human Rights Watch has called for a preemptive "ban on fully autonomous weapons," which "should apply to robotic weapons that can make the choice to use lethal force without human input or supervision."[268] It also proposes to ban their "development, production, and use," as well as calling for "reviews" of "technologies and components that could lead to fully autonomous weapons."[269] Also, hundreds of A.I. experts and revered thinkers, including Stephen Hawking and Elon

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[246] *What limits does the law of war impose on cyber attacks? supra* note 243.

[247] Andrea Shalal, *Nearly every U.S. arms program found vulnerable to cyber attacks*, Reuter (Jan.20, 2015), http://www.reuters.com/article/2015/01/21/us-cybersecurity-pentagon-idUSKBN0KU02920150121.

[248] Natalya Anfilofyeva, *CSBA Evaluates Cyber Warfare in a New Study*, CSBA, August 24, 2012, http://csbaonline.org/2012/08/24/csba-evaluates-cyber-warfare-in-a-new-study/.

[249] *Id.*

[250] Shalal, *supra* note 247.

[251] Isaac R. Porche, *Cyberwarfare Goes Wireless*, The Rand Blog (Apr. 7, 2014) http://www.rand.org/blog/2014/04/cyberwarfare-goes-wireless.html.

[252] *Id.*

[253] *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, *supra* note 161, at 73.

[254] *Id.*

[255] Kastan, *supra* note 142.

[256] *Id.*

[257] Frank Sauer, *Banning Lethal Autonomous Weapon System: The way forward*, Int'l Comm. for Robots Arms Control (Jun. 13, 2014) http://icrac.net/2014/06/banning-lethal-autonomous-weapon-systems-laws-the-way-forward/.

[258] John P. Sullins, *An Ethical Analysis of the Case for Robotic Weapons Arms Control*, 5th Int'l Conference on Cyber Conflict 10 (2013), https://ccdcoe.org/cycon/2013/proceedings/d2r1s9_sullins.pdf.

[259] *Id.*

[260] *Id.*

[261] *Id.*

[262] *Id.*

[263] *Concern & support at First Committee*, Campaign to Stop Killer Robots (Oct. 2015), http://www.stopkillerrobots.org/2015/10/unga-report/.

[264] *Id.*

[265] *Id.*

[266] *Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects*, Int'l Comm. of the Red Cross, 6 (Nov. 28, 2003) http://docplayer.net/105086-Convention-on-prohibitions-or-restrictions-on-the-use-of-certain-conventional-weapons-which-may-be-deemed-to-be-excessively-injurious-or-to-have.html.

[267] *Id.*

[268] Anderson, Reisner and Waxman, *supra* note 11, at 12.

[269] *Id.*

Musk, are calling for a global ban on military robots.[270] Furthermore, the International Committee for Robot Arms Control stated, "Given the rapid pace of development of armed teleoperated and autonomous robotic systems, we call upon the international community to commence a discussion about the pressing dangers that these systems pose to peace and international security and to civilians, who continue to suffer most in armed conflict.[271] In particular, autonomous systems may further the indiscriminate and disproportionate use of force and obscure the moral and legal responsibility for war crimes.[272] Christ Heyns of the United Nations Special Rapporteur on extrajudicial, summary, or arbitrary executions has called on nations with advanced weapons to agree to limit their weapons systems to actors with "meaningful" human control over the selection of targets.[273] A more formal and traditional approach for oversight of a new weapons category such as AWS would be some form of binding international arms control agreement.[274] Moreover, a legal framework to ensure the lawful use of AWS must be developed as soon as possible.[275] Some proponents of AWS suggest that it is too early to know how the technology will develop and that lawmakers must wait until a fully autonomous system is in hand before the legal questions can be resolved.[276] This view is not sustainable.[277] AWS are not a technology of the distant future: their development is already underway.[278] A legal framework should be created before the development of AWS advances to the point where their underlying architecture is difficult to change.[279]

6.5. *Just questions: no solutions for AWS laws*

This section discusses that there is no known solution for what laws can regulate AWS. Everyone is questioning the legality of AWS, but no one is coming up with any solution of those questions. However, *In International Governance of Autonomous Military Robots*, the authors suggest that there are four requirements for a successful legal regime.[280] First, it must involve "clearly defined and articulated expectations" which identify precisely the problems that need to be addressed.[281] Second, the solutions to those problems must be realistic and capable of actual implementation.[282] Third, they must be "holistic and inclusive" and include all relevant stakeholders in discussions.[283] Fourth, they must be "subject to assessment" that allows for improvement over time.[284] While codes of conduct offer some advantages, a framework convention is best suited to meeting these four criteria.[285] A framework convention can identify the precise problem of adherence to LOAC that comes from removing humans from the loop.[286] Its incremental approach allows for the realistic implementation of international standards and periodic reassessment.[287] A framework convention, in contrast to a state-by-state soft law approach, allows for the inclusion of all stakeholders.[288]

New issues will emerge depending on how the technology and intended uses develop.[289] Starting a military A.I. arms race is a bad idea, without having regulatory laws for AWS.[290] Moreover, there should be a new legal framework on AWS. It is suggested that all the nations involved in the development of A.I. and AWS must bind themselves to the legal framework that sets the rules to govern A.I. machines and their uses.

6.6. *Legal framework for AWS*

This section will discuss the different possible solution for the regulation of AWS. Despite attempts to ban AWS, experts on international law, robotics, and armed conflict should strive to clarify the application of LOAC to AWS, since such weapons are rapidly developing and are likely to be inevitable features on future battlefields.[291] There is a need of new legal framework for the AWS. This section presents the four possible solutions for the legal framework of AWS.

6.6.1. *Applying existing laws as written in the LOAC's weapon laws*

All weapons, new and old, are required to be regulated under LOAC's weapon laws. So obviously even AWS must be regulated under LOAC's weapons laws. However, at present trying to compare AWS with traditional weapons is useless. Even AWS that exist at present are so different from the old weapons fired by human beings that the two are not really comparable. Plus, given the speed of innovation in the field of information technology and robotics, their future capacity to comply with basic LOAC principles cannot be adequately predicted. As discussed above in this paper, existing laws of LOAC and its weapon laws appear to be ineffective and insufficient for the regulation of AWS.

Violations of the LOAC framework related to weapons are usually based on their indiscriminate or otherwise unlawful use in a particular military engagement, not on their inherently

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[270] Frank Sauer, *Laws: An Open Letter from AI & Robotics Experts*, Int'l Comm. for Robots Arms Control (Jul. 28, 2015) http://icrac.net/2015/07/laws-an-open-letter-from-ai-robotics-experts/.

[271] *Mission Statement*, Int'l Comm. for Robots Arms Control (2009), http://icrac.net/statements/.

[272] *Id.*

[273] *Autonomous weapons which select, destroy targets without human intervention proliferate*, *supra* note 27.

[274] Gary E. Marchant, et al., *International Governance of Autonomous Military Robots*, 12 Colum. Sci. & Tech. L. Rev. 298 (2011).

[275] Foy, *supra* note 57, at 69.

[276] *Id.*

[277] *Id.*

[278] *Id.*

[279] *Id.*

[280] *Id.*

[281] *Id.*

[282] *Id.*

[283] *Id.*

[284] *Id.*

[285] *Id.*

[286] *Id.*

[287] *Id.*

[288] *Id.*

[289] Lin, Bekey & Abney, *supra* note 7, at 86.

[290] *Autonomous Weapons: an Open Letter from AI & Robotics Researchers*, Future of Life (Jul. 28, 2015) http://futureoflife.org/AI/open_letter_autonomous_weapons#signatories.

[291] Steven Groves, *A manual adapting the law of armed conflict to lethal autonomous weapons systems*, The Heritage Foundation, April 7, 2016, http://www.heritage.org/research/reports/2016/04/a-manual-adapting-the-law-of-armed-conflict-to-lethal-autonomous-weapons-systems.

unlawful nature.[292] Unfortunately, there is a tendency among some critics of various weapons, including critics of AWS, to conflate or confuse the distinction between LOAC prohibitions against inherently unlawful weapons and those prohibitions applicable to the unlawful use of otherwise lawful weapons.[293] Also, trying to ban AWS now is too late. AWS are already in widespread usage around the world. Obviously, there is an urgent need for a new legal framework to regulate these AWS. Three possible international instruments could be a solution for the regulation of AWS: a new, stand-alone treaty; a United Nation's convention; or a new manual for AWS.

6.6.2. *New treaty*

A treaty is an agreement between States (Nations) which defines binding agreements in international law.[294] Drafting a new multilateral or bilateral treaty for the regulation of AWS could be one solution to establish an acceptable legal framework. Treaties can be bilateral – for example it could be as simple as an aviation agreement between Australia and the United States.[295] Multilateral treaties are those between three or more countries: an example is the United Nations Charter.[296]

Informed leaders generally agree that the use of AWS without judicious human control provides a unique threat to humanity. Treaties such as the Non-Proliferation Treaty for nuclear weapons have been successfully drafted in the past. Another example is the Treaty on the Limitation of Anti-Ballistic Missile Systems wherein the United States and the Soviet Union agreed that each may have only two ABM deployment areas, so restricted and so located that they cannot provide a nationwide ABM defense or become the basis for developing one.[297] Each country thus leaves unchallenged the penetration capability of the other's retaliatory missile forces.[298] The challenge in drafting a new treaty is that it is a very slow process. There is a lengthier process of consideration, including by subsidiary organizations, which itself constitutes an abbreviated version of the treaty-making process.[299] Indeed, in some instances the organization may in effect embark on the quest for a treaty, only to discover that that may be a difficult goal to attain and that at the current stage only the adoption of a non-binding resolution can be achieved.[300] It also requires that countries voluntarily agree to live within the confines of the treaty or resolution.

6.6.3. *UN convention*

A convention is a special type of treaty or agreement between many countries.[301] Many UN member countries may begin discussions on a global issue and reach a consensus regarding procedures and actions they all agree to follow.[302] Regulation of autonomous weapons system is becoming a global issue and reaching consensus on a regulatory convention could be the quickest solution. The possible problem of UN politics and infighting among member countries that might make this solution difficult.

6.6.4. *Manual by group of international scholars*

Another possible solution for the regulation of AWS would be to develop a manual to define a new legal framework specifically for regulation of AWS. A group of international law scholars could convene for the purpose of reviewing the problems presented by the unregulated proliferation of AWS, proposing solutions to these problems and drafting proposed regulations and rules for the protection of civilization. For example, the *Manual on International Law Applicable to Air and Missile Warfare* (2009), or the air and missile warfare (AMW) manual, developed under the International Humanitarian Law Research Initiative, is seen as a successor to the 1923 Hague Rules of Air Warfare, and was meant to address "the exponential changes brought about in air and missile technology" that "have transformed the face of the modern battlefield, revolutionized military strategy, and created a series of distinct challenges to the protection of civilians in time of armed conflict."[303] Another example, the Tallinn manual, which provides a legal framework for cyber-warfare, is the result of such a group. Because of the covert nature of cyber warfare it has proven impossible to apply LOAC. Similarly, AWS is a new technology and LOAC laws are not easily relevant to the modern technology of AWS. Perhaps the most effective vehicle to address such issues is a manual on AWS.[304] The U.S. should lead an effort to develop such a manual as an alternative to the regulation, or banning, of AWS through the CCW.[305] A non-profit organization can be formed for funding. National institutes such as the American Law Institute could also be used for creating a series of documents for the manual legal framework. Research can identify the applicable international laws that apply to AWS. Scholars can address topics related to the *jus ad bellum*, *jus ad bellum* LOAC, weapons laws, individual responsibility, meaningful human control and the impossibility of banning the AWS. One source for the laws of AWS could be Asimov's laws, modified with further research to comply with LOAC and weapon laws. It is suggested that countries that engaged in the development and usage of AWS, should have national policies for AWS. These policies create a starting place to develop an international instrument that could serve the purpose of achieving consensus on "some core minimum standards" for the development of AWS while retaining "flexibility for

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[292] Jack M. Beard, *supra* note 210, at 636.
[293] *Id.*
[294] *Treaty making process*, Australian Government, accessed on September 2, 2016, http://dfat.gov.au/international-relations/treaties/treaty-making-process/pages/treaty-making-process.aspx.
[295] *Id.*
[296] *Id.*
[297] *Treaty between the United States of America and the Union of Soviet Socialist Republics on the limitation of anti-ballistic missile systems*, Department of State, http://www.state.gov/www/global/arms/treaties/abm/abm2.html accessed on September 2, 2016.
[298] *Id.*
[299] *Steps in treaty-making process*, United Nation University, accessed on September 2, 2016, http://archive.unu.edu/unupress/unupbooks/uu25ee/uu25ee09.htm.
[300] *Id.*
[301] *Difference between treaty and convention*, Difference Between, July 30, 2012, http://www.differencebetween.com/difference-between-treaty-and-vs-convention/.
[302] *Id.*
[303] Steven Groves, *supra* note 291.
[304] *Id.*
[305] *Id.*

international standards and requirements to evolve as technology evolves."[306] This may well be the most feasible solution at the moment.

7. Positive aspects of the use of artificial intelligence in warfare

Every innovation has both negative as well as positive aspects. The biggest positive aspect of AWS is that it offers the ability to reduce the number of human lives at risk during war.[307] The cognitive burdens on human operators will be lessened by autonomous technology, and certain functions will be performed with greater speed, reliability, and precision.[308] For example, robots are now replacing human soldiers in dull, dirty and dangerous missions, like searching tunnels and caves for terrorists, rescuing wounded soldiers, spying on enemies and even killing humans.[309] Moreover, the Wall Street Journal reports that over the next decade, the military is aiming to create autonomous aircraft that can help soldiers carry out night raids, search oceans for trouble, and select targets for attack.[310] Also, in Iraq, robots have defused over 10,000 roadside bombs, which are responsible for 40% of U.S. casualties there.[311] In 2003, the U.S. had no ground robots in Iraq or Afghanistan; presently there are over 12,000 robots on the ground and 7000 in the air in these conflict areas.[312] Arkin, Professor at Georgia Institute of Technology, asserts that the laws of war can be programmed into an autonomous system and observed more effectively than by a human operator.[313] For example, an autonomous system could be programmed to minimize non-combatant casualties in an engagement and could execute this order more effectively due to faster data analysis and greater maneuvering capabilities.[314] If this technology were to reach maturation, it would be unethical *not* to use it in engagements since it has the potential to reduce unnecessary loss of life.[315]

Without underestimating the challenges, one cannot rule out the possibility that technological evolution might lead in the future to the development of cyber weapons that would, in specific circumstances, cause fewer casualties and less collateral damage than traditional weapons to achieve the same military advantage.[316] Autonomous technology is a new area of capability for the military.[317] With proper research and development, the cognitive burden on human operators will be lessened by autonomous technology, and certain functions will be performed with greater speed, reliability, and precision.[318] This pretty much assures that attorneys who specialize in international law will never be out of work.

8. Conclusion

A.I. has great potential to benefit humanity in many ways.[319] Starting a military A.I. arms race is a bad idea, without having regulatory laws for AWS.[320] Moreover, there should be a new legal framework on AWS. As a group of scientists that advocates restrictions on the use of military robots has said, "are these human-designated targets? Or are these systems automatically deciding what is a target?"[321] It is important that the AWS must satisfy the four general principles of LOAC so that they can be used in an armed conflict without risking human life. Most importantly, it looks challenging for AWS to fulfill the requirement laid out under the ICRC and the LOAC for the preservation of human life, especially as it relates to noncombatants. However, even if AWS could meet these criteria, it is dangerous to hand over our lives to an artificial intelligence that cannot discriminate between a terrorist, a civilian and a soldier; in fact, if every nation uses autonomous machines then there will not be a need for soldiers with boots on the ground because wars will be fought by the machines and their tele-operators. Many decisions will be made by machines based on their own on-board intelligence systems, and many will be against humans.

According to Peter Asaro, a co-founder and vice chairman of the ICRAC, "our concern is with how the targets are determined, and more importantly, who determines them."[322] With the rapid development of technology, humans might be able to develop machines that can think like humans; however, it is impossible for machines to have discriminating power informed by higher wisdom so that they can differentiate between a target and its surrounding; or between one person and another, between good and evil or between right and wrong. It may be great to have an iRobot to clean the house by itself, but getting so enamored with smart machines that handing over war-making capabilities to the weapons is not a smart thing. Desire to use machines instead of sons and daughters in the battlefield could be a driving force that might inadvertently give the machines the capability to eliminate human creatures from the world.

As discussed above, the present set of weapon laws are insufficient to regulate the AWS. There is a need for a separate legal framework on A.I., especially for the AWS. All the international scholars should get together and set the rules to govern autonomous machines and their uses. It would be dangerous to proceed if there are rogue nations that refuse to be bound by the ethical and moral conventions of Just War. And this identifies the major problem. Just as the international community

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[306] *Id.*

[307] Kasey Panetta, *Why artificial intelligence technology will cause more wars*, ECN (Jul. 28, 2015) http://www.ecnmag.com/blog/2015/07/why-artificial-intelligence-technology-will-cause-more-wars.

[308] Carafano, *supra* note 90.

[309] Patrick Lin, *supra* note 76.

[310] *Navy Unveils New Program to Create Drone-Like Autonomous Aircraft*, *supra* note 32.

[311] Patrick Lin, *supra* note 76.

[312] *Id.*

[313] Carafano, *supra* note 90.

[314] *Id.*

[315] *Id.*

[316] *What limits does the law of war impose on cyber attacks? supra* note 243.

[317] Carafano, *supra* note 24.

[318] *Id.*

[319] *Autonomous Weapons: An Open Letter from AI & Robotics Researchers*, *supra* note 290.

[320] *Id.*

[321] Markoff, *supra* note 16.

[322] Markoff, *supra* note 16.

tries to enforce compliance on nuclear weapons in unstable countries, similarly, the international community will have to enforce AWS compliance in a great number of countries.

The possible advantages of using A.I. and AWS with sensor-fusion capabilities and lethal warheads are matched by the equally devastating opportunity for their misuse. This will test commitment to LOAC as well as competence, foresight and ability to solve the problems while embracing the opportunities. It will test determination to be just, transparent and committed to engaging all nations in making and enforcing laws that will give humanity a good chance of keeping the autonomous machines under control for the benefit of all.