Preliminary Remarks on Lethal Autonomous Weapon Systems from an IHL Perspective

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ABSTRACT

During the past decades, developments for lethal autonomous weapons systems continued unabated and various States have dedicated significant resources to research and development on these systems. While there is no standard, universally-accepted definition of some of the key terms related to them, in their broadest sense, lethal autonomous weapon systems can operate outside direct human control and independently dispense lethal force in the battlespace based on internal programming. While these weapons, like all others, must comply with the law of armed conflict, there seems something troubling about this prospect. On one hand, there is growing advocacy asserting that these weapons can adhere to the law and even deliver more humanitarian outcomes in their dispensation of violence. Such advocacy assumes much about the normativity of the law. On the other hand, there exist grave concerns as to these weapons' level of autonomy. The fundamentals of IHL, best exemplified by the principles of distinction, proportionality, precaution and humanity require qualitative, context-dependent cognitive reasoning and judgment. These are the qualities that cannot be encoded into a weapon control system and machines are inherently incapable of. That is the reason humanitarians, roboticists and States have been struggling to define the extent to which weapons may be developed to conduct military operations without human control. This paper seeks to canvass the legal challenges posed by using autonomous weapons systems from an IHL perspective and interrogate how developments of the legal framework should be made on this matter.

Keywords: Lethal Autonomous Robots, Autonomous Weapons Systems, Human Control, New Technologies, Contemporary Challenges to IHL

1. Introduction

Physically removing weapons users or controllers from the battlefield has been the primary driving factor for advancements in military weapons technology: the greater the distance between the users and the battlefield, the safer the party is who is in possession of the technology.[1] This tendency reflects the so-called "third revolution

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[1] The American biologist Paul Bingham goes a good deal further, presenting the ability to kill or injure other human beings from a distance as the main force driving the evolution of the human species towards "cooperative social adaptation" to the extent that, as he puts it, the ability to kill remotely

of warfare" following gunpowder and nuclear weapons, namely autonomous weapons.[2] Lethal Autonomous Weapon Systems (LAWS) are no longer just something conjured up by Hollywood for their entertainment value; instead, they are increasingly used in today's armed conflicts. For instance, during the 2020 conflict over Nagorno-Karabakh, Azerbaijani forces used different loitering munitions, also known as suicide/kamikaze drones against Armenian armored and logistical forces.[3] Similarly, as reported by the United Nations Security Council, fighters in Libya "were subsequently hunted down and remotely engaged" by the same weaponry.[4]

On the other hand, LAWS have been the subject of much research and investment. While up-to-date open source information concerning national military research and development expenditure is often very scarce, studies show that the projected resources dedicated by States on the research and development of autonomous weapons systems to date is substantial. This is best exemplified by the United States' spending of $17.5 billion, China's $4.5, Russia's $3.9, South Korea's $1.9 and the members of the European Union's cumulative spending of $8 billion on drones only.[5] In the midst of all this, humanitarians, roboticists and States have been struggling to define the extent to which weapons may be developed to conduct military operations without human control.

Simply put, humans exercise control over weapons at different phases: in their development, deployment and operation, including the application of its "Critical Functions" which are authoritatively defined by the International Committee of the Red Cross (ICRC) as the "acquiring, tracking, selecting and attacking targets".[6] For LAWS or any other weapon for that matter, it is evident that

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dramatically reduces "the individual cost of punishing non-cooperative behaviour by allowing these costs to be distributed among multiple co-operators"; *See* P.M. Bingham, "Human Uniqueness: A General Theory", *Quarterly Review of Biology*, Vol. 74, No. 2, June 1999, pp. 133–169.

[2] *Autonomous Weapons: An Open Letter from AI & Robotics Researchers*, 28 July 2015; This open letter was announced at the opening of International Joint Conferences on Artificial Intelligence of 2015, seeking a ban on LAWS. To date, it has been signed by 30,717 individuals, including 4,502 AI/Robotics researchers. The letter is available and open to sign at: https://futureoflife.org/open-letter-autonomous-weapons/ (all internet references were last accessed in May 2021).

[3] *See* Seth J. Frantzman, "Israeli drones in Azerbaijan raise questions on use in the battlefield", *The Jerusalem Post*, 1 October 2020, available at: https://www.jpost.com/middle-east/israeli-drones-in-azerbaijan-raise-questions-on-use-in-the-battlefied-644161.

[4] *See* Final Report of the Panel of Experts on Libya established pursuant to Security Council resolution 1973 (2011), UN Doc. S/2021/229, 8 March 2021, para. 63.

[5] Justin Haner and Denisa Garcia, "The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development", *Global Policy*, Vol. 10, Issue 3, September 2019, pp. 331-337; *see* for more e.g., Vincent Boulanin and Maaike Verbruggen, *Mapping the Development Autonomy in Weapon Systems*, Stockholm International Peace Research Institute (SIPRI), 2017, pp. 94-105.

[6] *See* ICRC, *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, Report of Expert Meeting, Geneva, 26-28 March 2014, p. 1.

control at the first two stages cannot be relinquished. However, the technology is headed in such a direction that human interference may be excluded entirely from the critical functions stage. This is where grave concerns and imperative questions arise regarding the level of these weapons' autonomy. Having been the focus of an intergovernmental discussion under the framework of the Convention on Certain Conventional Weapons[7] since 2014, these concerns may be addressed under various bodies of law—including, primarily, International Human Rights Law (IHRL), the law on the use of force or "*jus ad bellum*" and International Humanitarian Law (IHL). The discussion in this paper, however, is limited to the use of LAWS as a means of warfare governed by the rules of IHL on the conduct of hostilities.

The legal concerns that arise during the said third stage of undertaking "critical functions" are manifold. Foremost among these is a machine's capability to make qualitative, context-dependent cognitive reasoning, in view of the fundamental rules of IHL (the principles of distinction, proportionality and precaution) which require analysis and application of the mind to each situation as and when they arise. In addition, there may be unpredictable situations on the battlefield which would require context-specific judgment to proceed further, rather than quantitative and technical indicators. A machine is inherently incompetent to tackle such situations no matter how high the degree of automation.[8] Such machines remain subject to their programming,[9] which is devoid of the ability to make any of these types of judgments and carries with it certain degrees of unpredictability and unreliability. These challenges have been best categorized in one of ICRC's collaborative works as the "numbers", "context" and "predictability" challenges.[10]

In comparison, a human counterpart is capable of analysing situations on the spot and, armed with prior knowledge of the law, can be able to apply the same in unforeseen scenarios. Moreover, humans have the critical ability to judge for themselves the legitimacy of orders, keeping in mind that not only are they not bound to follow unlawful orders, but that they are also bound not to carry out manifestly unlawful orders.[11] At the same time, a machine would be limited by its code and

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[7] 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, 1342 UNTS 137, 10 October 1980 (entered into force 2 December 1983) [hereinafter CCW].

[8] *See* Tyler D. Evans, "At War with the Robots: Autonomous Weapon Systems and the Martens Clause", *Hofstra Law Review*, Vol. 41, No. 13-17, 2014, p. 704.

[9] Christopher P. Toscano, "Friends of Humans: An Argument for Developing Autonomous Weapons Systems", *Journal of National Security, Law and Policy*, Vol. 8, No. 1, 2015, p. 14.

[10] *See* Vincent Boulanin *et al.*, *Limits on Autonomy in Weapon Systems - Identifying Practical Elements of Human Control*, SIPRI & ICRC, June 2020, pp. 4-7.

[11] *See* for e.g., Jean-Marie Henckaerts and Louise Doswald-Beck (eds.), *Customary International Humanitarian Law*, Vol. 1: *Rules*, Cambridge University Press, Cambridge, 2005, Rules 154, 155

execute orders as it is programmed without any cognitive understanding of their lawfulness. Therefore, a robot's adaptability cannot be compared to a human being's free will.[12]

In Section Two, this paper classifies autonomous weapon systems while describing their true capabilities. It further illustrates the extent of current technology and where it may be headed in the near future. Section Three analyses the compatibility of this new means of warfare with IHL and highlight primary legal complexities. Section Four concludes that different measures must be taken by various stakeholders, ranging from States to international humanitarian lawyers and NGOs, to develop and re-interpret the legal framework currently applicable to armed robots, in light of the fundamentals of humanitarian law, namely, the principles of military necessity, distinction, proportionality, precaution and humanity.

2. LAWS: What they really are

2.1. Often misunderstood notions of autonomy

"The term 'autonomy' can be very confusing for those not working in robotics",[13] or those who have not studied robots' characteristics as they really are, which is one of the main reasons why there is no standard, universally-accepted definition of some of the key terms related to LAWS.[14] In popular culture, autonomous robots have been influenced and mythicized by science fiction, and are thus assigned human-like attributes, such as thinking for themselves,[15] consciousness, guilt functions, and so

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[hereinafter ICRC Customary IHL Study]; *See also* Rome Statute of the International Criminal Court, 2187 UNTS 90, 17 July 1998 (entered into force 1 July 2002), Art. 33 [hereinafter the Rome Statute].

[12] Christopher P. Toscano, above note 9, p. 9.

[13] Noel E. Sharkey, "Automating Warfare: Lessons Learned from the Drones", *Journal of Law, Information and Science*, Vol. 21, Issue 2, 2011, p. 141.

[14] Amitia Etzioni and Oren Etzioni, "Pros and Cons of Autonomous Weapons Systems", *Military Review*, May-June 2017, p. 77, available at: http://www.armyupress. army.mil/Journals/Military-Review/English-Edition-Archives/May-June-2017/Pros-and-Cons-of-Autonomous-Weapons-Systems;" *contra* Maya Brehm, *Defending the Boundary: Constraints and Requirements on the Use of Autonomous Weapon Systems under International Humanitarian Law and International Human Rights Law*, Geneva Academy of International Humanitarian Law and Human Rights, May 2017, pp. 13-16, who believes "the lack of a common understanding is not simply due to a failure to agree on the correct nomenclature. Rather, participants in multilateral policy discussions frame issues of autonomy, agency and weapons in different ways."

[15] *See* Patrick Lin, George Bekey and Keith Abney, "Autonomous Military Robotics: Risk, Ethics and Design", *California Polytechnic State University*, 20 December 2008, p. 4, available at: http://ethics.calpoly.edu/ONR_report.pdf; Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, UN Doc. A/HRC/23/47, 9 April 2013, para. 39. [hereinafter Report of the Special Rapporteur].

forth.[16] Among various stakeholders, varying uses of the term "autonomous"[17] reflect uncertainty on the true nature of these new technologies.[18] In this respect, perceptions on both autonomy and artificial intelligence (AI) are constantly shifting, and with advances in technology certain systems once considered "autonomous" and "intelligent" are now deemed merely "automated".[19] For instance, mines have been considered by some States as "rudimentary autonomous weapon systems".[20]

It must be noted that the use of "autonomy" in the field of robotics should not be confused with how it is used in philosophy, politics, individual freedom or common parlance. "Autonomy in robotics is more related to the term 'automatic' than it is to individual freedom."[21] An automatic robot is controlled by an "IF/THEN statement" and carries out a pre-programmed sequence of operations or moves in a structured environment.[22] An autonomous robot is similar to an automatic machine, except that it operates in open or unstructured, or even "real-world"[23] environments. The robot is still controlled by an IF/THEN-based program; however, it now receives information from its sensors that enable it to adjust the speed and direction of its motors (and actuators) as specified by the program. Simply speaking, however, the bottom line for decision-making by machines, regardless of complexity, and "whether is it using mathematical decision spaces or [AI] programs, is the humble IF/THEN statement".[24]

ICRC has also acknowledged this confusion by taking the position that "there is no clear technical distinction between automated and autonomous systems, nor is there universal agreement on the meaning of these terms". In the eyes of the

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[16] *See* Ronald C. Arkin, *Governing Lethal Behavior in Autonomous Robots*, CRC Press, Boca Raton, Florida, 2009, p. 91.

[17] *See* for further reading United Nations Institute for Disarmament Research (UNIDIR), *The Weaponization of Increasingly Autonomous Technologies: Concerns, Characteristics and Definitional Approaches - A Primer*, 2017, pp 19-22, which discusses the three main approaches taken in the context of CCW talks to define autonomous systems, namely "Technology-centric", "Human-centered" and "Task/Functions" approaches.

[18] *See* Tim McFarland, *Autonomous Weapon Systems and the Law of Armed Conflict - Compatibility with International Humanitarian Law*, Cambridge University Press, Cambridge, 2020, pp. 41-42.

[19] ICRC, *Autonomy, Artificial Intelligence and Robotics: Technical Aspects of Human Control*, Geneva, August 2019, p. 7.

[20] *See* United States Department of Defence (US DoD), *DoD Law of War Manual*, Section 6.5.9.1, "Description and Examples of the Use of Autonomy in Weapon Systems", Washington, D.C. 2015, p. 328.

[21] *See* Noel E. Sharkey, above note 13, p. 141; *see also* Gregory P. Noone and Diana C. Noone, "The Debate over Autonomous Weapons System", *Case Western Reserve Journal of International Law*, Vol. 47, 2015, p. 27.

[22] A good example is a robot arm painting a car.

[23] Patrick Lin, George Bekey and Keith Abney, above note 15, p. 4.

[24] For more elaboration on this issue *see* Noel E. Sharkey, above note 13, pp. 140-42.

ICRC, "autonomous" represents "systems that interact with their environment".[25] Accordingly, anthropomorphizing LAWS and ascribing them characteristics similar to those of human beings, such as judgment, understanding of values, anticipation of the directions in which events are unfolding,[26] understanding people's intention[27] and situational awareness,[28] if not being used metaphorically, stems from nothing except a "weak analogy".[29] The importance of this issue will be borne in upon debates about robots making life and death decisions.

2.2. Different types of LAWS and the continuum loop

With no common understanding of what autonomy and LAWS are, the latter are categorized by different commentators on the basis of different criteria.[30] The mainstream trend, however, is to define and categorize LAWS based on human control, supervision, involvement or intervention[31] or their "level of autonomy".[32] In this regard, by taking a "functional approach",[33] the ICRC has authoritatively defined LAWS as "any weapon system with autonomy in its critical functions. That is, a weapon system that can select (i.e., search for or detect, identify, track, select) and

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[25] *See* ICRC, above note 19.

[26] *See* M. L. Cummings, "The Human Role in Autonomous Weapon Design and Deployment", *University of Pennsylvania Carey Law School*, [undated], p. 6, available at: https://www.law.upenn.edu/live/files/3884-cummings-the-human-role-in-autonomous- weapons.

[27] *See* United Kingdom Ministry of Defence, *Joint Doctrine Note 2/11: The UK Approach to Unmanned Aircraft Systems*, 30 March 2011, p. 2-3; which states "an autonomous system is capable of understanding higher level of intent and direction. From this understanding and…"

[28] Dan Saxon, "International Humanitarian Law and the Changing Technology of War", in Dan Saxon (ed.), *International Humanitarian Law and the Changing Technology of War*, Martinus Nijhoff Publishers, Leiden, 2013, p. 4; "Situational Awareness" corresponds to the ability to perceive the elements in the environment within a volume of time and space, to comprehend their meaning, and to project their status in the future. "In generic terms the three levels of situational awareness are level 1-perception, level 2-comprehension and level 3-projection. There is both individual and group or team situational awareness". *See* US DoD, *Unmanned Systems Safety Guide for DoD Acquisition*, Washington, D.C., 27 June 2007, p. 16.

[29] *See* Noel E. Sharkey, above note 13, p. 141.

[30] *See for e.g.,* Yoram Dinstein, "Autonomous Weapons and International Humanitarian Law", in Wolff Heinstchel von Heinegg *et. al.* (eds.), *Dehumanization of Warfare - Legal Implications of New Weapon Technologies*, Springer, Cham, 2017, pp. 17-19.

[31] *See* Human Rights Watch, *Losing Humanity: The Case against Killer Robots*, 19 November 2012, p. 2; US DoD, *Directive No. 3000.09; Autonomy in Weapon Systems*, 21 November 2012, p. 13.

[32] *See* Markus Wagner, "The Dehumanization of International Humanitarian Law: Legal, Ethical and Political Implications of Autonomous Weapon Systems", *Vanderbilt Journal of Transnational Law*, Vol. 47, 2014, pp. 1379-1384.

[33] *See* UNIDIR, above note 17, p. 21.

attack (i.e., use force against, neutralize, damage or destroy) targets without human intervention."[34]

Consequently, attention must be paid to the control exercised by humans at different stages of the life cycle of LAWS. As enunciated by the ICRC, this control may be exercised by human beings during the machines' development (including programming), deployment, and operation.[35] The last two stages have been the starting point for categorization of LAWS. Meanwhile, based on human involvement in each, robotic weapons are often divided into the following three categories:

> First are "Human-in-the-Loop Weapons", robots that can select targets and deliver force only with a human command. These include remote-controlled, or as put by some authors, "semi-autonomous" weapon systems;[36]
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> Second, "Human-on-the-Loop Weapons", also called semi-autonomous or human-supervised weapon systems, are systems subject to human intervention for specific functions, from target-selection to engagement.[37] Human operators exercise control in a way that they may monitor the machines' operations[38] or override the system's capabilities to launch lethal force.[39] Depending on the scale of intervention, these weapons may range from "humans in the loop" to "humans on the loop".[40] Classic examples of these weapons include air defence systems like the Iron Dome and the Phalanx Close-In Weapon System (CIWS).[41]
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> Third are "Human-out-of-the-Loop Weapons", or fully autonomous weapon systems, which are capable of selecting targets and

[34] ICRC, *Views of International Committee of the Red Cross on Autonomous Weapon System*, Geneva, 11 April 2016, p. 1.

[35] *Ibid.*, p. 3.

[36] *See* Tim McFarland, above note 18.

[37] William H. Boothby, "Highly Automated and Autonomous Technologies", in William H. Boothby (ed.), *New Technologies and the Law in War and Peace*, Cambridge University Press, Cambridge, 2019, p. 138.

[38] Aaron Saenz, *War 2.0 – Rise of the Robots*, 1 June 2009, available at: http://www.singularityhub.com/2009/06/01/war-20-rise-of-the-robots.

[39] Tyler D. Evans, above note 8, p. 702.

[40] Christopher P. Toscano, above note 9, pp. 12-13.

[41] *See for more examples and further references* Daniele Amoroso and Guglielmo Tamburrini, "In Search of the 'Human Element': International Debates on Regulating Autonomous Weapons Systems", *The International Spectator*, Vol. 56, No. 1, 2021, p. 22

> delivering force without any human input or interaction.[42] Fully autonomous robots are those weapons that keep humans entirely "out of the loop".[43] They are "robots that are capable of selecting targets and delivering force without any human input or intervention."[44] This suggests that machines would be capable of adapting to the situation at hand and respond accordingly.[45]

It must be noted that "autonomy" is not a binary conception. In other words, "a system does not have to be exclusively autonomous or exclusively remote operated. There is a continuum from fully controlled to fully autonomous."[46] For the present purposes, however, the phrase "remote-controlled weapon systems" means weapons which keep a human-in-the-loop, such as Unmanned Combat Aerial Vehicles (UCAVs or drones), which are not categorically under discussion here. The remaining two classes are semi-autonomous/human-supervised and fully autonomous weapon systems.

Moreover, having the above-mentioned definition and categorization of LAWS in mind, and based on the comprehensive studies conducted by the ICRC and other international institutions, it must be noted that all existing LAWS operate under some form of human control and intervention.[47] This has also been indicated by States leading technological developments in weaponry. For example, the United States Department of Defense (DoD) has made clear its policy that "autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force".[48] In the same vein, proponents of LAWS have also suggested that "fully" and "truly" autonomous weapon systems are still at the research stage and have not yet appeared, let alone deployed in armed conflicts. They have considered the study and discussions of LAWS to be based on possibilities and assumptions.[49] Regardless of the accuracy of such statements in the current state of technology, the fact that fully

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[42] *See* Human Rights Watch, above note 31, p. 2; Gregory P. Noone and Diana C. Noone, above note 21, p. 28.

[43] Tyler D. Evans, above note 8, p. 703.

[44] Human Rights Watch, above note 31, p. 2.

[45] Christopher P. Toscano, above note 9, p. 13.

[46] Noel E. Sharkey, above note 13, p. 142; *see also* Report of the Special Rapporteur, paras. 39-43.

[47] *See* for references Vincent Boulanin *et. al.*, above note 10, pp. 17-18; *see* also Report of the Special Rapporteur, paras. 43-45; Michael N. Schmitt, "Autonomous Weapon Systems and International Humanitarian Law: A Reply to Critics", *Harvard National Security Journal Features,* 2013, p. 3

[48] US DoD, above note 31, 4.a.

[49] Zhang Xinli, "Legal Issues concerning Autonomous Weapon Systems" in ICRC, *Autonomous Weapon Systems: Implications of Increasing Autonomy in the Critical Functions of Weapons*, Versoix, 15–16 March 2016, p. 41.

autonomous machines might not yet be a reality, does not preclude such an eventuality in the future.[50]

2.3. Robots in the real world: remote-controlled or autonomous?

Official statements from States capable of producing LAWS appear to indicate that "their use during armed conflict or elsewhere is not currently envisioned".[51] Some have even suggested that no designer, engineer, academic or practitioner believes we will see a deployable Fully Autonomous Weapon System within ten or twenty years at the least.[52] However, as has been previously pointed out, there exist systems with unsupervised autonomy that "possess automatic target-recognition software, enabling them to find a target on their own, match that target to a target-identification library or database, and then fire on the target."[53] In addition, there exists growing belief that soon, Unmanned Systems (UMS) "will operate without human input; in other words, a single platform will search for, identify, and destroy targets autonomously."[54]

In addition, States have been spending massively in the last two decades for research to take humans out of the loop, and plans are well underway so that robots can operate autonomously to locate targets and destroy them without human intervention[55] in the air, on the ground,[56] and in the maritime environment, whether on the high seas or underwater.[57] Moreover, as will be discussed later, even human-

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[50] *See* Human Rights Watch, above note 31, pp. 7-9.

[51] *See* US DoD, *Unmanned Systems Integrated Road Map FY2011-2036,* p. 50, available from http://publicintelligence.net/dod-unmanned-systems-integrated-roadmap-fy2011-2036, cited in Report of the Special Rapporteur, para. 29.

[52] Gregory P. Noone and Diana C. Noone, above note 21, p. 30.

[53] Heather Roff, "Sensor-Fused Munitions, Missiles and Loitering Munitions" in ICRC, *Autonomous Weapon Systems: Implications of Increasing Autonomy in the Critical Functions of Weapons*, Versoix, 15–16 March 2016, p. 33.

[54] Michael N. Schmitt, "War, Technology and the Law of Armed Conflict", in Anthony M. Helm (ed.), *The Law of War in the 21st Century: Weaponry and the Use of Force*, International Law Studies, Vol. 52, Naval War College, New Port, Rhode Island, 2006, p. 143; *See* also Ronald C. Arkin, above note 16, pp. 7-10.

[55] *See* Noel E. Sharkey, "Cassandra of False Prophet of Doom: AI robot and war", *IEEE Intelligent Systems,* Vol. 23, No. 4, 2008, pp. 14-17.

[56] For e.g., United States Congress had mandated in 2001 that by 2010, one-third of the aircraft in the operational deep strike force should be unmanned, and by 2015, one-third of the army's Future Combat Systems' operational ground combat vehicles should be unmanned. *See United States National Defence Authorization Act*, Fiscal Year 2001, Public Law No. 106-398, 114 Stat. 1654, Section 220(a).

[57] *See* generally UNIDIR, *The Weaponization of Increasingly Autonomous Technologies in the Maritime Environment: Testing the Waters*, 2017.

in/on-the-loop LAWS, if used as force multipliers, or in "swarms", would be indistinguishable from fully autonomous weapons.

The United States Department of Defence's Unmanned Air Vehicles (UAVs) inventory, for instance, has rapidly grown from 167 in 2002 to over 7,000 in 2010. In 2009 alone, the United States Air Force trained more drone operators than aircraft pilots.[58] These UMS are playing an increasingly significant role in the military operations of more and more States including Georgia, Israel[59] and Iran.[60] All these systems can navigate across the battlefield or the designated area and search for targets, but it is a remote operator who makes the final decision about when to apply lethal force.[61]

States are rapidly increasing their use of Unmanned Ground Vehicles (UGVs) too, for tasks such as defending borders and reconnaissance to bomb disposals.[62] From 2004 to 2006, UGVs/robots have increased from 160 to 4,000 in Iraq and Afghanistan, which performed nearly 30,000 explosive ordnance disposal missions and neutralized more than 11,000 improvised explosive devices in 2006 alone.[63] In 2008, between 4,000 to 6,000 United States UGVs were operating in Iraq and Afghanistan, more than the number of British soldiers on the battlefield.[64]

Current UGVs enjoy limited autonomy and are capable of conducting long-term surveillance tasks and collaboration with other UGVs, such as the United States government's Defence Advanced Research Projects Agency's (DARPA) "Crusher"; a six-wheeled robot that rolls through ditches, walls, streams, other vehicles and almost anything else that gets in its way.[65]

The same is true with regard to UAVs. In 2009, the United States released "Unmanned Aircraft Systems Flight Plan 2009-2047", a "plan to achieve the United

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[58] United States House of Representatives, *Rise of the Drones: Unmanned Systems and the Future of War*, Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government Reform, 111th Congress, 2nd Session, 23 March 2010, p. 2.

[59] *See* Larry Dickenson, "New Respect for UAVs", *Aviation Week and Space Technology*, Vol. 170, Issue 4, 2009, p. 94, cited in Jack M. Beard, "Law and War in the Virtual Era", *American Journal of International Law*, Vol. 103, 2009, p. 413.

[60] *See* Ned Parker, "U.S. Says It Downed Iran Drone over Iraq", *Los Angeles Times*, 17 March 2009, p. A23.

[61] Noel E. Sharkey, "Grounds for Discrimination: Autonomous Robot Weapons", *RUSI Defence System*, Vol. 11, No. 2, 31 October 2008, p. 87.

[62] Dan Saxon, above note 28.

[63] Ramon Lopez, "Foiling Bombs and Bad Guys", *Defense Technology International*, 1 December 2007, p. 30.

[64] Noel E. Sharkey, above note 55, p. 14.

[65] *See* "Pentagon's 'Crusher' Robot Vehicle Nearly Ready to Go", *Fox News*, 27 February 2009, available at: http://www.foxnews.com/story/2008/02/27/pentagon-crusher-robot-vehicle-nearly-ready-to-go.html.

States Air Force vision for the future of Unmanned Air Systems".[66] According to this plan, humans will remain "in the loop" and will still fly airplanes, but in a multitude. For example, since 2020, human operators are supposed to control four aircrafts each, thousands of miles away. This means that upon the human operator's issuing of the flight plan, the aircraft itself will complete many critical aspects of the mission, such as taking off, flying to the target, and avoiding detection by adversaries, unassisted.[67] The United States Air Force has also predicted that "by 2030 machine capabilities will have increased to the point that humans will have become the weakest component in a wide array of systems and processes."[68]

This has been high on the military agenda of all United States forces,[69] as well as the armies of other States.[70] In fact, due to UMS' ability to improve surveillance and minimize risks to combatants,[71] States have aimed to use UMS as a force multiplier in swarms, "so that one human on the battlefield can be a nexus for initiating a large-scale robot attack from the ground and the air."[72]

This progression, however, makes unclear how human control could be significantly—or as some have accurately pointed out, "meaningfully"[73]—maintained over the force.[74] It is obviously going towards something that, if nothing else, looks like autonomy. In ICRC's view, this trend dramatically exacerbates the humanitarian legal challenges posed by LAWS.[75] This is mainly due to the chaotic, time-critical nature of armed conflicts in which human beings' supervisory actions cannot be relied upon by UMS. There exists an "inherent" neuromuscular lag in humans, which means a half-second delay in a single hitting of a fire/stop button when needed, even when paying full attention.[76] This is while "the decision-making

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[66] United States Air Force, *United States Air Force Unmanned Aircraft Systems Flight Plan 2009-2047*, Washington, D.C., 18 May 2009, p. 14.

[67] *See* Joe Pappalardo, "The Future for UAVs in the U.S. Air Force", *Popular Mechanics*, 25 February 2010, available at: http://www.popularmechanics.com/military/a5383/ 4347306/.

[68] *See* the United States Chief Scientist, *Report on Technology Horizons: A Vision for Airforce Science & Technology During 2010-2030*, Vol. 1, AF/ST-TR-10-01-PR, 15 May 2010, p. 106.

[69] *See* Noel E. Sharkey, above note 61.

[70] *See generally* United Kingdom Ministry of Defence, above note 27.

[71] *See* Andy Nativi Genoa, "Automation Army: UGVs Meet a Growing Range of Battlefield Needs", *Defense Technology International*, December 2007, pp. 26-28.

[72] Noel E. Sharkey, above note 61.

[73] The term "Meaningful Human Control" has gained prominence in the international talks addressing the quality of required human control over the use of LAWS. See for definition and further references Human Rights Watch and International Human Rights Clinic, "Killer Robots and the Concept of Meaningful Human Control", *Human Rights Watch*, April 2016, available at: https://www.hrw.org/sites/default/files/supporting_ resources/robots_meaningful_human_control_final.pdf.

[74] *See* Merel Ekelhof and Giacomo Persi Paoli, *Swarm Robotics - Technical and Operational Overview of the Next Generation of Autonomous Systesms*, UNIDIR, 2020, pp. 1-2.

[75] ICRC, *ICRC Position and Background Paper on Autonomous Weapon Systems*, Geneva, 12 May 2021, p. 6.

[76] *See* M. L. Cummings, above note 26, p. 2.

processes of robots are often measured in nano-seconds, and the informational basis of those decisions may not be practically accessible to the supervisor."[77] This is well demonstrated by the following example: an operator with undivided attention and full situational awareness "on the loop" of a single drone is confident enough to cast doubt on the accuracy of the robot's decision-making process. Nonetheless, due to the aforesaid, they will not be able to override the drone's decision, when the robot and a wounded child soldier confront, and the first decides to shoot, while the latter is to drop the weapon and surrender. Given this, one would be constrained to expand the English language as much as imagination allows, to say that one human, who controls a swarm of UAVs teamed with UGVs,[78] a fleet of drones or land robots to attack multiple targets,[79] is still "in the loop", "on the loop" or clinging to it. The operator is *de facto* out of the loop,[80] as this is warfare conducted by machines largely unassisted by humans.[81]

3. LAWS and the Laws of War: Is using robots in compliance with the principles of IHL?

IHL applies to all weapons, including LAWS. This has been acknowledged as the first of 11 guiding principles affirmed by the 2019 report of the Group of Governmental Experts (GGE) related to emerging technologies in the area of LAWS in the context of the CCW, and adopted by consensus by the parties to Convention.[82] From an IHL perspective, it is first important to differentiate between a particular type of weapon being lawful, and the lawfulness of the way in which it is being used. It is evident that every weapon can be used in an unlawful manner, nevertheless, inherent attributes of certain weapons cause their use, in some or all circumstances, to be unlawful *per se.*

Generally speaking, weapons are considered inherently unlawful if: they have been specifically prohibited by treaty or customary law;[83] they are of a nature to

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[77] Report of the Special Rapporteur, para. 41.

[78] *See* United States Air Force, above note 66, p. 2; United States Army, *Eyes of the Army: U. S. Army Roadmap for Unmanned Aircraft Systems 2010-2035*, UAS Centre of Excellence, Fort Rucker, Alabama, 2010, p. 2.

[79] *See* Peter W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century*, Penguin Publishing, New York, 2009, p. 126.

[80] Report of the Special Rapporteur, para. 41.

[81] *See* Shane Harris, "Autonomous Weapons and International Humanitarian Law or Killer Robots Are Here. Get Used to It.", *Temple International and Comparative Law Journal*, Vol. 30, 2016, p. 79.

[82] *See* Guiding Principles affirmed by the GGE on Emerging Technologies in the Area of Lethal Autonomous Weapons System, *CCW/MSP/2019/9*, *Annex III*, 13 December 2019.

[83] *See* for e.g., Convention on the Prohibition of Anti-Personnel Mines, 2056 UNTS 211, 3 December 1997 (entered into force 1 March 1999); Protocol on Blinding Laser Weapons (Protocol IV) to the CCW, 1380 UNTS 370, 13 October 1995 (entered into force 30 July 1998); and Convention on the

cause superfluous injury or unnecessary suffering; they are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment;[84] or they are indiscriminate by nature because they cannot be aimed at a lawful target or their effects cannot be restricted as required by IHL.[85] Proponents of LAWS, consisting of major military powers, have repeatedly argued that since fully autonomous robots have not yet emerged, their complex nature is hard to determine, thus it is premature to come to any conclusion regarding the legality of the use of LAWS in armed conflicts and their compatibility with principles of IHL. Furthermore, no specific international instrument exists for their prohibition. In this regard, some have suggested that, subject to conducting a legal review of new weapons, it is safe to say that autonomous weapon systems are not "inherently illegal"; instead, their use may range from lawful to unlawful.[86] Nevertheless, having in mind the characteristics of LAWS, this issue seems to be not so undemanding. For instance, as stated by the ICRC, certain LAWS would be inherently indiscriminate and thus prohibited under IHL, since "their effects, in their normal or expected circumstances of use, could not be sufficiently understood, predicted and explained".[87]

Another important consideration for any discussion on LAWS is the prohibition on indiscriminate weapons. In order for LAWS to not be considered inherently unlawful, it must be ensured that their operation will not result in unlawful outcomes with respect to the principle of distinction and other IHL principles emanating therefrom. In fact, by using LAWS for the purpose of attack, parties to an armed conflict must still be able to first, distinguish between military objectives and civilians or civilian objects, and in case of doubt, presume civilian status (distinction); second, evaluate whether the incidental harm likely to be inflicted on the civilian population or civilian objects would be excessive in relation to the concrete and direct military advantage anticipated from that particular attack (proportionality and military necessity);[88] and third, take all feasible precautions to avoid, and in any event minimize, incidental harm to civilians and damage to civilian objects, as well as

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Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, 1974 UNTS 45, 13 September 1992 (entered into force 29 April 1997)

[84] *See* Protocol Additional (I) to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, 1125 UNTS 3, 8 June 1977 (entered into force 7 December 1978), Arts. 35-36 [hereinafter AP I].

[85] *See* ICRC Customary IHL Study, Rules 71, 11, 12; *See* for a thorough discussion regarding these four categories William H. Boothby, "Regulating New Weapon Technologies", in William H. Boothby (ed.), *New Technologies and the Law in War and Peace*, Cambridge University Press, Cambridge, 2019, pp. 16-42.

[86] Zhang Xinli, above note 49.

[87] *See* ICRC, above note 75, p. 7.

[88] ICRC Customary IHL Study, Rules 14

cancel or suspend the attack if it becomes apparent that the target is not a military objective, or that the attack may be expected to result in excessive (disproportionate) incidental harm (precaution).[89]

This section addresses the compatibility of LAWS with the above-mentioned principles of IHL to explore if and under what circumstances they can be used lawfully under the laws of war.

3.1. Military Necessity

Military operations under the laws of war derive their legitimacy from the principle of military necessity, the codification of a customary obligation. This customary duty was first enshrined in the Lieber Code,[90] according to Article 14 of which, "military necessity, as understood by modern civilized nations consists in the necessity of those measures which are indispensable for securing the ends of the war, and which are lawful according to the modern law and usages of war." The obligation further arises from the St. Petersburg Declaration, which states that "…the only legitimate object which States should endeavour to accomplish during war is to weaken the military forces of the enemy."[91] It allows for military operations that offer a "definite military advantage"[92] and prohibits the "infliction of suffering for the sake of suffering."[93] Clearly, the use of any weapon, whether autonomous or otherwise, against an adversary would fulfil the criterion of offering a definite military advantage.[94] Based on this, some authors have interpreted military necessity not as a distinct rule of IHL, but as "a foundational principle that undergirds" this "entire body of law". They are thus of the opinion that as long as other principles of IHL, particularly precaution, are applied, LAWS do not pose a challenge to the application of this rule.[95]

It must be borne in mind, however, that military necessity requires more of a qualitative assessment, restricted by other principles of IHL, as IHL requires that a

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[89] ICRC Customary IHL Study, Rules 15, 18, 19

[90] The United States Department of War, *General Order No. 100: Instructions for the Government of Armies of the United States in the Field*, 24 April 1863 [hereinafter the Lieber Code]

[91] St. Petersburg Declaration Renouncing the Use, In Time of War, of Explosive Projectiles Under 400 Grammes Weight, 138 CTS 297, 11 December 1868 (entered into force 11 December 1868), Preamble.

[92] AP I, Art. 52(2); Military advantage has been defined as "those benefits of a military nature that result from an attack. They relate to the attack considered as whole and not merely to isolated and or particular parts of the attack." *See* Program on Humanitarian Policy and Conflict Research at Harvard University, *HPCR Manual on International Law Applicable to Air and Missile Warfare*, Cambridge University Press, Cambridge, 2013, p. xxv.

[93] The Lieber Code, Art. 16.

[94] Benjamin N. Kastan, "Autonomous Weapons Systems: A Coming Legal 'Singularity'?", *Journal of Law, Technology and Policy*, Vol. 2013, No. 1, 2013, p. 58.

[95] Michael N. Schmitt, above note 47, p. 22.

balance be struck between military necessity and considerations of humanity. In other words, "an equilibrium between military necessity and humanitarian considerations underlies every norm of the law of international armed conflict, whether customary in nature or drawn up in treaty form".[96] It is for this purpose that the law incorporates several other principles to the military necessity equation, such as distinction, proportionality and precaution, to define the boundaries of legal advancement of military objectives during the conduct of hostilities. The determination of whether the use of LAWS would comply with the principle of military necessity and overall, IHL, must therefore be dependent on and be interpreted in light of the application of these other principles and legal constraints. For instance, if LAWS cannot distinguish between military or civilian targets, such as between a military or a civilian medical facility, they cannot determine whether the target's destruction would be militarily necessary.[97] The same argument applies to principles of proportionality and precaution, as discussed hereinafter. In sum, military necessity itself requires a cognitive analysis of the situation, or as put by some, "a context-dependent, value-based judgment of a commander".[98] These are functions that LAWS are inherently incapable of, and require strict human supervision.

3.2. Distinction

The fundamental principle of distinction has been held by the International Court of Justice as a "cardinal" principle of IHL, which together with the prohibition of causing unnecessary suffering, constitutes "the fabric of humanitarian law".[99] This principle lies at the heart of IHL and is applicable in every nature of armed conflict.[100] Embodied in Article 48 of Additional Protocol I to the 1949 Geneva Conventions (AP I), the principle of distinction obligates parties to a conflict to always distinguish between the civilian population and combatants and between civilian objects and military objectives and to only direct attacks against the latter.[101] The negative wording of Article 50 of AP I defining "civilians" protects them against direct attacks.

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[96] *See* Yoram Dinstein, "Military Necessity", *Max Planck Encyclopedia of International Law*, para. 7, available at: http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/ law-9780199231690-e333?rskey=7OmlD3&result=1&prd=EPIL.

[97] Benjamin N. Kastan, above note 94.

[98] *Ibid.*

[99] International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, 8 July 1996, ICJ Reports 1996, para.78.

[100] Cadet Allyson Hauptman, "Autonomous Weapons and the Law of Armed Conflict", *Military Law Review*, Vol. 218, 2013, p. 174.

[101] ICRC Customary IHL Study, Rules 1, 7, 10.

It provides that in case of doubt on status, an individual must be considered civilian unless determined otherwise, and that combatants act with caution in such attacks.[102] Civilian individuals only lose their protection from direct attacks if and "for such time as they take a direct part in hostilities".[103]

These characterizations by their nature require qualitative or evaluative judgments which are made on the basis of values and interpretation of a particular situation rather than numbers or technical indicators.[104] LAWS having autonomy in their "critical functions" means selecting targets and directing attacks are taken out of the hands of a human operator and encoded into the weapon control system.[105] They may be programmed to generate outputs corresponding to who humans would identify as fellow humans; however, that will be the extent of their existing capability, in the opinion of some prominent roboticists, for at least the next four decades.[106]

Secondly, it is not possible to program robots to ascertain the distinguishing features between civilians and *hors de combat* or combatants.[107] This is because the calculation of an individual as a civilian is not based on any fixed criteria. A computer can compute any given procedure that can be written down in a programming language. Instead, the law provides an ambiguous definition of civilians, which is insufficiently determinate to encode in LAWS. It is evident from AP I,[108] which defines a civilian as someone who is not a combatant, and also the Geneva Conventions of 1949[109] which require the use of common sense to identify.[110] These criteria are at times extremely hard to judge even for combatants,[111] particularly in today's combat situations, which increasingly involve fighting in the midst of urban areas and dynamic and congested places, so that programming them into a machine may not prove to be a possible task.

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[102] Cadet Allyson Hauptman, above note 100, p. 175.

[103] AP I, Art. 51(3); ICRC Customary IHL Study, Rule 6.

[104] *See* Vincent Boulanin *et al.*, above note 10, p. 5.

[105] *See* generally for the legal implications of this matter on IHL rules governing the nature and design of LAWS, Tim McFarland, above note 18, pp. 90-99.

[106] Noel E. Sharkey, "The Evitability of Autonomous Robot Warfare", *International Review of the Red Cross*, Vol. 994, No. 886, 2012, pp. 788-789.

[107] Hin-Yan Liu, "Categorization and Legality of Autonomous and Remote Weapons Systems", *International Review of the Red Cross,* Vol. 94, No. 886, 2012, p. 642-643.

[108] AP I, Art. 50(1); Art. 43.

[109] *See* Geneva Convention Relative to the Treatment of Prisoners of War, 75 UNTS 135, 12 August 1949 (entered into force 21 October 1950), Art. 4 [hereinafter GC III]

[110] Noel E. Sharkey, above note 106, p. 789.

[111] "It is extremely difficult to correctly identify targets on the battlefield. One study found that up to 70% of all civilian casualties caused by U.S. forces were cases of mistaken identity." Benjamin N. Kastan, above note 94, p. 60; *See also* Gregory S. McNeal, "Are Targeted Killings Unlawful?: A Case Study in Empirical Claims Without Empirical Evidence", in Claire Finkelstein, Jens David Ohlin & Andrew Altman (eds.), *Targeted Killings: Law and Morality in an Asymmetrical World,* Oxford University Press, Oxford, 2012, p. 331.

Thirdly, even if such advanced programming was possible and machines are made to distinguish between these categories of individuals, this determination remains more of a cognitive and highly contextual, conduct-, intent- and causality-related legal assessment, a deduction intrinsically better done by humans than machines,[112] or as ICRC puts it, shall be made by humans in the context of a specific attack. In ICRC's view, it is difficult to envisage realistic combat situations where the use of AWS against persons would not pose a significant risk of IHL violations.[113]

The same is true with regard to distinction between civilian objects and military objectives. Adherence to the rule requiring attacks to be directed against "objects which by their nature, location, purpose or use make an effective contribution to military action and whose partial or total destruction, capture or neutralization, in the circumstances ruling at the time, offers a military advantage",[114] requires an assessment based on knowledge of the context and the ability to adapt to changing circumstances. This is so long as LAWS do not see like humans, nor have any understanding of meaning or context, meaning that they can make mistakes that a human never would.[115]

This necessitates constant and significant levels of human control over the operations of LAWS, before and after attacks and negates, to a large extent, the compatibility of LAWS with IHL principles, particularly the principle of distinction. In this regard, the potential and actual incidents leading to civilian and/or friendly fire ("fratricide") casualties due to using human-in-the-loop, or human-on-the-loop autonomous systems[116] shows, unlike what LAWS proponents argue, that a greater autonomy in weapon systems neither decreases the risk of poor distinction between legal and illegal targets of attacks,[117] nor that there is any guarantee that robots would be capable of distinguishing more reliably.[118]

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[112] Noel E. Sharkey, above note 61, pp. 86–89.

[113] ICRC, above note 75, p. 9.

[114] AP I, Art 52(2), ICRC Customary IHL Study, Rule 8.

[115] ICRC, above note 19, p. 3.

[116] *See* generally Paul Scharre, *Army of None - Autonomous Weapons and the Future of War*, New York, W. W. Norton & Company, 2019, pp. 137-160; Paul Scharre, *Autonomous Weapons and Operational Risk*, Center for a New American Security, Washington, D.C., 2016; *see also* Luke Swartz, *Overwhelmed by Technology: How Did User Interface Failures on Board the USS Vincennes Lead to 290 Dead?*, available at: http://xenon.stanford.edu/ ~lswartz/vincennes.pdf; Neil Tweedie, "US Fighter Shot Down by Patriot Missile", *Telegraph*, 4 April 2003, available at: http://www.telegraph.co.uk/news/worldnews/middleeast/iraq/1426631/US-fighter-shot-down-by-Patriot-missile.html; Wade Boese, "Army Report Details Patriot Record in Iraq War", *Arms Control Association*, 1 November 2003, available at: https://www.armscontrol.org/act/2003_11/Patriotmissile.

[117] Hin-Yan Liu, above note 107, p. 641.

[118] Human Rights Watch and International Human Rights Clinic, *Fully Autonomous Weapons: Questions and Answers*, 21 October 2013, pp. 3-4

3.3. Proportionality

The principle of proportionality reflective of customary law[119] and enshrined in Article 51(5)(b) and Article 57 of AP I, provides that "incidental loss to 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 is prohibited."

Where a military operation poses risks to civilians, civilian life and objects, this principle evidently requires logic and reasoning in multiple aspects.[120] For such an assessment, "excessive incidental loss" and "anticipated military advantage", which must also be "direct and concrete", are crucial elements.[121] These determinations require application of evaluative decisions and value judgments, which are context-dependent and time-bound, and would differ in each case,[122] with the calculation of military advantage dependent on a military commander's constantly changing plans or development of operations.[123] Therefore, there is no set standard that can be effectively incorporated in a machine, and on top of that, it is not humanly possible to predict all scenarios in every situation to pre-program these machines to respond accordingly and proportionately. Even if such is possible, as argued by some authors[124] and as confirmed by the ICRC, the laws of war require parties to exercise unfettered discretion over the course of conflict. In fact, proportionality assessments which form part of planning assumptions, constantly vary over the course of attack. Hence, the continuing validity of the parties' assumptions about the context of target and its environment until the execution of the attack, is fundamental to its lawfulness.[125]

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[119] ICRC Customary IHL Study, Rule 14.

[120] Benjamin N. Kastan, above note 94, p. 62.

[121] Noel E. Sharkey, above note 106, pp. 789-790.

[122] Christopher P. Toscano, above note 9, p. 32-33; Michael N. Schmitt and Jeffrey S. Thurnher, "'Out of the Loop': Autonomous Weapon Systems and the Law of Armed Conflict", *Harvard National Security Journal,* Vol. 4, 2013, p. 255-256.

[123] Marco Sassoli, 'Can Autonomous Weapon Systems Respect the Principles of Distinction, Proportionality and Precaution?', in ICRC, *Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects*, Report of Expert Meeting, Geneva, 26-28 March 2014, pp. 41-42.

[124] *See* Eliav Lieblich and Eyal Benvenisti, "The Obligation to Exercise Discretion in Warfare: Why Autonomous Weapons Systems are Unlawful", in Nehal Bhuta et al. (eds.), *Autonomous Weapons Systems: Law, Ethics, Policy*, Cambridge University Press, Cambridge, 2006, p. 250, who by applying a global administrative law approach argue that LAWS embody pre-bound discretion of their programmers and deploying commanders, and this makes them unlawful *per se*.

[125] Vincent Boulanin *et. al.*, above note 10, p. 7; Schmitt has argued in favour of LAWS that in theory they could be pre-programmed with military advantage algorithms and a base maximum collateral damage level for a military target, which a human would make the determination that generally comports with the proportionality as well. However, he notes, as ICRC also marked down in its commentary to AP I that proportionality is a "subjective" evaluation allowing for a "fairly broad

These are decisions that a robot is incapable of making on its own. They require more than a balancing of quantitative data, and LAWS cannot be programmed "to duplicate the psychological processes in human judgment that are necessary to assess proportionality".[126] This necessitates a human operator's involvement during the whole course of attack by LAWS, at the very least, as far as proportionality is concerned.[127]

3.4. Precautionary Measures

The customary obligation[128] to take all feasible precautions is enshrined in AP I as requiring "constant care to spare the civilian population, civilians and civilian objects."[129] The "constant care" standard has been the point of much debate and is understood as a duty applicable not just at the planning stage of a military operation, rather, it is one that continues throughout its execution as well.[130] This interpretation is in accordance with the requirements of the provision, as under Article 57 of AP I, the precautionary principle further involves military commanders to verify targets, to carefully choose lawful means and methods of warfare, and to refrain from launching attacks that would be disproportionate.[131] Moreover, it also provides for the cancellation or suspension of attacks, when an objective is identified as civilian or under special protection, or when launching lethal force would be considered disproportionate.[132]

As with the preceding principles, feasible precautions also require context-specific qualitative judgments and complex evaluative assessments based on the circumstances prevailing at the time of the decision to attack, but also during the attacks, as and when they arise. In fact, "if an autonomous system is to minimize harm, it must also be 'cognizant' of possible harmful consequences of its actions, and it must select its actions in light of the 'knowledge' even if such terms are only

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margin of judgment" and "must above all be a question of common sense and good faith for military commanders", proportionality has to be adjustable by human operators based on "the military situation at a particular phase in the conflict". *See* Michael N. Schmitt, above note 47, pp. 20-21.

[126] Human Rights Watch, above note 31, p. 33

[127] John J. Klein, "The Problematic Nexus: Where Unmanned Combat Air Vehicles and the Law of Armed Conflict Meet", *Chronicles Journal Online*, 2003, p. 6, available at: http://www.sevenhorizons.org/docs/Kleintheproblematicnexus.pdf.

[128] ICRC Customary IHL Study, Rules 15-21.

[129] AP I, Art. 57(1).

[130] Michael N. Schmitt, *The Tallinn Manual on the International Law applicable to Cyber Warfare*, Cambridge University Press, Cambridge, 2013, p. 166, paras. 4-5.

[131] Michael N. Schmitt and Jeffrey S. Thurnher, above note 122, p. 259.

[132] AP I, Art. 57(2)(b).

metaphorically applied to machines."[133] This criterion cannot be "handed over" to machines and requires LAWS design and use to enable combatants to make these judgments.[134] It mandates human involvement at every juncture of a military attack; otherwise, a subsequent change in circumstances would make an attack unlawful.

In this regard, one may argue that attacks by many weapons, such as certain types of missiles, may not be suspended once they are launched, and that thus LAWS are no different. It must be borne in mind, however, that what make LAWS different in a way that necessitate the involvement of a person during its operation, are concerns regarding their "reliability", i.e. a measure of how often they fail, and "predictability", a measure of how the system will perform in a particular circumstance.[135] In order to be able to take precaution during an attack, combatants must be capable of limiting the effects of the weapons they use by reasonably foreseeing how it will function in any given circumstance and the effects that will result therefrom. Using LAWS carries a risk that determinations made by a user on the launching of an attack are invalidated by a change of circumstances. Not only can LAWS apply force at a specific time and place unknown to the user after activation, the consequences of them applying force will vary depending on the circumstances in the environment at the time of attack. This risk is increased as the environment in which LAWS operate varies over time. Considerations include rapid changes to the legal characterisation of military objectives, prolonged AWS attacks, expanded areas over which AWS may need to operate, the need for it to conduct a higher number of strikes and the introduction of a more dynamic, congested or complex operating environment.[136]

4. Conclusions and Suggestions

With LAWS posing serious challenges for compliance with fundamental rules of IHL for protection of civilians, action must be taken to prohibit the use of fully autonomous weapons and regulations must be adopted so that humans can exert "meaningful control" and judgment over the use of LAWS. Increased autonomy, whether as a result of the development and use of more advanced and complex weapon systems or the deployment of swarms of remote-controlled robots, exacerbates concerns with respect to these weapons' compliance with IHL. The

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[133] *See* Wendell Wallach and Colin Allen, *Moral Machines - Teaching Robots Right from Wrong*, Oxford University Press, New York, 2009, p. 17.

[134] *See* ICRC, "Artificial Intelligence and Machine Learning in Armed Conflict: A Human-Centered Approach", *International Review of the Red Cross*, Vol. 102, Issue 913, 2020, p. 472.

[135] These concerns and their legal implications have been extensively addressed by the ICRC, including in ICRC, above note 19, pp. 2-4

[136] *See* ICRC, above note 72, p. 9; Vincent Boulanin *et al.*, above note 10, p. 7

question of how to respond to these concerns has steadily climbed the international agenda since the issue was first discussed at the United Nations Human Rights Council in 2013. In this regard, the number of States, international and domestic organisations, policy makers, roboticists, and AI experts discussing LAWS and seeking a ban on their use is growing. Since then, ninety-seven States have publicly elaborated their views on LAWS, the vast majority of which consider human control and decision-making as critical to the acceptability and legality of LAWS. Among these, thirty States have called explicitly for a ban on LAWS,[137] including China[138] and Pakistan[139] in the Asia-Pacific region.

During the same time, the Campaign to Stop Killer Robots, a coalition of 165 non-governmental organisations in sixty-five countries, including Human Rights Watch, has been working to ban fully autonomous weapons and thereby retain a regime of requiring meaningful human control weapons.[140] In addition, since 2018, the UN Secretary-General has repeatedly called upon States to ban LAWS, considering them to be "politically unacceptable and morally repugnant".[141] Even the ICRC, as of May 2021, has endorsed a ban on fully autonomous weapons.[142]

Be that as it may, it was in December 2019 that international talks under the auspices of the CCW lead to the official adoption of a set of eleven Guiding Principles in the area of LAWS. These principles affirm the application of international law, particularly IHL, to LAWS, their development, review and deployment, the need for human control at various stages of their life cycle, the prohibition of anthropomorphizing LAWS, and the fact that the CCW is the appropriate framework to address LAWS.[143] Nonetheless, while of much value, these principles are merely intended to guide the CCW deliberations and do not seem to be an adequate or appropriate response, on their own, to the multiple concerns raised by increasing autonomy in weapons systems. Moreover, since decisions at the CCW are taken by consensus, a single State can block an agreement sought by the majority. So

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[137] *See* for States' Position Human Rights Watch, *Stopping Killer Robots - Country Positions on Banning Fully Autonomous Weapons and Retaining Human Control*, August 2020.

[138] *See* Government of China, *Working Paper Submitted to the CCW GGE on LAWS*, CCW/GGE.1/2018/WP.7, 11 April 2018.

[139] *See* Government of Pakistan, *Statement to the CCW Informal Meeting of Experts on LAWS*, 16 May 2014, available at https://reachingcriticalwill.org/images/documents/Disarmament-fora/ccw/2014/statements/13May_Pakistan.pdf.

[140] *See* for a full listing, the Campaign to Stop Killer Robots website: https://www.stopkillerrobots.org/endorsers.

[141] *See* UN Secretary-General's Address to the Paris Peace Forum, 11 November 2018, available at https://www.un.org/sg/en/content/sg/statement/2018-11-11/allocution-du-secrétaire-général-au-forum-de-paris-sur-la-paix.

[142] *See* ICRC, above note 75, p. 2.

[143] *See* above note 81.

far, several States such as the United States, Russia, Australia, and South Korea have rejected proposals to negotiate a new CCW protocol or standalone international treaty on LAWS, considering them to be "premature".[144] Given these developments, CCW does not appear to be the appropriate forum to create the necessary legal framework to deal with IHL challenges posed by LAWS.[145] It is for this reason that the call for new legally binding rules that specifically regulate LAWS is gaining prominence.[146] Nonetheless, as acknowledged by the ICRC, the negotiation of new legally binding rules and [other] efforts to develop aspects of an operational and normative framework under consideration in CCW GGE, can be "complementary and mutually reinforcing".[147]

Whatever the form and framework of these new rules may be, it is imperative that IHL be seen by stakeholders as an evolving and dynamic system, the re-interpretation and evolution of the rules of which are shaped by moral considerations, principles of humanity and the dictates of public conscience. In this regard, the very fundamental goal of IHL, namely the protection of the civilians from the effects of war, must at all times be given priority over other considerations, and any interpretation in the field should be made in a way which guarantees fulfilment of this goal.

In sum, and to achieve the compliance with IHL by LAWS, the following prohibitions and regulations constraining their use seem to be necessary:

- LAWS which by their nature select and engage targets without meaningful human control, should be prohibited. These are systems that are designed or used in a manner that makes it difficult to understand, predict and explain their effects and how they will perform in a particular circumstance. They are thus unpredictable, and eventually indiscriminate;
- Due to LAWS being incapable of making qualitative, context-dependent value judgments of situations, as and when they arise, or other IHL requirements that are primarily addressed to humans, use of LAWS to target human beings should be prohibited;

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[144] *See* for further references Human Rights Watch, above note 137, pp. 5, 9, 47, 53.

[145] *See for further reasons and references* Bonnie Docherty, "The Need for and Elements of a New Treaty on Fully Autonomous Weapons", in *Rio Seminar on Autuonomous Weapons Systesm*, Fundação Alexandre de Gusmão, Brasilia, 2020, pp. 227-228.

[146] *See* Human Rights Watch, *New Weapons, Proven Precedent - Elements of and Models for a Treaty on Killer Robots*, October 2020.

[147] *See* ICRC, above note 75, p. 4; *see also* Michael Biontino, "Challenges Towards a Regulatory Framework", in *Rio Seminar on Autonomous Weapons System*, Fundação Alexandre de Gusmão, Brasilia, 2020, pp. 211-221.

- Meaningful Human Control[148] is required at all times, particularly during the operation of LAWS in the battlefield with the option of deactivation and fail-safe mechanisms. Some believe that this will be achieved by means of controls in weapon system parameters, on the environment, and through human-machine interaction.[149] These controls have also been categorized as "decision-making", "technological", and "operational" components of Meaningful Human Control.[150] Regardless of the terminology used, these measures should be used to regulate the design and use of LAWS that are not prohibited, and as the ICRC has precisely indicated, through a combination of legally binding limits on:

  - The types of targets, such as constraining LAWS to objects that are military objectives by nature;
  - The duration, geographical scope and scale of use, including to enable human judgement and control in relation to a specific attack; and
  - Situations of use, such as constraining them to situations where civilians or civilian objects are not present.[151]

[148] *See* for reasons why using this term has benefits over other terms used by stakeholders Human Rights Watch, above note 146, pp. 21-23.

[149] Vincent Boulanin, *et al.*, above note 10, pp. 36-37.

[150] *See* Human Rights Watch, *The Need for and Elements of a New Treaty on Fully Autonomous Weapons*, June 2020, available at: https://www.hrw.org/sites/default/files/media_2020/06/202006arms_rio_autonomous_weapons_systems_2.pdf, p. 7.

[151] ICRC, above note 75, p. 10.