"Friend of Humans": An Argument for Developing Autonomous Weapons Systems

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"New eras don't come about because of swords; they're created by the people who wield them."
— Nobuhiro Watsuki

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Introduction[1]

With the introduction of robots[2] to the battlefield, critics and activists have raised doubts that echo a long history of opposition to landmines, aviation, submarines, and nuclear technologies.[3] War, however, is unavoidable, and weapons technology advancement is an inevitable consequence. Humanity's inability to live at peace has led combatants to seek enhanced weapons and strategies to defeat their adversaries more effectively.[4] More advanced weaponry never reduces humanity's propensity for violence. As Clausewitz notes, "[t]he tendency to destroy the adversary, which lies at the bottom of the conception of War, is in no way changed or modified through the progress of civilization."[5] While this tendency is a sad commentary on human nature, weapons development also provides a hidden opportunity to safeguard against unnecessary destruction and loss of life.

Technological advancement of weapons has led to better humanitarian protection for civilians not involved in conflicts. Despite the horrific exception of weapons of mass destruction, weapons development has also led to improved accuracy. For example, in World War II, aerial bombing campaigns resulted in devastating civilian causalities because air crews were not able to control the delivery of bombs with any effective precision. This resulted in

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[1] This topic was formulated in part upon a portion of an unpublished book, "When Weapons Become Warriors," on the Law Governing Fully Autonomous Fighting Vehicles, by the Honorable Evan J. Wallach, Judge, United States Court of Appeals for the Federal Circuit.

[2] Formally discussed as "Autonomous Weapon Systems" [hereinafter "AWS" or "AWSs"].

[3] Marco Sassòli, *Autonomous Weapons – Potential Advantages for the Respect of International Humanitarian Law*, PROF'LS IN HUMANITARIAN ASSISTANCE AND PROT. (Mar. 2, 2013), http://phap.org/articles/autonomous-weapons-%E2%80%93-potential-advantages-respect-international-humanitarian-law; Matthew Waxman & Kenneth Anderson, *Law and Ethics for Autonomous Weapon Systems: Why a Ban Won't Work and How the Laws of War Can*, HOOVER INST. 8 (Apr. 9, 2013), http://www.hoover.org/research/law-and-ethics-autonomous-weapon-systems-why-ban-wont-work-and-how-laws-war-can.

[4] P.W. SINGER, WIRED FOR WAR: THE ROBOTICS REVOLUTION AND CONFLICT IN THE 21ST CENTURY 5 (2009).

[5] RONALD ARKIN, GOVERNING LETHAL BEHAVIOR IN AUTONOMOUS ROBOTS 1 (2009) (quoting C. Von Clausewitz, *On the Art of War*, *in* THE MORALITY OF WAR: CLASSICAL AND CONTEMPORARY READINGS 115, 117 (Larry May, Eric Rovie & Steve Viner eds., 2005)).

civilian casualty estimates of up to 67 percent.[6] In Vietnam, aerial bombing accounted for more than 50,000 North Vietnamese civilian deaths by 1969.[7] In more recent conflicts, however, precision-guided munitions using mitigation methods are more effectively delivered on target, reducing the likelihood of collateral damage.[8] For example, in 2011, NATO aircraft conducted 17,939 armed sorties in Libya, employing approximately 7,700 precision-guided munitions.[9] The UN International Commission of Inquiry on Libya concluded that only 60 civilians were killed and 55 injured.[10] With the introduction of drones to the battlefield over the past decade, however, some argue that their precision fares no better than manned aircraft.[11] Stated differently, the highly technical capabilities of drones do not guarantee "surgical precision and the minimization of civilian casualties."[12] Nevertheless, the U.S. military is touting the utilization of robotic technology or autonomous weapons systems (AWS) as the next generation of weapons development in warfare.

Despite technological advancements, critics argue that ongoing AWS development and eventual full-scale use would actually increase loss of civilian life and widespread destruction,

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[6] William Saletan, *In Defense of Drones*, SLATE (Feb. 19, 2013), http://www.slate.com/articles/health_and_science/human_nature/2013/02/drones_war_and_civilian_casualties_how_unmanned_aircraft_reduce_collateral.html; *see also* Tim Maine, Jon Brachle & Art Arago, *Ethics and the Advancement of Military Technology*, *in* THE ETHICAL IMPERATIVE IN THE CONTEXT OF EVOLVING TECHNOLOGIES (2010), *available at* http://www.ethicapublishing.com/3CH9.htm ("In World War II, it took 108 B-17s dropping 648 bombs to destroy a target. In the Vietnam War, a similar target required 176 bombs. Now, only a few precision guided missiles can easily accomplish the same task, and do it more precisely.").
[7] Salentan, *supra* note 6.
[8] Naval War College, *CDE Brief | Panel Discussion: Collateral Damage Estimation*, YOUTUBE.COM (Oct. 23, 2012), http://www.youtube.com/watch?v=AvdXJV-N56A&list=PLamyp5uUR1YEwLbqC0IPrP4EhWOeTf8v&index=1&feature=plpp_video; *see also* Defense Intelligence Agency General Counsel, *Joint Targeting Cycle and Collateral Damage Estimation Methodology (CDM)* (Nov. 10, 2009), *available at* http://www.aclu.org/files/dronefoia/dod/drone_dod_ACLU_DRONES_JOINT_STAFF_SLIDES_1-47.pdf.
[9] Rep. of the Int'l Comm'n of Inquiry on Libya, U.N. Human Rights Council, 19th Sess., Feb. 25-Mar. 23, 2012, U.N. Doc. A/HRC/19/68 (Mar. 8, 2012).
[10] *Id.*
[11] Larry Lewis, *Drone Strikes: Civilian Causality Considerations*, JOINT & COAL. OPERATIONAL ANALYSIS CTR. (June 18, 2013), http://cna.org/sites/default/files/research/Drone_Strikes.pdf.
[12] Larry Lewis, *Drone Strikes in Pakistan Reasons to Assess Civilian Casualties*, CTR. FOR NAVAL ANALYSES 25 (Apr. 2014), http://www.cna.org/sites/default/files/research/COP-2014-U-007345-Final.pdf.

based in part on concerns fueled by Western literature and films that depict robotic machines turning on their creators.[13] These concerns are compounded by civilian causalities borne from drone strikes in areas such as Pakistan, Yemen, and Somalia.[14] Their focused criticisms revolve around the idea that mere robotic employment on the battlefield is legally, ethically, and morally unsupportable. For example, Human Rights Watch (HRW) released a report concluding that AWSs, by their very nature, shock the public conscience and will dehumanize warfare.[15] HRW, along with several other noteworthy participants, including roboticist Noel Sharkey, went on to release a separate report positing that AWSs will undermine Human Rights Law by depriving people of the rights to life, remedy, and dignity.[16] In contrast, AWS proponents note that such preemptive criticisms have actually detracted from healthy debate regarding the potential utility of AWS development. They also argue that AWSs would actually be more humane than human soldiers and would neither be programmed nor armed with the capacity for widespread destruction.

Notwithstanding either side of the debate, governments continue to develop AWSs as part of their national defense strategies, driven largely by two forces: public opinion and fiscal considerations. In the United States, political and strategic considerations coupled with public

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[13] Works such as "The Terminator," "The Matrix," or "I, Robot" illustrate this point. *See* I, ROBOT (20th Century Fox 2004); THE MATRIX (Warner Bros. Pictures 1999); THE TERMINATOR (Orion Pictures 1984). Opponents posit that humanity will become the architect of its own destruction by increasing AWS technologies availability. As such, critics utilize these fears as fodder for intense debate in an attempt to curtail or eliminate their development and usage. This premise does not discount the instances when debates have led to positive outcomes. Their opinions served to curtail horrific weapons that ultimately required regulation or outright prohibition. Examples include the binding international treaties banning the use of particular weapons such as the Biological Weapons Convention.

[14] Karen J. Greenberg, *Two Books Explore The High Cost Of Killing By Drone,* WASH. POST, Mar. 20, 2015, *available at* http://www.washingtonpost.com/opinions/the-moral-and-physical-destruction-wrought-by-drone-warfare/2015/03/20/ba580eb4-bb88-11e4-bdfa-b8e8f594e6ee_story.html.

[15] *Losing Humanity: The Case Against Killer Robots*, HUM. RTS. WATCH (Nov. 2012), *available at* http://www.hrw.org/sites/default/files/reports/arms1112ForUpload_0_0.pdf [hereinafter *Losing Humanity*].

[16] *Shaking the Foundations: The Human Rights Implications of Killer Robots*, HUM. RTS. WATCH (May 2014), *available at* http://www.hrw.org/sites/default/files/reports/arms0514_ForUpload_0.pdf [hereinafter *Shaking the Foundations*].

opinion have pressured leaders to reduce combat and civilian casualties.[17] In the Vietnam conflict, images of civilian causalities resulting from bombing campaigns reduced domestic support for the U.S. war effort. Over the past two decades, public access to information skyrocketed with the dawn of the Internet, and the general public now has a more "up close and personal" insight into the horrors of war. As a result, public opinion pressures have greatly increased both in volume and impact, gaining momentum by the public's ability to quickly disseminate its praise or censure.[18]

Contemporaneously, the costs of maintaining personnel, readiness and extended military campaigns have swelled defense budgets. Further compounding this issue are the immeasurable costs incurred from wounded personnel and loss of life. In response, U.S. military commanders are seeking cost-effective means to create safer distances between human operators and targeted belligerents on the battlefield, while concurrently safeguarding civilian life.[19] The increased use of unmanned aerial vehicles (UAVs) and drones in modern warfare has been the result. While drones, mostly remotely controlled by human counterpart, became significant over the past decade of warfare, autonomous technological development that removes human participation from specific functions has already begun. It is likely that major powers will continue this trend towards development and implementation of more autonomous robotic technology on the

[17] Waxman & Anderson, *supra* note 3, at 2.
[18] David D. Perlmutter, *Just How Big an Impact Do Pictures of War Have on Public Opinion?*, HISTORY NEWS NETWORK (Feb. 7, 2005), http://hnn.us/article/9880.
[19] Dan Parsons, *Budgets Permitting, Marines Could Be Fighting Alongside Robots by 2020s*, NAT'L DEF. MAG. (Jan. 2014), http://www.nationaldefensemagazine.org/archive/2014/January/Pages/BudgetsPermitting,MarinesCouldBeFightingAlongsideRobotsby2020s.aspx.

battlefield. Russia, China, Iran, and Israel are all currently undertaking similar development of AWS technologies, what to many has been perceived as a new international arms race.[20]

Elevated interest in these technologies has sparked calls for international regulation and prohibitions surrounding the use of AWSs, and discussions are underway. As with the development of any new weapon, questions arise under International Humanitarian Law (IHL), which governs the means and methods of war.[21] On its surface, IHL does not directly address AWSs. There are no international treaties or settled areas of customary international law that speak directly to AWS usage. Nevertheless, AWS use does not require a new legal paradigm because these machines are weapons systems at all times, not sentient beings. Thus, like all weapons, AWSs should be analyzed under the existing IHL paradigm, in order to address their potential utility. The United States, for its part, has already acknowledged this requirement and institutionalized it into the research and development parameters of AWSs. Assuming that these requirements are met, AWS utility will be aligned with the goals of other weapons development: improving the protection of civilians and safeguarding against widespread destruction.

This article posits that AWSs will perform warfighting functions in compliance with IHL norms more effectively than humans, thereby reducing collateral damage and avoiding unintended harm. In support of this argument, this article first highlights the background of AWSs. In particular, Part II provides a baseline understanding of robotic autonomy, the historical evolution of AWSs, and the expected outlook for continued AWS employment. Part III addresses the law applicable to AWSs, mentioned earlier. As a collateral legal consideration, this section also discusses the application of chivalry to the use of AWSs. Part IV discusses the

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[20] David Wood, *American Drones Ignite New Arms Race from Gaza to Iran to China*, HUFFINGTON POST (Nov. 27, 2012), http://www.huffingtonpost.com/2012/11/27/american-drones_n_2199193.html.
[21] International Humanitarian Law is also referred to as the "Law of Armed Conflict" (abbreviated as "LOAC").

key technological requirements and assumptions necessary to support this article's conclusion. Part V summarizes and discusses the various criticisms espoused by human rights groups and scholars.[22] Part VI describes and illustrates the reasons that AWSs can surpass humans in IHL compliance. Finally, Part VII will highlight the long-term strategy that should be implemented to realize this goal. This article's intent is to refocus the debate on the benefits AWSs can offer by surpassing human compliance with IHL: preventing unnecessary loss of life and destruction.

I. Background

A. Understanding "Autonomy"

Several terms tossed around when discussing AWSs merit explanation. There are various interpretations of "autonomy," which confuse the technical understandings and realistic application. Often the discussion derailed by philosophical debates that apply our understanding of human autonomy on a robotic system. Human autonomy finds its historical underpinnings in ethics and morality based on human choice—a significant disparity. Highlighting this issue, ethics and philosophy authors Merel Noorman and Deborah Johnson note:

> [A]utonomy implies acting on one's own, controlling one's self, and being responsible for one's actions. Being responsible for one's action in particular requires that the person had some kind of control over the outcome at issue. Thus, framing robots as becoming increasingly autonomous may suggest that robots will be in control and that human actors will, therefore, not be in control.[23]

Clearly, the term "autonomy" is clouded by interpretations that conflate or equate human free will and behavior with the concept of robotic independence. As we will discuss later, the conflation of human autonomy with robotic autonomy underscores many of the criticisms against

[22] Admittedly, this article's conclusion is premised upon the technological development and availability of sophisticated sensors and artificial intelligence capable of carrying out functions critics claim are currently impossible. Throughout history, humanity has accomplished feats that were considered impossible until they were accomplished (e.g. inventing the airplane, breaking the sound barrier, space travel, landing on the moon, etc.).
[23] Merel Noorman & Deborah G. Johnson, *Negotiating Autonomy and Responsibility in Military Robots*, 16 ETHICS & INFO. TECH. 51, 52 (2014).

AWSs, including the question of who is responsible for mishaps. To distinguish these, one must analyze the relationship between human control and robotic autonomy.

To begin with, robotic autonomy is more fundamentally understood in terms of *automation*. Roboticist Thomas Sheridan describes automation as "the mechanization of well-defined processes, in which routine tasks are translated into some formalized structure that allows human operators to delegate some level of control to an automated system."[24] Thus, automated systems take over part of a process previously done by humans, potentially performing it more efficiently, faster, or more accurately.[25] Sheridan and Verplank (1978) proposed a scale of automation where, on the lower end of the scale, automated systems are directly controlled humans, and on the higher end of the scale, human choices and control are more limited.[26] For example, in the early twentieth-century, car assembly lines employed automated railings and conveyor belts to better enable direct human production of the automobile. In contrast, more modern car assembly plants employ a variety of machines that assemble the automobile along the various stages of the production line. Sheridan and Verplank conclude that automated systems achieve autonomy when all of the machine's processes no longer require human interaction or control.[27] However, humans do remain a part of the design, programming, and upkeep of the automated system.

Sheridan and Verplank's automation scale serves as the foundation for current interpretations of robotic autonomy.[28] Author P.W. Singer describes robotic autonomy as "the relative independence of a robot . . . [that] is measured on a sliding scale from direct human

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[24] *Id.* at 57 (discussing THOMAS B. SHERIDAN & WILLIAM L. VERPLANK, HUMAN AND COMPUTER CONTROL OF UNDERSEA TELEOPERATORS 6-12 (1978)).
[25] *Id.*; *see also* THOMAS B. SHERIDAN, TELEROBOTICS, AUTOMATION, AND HUMAN SUPERVISORY CONTROL (1992).
[26] Noorman & Johnson, *supra* note 23, at 57.
[27] *Id.*
[28] *Id.*

operation at the low end to what is known as 'adaptive' at the high end."[29] This definition also describes a range of robot behavior where, on the lowest ebb, the machine's ability is under full control of its human counterpart. Terms such as "remote controlled" are often associated with this degree of autonomy. Graduating along this scale, human operation recedes and robotic independence increases. Certain functions become automatic or, in some cases, chosen by the machine, based on the programmed decision-processing capability, which utilizes data received from sensory inputs. The "adaptive" behavior noted on the high end refers to an AWS's ability to gather information in new ways and to learn, update, or change what it should search out.[30] However, this learning ability must be distinguished from human adaptive behavior. Adaptive behavior in humans suggests an indeterminate number of possibilities influenced by free will. For robots, probabilistic algorithms enable a system to adapt and learn to perform particular tasks and the extent to which its behavior can vary is constrained by its human developers and operators.[31] While some inherent uncertainty about the nature of robotic adaptive behavior remains, the distinction from its human counterpart is more readily apparent: robotic behavior parameters are controlled by humans—who remain a part of the process, whether at the developmental, operational, and/or maintenance phases.

For their part, the DoD described autonomous systems as ''self-directed toward a goal in that they do not require outside control, but rather are governed by laws and strategies that direct their behavior."[32] According to the DoD, ''[a]n autonomous system is able to make a decision based on a set of rules and/or limitations. It is able to determine what information is important in

[29] SINGER, *supra* note 4, at 74.
[30] *Id.*
[31] Noorman & Johnson, *supra* note 23, at 58.
[32] U.S. DEP'T OF DEF., REFERENCE NO. 11-S-3613, UNMANNED SYSTEMS INTEGRATED ROADMAP FY2011-2036, 43 (2011) (quoted in Noorman & Johnson, *supra* note 23, at 58).

making a decision."[33] The DoD's understanding of autonomy is distinct from automated behavior where an automated machine acts more repetitively along a preprogrammed path toward an anticipated outcome.[34] However, the Defense Science Board's (DSB) report on the role of autonomy in DoD systems identifies the need for a separate understanding of robotic autonomy from human application. The DSB defined autonomy as a "capability (or a set of capabilities) that enables a particular action of a system to be automatic or, within programmed boundaries, 'self-governing.'"[35] The report further explained the need to constrain the definitional understanding, because

> the word "autonomy" often conjures images in the press and the minds of some military leaders of computers making independent decisions and taking uncontrolled action. While the reality of what autonomy is and can do is quite different from those conjured images, these concerns are—in some cases—limiting its adoption. It should be made clear that all autonomous systems are *supervised* by human operators at some level, and autonomous systems' software embodies the designed limits on the actions and decisions delegated to the computer. Instead of viewing autonomy as an intrinsic property of an unmanned vehicle in isolation, the design and operation of autonomous systems needs to be considered in terms of human-system collaboration.[36]

Therefore, in its Directive 3000.09, Autonomy in Weapon Systems, the DoD explicitly provided that AWSs shall be designed to allow for humans to exercise judgment over the use of force.[37] Taking the DSB's report into account, the DoD framed the understanding of autonomy within the directive as one of human involvement within the various stages of development (e.g., design, manufacturing, programming, and testing) and subsequent operation.[38]

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[33] *Id.*
[34] Norman & Johnson, *supra* note 22, at 58.
[35] DEF. SCI. BD., U.S. DEP'T OF DEF., TASK FORCE REPORT: THE ROLE OF AUTONOMY IN DOD SYSTEMS 1 (July 2012).
[36] *Id.* at 1-2.
[37] U.S. DEP'T OF DEF., DIRECTIVE NO. 3000.09, AUTONOMY IN WEAPON SYSTEMS 2 (Nov. 2, 2012) [hereinafter DOD DIRECTIVE 3000.09] ("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.").
[38] *Id.* at 7.

While the notion of a human–system collaboration is easier to conceptualize in the development stage, such collaboration becomes more complex during the operational phase. Within this phase, the decision-making process for AWSs (as with military personnel) is commonly referred to as the "Observe, Orient, Decide, and Act (OODA) loop," or "the loop" for short.[39] Within this loop, a human can play a direct role in directing or affecting one or all of the categories within a robotic system. For example, a human can directly control where the robot focuses its sensors or what action the machine will take remotely. However, as technology improves, the robot could take on functions related to each stage. For each stage, a human's role may become limited to "deciding whether to override and veto a machine-initiated [action]."[40] In this, the human–system collaborative relationship becomes apparent: "the greater the machine's ability to observe, orient, decide and act [without human input or direction], the greater its autonomy."[41] Returning to Singer's sliding scale, the loop's scale relative to autonomy ranges from direct human operation ("in the loop"), to human monitoring and affecting AWS decision-making processes ("on the loop"), to the absence of human interaction ("out of the loop").[42]

There are several terms used in military and robotic parlance to describe how autonomy is measured. "Remote-controlled" or "tele-operated" systems refer to machines controlled or directed from a distance (such as within a military facility) by human operator who is in the loop,

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[39] John R. Boyd, The Essence of Winning and Losing (June 28, 1995) (unpublished lecture notes), http://tobeortodo.com/wp-content/uploads/2011/11/essence_of_winning_losing.pdf. For a more detailed discussion on the "OODA loop" as applied to robotic systems, see William C. Marra & Sonia K. McNeil, *Understanding "The Loop": Regulating the Next Generation of War Machines*, 36 HARV. J.L. & PUB. POL'Y 1139 (2012) (internal citations omitted).

[40] Kenneth Anderson, Daniel Reisner & Matthew Waxman, *Adapting the Law of Armed Conflict to Autonomous Weapon Systems*, 90 INT'L L. STUD. 386, 389 (2014).

[41] Marra & McNeil, *supra* note 39, at 1150; SINGER, *supra* note 4, at 74.

[42] *Id.* at 1144.

controlling most or all of the operations of the robot.[43] Basic examples of remote controlled machines included model boats and airplanes. More modern military examples of tele-operated machines would be unmanned aerial vehicles (UAVs), such as the Reaper and Predator drones.[44] Earlier versions of these systems involved humans directing each action within the decision-making process. For example, a human UAV operator would sit in a land-based cockpit, controlling all functions of in-flight operations no differently than would a pilot of a conventional aircraft.

Semi-autonomous systems, on the other hand, can perform some tasks without human intervention, but they still require a human operator to undertake certain functions.[45] So a human operator is more removed from the robot's loop, but still retains monitoring and override capabilities in some instances.[46] Examples include UAVs that can automatically take off, conduct in-flight refueling, and subsequently land without direct human interaction.[47] Other semi-autonomous platforms include ship-based self-defense systems, which we will discuss later on. DoD Directive 3000.9 clarifies the concept of "semi-autonomous," as applied to AWSs, as being able to "only engage individual targets or specific target groups that have been selected by a human operator."[48] This explanation implies a constrained relationship, where the AWS has preset rules and parameters and the human operator is available to make the ultimate decision or

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[43] Benjamin Kastan, *Autonomous Weapon Systems: A Coming Legal "Singularity"?,* 2013 U. ILL. J.L. TECH. & POL'Y 45, 49 (2013).
[44] *Id.*
[45] DOD DIRECTIVE 3000.09, *supra* note 37, at 14; *see also* Tyler D. Evans, Note, *At War With The Robots: Autonomous Weapon Systems and the Martens Clause*, 41 HOFSTRA L. REV. 697, 699 (2013).
[46] Evans, *supra* note 45, at 702.
[47] *X-47B Operates Aboard Theodore Roosevelt*, NAVY NEWS SERVICE (U.S. NAVY) (Nov. 10, 2013), http://www.navy.mil/submit/display.asp?story_id=77580.
[48] DOD DIRECTIVE 3000.09, *supra* note 37, at 14.

to intervene if the circumstances warrant.[49] With few exceptions, semi-autonomy would slide right on the autonomy scale, from in the loop to on the loop.[50]

Full autonomy is more complex and remains the subject of much debate at legal and philosophical levels.[51] Full autonomy implies that the robot can act without human direction, assistance, or input, and can adapt to its environment independently.[52] More extreme interpretations suggest that a machine that has full autonomy will become "self-aware" and may choose to go rogue because of free will.[53] Undoubtedly, these interpretations are derived from the conflation of human with robotic autonomy, as unpacked in Part V. However, the DoD directive does not go to this extreme. The directive defines a fully autonomous weapons system as able to "select and engage targets without further intervention by a human operator."[54] Furthermore, the directive defines AWSs as inclusive of both "human-supervised [AWSs] that are designed to allow human operators to override operation of the weapon system [and those that] can select and engage targets without further human input after activation."[55] Placing this in the context of autonomy scale and the loop, the directive implies that a human operator is on the loop for monitoring and overriding purposes, but sliding to the right, toward "out of the loop" where there is no human interaction.[56] Still, the directive's overarching theme of human

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[49] Marra & McNeil, *supra* note 39, at 1179.
[50] SINGER, *supra* note 4, at 123-26. A related investigation on semi-autonomy includes the USS Vincennes downing of Iranian Airbus in 1988. In that event, the on-board computer defense system (Aegis) was operating in semi-automatic, in which human operators interfaced with the system in order to verify the nature of detected threats. The Aegis system relayed to the human operators that the Airbus as an "unidentified assumed hostile" aircraft. When the Airbus failed to respond to repeated challenges over both the military and international emergency distress frequencies, the Vincennes shot down the Iranian Airbus. *See* U.S. DEP'T OF DEF., FORMAL INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE DOWNING OF IRAN AIR FLIGHT 655 ON 3 JULY 1988, at 4, 44, 49-50 (Aug. 19, 1988).
[51] ARKIN, *supra* note 5, at 8.
[52] SINGER, *supra* note 4, at 74-75.
[53] Robert Sparrow, *Killer Robots*, 24 J. APPLIED PHIL. 62, 70 (2007).
[54] DOD DIRECTIVE 3000.09, *supra* note 37, at 13-14.
[55] *Id.*
[56] *Id.*

supervision involved in the development, testing, and operation of AWSs suggests that the DoD has no immediate plans to place itself "out of the loop."[57]

Clashing viewpoints have served to obfuscate and misrepresent the practical reality of the term "full autonomy" in current technologies, as applied to AWSs.[58] As we will see in Part IV, fully autonomous AWSs, as described by the DoD, will require a more sophisticated system architecture and artificial intelligence (AI) in order for the system to carry out its objectives without human intervention and be IHL compliant.[59] This level of AI, let alone more advanced AI, where a robot is capable of exceeding human counterparts, is currently not available.[60] Recognizing this technological gap, which is compounded with the ongoing confusion surrounding robotic autonomy, the United States does not plan to pursue or employ out-of-the-loop machines in the near term, with the possibility of a policy change when technology evolves.[61] In the interim, humans will remain involved to some extent in the machines' processes, if for no other reason than to monitor AWS progress.[62] Even if AWS capabilities evolve to a sophisticated level exceeding human capabilities, humans will still be needed to design, program, deploy, and debrief AWSs.[63] Moreover, as a precautionary measure, AWS programming will undoubtedly include human-developed restrictions on the AWS AI to preclude mishaps or malfunctions leading to unnecessary death and destruction. Notions

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[57] *Id.* at 2.
[58] 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, 268 (2013).
[59] ARKIN, *supra* note 5, at 39; *see also* Evans, *supra* note 45, at 706.
[60] SINGER, *supra* note 4, at 79 ("This idea of robots, one day being able to problem-solve, create, and even develop personalities past what their human designers intended is what some call "strong AI." That is, the computer might learn so much that, at a certain point, it is not just mimicking human capabilities but has finally equaled, and even surpassed, its creators' human intelligence.").
[61] DOD DIRECTIVE 3000.09, *supra* note 37, at 7-8; *see also* Hum. Rts. Watch & Int'l Hum. Rts. Clinic, *Review of the 2012 US Policy on Autonomy in Weapons Systems*, HUM. RTS. WATCH (Apr. 16, 2013), *available at* http://www.hrw.org/news/2013/04/15/review-2012-us-policy-autonomy-weapons-systems.
[62] Schmitt & Thurnher, *supra* note 58, at 280.
[63] *Id.* at 235.

suggesting that evolved AWSs will become self-aware, "go rogue," or overtake humans in functions or policy decisions is pure science fiction; they should be disregarded in any serious AWS discussions.[64] For the foreseeable future, humans will never be fully out of the loop and the term "autonomous weapons system" should be interpreted in light of the DoD's directive.[65]

B. Historical Development and Usage

Use of unmanned or robotic systems is not a novel concept in warfare.[66] Since the 1970s, the U.S. Navy has employed a variety of mounted defensive systems to safeguard against fixed wing aircraft and anti-ship missiles. For example, the Phalanx Close-in Weapons System (CiWS) employs a mounted gun drive with detection sensors and can operate in automatic modes without intervention by a human operator.[67] The SeaRAM system is a successor to this weapons platform, replacing the CiWS gun mount with an 11-missile launching system with enhanced sensor capabilities and semi-autonomous modes.[68] The Republic of Korea has employed a defensive robotic sentry known as the Samsung SGR-A1 along the demilitarized zone (DMZ).[69] This machine employs K-4 machine guns and contains sensors capable of selecting human

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[64] *Id.* at 242. Such philosophical debates about the limitations on implementing machines as a substitution for humanity as a general practice are beyond the scope of this article.
[65] *Id.* at 235.
[66] The first attempt to develop unmanned aircraft included the "flying bomb" or "aerial torpedo" from 1913-1918 by Elmer Sperry in coordination with the U.S. Navy (later dubbed the Curtiss-Sperry Flying Bomb). The concept involved using an aircraft to fly in an automatic mode to deliver explosives to a designated target. Although the program was largely considered unsuccessful, on March 6, 1918, the "flying bomb" made the first stabilized flight, which was conducted by automatic control. *See* Lee Pearson, *Developing the Flying Bomb*, NAVAL HIST. & HERITAGE COMMAND, http://www.history.navy.mil/download/ww1-10.pdf.
[67] John Pike, *MK 15 Phalanx Close-In Weapons System (CIWS)*, FED'N OF A. SCI. MIL. ANALYSIS NETWORK (Jan. 9, 2003), http://www.fas.org/man/dod-101/sys/ship/weaps/mk-15.htm.
[68] Product Description of SeaRAM Anti-Ship Missile Defense System Technical Specifications, RAYTHEON COMPANY, http://www.raytheon.com/capabilities/products/searam/.
[69] Jean Kumagai, *A Robotic Sentry for Korea's Demilitarized Zone*, IEEE SPECTRUM (Mar. 1, 2007), http://spectrum.ieee.org/robotics/military-robots/a-robotic-sentry-for-koreas-demilitarized-zone (commenting on the SGR-A1's utility in the DMZ) ("Unlike the border between the United States and Mexico or even those separating Israel from the occupied territories, the demilitarized zone that stretches for 250 kilometers between South and North Korea is patrolled along its entire length.").

targets entering the DMZ.[70] It also contains non-lethal capabilities such as rubber bullets.[71] The SGR-A1 currently operates at the direction of a human controller, but it can also operate in an automatic mode capable of engaging targets independently.[72] A key limitation of this technology, however, is that the SGR-A1 cannot distinguish combatant and civilian.[73] Thus, when a human bypasses the numerous warning signs into the DMZ, the system automatically considers that person an enemy.[74] Still, the system can detect differences between shapes and certain behaviors.[75] For example, the SGR-A1 can interpret a human's arms held high, indicating surrender, and will thus not fire at them.[76] Additionally, the system can issue verbal warnings at specified distances prior to firing, as a means of promoting surrender.[77] Despite the availability of these automatic features, however, humans currently still retain firing authority.[78] In essence, the SGR-A1 serves as a sophisticated, "on-the-loop," area-denial weapon with more safeguards than the ordinary landmines employed in the DMZ.[79]

Another noteworthy machine is iRobot's PackBot, developed in coordination with the Defense Advanced Research Projects Agency (DARPA) in 1998.[80] Over time, subsequent work by outside entities expanded DARPA's original research leading to variations in design. The IRobot corporation's 510 Series PackBot performs numerous functions such as bomb disposal

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[70] *Seoul Deploys Armed Robot in DMZ*, CHOSIN ILBO ENGLISH EDITION (July 14, 2010), http://english.chosun.com/site/data/html_dir/2010/07/14/2010071400403.html.
[71] Erik Sofge, *Top 5 Bomb-Packing, Gun-Toting War Bots the U.S. Doesn't Have*, POPULAR MECHANICS (Oct. 1, 2009), http://www.popularmechanics.com/technology/military/4249209.
[72] *Seoul Deploys Armed Robot in DMZ*, *supra* note 70.
[73] *Samsung SGR-A1 Sentry Guard Robot*, GLOBALSECURITY.ORG, http://www.globalsecurity.org/military/world/rok/sgr-a1.htm (last updated Nov. 7, 2011).
[74] *Id.*
[75] *Id.*
[76] *Id.; see also* ARKIN, *supra* note 5, at 93-94.
[77] *Id.*
[78] Sofge, *supra* note 71.
[79] In light of the Ottawa Treaty, the SGR-A1 can serve as a technological alternative or replacement to traditional landmines. *See* The Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction, Mar. 1, 1999, 2056 U.N.T.S. 241.
[80] SINGER, *supra* note 4, at 22.

and similarly dangerous missions for forces engaged in ground warfare.[81] The PackBot has eight separate payload bays and hookups to enable users to adapt the machine to be a variety of things, such as a mine detector and chemical and biological weapons sensor.[82] The explosive ordinance disposal (EOD) version of the PackBot used in Iraq contained an extendable arm mounted with a high-powered zoom camera and a claw-like gripper.[83] Newer PackBots are equipped with semi-autonomous capabilities such as "retro-traverse," which allows the machine to automatically retrace its previous path to restore communications with human operators in the event of disruption.[84] Other PackBot variants include gun-sighting optics and weapons systems further enabling warfighters.[85]

No discussion about AWSs is complete without addressing the widely used UAVs. These devices made their first, albeit ineffective, appearance in the American Civil War, where both sides launched balloons loaded with explosive devices.[86] In World War II, the Japanese launched 9,000 similar balloon bombs between November 1944 and April 1945.[87] Of the balloons bombs launched, 1,000 made it to North America.[88] On May 5, 1945, one of the last Japanese balloon bombs landed near a church picnic in Oregon, killing a pregnant woman and

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[81] iROBOT CORPORATION, iROBOT 510 SPECIFICATIONS MANUAL 3-4 (2011-2012), http://www.irobot.com/us/learn/defense/~/media/3D0E32280AC94F52BC2C95E1B59BB1A8.ashx [hereinafter iRobot Packbot Manual].
[82] *Id.*
[83] SINGER, *supra* note 4, at 22.
[84] iRobot Packbot Manual, *supra* note 81, at 4.
[85] Ed Grabianowski, *How Military Robots Work*, HOWSTUFFWORKS.COM, http://science.howstuffworks.com/military-robot3.htm.
[86] Jim Garamone, *From U.S. Civil War to Afghanistan: A Short History of UAVs*, DEFENSE.GOV (Apr. 16, 2002), http://www.defense.gov/News/NewsArticle.aspx?ID=44164.
[87] Johanna Rizzo, *Japan's Secret WWII Weapon: Balloon Bombs*, NAT'L GEOGRAPHIC DAILY NEWS, (May 27, 2013), http://news.nationalgeographic.com/news/2013/05/130527-map-video-balloon-bomb-wwii-japanese-air-current-jet-stream/.
[88] *Id.*; *see also* Bill Miller, *Japanese Balloon Bomb Killed 7*, MAIL TRIB. (Nov. 22, 2009), http://www.mailtribune.com/apps/pbcs.dll/article?AID=/20091122/NEWS/911220338/-1/life.

five children.[89] On June 13, 1944, Nazi Germany employed the more advanced V-1 rocket/flying bomb system, which killed over 6,000 people and injured 17,000 during the war.[90] In September of 1944, the Nazis launched the V-2 as a successor platform capable of travelling at 3,500 miles per hour with a 2,000 pound warhead.[91] After WWII, the United States developed surveillance drones such as the U.S. Army's SD-2 (MQM-58 Overseer).[92] Employed from 1958 to 1966, this platform was designed as a reconnaissance drone that was later weaponized by adding the capability to distribute a chemical or bacteriological agent.[93]

More sophisticated UAVs came into service during the U.S. campaign in Vietnam. For example, the Firebee drone (AQM-34), equivalent in size to a modern day Predator, "flew more than 34,000 [Intelligence, Surveillance, and Reconnaissance or ISR] sorties over Southeast Asia during the Vietnam War—from Japan and China to Vietnam and Thailand."[94] Later successors include the Tomahawk missile system which currently uses "a two-way data link, allowing it to be remotely piloted like a UAV and guided towards its target from any of its on-board sensors."[95] However, unlike these previous platforms, UAVs only gained notoriety within the past 10–15 years, during the U.S. campaigns in Iraq and Afghanistan. In addition to surveillance functions, more modern UAVs with offensive capabilities were deployed to target enemy combatants. For example, the General Atomics Predator C ("Avenger") employed in Afghanistan in 2011 contains significant payload capacity for multiple sensors and an internal

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[89] David Kravets, *May 5, 1945: Japanese Balloon Bomb Kills 6 in Oregon*, WIRED (May 10, 1945), http://www.wired.com/2010/05/0505japanese-balloon-kills-oregon/.
[90] Tony Long, *June 13, 1944: V-1 Rocket Ushers in a New Kind of Warfare*, WIRED (June 13, 2007), http://www.wired.com/science/discoveries/news/2007/06/dayintech_0613.
[91] *Id.*
[92] John D. Blom, *Unmanned Aerial Systems: A Historical Perspective*, OCCASIONAL PAPER 37, 51 (Sept. 2010), *available at* https://www.hsdl.org/?view&did=9595.
[93] *Id.*
[94] Andrew Tarantola, *The Ryan Firebee: Grandfather of the Modern UAV*, GIZMODO.COM (Aug. 22, 2013), http://gizmodo.com/the-ryan-firebee-grandfather-to-the-modern-uav-1155938222.
[95] Andrew Tarantola, *The Newest Tomahawk Is a Mighty Morphin' Cruise Missile*, GIZMODO.COM (Mar. 6, 2014), http://gizmodo.com/this-tomahawk-is-a-mighty-morphin-cruise-missile-1536509027.

weapons bay that houses 3,500 pounds of precision munitions.[96] The use of offensive drones has also expanded to include the targeting of members of terrorist organizations such as the 2013 drone strike that killed Adan Garar, an al-Shabab member linked to the Westgate Mall massacre in Nairobi, Kenya that killed 67 people.[97] Additionally, these offensive platforms now incorporate functions such as autonomous functions such aerial refueling and take-off and landings. For example, Northrop Grumman's X-47B program is capable of fully autonomous flight and can carry increased payloads.[98] The X-47B has been undergoing testing aboard aircraft carriers such as the USS Theodore Roosevelt (CVN 71) as of November 2013.[99]

C. Future Outlook

As legal scholars Kenneth Anderson and Matthew Waxman suggest, AWS development and use are inevitable.[100] The International Committee of the Red Cross (ICRC) agrees that AWSs attract "considerable interest and research funding so such weapons may well be a feature of warfare in the future."[101] U.S. leaders will continue to pursue more evolved AWSs for a variety of reasons. If AWSs could reduce military personnel and civilian casualties, then politicians might be able to maintain heightened domestic public support during conflicts. Equally important, austere fiscal times call for innovative solutions and employment of cost-effective weapons systems. If AWSs can serve as cost-effective force multipliers to human counterparts, then military leaders would find them more desirable within constrained budgets.

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[96] General Atomics Aeronautical, *Predator C Avenger UAS Specifications*, http://www.ga-asi.com/products/aircraft/predator_c.php.
[97] Jim Michaels, *Drones: The Face of the War on Terror*, USA Today (Mar. 20, 2015), http://www.usatoday.com/story/news/world/2015/03/19/drones-pakistan-iraq/25033955.
[98] Northrup Grumman, *X-47B UCAS Specifications*, http://www.northropgrumman.com/Capabilities/X47BUCAS/Pages/default.aspx.
[99] *X-47B Operates Aboard Theodore Roosevelt*, *supra* note 47.
[100] Waxman & Anderson, *supra* note 3, at 2.
[101] ICRC Resource Center, *Autonomous Weapons: States Must Address Major Humanitarian Ethical Challenges* (Sept. 2, 2013), http://www.icrc.org/eng/resources/documents/faq/q-and-a-autonomous-weapons.htm [hereinafter ICRC Autonomous Weapons FAQ].

The cost of an explosive ordinance disposal (EOD) technician is approximately $1.0 million, whereas EOD robots only cost approximately $117,000. These estimates do not include the high costs for maintaining military readiness and specialized training these technicians receive over the long term.[102] More importantly, these estimates do not include the long-term costs for medical care for injured technicians or the immeasurable cost associated with the loss of a human life. All things considered, an AWS could provide a life and cost-saving solution by relieving warfighters of certain tasks over time.[103] As discussed in Part VI, AWSs capable of offensive attack could serve in a variety of combat roles in more hazardous environments, thus safeguarding military personnel. While developing an AWS is expensive, it is not nearly as costly, time-consuming, or resource prohibitive as nuclear weapons development.[104] While developing nuclear weapons requires vast resources and a robust infrastructure, artificial intelligence research can be done in a fairly constrained environment with more modest resources.[105] Moreover, once the technology is developed, mass production of these machines would lower the costs drastically. For these reasons, the situation is analogous to any other arms race.[106] State and non-state actors will certainly pursue such technology since the barriers to entry are much lower, with greater tactical advantages readily available.

A variety of institutions are investing heavily in AWS development. Recent analysis suggests that current markets for military robotics were at $4.5 billion in 2013 and will reach $12

[102] Sarah Barban, *An Elite Group of Airmen Call Dover Home*, Dover Post (Apr. 19, 2013), http://www.doverpost.com/article/20130419/NEWS/130419746/1001/NEWS; *see also* Sebastian Rupley, *Bomb-sniffing Bot,* PCMAG.com (Sept. 13 2006), http://www.pcmag.com/article2/0,2817,2013702,00.asp#disqus_thread.
[103] *Id.*; *see also Seoul Deploys Armed Robot in DMZ*, *supra* note 70.
[104] John O. McGinnis, *Accelerating AI*, 104 NW. U. L. REV. 1253, 1262 (2010).
[105] *Id.*
[106] *Id.* at 1267.

billion by 2019.[107] DARPA invests extensive resources into developing more advanced military mechanisms as a part of their overall 2014 budget of $2.8 billion.[108] Along with the PackBot mentioned earlier, another technology born of this research is the Counter Rocket-Propelled Grenade and Shooter System with Highly Accurate Immediate Response (CROSSHAIRS) program.[109] Through this program, DARPA sought to develop a vehicle-mounted detection and weapons unit capable of locating enemy ground forces and snipers, whether it is moving or stopped.[110] This system was capable of destroying incoming threats such as rocket-propelled grenades and mortars by firing directly on them using automated, radar-guided weapons.[111] Similar projects included the U.S. Army's Counter-Rocket, Artillery, and Mortar (C-RAM) program utilized in asymmetric environments such as Afghanistan to counter indirect fire threats.[112] DARPA also periodically supported competitions for roboticists and engineers, to help promote autonomous systems development.[113] The DARPA Urban Challenge in 2007 was premised upon making "one-third of all military land vehicles be autonomous by 2015 and two-thirds by 2025."[114] DARPA supported open competitions from 2012 through June 2015 for

[107] Winter Green Research, *Military Ground Robot Mobile Platform Systems of Engagement -- Markets Reach $12.0 Billion By 2019* (May 22, 2013), http://www.reportsnreports.com/reports/248754-military-robot-mobile-platform-systems-of-engagement-market-shares-strategies-and-forecasts-worldwide-2013-2019.html.
[108] DARPA, *DARPA 2014 Budget Projections*, *available at* http://www.darpa.mil/NewsEvents/Budget.aspx; *see also* Tonia Sudiano, *Will the 21th Century Become the Age of Killer Robots?* (Oct. 17 2013), http://www.united-academics.org/magazine/design-technology/will-the-21th-century-become-the-age-of-killer-robots/.
[109] Zak Rose, *DARPA: A Glimpse of All Tomorrow's Weapons*, GEOPOLITICALMONITOR.COM (Dec. 3, 2012), http://www.geopoliticalmonitor.com/darpa-a-glimpse-of-all-tomorrows-weapons-4758/.
[110] *Id.*
[111] *Id.*
[112] U.S. Army, *COUNTER-ROCKET, ARTILLERY, MORTAR (C-RAM)*, *available at* http://www.msl.army.mil/Pages/C-RAM/default.html.
[113] DARPA, *DARPA Robotics Challenges*, *available at* http://www.darpa.mil/Our_Work/TTO/Programs/DARPA_Robotics_Challenge.aspx.
[114] DARPA, *DARPA Urban Challenge Media Fact Sheet* (Mar. 2, 2007), *available at* http://oshkoshdefense.com/wp-content/uploads/2013/09/DARPA_Media_Fact_Sheet_3-13-07.pdf.

developers to explore the development of semi-autonomous robots with the endurance and strength to operate within non-permissive conditions such as natural disasters.[115]

Aside from DARPA's developments, numerous companies continue to compete for government contracts to fulfill robotic military requirements. Four companies, including HDT Robotics, iRobot, Northrop Grumman, and QinetiQ Robots, recently ran their M240 machine gun–armed robots through a live-fire demonstration at Fort Benning, GA—an event that has been dubbed the "Robotic Rodeo."[116] Northrop Grumman's Carry-all Mechanized Equipment Landrover (CaMEL) can be fitted with automatic weapons, anti-tank missiles and grenade launchers.[117] It can run for more than 20 hours on 3.5 gallons of fuel, according to the company, and can carry a load of 1,000 pounds.[118] It also can produce power to charge batteries or power other systems.[119]

Academic institutions are equally engaged in developing related technology. The Massachusetts Institute of Technology (MIT) is developing a system capable of tracking people through walls with impressive accuracy by using radio waves.[120] Their team demonstrated the system, which uses low-power signals to track human movement and to decipher motions behind walls, at MIT's Computer Science and Artificial Laboratory (CSAIL) in October of 2013.[121] AWSs with anti-sniper capabilities would greatly benefit from this technology's utility. To some extent, certain companies have refused working with DoD to focus on potentially more lucrative commercial opportunities. In one recent instance, the robotics firm Schaft developed an award-

[115] *DARPA Robotics Challenges*, *supra* note 113.
[116] Allen McDuffee, *Killer Robots With Automatic Rifles Could Be on the Battlefield in 5 Years*, WIRED (Oct. 18, 2013), http://www.wired.com/dangerroom/2013/10/weaponized-military-robots/.
[117] *Id.*
[118] *Id.*
[119] *Id.*
[120] Nancy Owano, *MIT Team Shows System That Tracks People Through Walls*, PHYS.ORG (Oct. 16, 2013), http://phys.org/news/2013-10-mit-team-tracks-people-walls.html.
[121] *Id.*

winning bipedal robot capable of performing disaster response tasks including navigating debris, climbing ladders and turning off a valve.[122] But after acquiring Schaft as part of its larger commercial robotics strategy, Google withdrew the robot from further participation in a multi-year, DARPA-sponsored competition aimed at accelerating the development of robots for disaster relief.[123] As other companies follow suit, it may be the case that the greatest technological developments occur in the private sector and then become acquired by defense contractors such as Northrop Grumman or Lockheed Martin for military applications, whether for the battlefield or for peacetime priorities such as disaster relief and humanitarian assistance.

Roboticist and AWS proponent Ronald Arkin concludes that "the trend is clear: warfare will continue and autonomous robots will ultimately be deployed in its conduct."[124] Even critics like Robert Sparrow and Human Rights Watch, who are one the other side of the debate, agree with this conclusion.[125] The idea is that as the technology gradually evolves, "the loop [will get] shorter and shorter . . . [and as a result] there won't be any time in it for humans."[126] As this evolution happens within the technology, human involvement in the loop will eventually become obsolete, which means AWSs will need to make some decisions independently.[127] Altogether, this means that AWSs offer an opportunity to safeguard against unnecessary loss of life while also extending humanity's reach beyond biological limits. This amazing potential ought to impel participants in this debate to seize the opportunity to focus on developing AWSs that surpass humanity's ability to comply with IHL norms. Since the United States will undoubtedly be a

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[122] Mike Hoffman, *Google Rejects Military Funding in Robotics*, DEFENSETECH.ORG (Mar. 25, 2014), http://defensetech.org/2014/03/25/google-rejects-military-funding-in-robotics/.
[123] *Id.*
[124] ARKIN, *supra* note 5, at 6.
[125] *Id.* at 8; *see also Losing Humanity*, *supra* note 15, at 1.
[126] SINGER, *supra* note 4, at 64.
[127] Schmitt & Thurnher, *supra* note 58, at 238. This premise is based on the assumption that technology will evolve. In the near term, humans will remain "on the loop," given technological constraints.

forerunner among competing nations, the United States ought to shape the debate around this goal.

II. Autonomous Weapons Systems and International Law

Currently, there are no treaties that specifically address or govern the use of AWSs.[128] In the absence of specific treaty prohibitions, however, parties can look to IHL (also known as the Law of Armed Conflict,[129] or the LOAC) to sufficiently address the issue of AWS employment.[130] In particular, in order to evaluate the overall lawfulness of AWSs, one must review two discrete areas of IHL: weapons law and targeting law.[131] This conclusion is generally accepted among scholars, and these two areas become the legal litmus test for AWSs.[132] The ICRC similarly interprets that new weapons should be evaluated through the lens of "means" and "methods."[133] The IHL's weapons law evaluates the AWS's lawfulness in and of itself (the means).[134] Targeting law, on the other hand, evaluates whether AWS employment (the methods) would violate the general principles of the LOAC.[135] The future utility of AWSs

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[128] However, certain treaties (e.g., Geneva Conventions IV) and LOAC concepts (e.g., prohibitions against unnecessary suffering) certainly govern the use of AWSs.

[129] RICHARD P. DIMEGLIO ET. AL., U.S. ARMY, LAW OF ARMED CONFLICT DESKBOOK 7 (William J. Johnson & Wayne Roberts eds., 2013), *available at* http://www.loc.gov/rr/frd/Military_Law/pdf/LOAC-Deskbook-2013.pdf [hereinafter LOAC Deskbook] (The law of armed conflict (LOAC) "is the 'customary and treaty law applicable to the conduct of warfare on land and to relationships between belligerents and neutral States.'"); *see also id.* at 19 ("While there are LOAC treaties in force today, most fall within two broad categories, commonly referred to as the 'Hague Law' or 'Hague Tradition' of regulating *means and methods* of warfare, and the 'Geneva Law' or 'Geneva Tradition' of *respecting and protecting victims* of warfare.").

[130] ICRC Autonomous Weapons FAQ, *supra* note 101.

[131] Jeffrey S. Thurnher, *The Law That Applies to Autonomous Weapon Systems*, ASIL INSIGHTS (Jan. 18, 2013), http://www.asil.org/insights/volume/17/issue/4/law-applies-autonomous-weapon-systems; *see also* Waxman & Anderson, *supra* note 3, at 8-11.

[132] *See* Thurnher, *supra* note 131; *see also* Waxman & Anderson, *supra* note 3, at 8-11.

[133] Int'l Comm. of the Red Cross (ICRC), *A Guide to the Legal Review of New Weapons, Means and Methods of Warfare: Measures to Implement Article 36 of Additional Protocol I of 1977*, 88 INT'L REV. RED CROSS 931, 932 (2006), *available at* http://www.icrc.org/eng/assets/files/other/irrc_864_icrc_geneva.pdf [hereinafter ICRC Article 36 Guide].

[134] Waxman & Anderson, *supra* note 3, at 10; *see also* Thurnher, *supra* note 131; Evan Wallach, *Chapter Three: Means and Conduct of Hostilities*, LAW OF WAR, *available at* http://www.lawofwar.org/Hostilities.htm#Conventional Weapons.

[135] Waxman & Anderson, *supra* note 3, at 11; *see also* Thurnher, *supra* note 131; Wallach, *supra* note 134.

depends on whether each system is developed and employed in compliance with these two areas of law.[136] In addition, chivalric norms, which are not directly related to weapons or targeting, remain relevant to AWS employment for the reasons discussed below.

A. Article 36: Weapons Law

AWSs 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.[137] Article 36 provides,

> In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party 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.[138]

This section codifies a customary international law obligation to conduct a legal review of new means of warfare before introducing it into warfare.[139] To pass muster, both prongs of the test must be satisfied.[140]

The first prong of the test prohibits indiscriminate weapons.[141] Indiscriminate weapons are those means of warfare which cannot be directed at a specific military objective and consequently strike military objectives and civilians or civilian objects without distinction.[142] Evaluating a weapon against this prong requires a focus on how the weapons system is

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[136] *See* ICRC Article 36 Guide, *supra* note 133, at 933.
[137] *See id.* While the U.S. has not ratified Additional Protocol I, the U.S. recognizes that many of AP I's principles reflect customary international law as reflected in the U.S. Commander's Handbook on the Law of Naval Operations. *See* U.S. NAVY, U.S. MARINE CORPS & U.S. COAST GUARD, THE COMMANDER'S HANDBOOK ON THE LAW OF NAVAL OPERATIONS (2007), *available at* http://www.usnwc.edu/getattachment/a9b8e92d-2c8d-4779-9925-0defea93325c/1-14M_(Jul_2007)_(NWP).
[138] ICRC Article 36 Guide, *supra* note 133, at 933 (citing Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts, art. 36, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I]).
[139] *Id.* at 938; *see also* LOAC Deskbook, *supra* note 129, at 154-55; Schmitt & Thurnher, *supra* note 58, at 250.
[140] *See* Thurnher, *supra* note 131.
[141] *See id.* (citing AP I, *supra* note 138, at art. 51(4)(b)).
[142] *See* ICRC Article 36 Guide, *supra* note 133, at 943; *see also infra* note 166 and accompanying text (The principle of distinguishing between military objectives (people and objects) and civilian people and objects (i.e. the principle of distinction) lies at the heart of IHL.).

designed.[143] All lawful weapons can be *used* in an indiscriminate manner, and thereby violate the IHL principle of distinction.[144] But a weapon is considered inherently indiscriminate if it cannot be aimed at a target. Relevant assessment factors include the accuracy and reliability of the targeting mechanism, the type of munitions used, and the area covered by the weapon.[145] When applying this test, there is nothing inherently indiscriminate in AWSs. If an AWS can process data received from its sensors in order to properly target a military objective, then the weapon is not indiscriminate. Moreover, nothing suggests that military developers, particularly the DoD, would create indiscriminate AWSs. Of course, fully autonomous weapons systems will require on-board sensors, resident AI, and weapons that are sophisticated enough to properly target a military objective independent of human interaction.[146] However, given these requirements, there is no evidence that AWSs would fail this prong of the test.

There is, of course, another dimension to indiscriminateness. A weapon may also be indiscriminate if it has "uncontrollable" effects.[147] "Indiscriminate" in this context means "whether the weapons' foreseeable effects are capable of being limited to the target or of being controlled in time or space (including the degree to which a weapon will present a risk to the civilian population after its military purpose is served)."[148] Therefore, the rule prohibits weapons systems that have uncontrollable or unpredictable effects despite their ability to strike a target

[143] *See* Thurnher, *supra* note 131.
[144] *See* Schmitt & Thurnher, *supra* note 58, at 246.
[145] *See* ICRC Article 36 Guide, *supra* note 133, at 946.
[146] *See* Thurnher, *supra* note 131.
[147] *See, e.g.,* AP I, *supra* note 138, at art. 51(4)(c) (noting that "[i]ndiscriminate attacks are . . . [t]hose which employ a method or means of combat the effects of which **cannot be limited** as required by this Protocol.") (emphasis added); *see also* Schmitt & Thurnher, *supra* note 58, at 250 ("A second form of prohibition on indiscriminate weapons is codified in Article 51(4)(c) of Additional Protocol I, and reflects customary international law. It disallows weapon systems that, despite being able to strike their targets accurately, have uncontrollable effects.").
[148] ICRC Article 36 Guide, *supra* note 131, at 946.

accurately.[149] Generally, biological weapons and arguably chemical weapons are classified as indiscriminate in this context because the ensuing effects cannot be readily controlled and will likely cause further collateral damage.[150] The preamble to a UN General Assembly resolution adopted in 1969 declares that biological and chemical weapons "are inherently reprehensible because their effects are often uncontrollable and unpredictable."[151]

However, there is no evidence to suggest that an AWS would violate this rule. To do so, an AWS would first have to be armed with on-board weapons or munitions which cause uncontrollable effects. This is possible but highly unlikely, given the blanket prohibitions against such munitions (e.g., biological weapons), regardless of the delivery system. And arguments which suggest that AWSs are by nature "uncontrollable" or "unpredictable," further discussed in Part IV, do not apply here, since the rule focuses on uncontrollable effects *caused* by AWSs, and not an uncontrollable AWS itself.[152] Assuming arguendo that, by extension, this prohibition applies to the AWS itself as an uncontrollable or unpredictable weapon is also not a sustainable counter, since humans will still exercise influence over AWS development. Through algorithm modeling, human developers will design the model of behavior upon which the AWS will operate within, constraining the AWS to only those tasks it must accomplish.[153] Developers will also set active rules and norms that restrain the AWS's behavior from performing any

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[149] *See* Schmitt & Thurner, *supra* note 58, at 250.
[150] *See* INT'L COMM. OF THE RED CROSS, WEAPONS THAT MAY CAUSE UNNECESSARY SUFFERING OR HAVE INDISCRIMINATE EFFECTS 16 (1973), *available at* http://www.loc.gov/rr/frd/Military_Law/pdf/RC-Weapons.pdf [hereinafter ICRC Weapons Guide]. Indeed, chemical weapons are largely considered unlawful for a variety of other reasons. However, the ICRC points out that the effects of chemical weapons unlike biological weapons can be better controlled and the time-lag before their effects become manifest rarely exceeds a few hours. *See* Schmitt & Thurnher, *supra* note 58, at 250.
[151] G.A. Res. 2603A, U.N. GAOR, 24th Sess., Supp. No. 30, at 16 U.N. Doc. A/7630 (Dec. 13, 1969), *available at* https://disarmament-library.un.org/UNODA/Library.nsf/b2966aadffd77423852578ae00675e2a/3b3ba1689f8fda02852578fc006643e4/$FILE/A-7890.pdf.
[152] *See* Anderson, Reisner & Waxman, *supra* note 40, at 400.
[153] *See* Noorman & Johnson, *supra* note 23, at 58.

potential actions that the AWS cannot or should not do.[154] Finally, AWSs will undergo verification and validation testing, as described in the DoD directive, in order to develop predictability.[155] Put plainly, if the weapons system cannot be controlled, it will not be deployed. And since humans will remain a part of the development, testing, and operational phases, AWSs are not, as a rule, uncontrolled.

The second prong of the test prohibits weapons that cause unnecessary suffering or superfluous injury.[156] Determining whether a weapon causes unnecessary suffering involves "weighing the relevant health factors together against the intended military purpose or expected military advantage."[157] While the interpretation of underlying factors varies, states generally agree that any suffering serving no legitimate military objective is unnecessary.[158] Examples of weapons prohibited on this basis include those that are hard to locate in the human body after impact, like glass, or those that cause unnecessarily severe wounds, like expanding bullets.[159] Without question, the horrific health-related considerations of certain chemical and biological weapons put them in this category. However, this concern appears simpler to resolve in AWSs. As discussed earlier, this issue will be readily resolved if developers and leaders do not arm the AWSs with otherwise prohibited weapons and munitions capable of superfluous injury or widespread destruction.[160] Undoubtedly, the DoD will develop AWSs outfitted with conventional weapons delivering permissible munitions, because DoD must still comply with other legal regimes that require it to responsibly and lawfully arm its weapons systems regardless

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[154] *See id.* at 59.
[155] *See id.*; *see also* DoD Directive 3000.09, *supra* note 37, at 2.
[156] *See* Thurnher, *supra* note 131 (citing AP I, *supra* note 138, at art. 35(2)).
[157] ICRC Article 36 Guide, *supra* note 131, at 947.
[158] *See id.*
[159] *See* ICRC Weapons Guide, *supra* note 150, at 21.
[160] *See* Thurnher, *supra* note 131.

of whether they are autonomous or not. Thus, an AWS is not per-se prohibited unless it cannot comply with this test.

B. The LOAC: Targeting Law[161]

The next step is to analyze how the weapons system will be used (the methods). This analysis falls squarely within LOAC targeting principles.[162] As noted earlier, a weapon which is otherwise lawful by design can still be used in a way that violates the foregoing principles. Targeting principles include military necessity, distinction, proportionality, and feasibility of precautions.[163] Assuming these can be satisfied, an AWS will be in compliance with LOAC targeting law.[164]

1. Military Necessity

Military necessity means combatants may only employ force against legitimate military objectives.[165] Article 52(2) of AP I, which reflects customary international law, provides that "military objectives are limited to those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization . . . offers a definite military advantage."[166] Expressed differently, military necessity means that combatants may use the requisite force necessary to achieve a legitimate military objective.[167] 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

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[161] *Id.*
[162] *See* IAN HENDERSON, THE CONTEMPORARY LAW OF TARGETING: MILITARY OBJECTIVES, PROPORTIONALITY AND PRECAUTIONS IN ATTACK UNDER ADDITIONAL PROTOCOL I 7 (2009).
[163] *Id.*; *see also* Thurnher, *supra* note 131.
[164] *See* Thurnher, *supra* note 131.
[165] HENDERSON, *supra* note 162, at 35.
[166] AP I, *supra* note 138, at art. 52(2); *see also* Schmitt & Thurnher, *supra* note 58, at 252.
[167] *See* HENDERSON, *supra* note 162, at 35.

LOAC.[168] Accordingly, AWSs may only target legitimate military objectives which result in a military advantage, and they cannot engage in wanton or unnecessary killing or destruction.[169] To satisfy this principle, combatants would program an AWS to engage only lawful military targets. While it may sound simplistic, this concept gets somewhat complicated since it directly correlates to distinction and proportionality.[170] For example, if an AWS targets a civilian instead of a military objective, then the AWS violates both the principles of military necessity and of distinction. So military necessity, while conceptually and academically distinct, is foundationally interconnected with the other AWS targeting considerations under the LOAC, and therefore requires no further independent evaluation.[171]

2. Distinction

Distinction means persons employing force must distinguish between lawful military targets (e.g., opposing combatants, equipment, or facilities) and protected persons (e.g., civilians, medical personnel, chaplains, or persons who are hors de combat) and property.[172] Distinction is the most operationally vital component, since AWSs must be able to distinguish between combatants and civilians if they are to be lawfully employed. Beyond aiming ability, as required by Article 36, AWS sensors and AI will need to understand and appreciate the differences between combatants and civilian persons and objects in order to avoid collateral damage. Of course, distinction rests on the objective and subjective factors associated with human behaviors. This analysis becomes exceedingly difficult to conceptualize, even for soldiers, when civilians directly participate in hostilities or when facilities are utilized by both military personnel and

[168] *See* Kastan, *supra* note 43, at 59.
[169] *See id.*
[170] *See* Schmitt & Thurnher, *supra* note 58, at 259.
[171] *See id.* (stating that military necessity "has little or no independent valence when assessing the legality of autonomous weapon systems or their use.").
[172] *See id.* at 251-52. While distinction is rooted in customary international law, these notions of protecting civilians and related objects are codified in Articles 51(2) and 51(1) of Additional Protocol I.

civilians. For example, in a counterinsurgency environment, where combatants do not always wear uniforms or have distinguishing features, an AWS will need to ascertain whether a targeted individual is indeed the desired target determined by human counterparts or whether that individual is engaging in hostile acts or has demonstrated hostile intent.[173]

Complicating matters, factors involved in distinction will vary depending upon the environment. The number of civilians present at the time of targeting is a relevant factor. In urban scenarios, civilian presence significantly increases as compared to aerial and maritime combat venues.[174] Even in maritime environments, civilian sea traffic patterns may differ depending upon the location (e.g., internal and territorial waters). A further challenge is that AWS technology must be able to make these determinations in dynamically evolving environments. For example, military planners may believe that an AWS will encounter no civilians during an operation; however, if civilians become present during execution, an AWS will need to be able to adapt its analysis and actions to avoid excessive collateral damage. Critics' arguments for banning AWS development hinge on this necessity, pointing to current technological limitations.[175] Whether or not an AWS can perform distinction successfully and independently will depend on the technological evolution of sensor strength and AI, as discussed below. At a minimum, AWSs programming could initially allow for more conservative actions until the technology evolves. As discussed further in Part VI, AWSs could be programmed not

[173] *See* U.S. DEP'T OF THE ARMY, FIELD MANUAL 3-24, COUNTERINSURGENCY para. 7-35 (Dec. 2006), [hereinafter FM 3-24],(stating that in counterinsurgency warfare, particularly in urban environments, "it is difficult to distinguish insurgents from noncombatants. It is also difficult to determine whether the situation permits harm to noncombatants. Two levels of discrimination are necessary: Deciding between targets; Determining an acceptable risk to noncombatants and bystanders.")
[174] *See id.* para. 2-3, 2-4; *see also* Waxman & Anderson, *supra* note 3, at 12.
[175] *Losing Humanity*, *supra* note 15, at 10; *see also* Noel Sharkey, *Grounds for Discrimination: Autonomous Robot Weapons*, 11 RUSI DEFENCE SYSTEMS 86 (Oct. 2008), *available at* http://rusi.org/downloads/assets/23sharkey.pdf.

to fire unless fired upon, perhaps making them *more* protective of civilians than human soldiers, who experience fear or have lapses of judgment or perception.

3. Proportionality

Proportionality requires that the anticipated harm (to civilian persons, objects, or a combination thereof) must not be excessive, in proportion to the concrete and direct military advantage anticipated.[176] A "concrete and direct military advantage" by itself is subjective and scenario-driven. For example, a commander may deem the destruction of an enemy's military logistics facility in one scenario more effective in accomplishing the mission than another commander who wants to preserve it for future occupation at a different point in the campaign. Determining excessive harm is also subjective and becomes case-specific, based on the value of the military objective.[177] A strike which results in a select number of civilian casualties may be legally acceptable if the target is a high-ranking leader of an enemy force. Given these variables, comparing military advantage against civilian losses or damages is somewhat dependent on the subjective value judgments of military commanders and political decision makers, who must evaluate reasonableness within specific scenarios.[178] This potential subjectivity is the target of routine attack by critics, who argue that the ability to program an AWS appropriate to perform this kind of subjective analysis is highly improbable.

Philosophically speaking, for an AWS to be fully autonomous, it would conduct the analysis via AI.[179] And it is true that technology has not evolved to this stage yet, especially in objectivizing the concept of "reasonableness" in AWS terms. Military lawyers, developers, and

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[176] *See* AP I, *supra* note 138, at arts. 51(5)(b), 57(2)(a)(iii); *see also* Sassòli, *supra* note 3, at 4.
[177] *See* Schmitt & Thurnher, *supra* note 58, at 255-56 (providing that if a target yields a greater military advantage, the more likely collateral damage will be tolerated under LOAC).
[178] *See* Sassòli, *supra* note 3, at 4; *see also* Thurnher, *supra* note 131.
[179] *See* Sassòli, *supra* note 3, at 4.

operational professionals will need to work with roboticists and humanitarian experts to develop programmable objective criteria to enable AWSs to conduct proportionality analyses.[180] While this may seem like a far-fetched goal, a collaborative effort could create more widely accepted legal standards and parameters for AWS employment. Practically speaking, a human operator will soon be able to program a value assessment of a military objective prior to mission execution. This assessment may need to be revisited by a human counterpart during mission execution for a variety of reasons, such as changes in the mission campaign.[181] Similarly, programmers will be able to input preset values consistent with national thresholds for collateral damage. To the extent that an AWS could not identify or distinguish noncombatants on a particular mission, the AWS programming could have a preset default to count those persons as civilians. Moreover, public opinion concerns alone will motivate leaders to seek to further avoid collateral damage by directing lower programmed thresholds.[182] Additionally, leaders will program restrictions on the use of force using rules of engagement, including limitations on what weapons an AWS will employ. As IHL scholars Michael Schmitt and Jeffery Thurnher have noted, it may also be possible to program the collateral damage estimation methodology (CDEM) for assessing the likelihood of collateral damage based on several factors (e.g., types of weapons, employment tactics, proximity of civilian structures).[183] If AWSs can objectively conduct all of the aforementioned analyses, and the "case-by-case" assessments meets specified, programmed parameters developed during the mission-planning phase, then an AWS can

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[180] *See id.*
[181] *See* Thurnher, *supra* note 131.
[182] "Public perception and diplomatic sensitivity put reins on the initiative of the [Commander]. The 'fog of war' broadcast around the world significantly altered the targeting authority of the field commander." William G. Adamson, *The Effects of Real-Time News Coverage On Military Decision-Making* (March 1997) (in partial fulfillment of the graduation requirements of Air Command and Staff College), *available at* http://www.au.af.mil/au/awc/awcgate/acsc/adamson.pdf.
[183] *See* Schmitt & Thurnher, *supra* note 58, at 254.

complete the mission.[184] If AWS AI confronts an event that fails to satisfy programmed restraint parameters, rules of engagement, or LOAC considerations such as distinction of protected persons, then an AWS can request clarifying guidance from a military commander on-the-loop, return to its point of origin, or pursue a secondary mission.[185]

4. Feasible Precautions

Lastly, it is customary under IHL principles to take all feasible precautions in an attack.[186] Codified in Article 57(1) of AP I, "feasible precautions" mean that combatants shall undertake all possible measures to target only military objectives while also safeguarding against incidental loss of civilian life, injury to civilians, and damage to civilian objects.[187] This obligation is very fact-intensive and subjective. For example, if an AWS is confronted with a targeting scenario complicated by the unanticipated presence of civilians—a crowd in an urban scenario, a civilian fishing vessel in a maritime environment—it can choose to loiter or await the dispersal of the civilians, employ lower-yield weapons, or not engage at all. Since humans will remain in or on the loop for the near term, human operators will supervise AWSs in making these determinations in dynamic environments. Human planners and operators will also determine whether AWSs have the requisite capabilities (i.e., sensors, AI, on-board weapons) to effectively carry out their objectives with precision and minimize civilian harm in a given scenario.[188] As discussed in Part VI, AWSs will be able to take additional precautions, precisely because a human pilot or operator is neither present nor at risk.[189]

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[184] AIR FORCE JUDGE ADVOCATE GENERAL'S DEPARTMENT, AIR FORCE OPERATIONS AND THE LAW: A GUIDE FOR AIR AND SPACE FORCES 19 (2014), *available at* http://www.afjag.af.mil/shared/media/document/AFD-100510-059.pdf [hereinafter AIR FORCE OPERATIONS AND LAW GUIDE].
[185] *See* Kastan, *supra* note 43, at 59.
[186] *See* AP I, *supra* note 138, at art. 57(1); *see also* Schmitt & Thurnher, *supra* note 58, at 259.
[187] *See* AP I, *supra* note 138, at art. 57(1).
[188] *See* Schmitt & Thurnher, *supra* note 58, at 260; *see also* Thurnher, *supra* note 131.
[189] *See* Sassòli, *supra* note 3, at 5.

C. Chivalry

Contrary to popular belief, chivalry is not dead. Negotiations to end hostilities become difficult if a perception of untrustworthiness or dishonor exists on either side.[190] Although technology and industrialization have perhaps made war *appear* less knightly or gentlemanly, chivalry is at the foundation of the LOAC. As such it is germane to any discussion of warfare and certainly bears on AWS utility.[191] While not all chivalric norms have survived the passage of time,[192] core medieval virtues such as courage, mercy, justice, and honor endure throughout the U.S. military's service cultures and academies.[193] And while chivalry is not used directly in legal reviews for operation planning or analysis, its principles are inextricably interwoven into the DoD Law of War Manual.[194] More importantly, chivalry becomes even more relevant post-mission, when LOAC violations are addressed by the Uniform Code of Military Justice (UCMJ), where chivalric norms remain intact. This notion remains important considering that military courts martial evolved from medieval courts of chivalry designed to uphold honor, loyalty, and high morals.[195] Although chivalry overlaps at points with IHL, these norms are not subsumed.[196] To illustrate, IHL does not always require action, while chivalry mandates action and punishes inaction.[197] In fact, the United States enforces this requirement through Article 99 of the

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[190] *See* Evan J. Wallach, *Pray Fire First Gentlemen of France: Has 21st Century Chivalry Been Subsumed by Humanitarian Law?*, 3 HARV. NAT'L SEC. J. 431, 450 (2012).
[191] *See* AIR FORCE OPERATIONS AND LAW GUIDE, *supra* note 184, at 19.
[192] *See* Sassòli, *supra* note 3, at 2 (suggesting that traditional notions of "fairness" are no longer in force).
[193] *See* Wallach, *supra* note 190, at 433.
[194] *See* E-mail from Evan Wallach, Judge, Fed. Cir. (Apr. 4, 2013) (on file with author) (based on audience participation at an ICRC panel discussion, where a senior DoD attorney directly responded to Judge Wallach's query confirming chivalry's incorporation into the forthcoming DoD Law of War Manual).
[195] *See generally* David A. Schlueter, *The Court-Martial: An Historical Survey*, 87 MIL. L. REV. 135 (1980).
[196] *See* Wallach, *supra* note 190, at 433.
[197] *See id.* at 445, 462 ("The failure of the Dutch troops to act swiftly, decisively, and courageously was not a violation of international humanitarian law. Nothing in IHL specifically requires that military personnel, even those assigned to protect civilians, are required to risk their lives or units to fulfill that obligation. The Dutch failure was certainly, however, a violation of the principles of chivalry.").

UCMJ.[198] For U.S. military personnel, chivalry is not limited to the prohibitions against perfidy alone.[199] As Judge Evan Wallach writes that

> [U.S. military personnel] are prohibited from cowardly failure to fulfill international battlefield obligations, that U.S. officers are governed by a strict (if intentionally amorphous) code of chivalric conduct, that the quality of mercy goes beyond the mandates against denying quarter, that certain promises, even to an enemy, must be kept, and that violation of all these requirements still infers a penal response.[200]

With the inevitable approach of AWSs, some believe that chivalry will be eliminated, that as machines engage other machines, war will become dehumanized.[201] This does seem possible, given that UAVs will engage other UAVs in combat. Nevertheless, to quote Clausewitz, "war is nothing but the continuation of [humanity's] politics by other means."[202] In other words, war will always be instigated and carried out by humans who in turn seek to affect or influence other humans. Warfare will always be influenced by human political, legal, diplomatic, and economic factors—humanity's role as the decision maker will not change.[203] The idea that international

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[198] *See id.* at 445; *see also* U.S. DEP'T OF DEF., MANUAL FOR COURTS-MARTIAL UNITED STATES art. 99 (2012) ("Any member of the armed forces who before or in the presence of the enemy—
(1) runs away;
(2) shamefully abandons, surrenders, or delivers up any command, unit, place, or military property which it is his duty to defend;
(3) through disobedience, neglect, or intentional misconduct endangers the safety of any such command, unit, place, or military property;
(4) casts away his arms or ammunition;
(5) is guilty of cowardly conduct;
(6) quits his place of duty to plunder or pillage;
(7) causes false alarms in any command, unit, or place under control of the armed forces;
(8) willfully fails to do his utmost to encounter, engage, capture, or destroy any enemy troops, combatants, vessels, aircraft, or any other thing, which it is his duty so to encounter, engage, capture, or destroy; or
(9) does not afford all practicable relief and assistance to any troops, combatants, vessels, or aircraft of the armed forces belonging to the United States or their allies when engaged in battle; *shall be punished by death or such other punishment as a court-martial may direct.*") (emphasis added).

[199] *See* Wallach, *supra* note 190, at 464.

[200] *Id.* at 465.

[201] *See* Ryan Haecker, *Chivalry in the Age of Autonomous Weapons pt.1*, TRANSHUMAN TRADITIONALISM BLOG (Mar. 6, 2008), http://transhumantraditionalism.blogspot.com/2008/03/chivalry-in-age-of-autonomous-weapons.html.

[202] CARL VON CLAUSEWITZ, ON WAR 69 (Michael Eliot Howard & Peter Paret eds., trans., 1989).

[203] *See* Waxman & Anderson, *supra* note 3, at 18.

disputes will be determined by bloodless wars fought by AWSs duking it out in a boxing-ring setting, manned by video game controllers is simply absurd—it is pure science fiction. Human civilians will always be the victims of war. This does of course raise the question of whether compassion or empathy will decrease as AWS usage further lengthens the distance between human combatants and the battlefield to a degree. It is also plausible that people will express fear and disgust with AWSs in the same manner they protested nuclear weapons in the twentieth century.[204] Since human victims will always be central to warfare, chivalric values will likewise always be relevant, regardless of the technological advances.[205] Governments must avoid dehumanizing enemies into the means that "fuel the cogs of war," by employing AWSs in a just and respectful manner consistent with the modern notions of chivalry incorporated into the U.S. military manuals and traditions.[206]

III. Key Technological Requirements

Generally, AWSs contain three key components common to robotics: sensors, processors (or AI), and effectors.[207] Sensors monitor the environment and detect changes in it.[208] Processors interpret the information received from the sensor and decide how the robot will respond.[209] Effectors are the robot's mechanisms that then take action in its physical environment, based on the processors' decisions.[210] When these three parts act together, a robot gains the functionality of an artificial organism.[211] Each of these components must be evolved, both individually and collectively, to make AWSs lawful within semi-autonomous or fully

[204] *See* Haecker, *supra* note 201.
[205] *See id.*
[206] *See id.*
[207] *See* SINGER, *supra* note 4, at 67.
[208] *See id.*
[209] *See id.*
[210] *See id.*
[211] *See id.*

autonomous modes of warfare. While some argue the legal standard for AWS performance should be "no worse than humans," the purpose of AWSs, as with robots in general, is to assist and ultimately surpass humans in carrying out lethal actions that are IHL compliant.[212] Humanity should strive for this higher standard, and these technologies must be greatly advanced if they are to exceed the expectations of AWS proponents and critics alike.[213] In other words, AWS technology must be able to surpass human biological ability to properly assess and respond to threats while concurrently safeguarding innocent lives.

In order to do this, AWS sensors must first function like human sensory receptors and be able to ascertain differences between sizes, objects, sounds, movements, and physical behavior. For example, sensors must be able to detect the physical differences between a stick and a rifle.[214] Similarly, such sensors will need to be able to distinguish between the visual and acoustical signatures of that stick being thrown versus a rifle being fired. Sensors' potential ability to determine physical distinctions between age, gender, height, and related factors would lend themselves favorably to a distinction and proportionality analysis by the AWS AI. More complex examples include sensors that can exceed humanity's biological limitations, such as infrared or thermal imaging technologies that not only can determine the physical attributes of objects, but also can ascertain the object's current physical condition. Should an AWS with such sophisticated sensors encounter an enemy combatant, the resident sensors ought to be able not only to determine the individual's body temperature, but also to ascertain heart rate and other vital signs. Such factors may assist the AWS AI to interpret whether the individual is hors de

[212] *See* Kastan, *supra* note 43, at 64 (citing ARMIN KRISHNAN, KILLER ROBOTS: LEGALITY AND ETHICALITY OF AUTONOMOUS WEAPONS 110, 110 (2009) ("An [AWS] that was not as good as a human in making targeting decisions would be illegal under international law.")).
[213] *See* ARKIN, *supra* note 5, at 57.
[214] *See* SINGER, *supra* note 4, at 76.

combat or potentially committing an act of treachery. More sophisticated sensors and AI would not only process sensory data received, but would also concurrently process and reconcile various intelligence inputs (e.g., signals, imagery, electronics, human intelligence).

Second, the AWS AI must be capable of distinguishing between an enemy combatant and a civilian who is not taking direct part in hostilities. Sophisticated, or "strong," AI is regarded as "the creation of machines with the general human capacity for abstract thought and problem solving."[215] The availability of this adaptive AI is critical to AWS's expanded usefulness in the future.[216] Proponents and critics generally agree that if such AI were available, robots would surpass humans and their cognitive abilities, because the same processes that created it could rapidly improve it.[217] This level of artificial intelligence may be unavailable for the near term.[218] Singer notes that while current robots may be able to "calculate faster than any human being . . . they lack the common sense of a two-year-old."[219] Under these AI conditions, an AWS would not be able to process the differences between a rifle and a stick that its sensors had detected; so an AWS would not be able to distinguish these objects without human assistance. This ability is even more critical when an AWS must distinguish between civilians and combatants, where subjective factors dominate. The concern is that the AI must not only interpret distinctions in clothing, weapons, or other physical attributes, but it must also discern the often subtle differences in human behavior. While the current technology does not possess this ability, its limitations do not foreclose the possibility of more highly developed AI at some point in the future. Even noted AWS critic Noel Sharkey concedes that several European universities are

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[215] McGinnis, *supra* note 104, at 1256.
[216] *See* SINGER, *supra* note 4, at 77.
[217] *See* McGinnis, *supra* note 104, at 1256.
[218] *See* SINGER, *supra* note 4, at 78; *see also* Evans, *supra* note 45, at 706.
[219] SINGER, *supra* note 4, 76.

presently invested in developing AWS AI abilities that interpret the distinction between humans and inanimate objects.[220] While the attempts are very rudimentary, they forecast developers' intentions for pursuing technologies capable of these distinctions. Nonetheless, since humans will continue to be either in or on the loop, monitoring machine actions, any concerns about distinction will be mitigated.[221]

The programming proportionality of AI is partly a technical issue: that of designing systems capable of measuring predicted collateral civilian harm. But it is also partly an ethical issue of attaching weights to the variables at stake.[222] Thus, at least for now, acceptable collateral damage becomes case-specific.[223] This is very true for air or sea-based warfare, where civilian presence is distinctly lower than in land and urban warfare settings.[224] Sharkey and Human Rights Watch retort that it is improbable that one could program an AWS with an infinite number of potential scenarios to be able to interpret a situation in real time.[225] This is a reasonable concern, not just for deliberate targeting, but also for dynamic situations where uncertainty is prevalent. While the U.S. Air Force proposes preprogramming scenarios, an AWS's AI may encounter situations for which it does not have a planned response, or in other words, a "brittleness" problem.[226] Thus, more advanced AI algorithms must be available in order to adapt to dynamic situations while still complying with IHL—although, as a failsafe, AWSs can always refrain from employing kinetic force when uncertainty is an issue.

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[220] *See* Interview by Alex Jones with Dr. Noel Sharkey, Emeritus Professor of Artificial Intelligence and Robotics, Univ. of Sheffield (Aug. 28, 2013), *available at* http://www.prisonplanet.com/the-case-against-killer-robots-with-dr-noel-sharkey.html [hereinafter Sharkey Interview].
[221] *See* DoD DIRECTIVE 3000.09, *supra* note 37, at 7-8 (requiring high level approval for fully autonomous weapons); *see also* Kastan, *supra* note 43, at 65.
[222] *See* Schmitt & Thurnher, *supra* note 58, at 256; *see also* Sassòli, *supra* note 3, at 4.
[223] *See* Schmitt & Thurnher, *supra* note 58, at 255.
[224] *See* Waxman & Anderson, *supra* note 3, at 6.
[225] *See Losing Humanity*, *supra* note 15, at 32.
[226] *See id.*; *see also* Kastan, *supra* note 43, at 51 (quoting Michael L. Anderson et al., *A Self-Help Guide for Autonomous Systems*, 29 AI MAGAZINE 67 (2008)).

In fairness to AWS proponents, AWS AI's social utility does not depend on predicting the future with absolute precision.[227] Since uncertainty is a universal principle, predictions accounting for every possible scenario are unreasonable, no matter how sophisticated the level of AI.[228] Even if humanity were to continue warfare without AWSs, this uncertainty will still exist for soldiers on the battlefield.[229] However, with increased calculation powers beyond human capacity, if AWS AI can assess the likelihood of future contingencies, then an AWS system can address them or request a decision from its human counterpart in an on-the-loop scenario.[230] Over the long term, military and humanitarian experts will need to partner with roboticists to objectively identify what indicators and criteria are required to evaluate proportionality, and to make the subjective judgments required to determine proportionality slightly more objective.[231]

In addition to the AWS AI requirements, certain AI safeguards will enable enhanced compliance with IHL. Arkin proposes the use of the "ethical governor" model.[232] This process would require the AWS to evaluate the sensory information and determine whether an attack is prohibited under IHL or under the applicable rules of engagement (ROE).[233] If an attack violates programmed constraints, such as distinction or proportionality thresholds, the AWS will not fire.[234] If the attack does not violate a constraint, the AWS can only proceed if attacking the target is required under programmed operational orders.[235] Thus, the AI must not only be capable of calculations or algorithms associated with distinction and proportionality, the AI must

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[227] *See* McGinnis, *supra* note 104, at 1260.
[228] *See id.*
[229] *See id.*
[230] *See id.*
[231] *See* Sassòli, *supra* note 3, at 4.
[232] *See* ARKIN, *supra* note 5, at 63.
[233] *See id.* at 63-64.
[234] *See id.* at 64 (suggesting that the AI will "always [act] in the most conservative manner to ensure that the [Law of War] is adhered to, while progressively migrating from a conservative to a more aggressive method as obligations are evaluated.").
[235] *See id.*

also interpret whether such actions are lawful under preprogrammed constraints.[236] Additionally, as a part of this ethical–behavioral control process, Arkin proposes the use of an "ethical adaptor" that would analyze and address any AWS errors regarding the use of lethal force.[237] If the AWS AI perceives its actions violated preset legal and ethical constraints, the ethical adaptor's associated algorithm could further restrict the AWS's ability to employ lethal force (e.g., raising sensory confidence levels).[238] Thus, the AWS becomes more restrictive or potentially ceases to be able to deploy lethal force.[239]

Another safeguard connected to the ethical governor is Arkin's "responsibility advisor" model.[240] This AI model would assist with mission planning by advising human military counterparts of their ethical responsibilities and managing subsequent overrides.[241] For example, if the AWS were programmed with a set of rules that would violate baseline programmed constraints (e.g., LOAC principles), then the machine would query the human programmer and potentially the commander for override authorization.[242] Similarly, when the AWS's AI (its ethical governor) confronts a combat scenario that falls below preset confidence levels or that conflicts with its programmed constraints (e.g., LOAC norms, ROE, etc.), the AWS will cease further action and request clarification from its human operator/commander counterpart.[243] The

[236] *Id.*
[237] *Id.* at 72.
[238] *See id.*
[239] *See id.* Arkin notes that an AWS "will never be perfect, but it is designed and intended to perform better than human soldiers operating under similar circumstances. The ethical adaptor will operate in a monotonic fashion, acting in a manner that progressively increases the restrictions on the use of lethal force."
[240] *Id.* at 61.
[241] *See id.* ("It advises in advance of the mission, the operator(s) and commander(s) of their ethical responsibilities should the lethal autonomous system be deployed for a specific battlefield situation. It requires their explicit acceptance (authorization) prior to its use. It also informs them regarding any changes in the system configuration, especially in regards to the constraint set C. In addition, it requires operator responsibility acceptance in the event of a deliberate override of an ethical constraint preventing the autonomous agent from acting.").
[242] *See id.* at 77.
[243] *See id.*

human counterpart retains the ability to override the AWS's constraints on a case-by-case basis. In both scenarios, the human counterpart's responsibilities are clear and explicit.[244]

Lastly, the AWS actions, or "effectors," will require evaluation. AWS effectors refer not only to an AWS's onboard weapons systems, but also to the nature and results of weapons usage based upon sensory information received and processed by the AI.[245] As part of a gradual implementation strategy, AWSs will be properly fielded and tested to carry out these actions.[246] This will of course require AWSs to undergo trials under numerous conditions while observed by experts from military, technical, health, and environmental disciplines.[247] These tests will not only address the characteristics of a weapon, but also the methodology behind its employment, since the weapon's effects are the direct result of these two factors combined.[248] As the ICRC suggests, the empirical evidence derived from these tests should be evaluated to assess whether specific prohibitions or restrictions apply or whether the AWS contravenes one or more of the general rules of IHL, as applicable to weapons, and means and methods of warfare.[249] Evaluations by U.S. military leaders are required and already occur.[250] As the technology evolves, military and political leaders should make the empirical evidence illuminating the weapons' effectiveness in compliance with IHL available to the public, consistent with necessary secrecy, since this would help further sophisticated development and quell the critics' opposition.[251]

IV. **Current Criticisms of Autonomous Weapons Systems**

[244] *See id.*
[245] SINGER, *supra* note 4, 81.
[246] *See* ICRC Article 36 Guide, *supra* note 133, at 953; *see also* Waxman & Anderson, *supra* note 3, at 25.
[247] ICRC Article 36 Guide, *supra* note 133, at 945.
[248] *Id.*
[249] *See id.*
[250] *See* DOD DIRECTIVE 3000.09, *supra* note 37, at 2; *see also* McDuffee, *supra* note 116 (involving the Robot Rodeo mentioned earlier where AWSs were evaluated for, *inter alia*, weapons accuracy).
[251] *See* Waxman & Anderson, *supra* note 3, at 25.

There is a wide array of concerns that undergird many of the arguments posed by critics. Some of these concerns appear well founded. Selected roboticists believe that robots will be incapable of carrying out those functions required under IHL. Admittedly, a deployed fully autonomous weapon simply being unable to distinguish civilians from combatants would alarm political and military leaders alike, let alone the general public. Others argue that the mere notion of a robot conducting warfare would be as shocking as the use of biological or chemical agents. In fairness, there are misconceptions that underscore many of the various arguments that critics of AWS development pose. Many of these misperceptions stem from fears that, as one scholar notes, date back "to the Romantic Era and [were] first represented by the Frankenstein monster who symbolized the idea that all scientific progress is really a disguised form of destruction."[252] As mentioned in Part II, many of these criticisms emanate from a conflation of our understanding of human autonomy with that of a robot. In short, critics fear humans developing and subsequently losing control over AWSs (and the underlying AI), making machine the master.[253] By extension, critics argue, AWSs will be incapable of following programmed instructions as designed and will cause unnecessary death. Various groups and scholars attempt to play it safe and, as Singer points out, "often try to knock down anything that feels too unfamiliar" on the basis of emotional subtexts rather than engage in a meaningful discussion about how to ensure greater IHL compliance.[254] Prompted by these underlying fears, critics call for international prohibitions on the development and employment of AWSs, citing a

[252] McGinnis, *supra* note 104, at 1260.
[253] *See id.*
[254] SINGER, *supra* note 4, at 9.

variety of reasons, such as the Martens Clause.[255] While this article cannot highlight every criticism, a few key points must be addressed.

First, some critics argue that AWSs raise accountability concerns over LOAC violations. Specifically, they argue about who should be held accountable in the event that an autonomous weapon causes civilian deaths. Philosopher Robert Sparrow (cited in the HRW report), argues that no one, including the machine as a sentient being, can "justly be held responsible for the actions of these systems, [and thus] it will be unethical to use them in war."[256] By his logic, many weapons currently considered lawful would be illegal if a human being isn't controlling every aspect of their use. Sparrow fails to acknowledge that AWSs always remain a weapons system that the commander ordered into action and for which the commander remains ultimately responsible.[257] Sparrow's argument fails to recognize that humans will develop, test, deploy, and maintain oversight for AWSs. Deficiencies in AWSs resulting from human error in design, manufacturing, and employment will dictate responsibility analogous to tort or criminal liability theory, as is done currently with non-AWSs.[258] As will be discussed more thoroughly in Part VI, this article proposes that command responsibility in the AWS realm will actually improve by using current accountability notions.

Critics like Sparrow also contend that AWSs may "go rogue," killing innocent civilians "to strike fear into the hearts of onlooking combatants . . . to test its weapon systems, or because

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[255] *See Losing Humanity*, *supra* note 15, at 35-36; *see also* Evans, *supra* note 45, at 699. The "Martens clause" is derived from the Hague Convention Article IV and states: "Until a more complete code of the laws of war has been issued, the High Contracting Parties deem it expedient to declare that, in cases not included in the Regulations adopted by them, the inhabitants and the belligerents remain under the protection and the rule of the principles of the law of nations, as they result from the usages established among civilised peoples, from the laws of humanity, and the dictates of the public conscience." Evan Wallach, *Chapter Five: Protected Persons,* LAW OF WAR, http://lawofwar.org/Protected%20Persons.htm.
[256] Sparrow, *supra* note 53, at 66.
[257] *See* Schmitt & Thurnher, *supra* note 58, at 258.
[258] *See id.*

the robot was seeking to revenge the 'deaths' of robot comrades."[259] Sparrow attempts to analogize or promote the comparative notion of future AWS autonomy to human autonomy in a metaphorical or philosophical sense, thus conflating two separate understandings. He assumes that AWSs will make their own independent choices the way humans do and will therefore be unpredictable.[260] His argument is fatally flawed for several reasons. First, he accepts current technological notions as predictive of future outcomes. Sparrow accepts selected AI research as dispositive on how all AWSs will perform in the future.[261] Next, his argument assumes that developers will program AWSs with humanity's flaws.[262] Further, he ignores the requirement that military and political leaders will demand programmed IHL and ROE constraints within the systems' AI architecture, as discussed earlier. While fully autonomous weapons will act without further input from their human counterparts, nothing suggests humanity will enable a fully autonomous/adaptive mode without the baseline restriction of "do no harm" to civilians as Arkin suggests.[263] Lastly, his argument dismisses the extensive AWS testing to safeguard against mishaps that will occur before any AWSs would be employed.

Critics also argue that AWSs will be incapable of discriminating between combatants and innocent civilians. Robotics professor Noel Sharkey argues robots could not be programmed to understand the difference between a civilian and a combatant.[264] HRW's report, which Sharkey advised on, expounds on this point by arguing that "fully autonomous weapons would not have the ability to sense or interpret the difference between soldiers and civilians especially in

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[259] Sparrow, *supra* note 53, at 66.
[260] *Id.* at 65.
[261] *See* Noorman & Johnson, *supra* note 23, at 53.
[262] *See* ARKIN, *supra* note 5, at 2.
[263] *See id.* at 39.
[264] Sharkey, *supra* note 175, at 87.

contemporary combat environments."[265] Thus, Sharkey and HRW advise that further AWS development should be prohibited. Their "take-our-word-for-it" approach is based on the current state of technology, excluding the possibility of innovative developments over the long haul, and it is currently inaccurate in limited environments (e.g., no-fly zones). In short, critics argue that AWSs will never distinguish between civilians and combatants, basing this conclusion solely upon current empirical data or theories, rather than participating in a debate to ensure that the inevitable development in AWS technology meets or exceeds the parameters set by IHL.

Critics also argue that mere possession of AWSs will lower the barriers to warfare. Philosophy professor Peter Asaro argues that the aim of military technology is to develop tactical advantages while lowering combat risks and casualties.[266] He contends that by reducing the negative consequences of war, governments with advanced technologies will be incentivized to start wars with other states.[267] He further argues that every war begins with the actions of unjust nations, and that such nations will seek to use these technologies to impose their will on others.[268] He states that nations will argue that using AWSs is a "safe" form of fighting that limits casualties, to strategically justify belligerence.[269] Similarly, Sharkey argues that tyrannical despots or terrorists can use these weapons to kill civilians.[270] These arguments, however, are flawed for two reasons.

First, Asaro's argument ignores the greater political, economic, and legal implications associated with war.[271] Technological superiority alone has never served as the impetus for war.

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[265] *Losing Humanity*, *supra* note 15, at 10.
[266] *See* Peter Asaro, *How Just Could a Robot War Be?*, *in* CURRENT ISSUES IN COMPUTING AND PHILOSOPHY 50 (Adam Briggle, Katinka Waelbers & Philip A. E. Brey eds., 2008).
[267] *See id.*
[268] *See id.* at 5.
[269] *See id.*
[270] Sharkey Interview, *supra* note 220.
[271] Waxman & Anderson, *supra* note 3, at 18.

If this were true, the United States would have engaged in expansive warfare simply for being technologically superior to other nations. Moreover, the power of public opinion has grown through the Internet, as mentioned earlier. Any loss of life through AWS warfare on either side can sway that public opinion. So while one party to the conflict may enjoy lower causalities through technological superiority, that nation's populace may still disapprove when it sees the results. Secondly, all military technological advancements have made the process of warfare easier.[272] In the eleventh and twelfth centuries, crossbows allowed a peasant to kill a professional knight more effectively and from greater distances.[273] Because of this, Pope Urban II banned the use of crossbows in 1096, and other leaders ordered that captured crossbowmen were either to be dismembered or killed.[274] However, a weapon's ability to kill an opponent more effectively or from greater distances does not embolden terrorists or provide justification for war under jus ad bellum. Although AWSs offer the ability to kill at greater distances, that proposition would also be true for missiles or cannon fire. Similarly, if a terrorist or rogue state has the ability to develop an AWS, then it likely has the ability to develop any weapon, nuclear bombs included. In essence, AWSs are simply subject to the same "general problem of disarmament" applicable to all weapons.[275] Arguments that the possession or usage of AWSs will in itself lower barriers to warfare or further embolden tyranny and terrorism are fatally flawed.

Some critics may also argue that the use of AWS systems would be unfair, given other nations' limited access to such technologies, at least currently.[276] Chivalry notwithstanding, the

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[272] *See* Sassòli, *supra* note 3, at 1.
[273] *See* N.H. Mallett, *The Crossbow — A Medieval Doomsday Device?*, MILITARY HISTORY NOW (May 23, 2012), http://militaryhistorynow.com/2012/05/23/the-crossbow-a-medieval-wmd.
[274] *See id.*
[275] *See* Sassòli, *supra* note 3, at 1.
[276] *See id.* at 2.

notion of fairness in weapons equality among knights is no longer a binding principle.[277] While chivalric courtesy dictated that knights fought on "essentially equal terms," as a practical matter, "strategic prudence" was favored.[278] Distance tactics using air-, sea-, and land-based systems such as artillery are rooted in catapults or archery.[279] Parties to conflicts employed these distance measures even when the opposition had not been equally equipped. During the battle of Agincourt, the heavily armored French outnumbered the English opposition.[280] However, the English use of highly mobile archers led to victory.[281] One nation's failure to develop or possess an AWS does not preclude another nation from using its own.[282] As a present illustration, U.S. military doctrine has long abandoned fairness on the battlefield through the employment of advanced weapons, combined arms, and joint military warfare to overwhelm the adversary, thus creating an unequal fight.

Moreover, technologically superior military force does not guarantee a successful campaign.[283] Contemporary conflicts, such as Vietnam, Iraq, and Afghanistan, illustrate that the technologically weaker sides may have other advantages, utilizing tactics that prevail over their more technologically advanced opponents. In Iraq and Afghanistan alone, Coalition forces suffered extensive losses of armored vehicles to insurgents' low-cost, improvised explosive devices.[284] Moreover, technologically weaker opponents often compensate by breaking the laws

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277 *See id.*
278 Wallach, *supra* note 190, at 454.
279 *See* Waxman & Anderson, *supra* note 3, at 8.
280 *See* Hannah Ellis-Petersen, *Battle of Agincourt: ten reasons why the French lost*, THE TELEGRAPH (July 20, 2011), http://www.telegraph.co.uk/news/8648068/Battle-of-Agincourt-ten-reasons-why-the-French-lost.html.
281 *See id.*
282 *See id.*
283 *See* Sassòli, *supra* note 3, at 2.
284 *See* Neil Waghorn, *With Advanced IEDs, Structural Changes May Trump Increased Armour*, DEFENCE IQ (Sept. 29, 2011), http://www.defenceiq.com/army-and-land-forces/articles/with-advanced-ieds-structural-changes-may-trump-in.

of war.[285] However, according to IHL, such risks do not imply a party is not allowed to use technology not available to the enemy.[286] In summary, nothing within IHL generally requires both sides in a conflict to limit themselves to the weapons available to their opponents.

A final criticism is that AWSs will undermine Human Rights Law (HRL), an argument put forth in a report published by HRW.[287] The report contends that AWS use would violate HRL principles, many of which underpin or inherently exist within IHL.[288] The report points out that during an armed conflict, IHL is the governing law (lex specialis); the report goes on to interpret certain human rights provisions.[289] While it is true that HRL and IHL overlap in certain respects, the former does not comprise the latter. The IHL remains lex specialis—and that debate is beyond the scope of this article. Ignoring this consideration, their report first argues that AWSs will undermine the right to life by engaging in arbitrary killing.[290] In their words, the HRL understanding of arbitrary killing refers, by extension, to unlawful killing under IHL.[291] Second, HRW argues that AWSs will violate the right to a remedy because no one could be held accountable for AWS mishaps resulting in unlawful injury, death, or destruction and reiterates that current accountability measures are wholly inadequate.[292] Lastly, HRW posits that the use of AWSs violates the principle of dignity, further dehumanizing warfare by delegating the use of lethal force to inanimate objects.[293]

As with similar critiques, the problem with their entire analysis is that HRW makes notional and very speculative assumptions about the development, evolution, and employment of

[285] *See* Sassòli, *supra* note 3, at 2.
[286] *See id.*
[287] *See Shaking the Foundations*, *supra* note 16, at 1.
[288] *See id.* at 7.
[289] *Id.* at 14.
[290] *Id.*
[291] *Id.*
[292] *Id.* at 17-22.
[293] *Id.* at 23-24.

future technology not yet currently available. Furthermore, HRW assumes lawmakers' and commanders' decisions will arbitrarily allow wholly unpredictable or unmanageable weapons to be employed. Driven by this assumption, HRW calls for an outright ban on the technology and, by extension, immediately dismisses any possibility of collaboration that could shape AWS development toward greater humanitarian protections. Many of these considerations have already been addressed. Nothing in AWS technology alters the law or negates accountability, whether HRL or IHL. In fact, the role of humans will remain the key factor in this entire debate. Designers, developers, human operators and managers, regulators, and policymakers, will all set constraints on AWS actions.[294] Giving humans some credit, the DoD has already institutionalized the need to keep humans in the AWS decision loop and the need for humans to thoroughly test AWSs to safeguard against mishaps.[295] As the technology continues to progress, further U.S domestic legal or policy debate and revisions will likely occur.

V. Autonomous Weapons Can Perform Warfighting Functions in Compliance with International Humanitarian Law More Effectively than Humans

Assuming technological requirements (such as AI) are fulfilled, AWSs offer a distinct opportunity to surpass human counterparts at complying with IHL and at safeguarding against unnecessary loss of life. As scholars note, the common problem with a per-se prohibition against AWS development is that it would preclude the eventuality of any positive outcome from such development, including the possibility of mitigating collateral damage.[296] Scientists and developers have often stumbled upon better ideas and technological developments, to the great benefit of society, while researching entirely unrelated matters. One well-known example is the microwave oven, which was discovered by a Raytheon engineer while testing a new vacuum

[294] *See* Noorman & Johnson, *supra* note 23, at 60.
[295] *See* DoD DIRECTIVE 3000.09, *supra* note 37, at 1.
[296] *See* Schmitt & Thurnher, *supra* note 58, at 281; Waxman & Anderson, *supra* note 3, at 15.

tube known as a magnetron and discovering that his candy bar had melted in his pocket in the process.[297] Similarly, X-rays, were accidentally discovered by a German physicist testing cathode tubes with cardboard.[298] The developments made by merging technology with weapons, making firearms more precise, have also led to "smart guns" that require biometric recognition of their original owners before firing.[299] If Sharkey and HRW have their way, developers would be foreclosed from any technological benefits AWSs would offer, including the ability to further reduce collateral damage better than humans can. The below discussion illustrates some of the reasons AWSs can surpass humans in this capacity.

A. AWSs Will Remain Objective through the Conflict

Warfare carries a heavy cost on the human psyche. Feelings of anger, anxiety, and frustration among armed forces are magnified in theaters of combat. AWS Critics, such as the ICRAC, argue that emotions such as compassion or empathy are a critical safeguard against IHL violations among warfighters. However, they forget that anger and fear are equally probable responses that cannot be divorced from their more positive counterparts in the emotional repertoire. As author Michael Walzer observes, "Fear and hysteria are always latent in combat . . . and . . . press us toward fearful measures and criminal behavior."[300] Psychologically speaking, "emotions infuse into a cognitive task, and influence memory and judgment."[301] Since emotions

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[297] Jaime Clevenger, *The Engineering Behind the Microwave Oven*, ILLUMIN (Nov. 1, 2000), https://illumin.usc.edu/76/the-engineering-behind-the-microwave-oven/.
[298] Pamela Cyran & Chris Gaylord, *The 20 Most Fascinating Accidental Inventions*, C.S. MONITOR (Oct. 5, 2012), http://www.csmonitor.com/Innovation/2012/1005/The-20-most-fascinating-accidental-inventions/X-ray-images.
[299] *See* Logan Whiteside, *Smart Guns Could Be Next Step in Gun Control*, CNN (Apr. 23, 2013), http://money.cnn.com/2013/04/23/technology/smart-guns/ [hereinafter Whiteside].
[300] ARKIN, *supra* note 5, at 6 (quoting MICHAEL WALZER, JUST AND UNJUST WARS 251 (Basic Books ed., 3d. ed. 2000)).
[301] Molly Moon, *Cognition and Emotion Together at Abu Ghraib: Utilizing the Affect Infusion Model*, at 3 (unpublished comment) (citing Joseph Forgas, *The Affect Infusion Model (AIM): An Integrative Theory of Mood Effects on Cognition and Judgments*, *in* THEORIES OF MOOD AND COGNITION 99-133 (L.L. Martin & G.L. Clore eds., 2001)), *available at* http://www.stolaf.edu/depts/ciswp/mmoon/documents/socialpsych2.pdf.

and cognition are not mutually exclusive, emotions ultimately influence human actions.[302] Conversely, AWS platforms will not be programmed with human emotions that will influence judgment and resultant actions.[303] Singer notes that "[robots] don't carry all our wonderful 'human baggage.' They don't show up at work red-eyed from a night of drinking, they don't think about their sweethearts back home when they are supposed to be on mission, and they don't get jealous when a fellow soldier gets a promotion."[304] Similarly, the ICRC highlights the human–robot comparison by stating that emotion emanating from a "loss of colleagues and personal self-interest is not an issue for AWS, and the record of respect for IHL by human soldiers is far from perfect."[305] Relying on surgeon general reports, Arkin states that the ethical governor component of AWS AI, discussed earlier, will not programmatically involve emotion because empirical evidence suggests that emotions impede the ethical judgment of humans in wartime.[306]

"Fog of war" scenarios in Iraq and Afghanistan illustrate this point. During these campaigns, U.S. soldiers and Marines conducted house and building searches for insurgents. Undoubtedly, tensions and adrenaline levels ran high, and fear of uncertainty became pervasive. Notwithstanding their bravery and extensive training, soldiers' emotions can and will impact their actions. Thus, the potential for LOAC violations, such as killing those hors de combat, remains present. Take, for example, a U.S. Marine in Fallujah, Iraq, who was suspected of

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[302] *See id.*
[303] *See* ARKIN, *supra* note 5, at 6.
[304] SINGER, *supra* note 4, at 65.
[305] 31ST INT'L CONFERENCE OF THE RED CROSS AND RED CRESCENT, 31IC/11/5.1.2, INTERNATIONAL HUMANITARIAN LAW AND THE CHALLENGES OF CONTEMPORARY ARMED CONFLICT 40 (2011), *available at* https://www.icrc.org/eng/assets/files/red-cross-crescent-movement/31st-international-conference/31-int-conference-ihl-challenges-report-11-5-1-2-en.pdf.
[306] ARKIN, *supra* note 5, at 56 (citing OFFICE OF THE SURGEON MULTINATIONAL FORCE-IRAQ ET AL., MENTAL HEALTH ADVISORY TEAM (MHAT) IV OPERATION IRAQI FREEDOM 05-07, FINAL REPORT (2006)).

killing a wounded insurgent in a mosque.[307] U.S. Marines were involved in intense fighting throughout the previous several days and the day in question.[308] As a result, there were numerous physical and psychological factors that the U.S. Marines endured at the time.[309] While in the mosque, a marine corporal observed a wounded insurgent lying on the floor with his left arm concealed behind his head.[310] This marine already experienced an act of treachery during a previous incident, where an insurgent feigning serious injury rolled over while lying on the ground, apparently injured or dead, and shot his weapon in the corporal's face, wounding him.[311] Upon approaching the wounded insurgent in the mosque, the marine corporal shouted repeatedly, "He's [expletive deleted] faking death!" and then shot the insurgent.[312] Other than the fact that the insurgent's left arm was concealed, there were no immediate indicators suggesting the insurgent's treachery.[313] While initially suspected of a LOAC violation, the corporal was cleared of any wrongdoing in the incident, since he had observed that the wounded Iraqi posed a threat

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307 *Military Investigates Shooting of Wounded Insurgent*, CNN (Nov. 16, 2004), http://www.cnn.com/2004/WORLD/meast/11/15/marine.probe/.

308 Owen West & Phillip Carter, *What the Marine Did,* SLATE (Nov. 18, 2004), http://www.slate.com/articles/news_and_politics/war_stories/2004/11/what_the_marine_did.html.

309 *See id.* (stating "[i]n this unit's case, one early lesson in Fallujah was to avoid Iraqis altogether, dead or alive. Iraqis wearing National Guard uniforms had ambushed them, killing one of their own. Another Marine had been killed when an explosive detonated under an insurgent corpse. Several insurgents had continued desperate fights notwithstanding gruesome wounds. Others tried to exploit the civil-military moral gap, acting as soldiers at 500 meters and as civilians when the Marines closed in. The Iraqis in the mosque may have been immobile, but to the Marines, they posed a threat. Further, the Marines were fighting in an enemy city with little uncontested territory. There were no "friendly lines" behind which they could rest. The Marine in question had been wounded already. He was no doubt exhausted by five days of continuous fighting by the time he risked his life and burst into the mosque on Saturday. A well-rested man would have faced a dilemma inside, filled with shades of gray. A sleep-deprived man weary from days of combat saw only a binary choice: shoot or don't shoot, life or death.").

310 Jamie McIntyre, *Marine cleared in videotaped shooting,* CNN (May 5, 2005), http://www.cnn.com/2005/US/05/05/falluja.marine/index.html?eref=sitesearch.

311 Kevin Sites, Jim Miklaszewski & Alex Johnson, *US Probes Shooting at Fallujah Mosque,* NBC (Nov. 16 2004), http://www.nbcnews.com/id/6496898/ns/world_news-mideast_n_africa/t/us-probes-shooting-fallujah-mosque/#.VMHKtbl0yrQ.

312 *Id.*

313 *See* McIntyre, *supra* note 310.

and had acted in self-defense.[314] Regardless of the actual outcome, the marine corporal's situation illustrates the impact of emotions on human warfare.

On the other hand, DARPA's conceptualized insect drones could conduct initial surveillance of the mosque.[315] These insect drones, which resemble mosquitoes, could conceivably employ video cameras and microphones assisting human counterparts in distinguishing civilians from enemy combatants.[316] More evolved PackBots with advanced telemetry could be deployed into the mosque to determine the presence and status of the insurgents. The benefit would be that these machines could assist in identifying the presence of weapons and explosives and could distinguish between wounded or dead personnel and those treacherously "playing dead." For example, if an insurgent is wounded or incapacitated, then the information these machines pass on regarding the location of weapons and other insurgents would render the situation more certain. On the other hand, where potentially a treacherous insurgent is present, AWSs can warn their human counterparts or take action. Other technological companies and their designs could conceive weaponized insect drones or robots similar to PackBots which could neutralize a perceived threat upon order from their human counterparts. If this alternative insect drone or robot is attacked, nothing precludes either of these systems from employing on-board lethal or nonlethal capabilities in either semi-autonomous or autonomous modes.[317] What this all means is that fog of war in these instances will be mitigated.

[314] *See id.*
[315] *See* Emily Athens, *The Race to Create 'Insect Cyborgs,'* THE GUARDIAN (Feb. 16, 2013), http://www.theguardian. com/science/2013/feb/17/race-to-create-insect-cyborgs.
[316] *See id.*
[317] *See*, *e.g.*, Waxman & Anderson, *supra* note 3, at 7.

The maltreatment of detainees in Abu Ghraib also illustrates the problems posed by human susceptibility to unethical, emotion-based actions. The military personnel in question did not adequately receive appropriate corrections training prior to mobilization and thus relied heavily on the personnel with civilian experience.[318] Without exploring the psychological underpinnings too deeply, the participants in the Abu Ghraib crimes were influenced by emotions and other psychological factors, which, when coupled with a lack of training, led to the dehumanizing treatment of the detainees.[319] The Taguba report found that

> psychological factors, such as the difference in culture, the Soldiers' quality of life, the real presence of mortal danger over an extended time period, and the failure of commanders to recognize these pressures contributed to the perversive atmosphere that existed at Abu Ghraib (BCCF) Detention Facility and throughout the 800th MP Brigade.[320]

The report also concluded that the abuses detainees suffered were wanton acts based on the complex interplay of many psychological factors for soldiers in an unsupervised and dangerous setting.[321] An analogous example of this problem is the Stanford prison experiment in 1973.[322] In that experiment, researchers found that over time, prison guards harassed and tormented the prisoners and ultimately became "brutal and abusive" through a breakdown of various emotional and psychological factors.[323] In the case of Abu Ghraib, the emotional and psychological

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[318] MAJ. GEN. ANTONIO M. TAGUBA, ARTICLE 15-6 INVESTIGATION OF THE 800TH MILITARY POLICE BRIGADE 37 (2004), *available at* http://www.npr.org/iraq/2004/prison_abuse_report.pdf [hereinafter TAGUBA REPORT].
[319] *See id.* at 43.
[320] *Id; see also* MAJ. GEN. GEORGE R. FAY & LT. GEN. ANTHONY R. JONES, ARTICLE 15-6 INVESTIGATION OF THE ABU GHRAIB DETENTION FACILITY AND 205TH MILITARY INTELLIGENCE BRIGADE 109-120 (Aug. 25, 2004), *available at* http://corpwatch.org/downloads/FayReport.pdf.
[321] *See* TAGUBA REPORT, *supra* note 318, at 48-49.
[322] *See* John Schwartz, *Simulated Prison in '71 Showed a Fine Line Between `Normal' and `Monster,'* N.Y. TIMES, May 6, 2004.
[323] *See id.*

underpinnings of war further enabled this behavior, along with the same kinds of psychological factors found in the Stanford experiment.[324]

A possible solution would be to employ a prison guard robot, developed by the government of the Republic of Korea together with the Electronics and Telecommunications Research Institute and the manufacturer SMEC.[325] Unlike a human guard, a robotic guard would not suffer the long-term psychological or emotional stress associated with either war or the relationship between guards and detainees. The guard would undertake such functions as providing food, escorting, and overall monitoring of the detainees. If the detainees riot or become unruly, nothing precludes the robot guard from employing non-lethal measures, provided such measures are lawful in nature and employment. If for no other reason, the robot guard provides an additional buffer between human guards and detainees, thereby reducing or precluding the emotional effects. While the events of Abu Ghraib are not representative of the behavior of U.S.-run detention operations, these events are illustrative of why robots could be a better solution to such concerns.

B. AWSs Can Act with Greater Caution

In theory, AWSs will have greater ability to act more conservatively than humans.[326] This point will remain fundamentally important for future urban conflicts, where civilian presence is prevalent.[327] In such environments, de-escalation tactics are desired, as has been found in Iraq and Afghanistan.[328] To understand this benefit within the context of AWSs and

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[324] *See id.*
[325] Lena Kim, *Meet South Korea's New Robotic Prison Guards Digital Trends*, DIGITAL TRENDS (Apr. 21, 2012), http://www.digitaltrends.com/international/meet-south-koreas-new-robotic-prison-guards/#ixzz2kDBt6cTB.
[326] *See* ARKIN, *supra* note 5, at 6.
[327] *See* Waxman & Anderson, *supra* note 3, at 7 (noting automation might help "distinguish hostile threats from innocent civilians, especially in situations where the former deliberately hides among the latter.").
[328] *See* Kevin Sites, *What We Can Learn from the Uzbek and Tajik Conflict in Afghanistan*, VICE.COM, (July 1, 2013), http://www.vice.com/en_ca/read/afghanistan-may-turn-into-a-bloody-mess; William S. Lind, *De-escalation*

IHL, we must explore the doctrine of self-defense briefly.[329] Generally, combatants can defend against hostile acts or demonstrated hostile intent.[330] While an AWS can be programmed to interpret hostile acts, interpreting demonstrated hostile intent becomes exceedingly difficult to conceptualize, even for a human.[331] Under certain circumstances, human combatants need not wait to be attacked first and may engage the enemy when faced with demonstrated hostile intent.[332] However, even if sufficient AWS AI were available to interpret human behavior and demonstrated hostile intent, an AWS has no inherent need for self-defense, other than to preserve its ability to complete the mission.[333] Even in such an instance, nothing precludes military commanders from directing an AWS's programming to wait for a hostile act to occur before responding.

To support this proposition, humanity's self-preservation instincts would not necessarily be programmed into AWS AI.[334] Thus, an AWS could "actively ferret out the traits of a combatant by using a direct approach . . . or other risk-taking (exposure) methods [which] further illuminate[s] what constitutes a legitimate target or not in the battlefield."[335] In short, a machine can take the first or several shots from the enemy in an effort to better distinguish between a combatant and a civilian. Such actions would better protect accompanying soldiers and AWS counterparts by drawing out the enemy. Thus, the greater benefit of using the AWS is realized:

Is Best Tactic for Us in Iraq, MILITARY.COM, (June 30, 2005), http://www.military.com/NewContent/0,13190,Defensewatch_063005_Lind,00.html.

[329] *See* LOAC Deskbook, *supra* note 129, at 31-33.

[330] *See id.* at 37-38.

[331] See *id.* at 38; ARKIN, *supra* note 5, at 58.

[332] *See* LOAC Deskbook, *supra* note 129, at 37-38.

[333] *See* ARKIN, *supra* note 5, at 6.

[334] *See id.* at 11 ("[r]obotic systems need make no appeal to self-defense or self-preservation in this regard, and can and should thus value civilian lives above their own continued existence. Of course there is no guarantee that a lethal autonomous system would be given that capability, but to be ethical I would contend that it must.").

[335] *Id.*

"fog of war" errors resulting in civilian deaths, which would otherwise be tolerated for human combatants, are diminished or eliminated.[336] In similar situations, AWSs can also undertake more precautionary measures than can human soldiers to ascertain a legitimate target. An AWS can request authority to fire from its human counterpart for a variety of reasons. Moreover, an AWS could respond to lethal force with non-lethal measures (e.g., flares, dazzlers, rubber bullets, foaming agents, or nets).[337] AWSs can employ non-lethal measures in more hostile or uncertain situations than can their human counterparts. While employing non-lethal measures in response to lethal force may seem dangerous for humans, an AWS will not have self-preservation instincts.[338] In the end, military commanders might well prefer that an AWS be destroyed through enemy fire rather than run the risk of potential LOAC violations. Alternatively, if the AWS AI perceives an accomplished action in violation of the LOAC, the "ethical adaptor" algorithm can exercise caution by restricting the AWS's lethality for the remainder of the mission.[339]

To illustrate this benefit, take for example a roadside checkpoint in Iraq or Afghanistan, where soldiers or marines must inspect oncoming vehicles for potential terrorist occupants or related munitions. Throughout both conflicts, U.S. forces confronted insurgents who attempted to evade capture or commit suicide attacks with explosive-laden vehicles at these checkpoints. On the other hand, the U.S. forces faced circumstances where civilians at checkpoints were

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[336] *See id.* at 12 ("We will strive to hold the ethical autonomous systems to an even higher standard, invoking the Principle of Double Intention. [Walzer] argues that the Principle of Double Effect is not enough, i.e., that it is inadequate to tolerate noncombatant casualties as long as they are not intended, i.e., they are not the ends nor the means to the ends. He argues for a stronger stance – the Principle of Double Intention, which has merit for our implementation. It has the necessity of a good being achieved (a military end) the same as for the principle of double effect, but instead of simply tolerating collateral damage, it argues for the necessity of intentionally reducing noncombatant casualties as far as possible.").

[337] This argument assumes that the non-lethal measures employed do not violate the prohibitions against unnecessary suffering.

[338] *See* ARKIN, *supra* note 5, at 6.

[339] *See id.* at 72.

killed because they failed to heed warnings. In 2003, U.S. forces killed seven Iraqi women and children in Najaf when their vehicle approached the army checkpoint but did not stop after signals, warning shots, and disabling fire.[340] U.S. Central Command indicated that soldiers followed the rules of engagement to protect themselves and "exercised considerable restraint to avoid the unnecessary loss of life."[341]

An AWS system can address checkpoint scenarios with more caution. For example, QinetiQ's Modular Advanced Armed Robotic System (MAARS) carries day and night cameras, motion detectors, hostile fire detection systems, machine guns, 40mm grenade launchers, a green laser "dazzler," tear gas, and a loudspeaker to warn oncoming insurgents.[342] Assuming the availability of advanced sensors and telemetry, the MAARS (or next-generation platform) could theoretically detect the presence of weapons or explosives in the vehicles at greater distances, whether moving or stopped. Moreover, should the MAARS system detect weapons within preset confidence levels, the MAARS can disable the vehicle through gunfire or other means, at greater distances. If for any reason it could not detect, the MAARS platform could otherwise engage in escalation-of-force methods such as flares and laser dazzlers in quicker succession and at greater distances than its human counterparts. If the vehicle did not stop, the MAARS could be used to disable the vehicle with great precision, while human military counterparts were able to remain at a safe distance. If the AWS sensors detect weapons, the AWS's system can warn human counterparts and employ escalation of force up to non-lethal measures to compel surrender. At worst, if the AWS is fired upon, then either the AWS or a human counterpart will have positively

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[340] Jaime Holguin, *7 Iraqis Killed At Checkpoint*, CBS NEWS (Apr. 1, 2003), http://www.cbsnews.com/news/7-iraqis-killed-at-checkpoint/.
[341] *Id.* (internal quotations omitted).
[342] *See* SINGER, *supra* note 4, at 111; *see also* Adam Clark Estes, *The Next Generation Drones Will Carry Gear and Machine Guns Into Battle*, GIZMODO (Oct. 15, 2013), http://gizmodo.com/these-next-generation-drones-carry-gear-and-machine-gun-1445664557.

distinguished between an insurgent and a civilian. This example is not meant to be a one-size-fits-all solution, but rather an illustration of the positive possibilities based on historical examples within the past decade of war.

C. AWS Capabilities Will Exceed Humanity's Biological Limitations

There is no doubt that the human body is capable of great feats. However, like any system, there are limitations. Humans try to compensate for such biological limitations through risk-taking, relying on gut instincts, intuition, or other intangible factors. Technology has assisted humans, especially in combat. Simple inventions like telescopic sights mounted on rifles serve as an example. If we aspire to lower or eliminate collateral damage, then AWSs with capabilities exceeding humanity's limitations may be a proper solution. One reason is that the development and use of robotic sensors will conduct battlefield observations more effectively than humans.[343] At the same time, AWSs can integrate and process information derived from sensory observations and other sources more rapidly before responding with lethal force than a human possibly could in real time.[344] The following examples illustrate this point.

First, AWSs can be more accurate than humans. In Iraq and Afghanistan, enemy snipers plagued military units by firing from civilian-populated buildings. Through targeting analyses that include proportionality, on-scene commanders could opt for destroying the relevant section of the building or, in extreme cases, the entire building if circumstances warranted. While current technology, such as the Robotic Enhanced Detection Outpost with Lasers (REDOWL) systems,[345] can visually and acoustically detect enemy snipers in a post-shot scenario, such

[343] *See* ARKIN, *supra* note 5, at 6.
[344] *See id*. at 7.
[345] SINGER, *supra* note 4, at 111, 145.

reactive detection systems are largely ineffective if targeted troops are killed by sniper fire.[346] One proposed technology is an AWS outfitted with PRE-Shot Photonic Automatic Linking System – Sniper Detection (PALS-SD), capable of proactively detecting enemy snipers or IED trigger teams prior to their impending actions.[347] Similar capabilities could identify snipers through locations and weapons optics that read heat signatures. The AWS can subsequently target the sniper, assuming either the system AI or a human counterpart on the loop positively identified the target.

In terms of precision, using the same example, an AWS would not have the biological impediments of human snipers aiming at the target. As Singer writes,

> The robot's zoom lens not only extends the shooter's sight, but matches it exactly to the weapon's. Rather than trying to align their eyes in exact symmetry with the gun in their hand, it is as if the soldier's eagle eye was the gun. The weapon also isn't cradled in the soldier's arms, moving slightly with each breath or heartbeat. Instead, it is locked into a stable platform. As army staff sergeant Santiago Tordillos says, "It eliminates the majority of shooting errors you would have."[348]

More recently, Texas gun manufacturer TrackingPoint created a $25,000 smart rifle with a "networked tracking scope," that uses a color heads-up display, which monitors factors such as wind speed, direction, target distance, gravity, the rotation of the earth, and calculations of how and when to accurately fire.[349] TrackingPoint's smart rifles also employ Wi-Fi capability, allowing them to transmit live video of their shots to other digital devices.[350] With this technology, an AWS can objectively consider environmental factors that would otherwise affect

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346 Press Release, Advanced Anti-Terror Tech. Corp. (A2-T2), Photonic Automatic Linking System -Sniper Detection (PALS-SD), Proposal No. N2-3158 1 (on file with author).
347 *See id*. at 7.
348 SINGER, *supra* note 4, at 31.
349 Dara Kerr, *Now You're a Sharpshooter: The Smart Rifle Arrives*, CNET (Sept. 25, 2013), http://www.cnet.com/news/now-youre-a-sharpshooter-the-smart-rifle-arrives/ [hereinafter Kerr]. For further information on the manufacturer's website see TRACKINGPOINT, http://tracking-point.com.
350 *See id*.

the shot.[351] Coupled with the pre-shot indicators, the AWS would have better accuracy and a smaller margin of error than a human sniper consistently could achieve. AWSs can also transmit live video signals to human counterparts who can then intervene if circumstances warrant. In hostage scenarios, these accuracy-enabling technologies would be critical.

In sea-borne scenarios, AWSs have demonstrated great utility. If an AWS is programmed to engage only military targets, a fully autonomous weapons system could be effectively employed in the maritime environment, given the lower likelihood of collateral damage in the ocean. To illustrate utility, the so-called Spartan Scout performed surveillance, patrolled harbors, and inspected suspicious vessels, armed with .50-caliber machine gun.[352] This platform was utilized in Iraqi waters in 2003.[353] DARPA is already developing a new unmanned underwater vehicle (UUV) program known as "Hydra."[354] DARPA envisions that the Hydra platform would use "develop modular payloads that would provide key capabilities, including Intelligence, Surveillance and Reconnaissance (ISR) and Mine Counter-Measure."[355] DARPA initiated this program to help address the challenges the U.S. Navy faces over vast regions coupled with ongoing force reductions and fiscal constraints.[356] This cost-effective platform would serve critical functions "to develop distributed network of unmanned payloads and platforms to complement manned vessels."[357] Similarly, DARPA is pursuing a UUV program (Distributed Agile Submarine Hunting or DASH) capable of tracking undersea threats.[358]

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[351] *See id*.
[352] SINGER, *supra* note 4, at 115.
[353] *Id*.
[354] *See DARPA.milHydra,* http://www.darpa.mil/Our_Work/TTO/Programs/Hydra.aspx.
[355] *Id.* (internal quotations omitted).
[356] *See id*.
[357] *Id.* (internal quotations omitted).
[358] Press Release, DARPA, Distributed Agile Submarine Hunting (DASH) Program Completes Milestones (Apr. 3, 2013), *available at* http://www.darpa.mil/NewsEvents/Releases/2013/04/03.aspx ("The second prototype is Submarine Hold at Risk ("SHARK"), an unmanned underwater vehicle ("UUV") developed by a team led by

More advanced sea-borne AWSs could further exceed humanity's limitations in this area. Over the past several years, the U.S. Navy has participated in anti-piracy operations in the Gulf of Aden, off the coast of Somalia.[359] While these efforts have been successful in this region, piracy has shifted into areas such as the Gulf of Guinea, where 966 sailors were attacked during 2012.[360] Given the vastness of the ocean alone, the U.S. Navy would either be spread too thin or potentially play whack-a-mole, chasing after pirates when trending locations change. Also, the amount of infrastructure and upkeep ships and personnel require renders continuing these missions long term a costly proposition. On the other hand, the availability of a Sea Hydra or analogous Sea Predator AWS platform, capable of undertaking surface and undersea surveillance and kinetic military operations, could be dispositive.[361]

With mass production, the navy can deploy a multitude of sea-based AWSs capable of long-term loitering and patrol. These AWSs can be stationed at designated locations and tasked to protectively escort merchant vessels upon their entrance into an AWS's vicinity on the high seas. If armed pirates in fast boats approach the escorted vessels, then the AWS can assist by initially querying these vessels through various means (e.g., radios, flares, loud speakers). This scenario presumes that these AWSs would be able to distinguish such vessels and their behavior from other ordinary sea traffic. If the fast boats continued to approach, then an AWS could notify a human counterpart for further guidance or subsequently disable the fast boats' engines.

Applied Physical Systems (APS). SHARK intends to provide a mobile active sonar platform to track submarines after initial detections are made. APS team member Bluefin Robotics recently deployed the prototype to depth in February 2013.").

359 *See*, *e.g.*, *Somali Pirates Jailed in US over American Deaths*, BBC NEWS (Nov. 15, 2013), http://www.bbc.co.uk /news/world-us-canada-24954797.

360 Alan Cowell, *West African Piracy Exceeds Somali Attacks, Report Says*, N.Y. TIMES, June 18, 2013.

361 Dr. Ray Widmayer & Dr. Scott C. Truver, *Sea Predator a Vision for Tomorrow's Autonomous Undersea Weapons*, 7.6 UNDERSEA WARFARE 12, 12-15 (Winter 2006), *available at* http://www.navy.mil/navydata/cno/n87/usw/issue_ 29/predator2.html.

Merchant vessel distress signals would also assist the AWS's interpretation in this regard. Once disabled, the AWS can notify its human counterparts for search and detention operations. The resulting benefit is obvious: the navy's reach is extended by covering larger areas of the ocean for extended durations otherwise unattainable by human-piloted vessels.

Similarly, airborne AWSs can surpass humans on a variety of missions, including reconnaissance and targeted strikes. For the most part, many of the benefits of airborne AWSs were already demonstrated by current UAVs. By example, the increased loitering capability of UAVs allowed human teams to relay real-time tactical information from the UAVs to aid commanders' decisions during ground operations.[362] AWSs would also be able to "loiter" in the air far beyond traditional manned aircraft, since even the most well-trained human pilots would eventually suffer from fatigue.[363] AWSs, like UAVs, can remain airborne for up to 30 hours based on current technologies.[364] More importantly, AWSs can loiter and perform more precisely during surveillance and attack missions under constrained environmental or otherwise hostile conditions without human biological limitations. During a targeted strike operation, an AWS can loiter high above an objective until such time when the number of civilians present decreases below collateral damage thresholds. Also, the next generation of the X-47 platform could conceivably employ DARPA's "Excalibur" program which could produce "functional and lethal effects [with] surgical precision against certain air and ground targets."[365] Combined with other technologies, such as advanced over-the-horizon radar, the loitering X-47 would act as a missile or enemy UAV interceptor.

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[362] Chris Powell, *We Are Not Drones*, AIRMAN (Oct. 21, 2013), http://airman.dodlive.mil/2013/10/we-are-not-drones/.
[363] *Id*.
[364] *See* DARPA.mil, *EXCALIBUR*, http://www.darpa.mil/Our_Work/MTO/Programs/EXCALIBUR.aspx.
[365] Allen McDuffee, *DARPA Plans to Arm Drones With Missile-Blasting Lasers*, WIRED (Nov. 1, 2013), http://www.wired.com/2013/11/drone-lasers (internal quotations omitted).

D. AWSs Will Improve Accountability

Contrary to the arguments posed by critics like Sharkey, Sparrow, and HRW, AWS accountability is a solvable issue.[366] Accountability and "command responsibility" are well established principles in both the LOAC and the U.S. military.[367] Parties potentially liable for AWS mishaps are as follows: designers, programmers, manufacturers, technicians, and military commanders. While this list is not exhaustive, noticeably absent is the AWS itself. Arguments by Sharkey and Asaro that AWSs will develop "a mind of their own" and "go rogue" are nonsensical. As a machine, an autonomous weapon could not itself be held responsible for a violation of international humanitarian law. Furthermore, Sparrow's assertion that AWSs are the technological equivalent of a child soldier, where accountability is concerned, is equally absurd.[368] At all times, the AWS remains a weapon that is tasked by, under command of, and subsequently debriefed by humans.[369] As discussed herein, commanders who directed the employment of AWSs in warfare can be held accountable for LOAC violations consistent with traditional understandings of command responsibility.

As humans will remain in the loop, or on it, for the near term, current civil and criminal liability mechanisms would adequately address those specific acts that result in AWS mishaps, whether negligent or intentional.[370] For the purposes of this article, command responsibility remains the focus. In 1945, a U.S. military commission held in *United States v. Yamashita* that

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[366] *See* ARKIN, *supra* note 5, at 8-13.
[367] *See*, *e.g.*, Evan Wallach & Maxine Marcus, *Command Responsibility*, *in* INTERNATIONAL CRIMINAL LAW, VOLUME 1 SOURCES, SUBJECTS AND CONTENTS (M. Cherif Bassiouni ed., 3rd ed. 2008) [hereinafter Wallach & Marcus].
[368] Sparrow, *supra* note 53, at 73-74; *see also* Kastan, *supra* note 43, at 67-68 ("It is ironic that Prof. Sparrow compares AWSs to children, for, at Roman law, children were treated similarly to inanimate objects, slaves, and animals for purposes of tort liability. For all of these entities, the owner, the master, or the parent was held liable for its actions through surrender of the offending object or payment of damages.").
[369] *See* ARKIN, *supra* note 5, at 80.
[370] *See* Kastan, *supra* note 43, at 78-81 (internal quotation omitted).

"a commander is liable for the criminal misconduct of subordinates which the commander ordered, or about which the commander knew or should have known, and failed to take reasonable action to prevent."[371] The principles of *Yamashita* and *Nuremburg* endured and are incorporated into the Geneva Conventions, the Statutes of the International Criminal Tribunals for Yugoslavia and Rwanda, and customary international law.[372] Under international criminal law, the concept of command responsibility provides that "an accused is alleged to have been in effective control over those who personally committed war crimes or crimes against humanity, to have known or have had reason to know that these crimes were being committed or had been committed, and to have failed to either prevent their commission or to punish those directly responsible."[373] Although the United States has not ratified AP I or AP II, it follows these underlying precepts as reflective of customary international law and incorporates these principles into its military manuals.[374] For example, U.S. Army Field Manual 27-10 further provides:

> The commander is also responsible if he has actual knowledge, or should have knowledge, through reports received by him or through other means, that troops or other persons subject to his control are about to commit or have committed a war crime and he fails to take the necessary and reasonable steps to insure compliance with the law of war or to punish violators thereof.[375]

Therefore, military commanders are assigned responsibility even if they do not control the outcome, because they are accountable for the creating conditions under which their subordinates act.[376] Although an AWS is not a subordinate, *stricto senso*, because it is a weapon and not a sentient being, a commander nevertheless retains effective control over this weapon and

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371 Wallach & Marcus, *supra* note 367, at 1.
372 *See id*. at 10-11; *Appl. of Yamashita v. Styer*, 327 U.S. 1 (1946); Agreement for the Prosecution and Punishment of the Major War Criminals of the European Axis, Aug. 8, 1945, 59 Stat. 1544, 82 U.N.T.S. 279; 3 Bevans 1238; 39 A.J.I.L. 258.
373 Wallach & Marcus, *supra* note 367, at 11 (internal citation omitted).
374 *See id*. at 9.
375 U.S. DEP'T OF ARMY, THE LAW OF LAND WARFARE: DEPARTMENT OF THE ARMY FIELD MANUAL NO. 27-10 ¶ 501, at 178-79 (1975), *available at* http://www.loc.gov/rr/frd/Military_Law/pdf/law_warfare-1956.pdf.
376 *See* Noorman & Johnson, *supra* note 23, at 59.

subsequent employment on the battlefield no differently from any other military equipment. This idea is incorporated into naval culture through the maxim that "if a ship runs aground, it is the captain's responsibility."[377] Similarly, a commander could foreseeably be held accountable for no other reason than ordering the deployment of an AWS into a battle in which LOAC violations occur. Whether he or she will be criminally accountable depends upon satisfaction of the knowledge element required by both domestic and international criminal law standards.[378] Similarly, Article 92 of the U.S. Uniform Code of Military Justice (which addresses dereliction of duty) requires proof of a knowledge element that is satisfied through criminal negligence or actual intent.[379] This requirement finds support in the International Criminal Tribunal for Yugoslavia, which found that command responsibility does not impose strict liability on a superior for the offenses of subordinates.[380] Therefore, a commander can be held criminally liable if he or she was actually or constructively aware of LOAC violations by an AWS, due to malfunction, and failed to take corrective actions.[381]

Alternatively, even if a commander is not criminally liable, accountability is administratively possible and in most cases probable. The idea that a commander is responsible for the actions his or her unit does or fails to do is philosophical in nature. Administrative accountability carries consequences including censures, reprimands, non-judicial punishments, relief for cause, and poor performance evaluations.[382] For example, in September 2013, the

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377 Joe Doty & Chuck Doty, *Command Responsibility and Accountability*, MIL. REV. 35 (Feb. 29, 2012), *available at* http://usacac.army.mil/CAC2/MilitaryReview/Archives/English/MilitaryReview_20120229_art009.pdf [hereinafter Doty & Doty].

378 For examples of those standards see Wallach & Marcus, *supra* note 367, at 21.

379 *See* MANUAL FOR COURTS-MARTIAL, *supra* note 198, at art. 92.

380 *See* Wallach & Marcus, *supra* note 367, at 13.

381 Conceivably, an AWS mishap that results in the loss of civilian life could be described as an accident or malfunction vice a LOAC violation. However, military commanders could be held similarly responsible for such incidents analogous to Navy ships running aground.

382 *See* Doty & Doty, *supra* note 377, at 37.

commandant of the Marine Corps relieved two generals for not adequately protecting a U.S. base in southern Afghanistan that Taliban fighters attacked in 2012, resulting in the death of two marines and the destruction of six U.S. fighter jets.[383] Upon being relieved, Major General Gurganus told the Commandant, "As the most senior commander on the ground, I am accountable."[384] Thus, a commander could be held administratively responsible for the actions of an AWS if criminal liability falls short.

Should any philosophical questions remain, Arkin proposes that use of what he terms the responsibility advisor throughout all aspects of AWS use, ranging from pre-deployment programming to post-deployment debrief, will suffice. This responsibility advisor will consistently query human counterparts for authorization where instructions come into contravention with programmed constraints, whether during the pre-deployment phase or in action. In this instance, once human override authorization is provided, responsibility becomes further transparent and explicit. Override authorizations could be audio- and video-recorded.[385] If commanders override AWS "resistance to executing an order which it deems unethical, he or she . . . assume[s] responsibility for the consequences of such action."[386] The responsibility advisor thus places additional notice of their potential liability on designers, programmers, operators, and commanders, creating incentives to ensure that AWS actions are in compliance with the LOAC.[387]

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383 Rajiv Chandrasekaran, *Two Marine Generals Fired for Security Lapses in Afghanistan*, WASH. POST, Sept. 30, 2013.
384 *Id.* (internal quotations omitted).
385 *See* ARKIN, *supra* note 5, at 76-83*; see also* KRISHNAN, *supra* note 212, at 105.
386 *See* ARKIN, *supra* note 5, at 4.
387 Stephen E. White, *Brave New World: Neurowarfare and the Limits of International Humanitarian Law*, 41 CORNELL INT'L L.J. 177, 209-210 (2008) [hereinafter White]; *see also* ARKIN, *supra* note 5, at 7 ("the potential capability of independently and objectively monitoring ethical behavior in the battlefield by all parties and reporting infractions of human soldiers that might be observed. This presence might possibly lead to a reduction in human ethical infractions.").

In practice, the above solution is not a panacea for the "fog of war" or collateral damage. Arguably, there are circumstances where, notwithstanding all the feasible precautions employed, an AWS could commit an error resulting in a LOAC violation. For example, assume an X-47B aircraft is on mission to strike a targeted insurgent leader based on facial and voice recognition parameters. This scenario also assumes that the X-47B conducts a CDEM analysis inclusive of proportionality and the X-47B determines it can act autonomously. However, suppose the AWS errs by killing an innocent medical doctor, the twin brother of the targeted insurgent leader, who was visiting the area. While this may seem like a simplistic or irrational example, it illustrates that there may be scenarios where no design, programming, manufacturing, or command-planning and execution error was committed. However, these cases may still undermine public support for respective U.S. military campaigns depending on the circumstances. Practically speaking, commanders may still be held accountable for such events through the administrative measures discussed earlier. Thus, commanders must exercise additional care in AWS usage to ensure LOAC compliance.

As a part of command responsibility, military commanders have a duty to investigate allegations of LOAC violations. This rule is also founded upon customary international norms and codified in various military manuals.[388] Certainly, investigations into unmanned weapons systems are not new. For example, an investigation was conducted in the aftermath of the USS Vincennes mishap, where the onboard Aegis Combat System shot down an Iranian Airbus flight over the Strait of Hormuz.[389] The United States ultimately compensated Iran $131,800,000 for

[388] *See United States of America Practice Relating to Rule 153. Command Responsibility for Failure to Prevent, Punish or Report War Crimes*, INT'L COMM. OF THE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v2_cou
_us_rule153.
[389] SINGER, *supra* note 4, at 124-25; *see also* Schmitt & Thurnher, *supra* note 58, at 248-49.

the civilian casualties.[390] Thus, military commanders will bear the same responsibility to investigate AWS mishaps causing LOAC violations, regardless of the sophistication of the technology or other underlying circumstances.

In theory, AWSs will improve command responsibility. In ordinary LOAC violation inquiries, an investigator often interviews military personnel to provide statements articulating their recollection of the events. Often, these statements and underlying observations are heavily subjective or influenced by a myriad of psychological and emotional factors. For example, witnesses may fear reprisal for having cooperated. In other cases, a sense of loyalty to fellow combatants may override objective observations. Subsequently, investigation results can be skewed. In the case of AWSs, data, audio, and video recordation logs will provide indispensable objective records of the events as they occurred. This is not to suggest human statements lose their value, but rather that investigation processes and results will be based on more objective evidence.[391]

In practice, one concrete example is taken from a United Kingdom military case in which British marines allegedly executed a wounded Afghan insurgent on September 15, 2011.[392] Avoiding aerial detection under the cover of trees, a marine taunted the insurgent in front of other marines about not providing medical aid and then shot the insurgent dead.[393] Even more damning, the marine acknowledged his illegal acts when he ordered the other marines to not repeat anything, stating, "Obviously this doesn't go anywhere, fellas. I just broke the Geneva

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[390] *See* The Case Concerning the Aerial Incident of 3 July 1988, Settlement Agreement, 1996 I.C.J. 649, ¶ 1 (Feb. 9), *available at* http://www.icj-cij.org/docket/files/79/11131.pdf.
[391] *See* Sassòli, *supra* note 3, at 1.
[392] Anna Edwards, *Royal Marine Is Convicted of Murder of Taliban Insurgent Who Was Shot in the Chest at Close Range - But Two Comrades Are CLEARED*, DAILY MAIL (Nov. 8, 2013), http://www.dailymail.co.uk/news/article-2492816/Royal-Marine-convicted-murder-Taliban-insurgent-shot-chest-close-range—comrades-CLEARED.html.
[393] *See id.*

Convention."[394] The marines discussed covering up the killing to appear lawful.[395] Paramount to our discussion, the audio and video of this damning evidence was captured by the helmet cameras of the marines involved.[396] The Royal Military Police launched an investigation after initially recovering a video clip showing the Afghan national being roughly handled across the field.[397] Eventually, the investigators recovered footage showing the killing and the marine was convicted.[398] While this incident did not involve an AWS, it illustrates the benefit a video and audio-enabled AWS could provide in upholding accountability. At a minimum, if military personnel attempted to work around the AWS, through disablement or other means, nothing precludes the AWS from notifying higher headquarters of these events or enabling recordation logs or similar "black boxes" to remain active.

E. AWSs Will Uphold Chivalric Norms More Effectively

AWSs are weapons, not sentient beings. Thus, an AWS would not be chivalrous in and of itself, any more than a sword or a firearm can be chivalrous. However, the manner in which the weapon employs itself can better enable chivalry. As applied, an AWS with programmed restrictions will reinforce chivalric norms through use and programmed restrictions and thus can act in a chivalrous manner. To illustrate, this section focuses on the norms of mercy, courage, skill, and trustworthiness when applied to AWSs in present-day conflicts.

Mercy remains very relevant in contemporary warfare, and it underscores many precepts of IHL.[399] Commenting on current concerns, Wallach notes that "mercy raises questions of

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[394] *Id.*
[395] *See id.*
[396] *See id.*
[397] *See id.*
[398] *Id.*
[399] *See*, *e.g.*, Wallach, *supra* note 190, at 450-51 (noting "[i]t is, perhaps, at the core of IHL, and yet it is, again, more enforceable as a military requirement than one governing civilian conduct.").

conflict with duty centered on when the target becomes hors de combat."[400] The utility of AWSs here can be illustrated by an Iraq scenario taken from the video entitled *Apache Rules the Night*,[401] in which Apache helicopter pilots engaged a wounded insurgent after an initial attack that killed two others.[402] In that instance, after confirming the insurgent was wounded, the senior commander instructed the pilot to target the wounded insurgent, who was still crawling.[403] Despite showing initial reluctance, the pilot targeted and killed the insurgent.[404] While it is difficult to know whether the insurgent retained the ability to fight (e.g., detonate an IED), it is at least conceivable that an AWS could address this situation differently. Assuming the AWS, as either an air or ground asset, has the necessary advanced capabilities, the AWS can further assess whether the insurgent remains a possible threat through sensors on a variety of factors (e.g., health, weapons proximity). Thus, an AWS can refuse or second-guess senior commanders' orders to target the wounded insurgent when it conflicts with baseline programming not to kill a person who is hors de combat. The AWS can afford to wait and verify the threat status of the crawling insurgent through his/her follow-on actions, and the AWS can request that humans or another AWS secure the wounded insurgent.[405] Thus, AWSs uphold mercy by preserving life and ensuring that an enemy receives medical treatment.

The next example involves courage. As reflected earlier, AWSs will not endure the consequences borne from emotions or instincts of self-preservation. Notwithstanding the

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[400] *Id.* at 451.
[401] ARKIN, *supra* note 5, at 88-91.
[402] *Id.*
[403] *Id.*
[404] *Id.*
[405] Conceivably, AWSs can request other robotic counterparts, such as a DARPA's ChemBot. The ChemBot resembles a gelatinous globule capable of changing shapes, carrying heavy payloads, and could conceivably be used for medical purposes by providing stabilizing aid and transportation out of hostilities. *See* Katie Drummond, *DARPA's Creepy Robo-Blob Learns to Crawl*, WIRED (Dec. 2, 2011), http://www.wired.com/dangerroom/2011/12/darpa-chembot/; *Futuristic Chembots Squeeze Through Small Spaces*, LIVE SCIENCE (June 30, 2008), http://m.livescience.com/5003-futuristic-chembots-squeeze-small-spaces.html.

gallantry of today's warfighters, AWSs will not "fear" uncertainty, be cowardly, or fail to rescue and provide aid to U.S. forces and allies in violation of Article 99 of the UCMJ.[406] Similarly, Wallach notes that provisions such as those found in Geneva Conventions I and III "require succor to certain enemies who are hors de combat," while not necessarily criminalizing inaction.[407] Returning to the Apache example above, a ground-based AWS could not only retrieve the wounded insurgent, but could do so during ongoing hostilities. An AWS need not worry about avoiding gunfire or explosions. Similarly, in the case of a small AWS such as a PackBot, the device could physically reach the insurgent even if environmental conditions, such as rubble or debris, would not allow human access. At a minimum, the AWS can identify the insurgent as hors de combat until conditions permit movement or further assistance arrives. Thus, as a by-product of the AWS's actions, courage is upheld.

The third example involves skill as a chivalric norm.[408] Returning to the earlier example of an urban sniper, an AWS may achieve greater results than a human counterpart at eliminating the threat. In this scenario, the AWS, devoid of emotions and human biological limitations, can—with advanced telemetry—detect and engage the enemy sniper at greater ranges than a human sniper could. The AWS would be able to employ a single shot to kill the target in the most non-permissive conditions. In such circumstances, an AWS would not need to "spray" the building area with gunfire or use artillery to destroy the building's area of concern. An immediate benefit is the safety of civilians co-located in the building. In effect, the AWS has demonstrated an inhuman (but not inhumane) level of skill.

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[406] *Id*. at 444-45.
[407] *Id.* at 445 (citing the Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (First Geneva, Convention), Aug. 12, 1949, 75 U.N.T.S. 31).
[408] *See id.* at 438.

Lastly, an AWS could also uphold trustworthiness as a chivalric norm. As Wallach notes, knightly oaths were "economically important, and vital to planning for combat."[409] Modern analogues of loyalty oaths occur with U.S. military members entering into service.[410] Indeed, trust remains at the "core of the honor codes of all three military academies."[411] Perceptions of distrust perpetrated by acts of treachery or violations of IHL can prolong hostilities and hinder negotiations between parties to a conflict.[412] The actions of former U.S. Army staff sergeant Robert Bales are examples of how dishonorable acts undermined U.S. efforts in Afghanistan.[413] In that matter, the defense's arguments were that Bales was psychologically "crazed" and snapped under the pressures of warfare, leading to the death of 16 Afghan civilians.[414] Afghan public opinion worsened when Bales did not receive the death penalty, because they believed it was warranted as vengeance.[415] As suggested earlier, AWSs would not go rogue (assuming sophisticated technology and proper safeguards are employed). AWSs will be more compliant with programmed restrictions. Arguably, advanced AWS AI can be configured to enable greater restrictions if the AWS is unable to address a given scenario. At a minimum, an AWS will not commit acts of treachery, contrary to the arguments posed by critics, who presume humanity's flaws will be encoded into the AWS AI.

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[409] *Id.* at 448.
[410] *See*, *e.g.*, 10 U.S.C. §§ 502, 4346.
[411] Wallach, *supra* note 190, at 449.
[412] *See id.* at 450. The ongoing civil war and negotiation in Syria illustrates this point. *See* Patrick Cockburn, *Geneva II Negotiations: Gravediggers Will Stay Busy in Syria as Peace Talks End in Failure*, THE INDEPENDENT (Jan. 31, 2014), http://www.independent.co.uk/news/world/middle-east/geneva-ii-negotiations-gravediggers-stay-busy-in-syria-as-peace-talks-end-in-failure-9100210.html.
[413] *See* Gene Johnson, *Soldier to Admit Afghan Massacre*, ASSOCIATED PRESS (May 30, 2013), http://www.military.com/daily-news/2013/05/30/soldier-to-admit-afghan-massacre.html [hereinafter Johnson]; Khadija Ibrahimi, *The Understanding of Honor In Afghanistan*, AFG. ONLINE PRESS (May 5, 2009), http://www.aopnews.com/opinion/khadija_honor.shtml.
[414] Johnson, *supra* note 413; *see also Staff Sgt. Bales Sentenced to Life in Prison for Murdering 16 Afghan Civilians*, PBS (Aug. 23, 2013), http://www.pbs.org/newshour/bb/military-july-dec13-bales_08-23/.
[415] *See*, *e.g.*, Gabriel Rodriguez, *Robert Bales: U.S. Soldier to Admit to Horrific Massacre Of 16 Afghan Civilians*, POLICYMIC (May 30, 2013), http://www.policymic.com/articles/45401/robert-bales-u-s-soldier-to-admit-to-horrific-massacre-of-16-afghan-civilians.

VI. Long-term Implementation

Over the next several decades, AWS development will likely continue, given the large-scale investment in research by the United States and other countries. As suggested by authors like Singer, Anderson, and Waxman, the employment of fully functional AWSs will be a gradual or incremental approach over time.[416] Current technologies will continually evolve, and with each progressive step, humans will slowly be removed from the loop.[417] Unlike beliefs grounded in fiction, governments will not push a button unleashing an autonomous army tantamount to a "March of the Wooden Soldiers" approach at a given moment.[418] As stated earlier, the idea that AWS armies will fully replace humans or engage in bloodless wars is implausible, if for no other reasons than humanity's aggressive nature or an innate distrust of robots.[419]

In light of present limitations on technology (such as AI) and persistent criticisms over legality, technology companies will continue to research transitional technologies, such as robot-based devices that enhance human performance (e.g., Human Assisted Neural Devices).[420] For example, such companies will pursue man–machine "symbiotic systems," such as suits designed for pilots that let them "feel" parts of the plane. In this example, these systems will enable human pilots to feel vibration, heat, or heaviness in their corresponding arm if there is an overload in the plane's wing.[421] Other examples include an exoskeleton program, where Raytheon's XOS2 Exoskeleton Robotics Suit allows human operators to carry heavier payloads

[416] Waxman & Anderson, *supra* note 3, at 19.
[417] SINGER, *supra* note 4, at 64, 123-34.
[418] *See* MARCH OF THE WOODEN SOLDIERS (Metro-Goldwyn-Mayer 1934). In this film, Laurel and Hardy's last resort to ward off the Bogeymen mob involved pushing a button, thus activating the wooden soldier army.
[419] *See* White, *supra* note 388, at 185.
[420] *Id.*
[421] SINGER, *supra* note 4, at 69-70.

or punch through heavy obstacles.[422] Weaponizing and employing armor on such devices is not far-fetched.

Over time, incremental employment of AWSs will involve humans being supported by fully autonomous systems in logistical settings. Military personnel will work side-by-side with drones that will enhance lift capabilities no differently from manned machines. For example, DARPA has developed an "autonomous pack horse" known as the Legged Squad Support System, or BigDog.[423] This autonomous quadruped can carry 400 pounds of military gear travelling at 7–8 miles per hour and is capable of quieter modes and voice recognition.[424] More advanced versions include a strong arm capable of throwing cinder blocks across great distances.[425] Carrying wounded soldiers out of combat appears plausible.[426] DARPA's next generation robot, known as the WildCat, is being developed with the capability to run at speeds up to 50 miles per hour on all types of terrain.[427] Such capabilities could enable faster resupply operations to troops in combat. Other possible enhancing options for similar platforms could involve smaller-scale versions capable of bomb or narcotics detection analogous to a military working dog. More aggressive versions could involve a weaponized quadruped robot.

Lastly, employing fully autonomous weapons systems working without human counterparts will be a gradual incremental step, once the technology and AI have fully matured. Technological advancement and field testing alone support this conclusion. However, given

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[422] *See* Mike Hanlon, *Raytheon XOS 2: Second Generation Exoskeleton*, GIZMAG (Sept. 28, 2010), http://www.gizmag.com/raytheon-significantly-progresses-exoskeleton-design/16479/.
[423] Kelsey D. Atherton, *DARPA Spends $10 Million To Make BigDog Stronger And Stealthier*, POPULAR SCIENCE (Sept. 27, 2013), http://www.popsci.com/article/technology/darpa-spends-10-million-make-bigdog-stronger-and-stealthier.
[424] *Id.*
[425] *See id*.
[426] *See id.*
[427] Sebastian Anthony, *Meet DARPA's WildCat: A Free-Running Quadruped Robot That Will Soon Reach 50 MPH Over Rough Terrain*, EXTREMETECH (Oct. 4, 2013), http://www.extremetech.com/extreme/168008-meet-darpas-wildcat-a-free-running-quadruped-robot-that-will-soon-reach-50-mph-over-rough-terrain.

criticisms and DoD's own hesitancy to enable these lethal systems in fully autonomous modes, initial platforms will be more defensive in nature, resembling measures such as more advanced ballistic missile defense systems, perimeter security drones or anti-UAV robotics similar to a former DARPA program called Peregrine.[428] Once these defensive capabilities establish reliability in preventing unnecessary loss of life or destruction, technological advancements will eventually graduate to fully autonomous offensive measures over time. However, in the near term, defensive and offensive AWSs will likely require that human operators approve any decision to use lethal force to avoid the dilemmas posed by critics.[429] Moreover, employing AWSs to intercept missiles, drones, or similar unmanned devices is a logical progression.

Nevertheless, roboticists and critics will continue to resist change. Singer notes that "while many roboticists are happy that their systems are being used to save lives, when it comes to talking about other military outcomes . . . most of the field demurs."[430] Thus, many roboticists do not want to take part in weapons development for perceived ethical reasons. Academics insist that governments ban the development of these machines rather than promote a rational debate on the issue, taking into account the inevitability of AWS development.[431] Taking an unreasonable position that seeks a prohibitive ban will only alienate the governments they wish to convince. Thus, they miss an opportunity to make the inevitable arrival of AWSs safer and more compliant with IHL than humans to date.

The U.S. government can steer this debate toward a compromise. First, in addition to cautious policies, the United States can provide assurances that AWS development will not be

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[428] Noah Max, *DARPA'S Drone Killer*, DEFENSETECH (Mar. 23, 2005), http://defensetech.org/2005/03/23/darpas-drone-killer/.
[429] Sparrow, *supra* note 53, at 68.
[430] SINGER, *supra* note 4, at 175.
[431] Charles J. Dunlap, Jr., *Lawfare Today . . . and Tomorrow*, U.S. NAVAL WAR COLLEGE INT'L. L. STUDIES 315, 324 (2011).

geared toward autonomy as a threat to mankind.[432] Arguments for "friendly AI" begin by the United States rejecting the argument that advanced AI research will incorporate the negative attributes of human tendencies.[433] This proposition will eliminate the misconceptions underpinning many criticisms. Second, the United States can partner with roboticists, international entities, and allies to develop common standards analogous to the Tallinn Manual effort for warfare in the cyber domain.[434] While this argument is potentially limited by the feasibility associated with constraints of classified information or export controls, the United States ought to develop creative ways to enable access to the development of these technologies.[435] Future demonstrations that allow for observation by international organizations like the ICRC and the International Committee for Robot Arms Control might placate some of the criticism. Lastly, if the United States continually reinforces these common standards through practice in partnership with key allies, this will foster international practice and perhaps crystallize these standards into customary international law or codify them in an international treaty. Assuming this worthy goal can be accomplished, concerns over rogue states programming AWSs to kill civilians will be better satisfied beyond the current offerings of IHL. In summary, the United States can shape the debate by ensuring that these technologies are being developed to promote the supposition that AWSs can comply with IHL standards better than humans.

Conclusion

This article concludes with the same notion stated at the beginning: War is unavoidable.

[432] McGinnis, *supra* note 104, at 1263-65.
[433] *Id.*
[434] Waxman & Anderson, *supra* note 3, at 22-23; *see generally* INT'L GROUP OF EXPERTS, TALLINN MANUAL ON THE INTERNATIONAL LAW APPLICABLE TO CYBER WARFARE 1-6 (Michael N. Schmitt ed., 2013).
[435] Arguably, the U.S. could also be limited by International Traffic in Arms Regulations (ITAR), the Export Administration Regulations (EAR) or other laws regarding the sharing of defense related technology. Conversely, such restraints could be waived or excepted. Waxman & Anderson, *supra* note 3, at 25-26.

Yet AWSs may actually make warfare more humane by better enforcing IHL norms and holding military commanders accountable. Concerns about AWSs undoubtedly reflect cultural bias. Yet some cultures actually revere robots. For example, Japan and other Eastern cultures generally regard them as society's protector and as a "friend of humans."[436] The Japanese word for "crisis" is represented by two characters that individually denote "danger" and "opportunity." Similarly, the development and employment of AWSs in warfare may appear dangerous at first glance. However, the AWS controversy may reveal a hidden opportunity to make warfare less horrific on humanity notwithstanding the bleak outlook associated with war's persistence. Since weapons development is a causal effect of humanity's "inability to live at peace," an opportunity exists to shape AWS development to exceed the performance of human counterparts in IHL compliance.[437] One counterargument insists that while building smarter or more precise weapons has historically reduced casualties, these weapons could also be used to target civilians with greater accuracy. But this argument is true for all weapons. Besides that, this argument also discounts the possibility that technological advancements could involve robot-based safeguards that could minimize or eliminate collateral damage by preventing their users from employing a weapon in a manner contrary to IHL. Smart handguns requiring biometric imprinting to enable usage serve as an obvious example.[438] Developing AWSs with appropriate safeguards and restrictions with an end goal of protecting civilians will serve to counter this proposition.

Critics' arguments against AWSs reflect fear of uncertainty or their potentially indiscriminate nature. These arguments share the same criticisms as other weapon advances,

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[436] SINGER, *supra* note 4, at 167.
[437] *Id*. at 5-6.
[438] Whiteside, *supra* note 299.

including nuclear weapons development. The International Court of Justice found that there were no comprehensive and universal prohibitions against nuclear weapons but that their use should be in compliance with IHL.[439] Thus, nuclear weapons still do exist and calls for per-se prohibitions proved unsuccessful.[440] Yet critics such as Sharkey claim that a per-se prohibition on development is needed to forestall any disastrous effect caused by AWSs. Does Sharkey imply that technology in warfare is a bad thing? If so, then one would imagine he could pose a robotic solution to quell humanity's violent nature. At the same time, Sharkey contends that if AWSs were capable of functions such as distinction, he would have no criticism.[441] Perhaps this lack of sound reasoning supporting the proposed ban explains why the ICRC has not joined these calls for putting an end to AWS development.[442] The ICRC has a long-standing history of advocating against indiscriminate weapons, such as landmines. Unlike landmines, if an AWS demonstrates unparalleled results while protecting civilian life, the ICRC presumably would abstain from criticism.

If humans are to continue to strive to eliminate collateral damage in warfare, military technological advancements will be required. Scholars should remain open to a healthy debate on future AWS utility rather than adhere to Western filmmaking notions that AWSs will overtake their human creators. Major powers will undoubtedly pursue AWS technology; roboticists and scholars alike can play an integral role in ensuring humane AWS development. Like any other new weapon, better safeguards can be introduced during the developmental phase. In this case, such measures can also ensure that AWSs perform better than humans at the

[439] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 105 (July 8).
[440] *Id.*; *see also* Ray Acheson & Beatrice Fihn, *High-level Meeting Issues Resounding Call for Banning and Eliminating Nuclear Weapons*, REACHING CRITICAL WILL (Sept. 26, 2013), http://www.reachingcriticalwill.org/disarmament-fora/others/hlm-nuclear-disarmament/report.
[441] Sharkey, *supra* note 175, at 87.
[442] ICRC Autonomous Weapons FAQ, *supra* note 101.

very tasks deemed impossible. If conceivable, AWSs capable of exceeding their human counterparts in IHL compliance will certainly be the work of people, ushering in a new era.