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The Killer Robots Are Here: Legal and Policy Implications

Rebecca Crootof
University of Richmond - School of Law, rcrootof@richmond.edu

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Rebecca Crootof†

In little over a year, the possibility of a complete ban on autonomous weapon systems—known colloquially as "killer robots"—has evolved from a proposal in an NGO report to the subject of an international meeting with representatives from over eighty states. However, no one has yet put forward a coherent definition of autonomy in weapon systems from a law of armed conflict perspective, which often results in the conflation of legal, ethical, policy, and political arguments. This Article therefore proposes that an "autonomous weapon system" be defined as "a weapon system that, based on conclusions derived from gathered information and preprogrammed constraints, is capable of independently selecting and engaging targets."

Applying this definition, and contrary to the nearly universal consensus, it quickly becomes apparent that autonomous weapon systems are not weapons of the future: they exist and have already been integrated into states' armed forces. The fact that such weaponry is currently being used with little critique has a number of profound implications. First, it undermines pro-ban arguments based on the premise that autonomous weapon systems are inherently unlawful. Second, it significantly reduces the likelihood that a complete ban would be successful, as states will be unwilling to voluntarily relinquish otherwise lawful and uniquely effective weaponry.

But law is not doomed to follow technology: if used proactively, law can channel the development and use of autonomous weapon systems. This Article concludes that intentional international regulation is needed, now, and suggests how such regulation may be designed to incorporate beneficial legal limitations and humanitarian protections.

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† Ph.D. Candidate in Law, Yale Graduate School of Arts and Sciences; Resident Fellow, Yale Information Society Project. Thanks to Douglas Bernstein, Eyal Benvenisti, Bonnie Docherty, Stuart Ford, Harold Hongju Koh, and Paul Scharre for their thoughtful edits and contributions; to Jack Balkin, Lea Brilmayer, Oona Hathaway, Zachary Herz, Margot Kaminski, Ryan Liss, Robert Post, Reva Siegel, Julia Spiegel, and my fellow Ph.D.s in Law for their insights and encouragement; and to Mark Crootof for my lifelong love of science fiction. This Article also benefited greatly from participants' comments at ASIL's 2014 Midyear Meeting.

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INTRODUCTION

Autonomous weapon systems have long been a bugaboo of science fiction. Hal 9000 of *2001: A Space Odyssey*, the Cylons of *Battlestar Galatica*, the spider robots of *Kabu-Kabu*, and the *Terminator*'s namesake all are imagined self-directed lethal robots, terrifying in large

part because they do not experience empathy, pity, and mercy—and because they might escape all human control.[1]

But, contrary to the general consensus,[2] autonomous weapon systems are far from fictional. Weapon systems with varying levels of autonomy and lethality have already been integrated into the armed forces of numerous states. Israel, Russia, and South Korea reportedly have autonomous weapon systems currently patrolling their borders and bases; Israel and the United Kingdom have fire-and-forget missiles which independently select and engage targets; China and Russia employ sea mines which determine when and against what to deploy torpedoes; and the United States is developing and using a host of autonomous ground, air, and sea-based weapon systems.

Spurred by dystopic visions of indiscriminate robotic warfare, in December 2012, Human Rights Watch and the Harvard International Human Rights Clinic issued a report calling for a complete ban on fully autonomous weapon systems.[3] While not the first such plea, this highly publicized report sparked a heated debate on whether such weapons should (or could) be banned.[4] In April 2013, the conglomerate nongovernmental organization Campaign to Stop Killer Robots formed for the sole purpose of promoting a ban. One month later, the UN Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions for the Office of the High Commissioner for Human Rights presented a

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1 To be fair, there are also benign, even invaluable, autonomous weapon systems populating science fiction as well, including Lieutenant Commander Data, R2D2, and the reprogrammed Terminator of *Terminator 2: Judgment Day*.

2 Both proponents and skeptics of a ban tend to agree that, while states may begin integrating autonomous weapon systems into their armed forces within the next few decades, such weapons do not yet exist. *See, e.g.*, HUMAN RIGHTS WATCH & INT'L HUMAN RIGHTS CLINIC, HARVARD LAW SCH., LOSING HUMANITY: THE CASE AGAINST KILLER ROBOTS 46 (2012) [hereinafter LOSING HUMANITY], *available at* http://www.hrw.org/sites/default/files/reports/arms1112ForUpload_0_0.pdf ("Although fully autonomous weapons do not exist yet, technology is rapidly moving in that direction."); Michael N. Schmitt & Jeffrey S. Thurnher, *"Out of the Loop": Autonomous Weapon Systems and the Law of Armed Conflict*, 4 HARV. NAT'L SECURITY J. 231, 234 (2013) ("[A]n outright ban is premature since no such weapons have even left the drawing board.").

3 LOSING HUMANITY, *supra* note 2.

4 Many join Human Rights Watch and the Harvard International Human Rights Clinic in advocating for a complete ban. *See, e.g.*, Mary Ellen O'Connell, *Banning Autonomous Killing: The Legal and Ethical Requirement that Humans Make Near-Time Lethal Decisions*, *in* THE AMERICAN WAY OF BOMBING: CHANGING ETHICAL AND LEGAL NORMS, FROM FLYING FORTRESSES TO DRONES 224 (Matthew Evangelista & Henry Shue eds., 2014); Peter Asaro, *On Banning Autonomous Weapon Systems: Human Rights, Automation, and the Dehumanization of Lethal Decision-Making*, 94 INT'L REV. RED CROSS 687 (2012); Noel E. Sharkey, *The Evitability of Autonomous Robot Warfare*, 94 INT'L REV. RED CROSS 787 (2012).

There are a number of vocal skeptics of such a ban. *See, e.g.*, Shane R. Reeves & William J. Johnson, *Autonomous Weapons: Are You Sure These Are Killer Robots? Can We Talk About It?*, 2014 ARMY LAW. 25, 31 (2014); Schmitt & Thurnher, *supra* note 2, at 234; Kenneth Anderson & Matthew Waxman, *Law and Ethics for Autonomous Weapon Systems: Why a Ban Won't Work and How the Laws of War Can*, HOOVER INST. (Apr. 9, 2013), http://media.hoover.org/sites/default/files/documents/Anderson-Waxman_LawAndEthics_r2_FINAL.pdf.

report to the Human Rights Council questioning whether the deployment of autonomous weapon systems was permissible.[5] Many state delegates suggested that the topic be addressed at the upcoming meeting of state parties to the Convention on Certain Conventional Weapons—and, in November, the state parties to the Convention agreed. Consequently, in May 2014, representatives from over eighty states and from United Nations agencies, civil society, and other international and transnational organizations attended a "Meeting of Experts on Lethal Autonomous Weapons Systems" to discuss the possibility of a complete ban on such weaponry.[6]

Ban proponents have good reason to be enthused: this may well be one of the swiftest campaigns in history to ban a class of weaponry.[7] But in the excitement of the progressing debate, neither side has managed to construct a coherent definition for autonomous weapon systems for the purpose of a weapons ban. Instead, "autonomy" in weapon systems often means different things to different stakeholders, and as a result, state representatives, developers, military lawyers, human rights activists, philosophers, and other policymakers often talk past each other.[8] Indeed, during the recent international Experts Meeting on Autonomous Weapon Systems, multiple states noted the need for clarification.[9] Thus, not only is a definition of autonomy for weapon systems from a law of armed conflict perspective necessary to fill a gap in the legal literature, it is crucial to current and ongoing treaty discussions.

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5 Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, *Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions*, 20–21, Human Rights Council, U.N. Doc. A/HRC/23/47 (Apr. 9, 2013) [hereinafter Heyns Report] (written by Christof Heyns and calling for national moratoria on the testing, production, assembly, transfer, acquisition, deployment, and use of lethal autonomous weapons).

6 Jean-Hugues Simon-Michel, *Report of the 2014 Informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS)*, UN OFF. GENEVA (May 16, 2014), http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/350D9ABED1AFA515C1257CF30047A8C7/$file/Report_AdvancedVersion_10June.pdf [hereinafter Chairperson Simon-Michel Report]. A follow-up meeting was held in April 2015.

7 *See* Sarah Knuckey, *Start of First Inter-Governmental Expert Meeting on Autonomous Weapons*, JUST SECURITY (May 13, 2014, 3:17 PM), http://justsecurity.org/2014/05/13/start-inter-governmental-expert-meeting-autonomous-weapons (quoting the Netherlands representative as saying "'never before has a disarmament issue gained interest so quickly'").

8 *See, e.g.*, ARMIN KRISHNAN, KILLER ROBOTS: LEGALITY AND ETHICALITY OF AUTONOMOUS WEAPONS 43 (2009) (describing political, philosophical, and technical definitions of "autonomy" and observing that, "[a]s the discourse on autonomous robots gets seized more and more by philosophers . . . the confusion about 'autonomous weapons' in the public debate increases"); Kathleen Lawand, *Fully Autonomous Weapon Systems*, INT'L COMMITTEE RED CROSS (Nov. 25, 2013), http://www.icrc.org/eng/resources/documents/statement/2013/09-03-autonomous-weapons.htm (noting that, although there is "a wealth [of] expert literature on this subject, there is somewhat of a lack of consistency in the use of terms").

9 *See* Knuckey, *supra* note 7.

Part I begins with a review of existing definitions and their flaws. It then proposes a new definition for autonomy in weapon systems, which turns on the central issue in legal debates regarding a weapon ban—whether a human being must take an affirmative action before lethal force is used against a specific target. Accordingly, an "autonomous weapon system" is "a weapon system that, based on conclusions derived from gathered information and preprogrammed constraints, is capable of independently selecting and engaging targets." With this clarified definition it quickly becomes apparent that autonomous weapon systems are not weapons of the future: they exist and are in use today. This is not to say there is not ample space along the autonomy spectrum from weaponry currently in use to the Terminator—but that space is far less significant than the distinction between a weapon that cannot use lethal force against a specific target without a human operator's affirmative action and one that can.

The fact that autonomous weapon systems are already in use has two profound implications. First, as discussed in Part II, it undermines arguments that autonomous weapon systems are inherently illegal. Ban advocates make a number of important moral, policy, and strategic arguments, but their primary legal claim is that autonomous weapon systems will never be able to comply with the law of armed conflict. Specifically, they argue that autonomous weapon systems will not be able to distinguish between lawful and unlawful targets; that they will not be able to conduct *in bello* proportionality assessments, which entail determining whether the military objective to be gained is worth the risk of likely collateral damage; and that their use may not accord with the Martens Clause of the First Additional Protocol to the 1949 Geneva Conventions—which, ban proponents argue, requires new technology to comply with "the principles of humanity" and "the dictates of the public conscience." Some question whether states will be able to hold individuals accountable for war crimes committed by autonomous weapon systems; still others posit that the decision to kill another human being can never be lawfully delegated to a machine. Ban skeptics, responding to these arguments, dispute the associated analyses—but they accept the proponents' assumption that autonomous weapon systems are futuristic weaponry. However, insofar as such weaponry is currently being used with little to no critique, legal arguments for a ban lose their force. Autonomous weapon systems now in use are being lawfully employed—thus, such weapons as a class are not inherently unlawful.

Should autonomous weapon systems nonetheless be banned? Some ban proponents are willing to concede that these weapons are not *per se* unlawful, but argue that they should nonetheless be banned for a host of other reasons. However, the fact that autonomous weapon systems are

already in use significantly reduces the likelihood that states will enact an effective ban. Scholars on both sides of the ban debate have mined history for evidence that states will or will not be able to successfully ban autonomous weapon systems, but by and large they provide little analysis of which of these precedents are most apt. Part III therefore discusses eight qualities which seem to increase the likelihood that a given ban will be successful: the weapon causes superfluous injury or unnecessary suffering; the weapon is inherently indiscriminate; the weapon is ineffective; other means exist for accomplishing a similar military objective; the ban is clear and narrowly tailored; there has been related prior regulation; there is significant public concern and civil society engagement; and there is sufficient state commitment. Of these, only one characteristic—civil society engagement—suggests that a ban on autonomous weapon systems would be successful; the others are either inconclusive or currently weigh against the likelihood of a successful ban.

"Killer robots" are here, and they are here to stay. But law is not doomed to follow technology: if used proactively, law can channel the development and use of autonomous weapon systems. Part IV therefore considers the question of how such weaponry might be effectively regulated. After discussing the need for intentional international lawmaking, now, this Part concludes with concrete suggestions as to how it might be designed to incorporate many of the beneficial legal limitations and humanitarian protections associated with a complete ban.

I. WHAT'S IN A NAME?

Autonomous Weapon Systems. Killer Robots. Unmanned Lethal Weapons. Lethal Autonomous Robots. Many writers on this subject use the terms "autonomous," "robots," "lethal," and "weapon systems" in various combinations, often presuming that the reader will intuitively grasp the distinction between hypothetical, futuristic weaponry and existing, lawful weapon systems.

But as there is no coherent definition of "autonomy" in weapon systems, that distinction is far from clear. Why, for example, do some consider a weapon system that independently identifies, tracks, and engages an incoming threat merely "automated" or "automatic," but rail against prospective "autonomous" weapon systems that would independently identify, track, and engage a target? Until there is a shared legal definition of autonomy for weapon systems, it will be impossible to have a productive conversation about what a new treaty should ban or regulate.

After reviewing existing definitions and their flaws, this Part proposes a new definition for autonomy in weapon systems. It should be acknowledged at the outset that this definition, like any definition in law, is not an independent, abstract formulation. Instead, its construction is necessarily tied to the purpose it is designed to serve—clarifying what should constitute an autonomous weapon system from a law of armed conflict perspective. As a result, this definition turns on whether human involvement is necessary for a weapon system to exercise lethal force against a specific target. Different legal regimes or different disciplines might require definitions that emphasize other attributes of autonomous weapon systems.

This new definition allows for a relatively clear categorization of existing weapon systems into inert, automated, semi-autonomous, and autonomous weapon systems.[10] Once these categories are delineated, a surprising fact quickly becomes clear: contrary to the nearly universal consensus, autonomous weapon systems currently exist and have already been integrated into states' armed forces. As discussed in greater detail in the remainder of this Article, this fact has profound implications for the discussion over how such weapons should be regulated.

A. *The Need for a Law of Armed Conflict-Based Definition*

"Autonomy" carries vastly different meanings in different fields. A political scientist might define autonomy as the ability to be self-governing; a philosopher might focus on an entity's moral independence; an engineer might be concerned with a machine's level of dependence on human beings in completing different tasks. Due in part to these differing understandings of autonomy, various stakeholders in the debate over banning autonomous weapon systems often speak past each other. And, as discussions of autonomy in weapon systems are "fraught with terms that are both loaded and vague,"[11] they can easily become heated and unproductive—especially as none of the aforementioned definitions provide an appropriate orientation for

10 The term "semi-autonomous" is somewhat misleading, as it implies that autonomy in weapon systems is not a binary characteristic. However, in accordance with other writing in the field, this Article uses it to describe weapon systems that have some autonomous capabilities but which cannot independently select and engage targets. A drone that suggests a target to a human operator, but which cannot engage that target without approval, would be semi-autonomous; a drone which could select and engage targets post-deployment without human involvement would be autonomous. As discussed below, this distinction is complicated by the fact that otherwise autonomous weapon systems may be operated in semi-autonomous modes.

11 William C. Marra & Sonia K. McNeil, *Understanding "The Loop": Regulating the Next Generation of War Machines*, 36 HARV. J.L. & PUB. POL'Y 1139, 1143 (2013).

defining "autonomy" for weapon systems in the context of treaty negotiations. A treaty banning or regulating a class of weaponry is fundamentally a legal instrument memorializing an agreement between states.[12] To draft a treaty regarding the creation, use, or transfer of autonomous weapon systems, it is necessary to determine what "autonomy" in weapon systems entails from a law of armed conflict perspective.

While developments in technology regularly challenge basic precepts of law, autonomous weapon systems threaten one of the law of armed conflict's most fundamental assumptions: that, ultimately, a human being decides whether another human being lives or dies. Various automated weapon systems, like anti-personnel landmines, have tested this principle in the past, but the prospect of a fully autonomous weapon system strikes a more visceral note. As former U.S. Major General Robert Latiff describes it, "[f]ull lethal autonomy is no mere next step in military strategy: [i]t will be the crossing of a moral Rubicon."[13] No longer will responsibility for the consequences of a decision to use lethal force be directly traceable to a human operator; instead, responsibility may rest with the operator, the military commander, the programmer, the manufacturer, the weapon system itself, or some combination thereof. Thus, part of the purpose of a definition for autonomy in weapon systems from a law of armed conflict perspective is to distinguish between traditional weaponry and associated responsibility regimes and this new form.[14] Accordingly, the distinctions between a non-autonomous, semi-autonomous, and autonomous weapon systems should turn on the level of human involvement necessary for the system to exercise lethal force against a specific target.

In attempting to evaluate levels of human control, it is tempting to rely on an engineer's definition of robotic autonomy. But engineers do not measure robotic autonomy along a single continuum; instead, machines are understood as progressively more autonomous based on various qualities, including how frequently the robot must be in contact with a human operator, how well it functions in response to increasing levels of uncertainty in its environment, and its "assertiveness"—its ability to alter its operating plan to complete its mission.[15] Evaluating

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12 Vienna Convention on the Law of Treaties art. 2, May 23, 1969, 1155 U.N.T.S. 331.

13 Robert H. Latiff & Patrick J. McCloskey, Opinion, *With Drone Warfare, America Approaches the Robo-Rubicon*, WALL ST. J. (Mar. 14, 2013, 7:37 PM), http://online.wsj.com/news/articles/SB10001424127887324128504578346333246145590.

14 *See* Asaro, *supra* note 4, at 695 ("It is the delegation of the human decision-making responsibilities to an autonomous system designed to take human lives that is the central moral and legal issue.").

15 Marra & McNeil, *supra* note 11, at 1151–55; *see also* ANDREW P. WILLIAMS, MULTINATIONAL CAPABILITY DEVELOPMENT CAMPAIGN (MCDC), TYPOLOGICAL ANALYSIS:

autonomy along these different axes introduces a confusing and unnecessary level of particularity. Not only might a weapon system have varying levels of autonomy with regard to each of these three attributes, it may have differing amounts of autonomy with regard to each of these qualities at each stage of the "OODA Loop" (a simplified description of human decisionmaking as a four-step process: Observe, Orient, Decide, Act).[16] One weapon system might be extremely assertive at the Observe and Orient stages, but not at the Decision and Action stages; another might have a high degree of independence at the Action stage, but not at the Observe, Orient, or Decide stages. These varying levels of autonomy along multiple cognitive axes at the four stages of the OODA Loop result in complicated and difficult-to-compare technical distinctions.

Although these gradations may be extremely useful in research and development,[17] they are unnecessarily precise for a legal document that is ultimately concerned with regulating weaponry that might independently exercise lethal force. In fact, a purely mechanical definition of autonomy for weapon systems might have the perverse effect of distinguishing among different weapon systems for technical reasons regardless of whether they operate similarly in practice, or vice versa.

Instead, a relevant definition of autonomy for weapon systems should turn on whether a human being's affirmative action is necessary for a weapon system to use lethal force against a specific target. The definition ultimately proposed in this Article therefore conceives of autonomy in weapon systems as both a binary characteristic and as existing along as spectrum. A given weapon system will or will not be autonomous,[18] but autonomous weapon systems may have differing degrees of autonomous capabilities.

AUTONOMOUS SYSTEMS FOCUS AREA 18–28 (2014) (collecting and discussing problems with various scales of machine autonomy); Paul Scharre & Michael C. Horowitz, An Introduction to Autonomy in Weapon Systems 5–7 (Feb. 2015) (working paper), *available at* http://www.cnas.org/sites/default/files/publications-pdf/Ethical%20Autonomy%20Working%20Paper_021015_v02.pdf (discussing three independent dimensions of weapons autonomy: the human-machine command-and-control relationship, the machine's complexity, and the type of function being automated).

16 *See* Marra & McNeil, *supra* note 11, at 1144–45; *see also id.* at 1146–49 (comparing how a human being and machine might make a decision based on the OODA loop framework).

17 For example, the Air Force Research Lab employs an eleven-level spectrum of robotic autonomy, which requires an analysis of how much independence a given system has with regard to the four OODA tasks to determine its overall level of autonomy. *See id.* at 1157–58.

18 *See* Mark Gubrud, *Autonomy Without Mystery: Where* Do *You Draw the Line?*, 1.0 HUM. (May 9, 2014), http://gubrud.net/?p=272 (arguing for a definition of "human control" that is "free of degrees of meaning").

B. *Existing Definitions and Their Problems*

The U.S. Department of Defense's (DoD) definition, which was made public in a 2013 Directive, is currently the best and most commonly cited definition for autonomous weapon systems. While the definition standing alone is useful, the Directive's ambiguities invite certain misreadings and fail to logically distinguish between autonomous and semi-autonomous weapon systems.

Few legal scholars have advanced alternative definitions. To the extent other definitions have been stated or may be inferred, they tend to be either overly inclusive or exclusive. Some set the bar for autonomy in weapon systems too low, eliding important distinctions between different levels of human involvement. Others set the bar too high, effectively defining autonomous weapon systems out of existence and thereby ignoring a host of issues associated with weapon systems in use today. Finally, some definitions propose distinctions based on factors which might be highly relevant in other fields, such as engineering or philosophy, but which are less appropriate when attempting to evaluate relative levels of human control over target selection and engagement.

1. The DoD's Definition

In its 2013 Directive, the DoD defined "autonomous weapon systems" as ones which, "once activated, can select and engage targets without further intervention by a human operator. This includes human-supervised autonomous weapon systems that are designed to allow human operators to override operation of the weapon system, but can select and engage targets without further human input after activation."[19]

This definition has a number of advantages. By beginning with "once activated," it highlights how human beings are initially responsible for the decision to deploy autonomous weapon systems. It underscores the fact that it is the delegation of target selection and engagement (as opposed to other functions or tasks, such as piloting) to a machine that makes a weapon system an "autonomous weapon system." It also does not create an unnecessary distinction between "autonomous" and "fully autonomous" weapon systems:[20] rather, a system's autonomy is determined solely by whether it "can select and engage targets without further intervention by a human operator."

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19 U.S. DEP'T OF DEF., DIRECTIVE NO. 3000.09: AUTONOMY IN WEAPON SYSTEMS 13–14 (2012) [hereinafter DoD DIR. 3000.09].

20 *See infra* Part I.C.4.c.

Finally, it spells out that autonomy for weapon systems depends on the system's capability for autonomous action—not whether it is supervised in practice or used in that capacity.

Unfortunately, this apparently clear definition is muddied by the Directive's attempt to distinguish between "autonomous" and "semi-autonomous" weapon systems. It defines the latter as those which "once activated, [are] intended to only engage individual targets or specific target groups that have been selected by a human operator."[21] At first, this distinction seems appropriate: autonomous weapon systems "can select and engage targets without further intervention," but semi-autonomous weapon systems may "only engage [targets] selected by a human operator." But the crucial distinguishing factor between autonomous and semi-autonomous weapon systems in these definitions—human responsibility for target selection—is vague, and the provided examples of semi-autonomous weapon systems confuse rather than clarify.[22]

According to the Directive, semi-autonomous weapon systems include those "that employ autonomy for engagement-related functions . . . provided that human control is retained over the decision to select individual targets and specific target groups for engagement" and "'[f]ire and forget' or lock-on-after-launch homing munitions that rely on [tactics, techniques, and procedures] to maximize the probability that the only targets within the seeker's acquisition basket when the seeker activates are those individual targets or specific target groups that have been selected by a human operator."[23] Presumably, targets preselected by human operators would need to be fairly specific, limited, or predictable to preserve a meaningful distinction between semi-autonomous and autonomous weapon systems.[24]

Guided munitions that "lock on" prior to launch easily meet the specificity requirement. Those which "lock on" afterwards are more problematic. The Directive defines as "semi-autonomous" any homing munition that, after deployment, independently identifies targets and engages them based on tactics, techniques, and procedures proscribed by a human operator.[25] The DoD does not consider this autonomous "target selection," insofar as constraints on what the munition may target are determined by a human being and its infrastructure. But this blurs the line between autonomous and semi-autonomous weapon systems, as autonomous weapon systems will also operate under an

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21 DOD DIR. 3000.09, *supra* note 19, at 14.

22 *See* Gubrud, *supra* note 18 (discussing ambiguities in the DoD's definition of target selection).

23 DOD DIR. 3000.09, *supra* note 19, at 14.

24 *See infra* Part I.C.4.a.

25 DOD DIR. 3000.09, *supra* note 19, at 14.

array of preprogrammed and practical constraints; an autonomous weapon system will not simply be directed to "eliminate the enemy." Some have therefore concluded that such "lock-on-after-launch homing munitions" actually are making lethal decisions autonomously—and, as the Directive "places no upper limit on the sophistication of the sensors and computers or complexity of the algorithms," nor does it limit "homing munitions" to flying objects, "this is a loophole The Terminator could walk through."[26]

Additionally, the Directive's definition of semi-autonomous weapon systems sometimes privileges form over function. In one case, "human control . . . over the decision to select individual targets and specific target groups for engagement" could constitute a human operator identifying and selecting targets, while the weapon system merely exercises autonomy in "providing terminal guidance to home in on" them.[27] In another, "human control" might consist only of a human being not vetoing the engagement of a target the weapon system had acquired, tracked, identified, and prioritized—and which possibly poses an incoming threat which must be neutralized as quickly as possible, leaving little time for considered evaluation of the situation.[28] In the latter case, the human being only nominally exercises control, insofar as he tacitly approves an engagement—the weapon system is effectively using lethal force with no genuine human supervision or involvement.[29]

Shortly before this Article was finalized for publication, the Center for New American Security's Ethical Autonomy project advanced a new definition intended to address some of these concerns.[30] It defines an autonomous weapon system as "a weapon system that, once activated, is intended to select and engage targets where a human has not decided those specific targets are to be engaged."[31] It distinguishes these from "human-supervised autonomous weapon systems," which have "the characteristics of an autonomous weapon system, but with the ability for human operators to monitor the weapon system's performance and intervene to halt its operation, if necessary."[32] It also distinguishes a "semi-autonomous weapon" as one which "incorporates autonomy into one or more targeting functions and, once activated, is intended to only engage individual targets or specific groups of target[s] that a human has decided are to be engaged."[33]

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26 Gubrud, *supra* note 18. *But see* Scharre & Horowitz, *supra* note 15, at 8–10 (arguing that both types of guided munitions engage only targets preselected by a human operator).

27 DOD DIR. 3000.09, *supra* note 19, at 14.

28 *Id.*

29 *See infra* Part I.C.4.b–c.

30 Scharre & Horowitz, *supra* note 15, at 16.

31 *Id.*

32 *Id.*

33 *Id.*

These definitions share some of the positive qualities of the Directive's definition, in that they highlight the importance of target selection and engagement and the human decision to activate the weapon system. They also improve upon the Directive's definition by clarifying the role of human decisionmaking and the importance of the specificity of the preselected target.

Unfortunately, these definitions create a different type of confusion. The distinction between "autonomous weapon systems" and "human-supervised autonomous weapon systems" is phrased as a technical one, insofar as the latter permit human monitoring and intervention. But this raises two issues. First, because nothing in the definition for "human-supervised" systems requires such monitoring and intervention, this distinction might be rendered moot if, in practice, such systems are operated without supervision. Second, despite being cast as technical, this distinction is ultimately a question of possible usage or modes, not autonomy. As such, it may well be important—even crucial—in creating research and design regulations, but not in differentiating between autonomous and non- or semi-autonomous systems.[34]

2. Irrelevant Distinctions

There are a number of definitions cited in the literature on banning autonomous weapon systems that introduce distinctions between "non-autonomous" and "autonomous" weapon systems which, while likely useful in certain contexts, are irrelevant when constructing a regulatory treaty's definition—usually because they fail to account for the level of human involvement in the decision to use lethal force.

For example, the DoD's Roadmap appears to define "automatic" unmanned systems as those which cannot "initially define the path according to some given goal or to choose the goal that is dictating its path."[35] An "autonomous system," in contrast, "is self-directed by choosing the behavior it follows to reach a human-directed goal."[36] Putting aside the fact that all robotic systems will be extensively preprogrammed and the difficulty in determining when a system's controlling algorithms become sufficiently complex to state that it is "choosing" its actions, the Roadmap's distinction turns on the level of independence the system has in accomplishing a goal—which has nothing to do with what the goal is. Should the goal require selecting

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34 *See infra* Part I.C.4.c.

35 U.S. DEP'T OF DEF., UNMANNED SYSTEMS INTEGRATED ROADMAP FY 2013–2038, at 66 (2013) [hereinafter DOD ROADMAP].

36 *Id.* at 67.

and engaging targets, the degree of human involvement is highly relevant. But weapon systems need not have destructive goals: one useful weapon system might be an autonomous version of the U.S. Miniature Air Launched Decoy Jammer, an air vehicle designed to "confuse and deceive enemy [integrated air defense systems]" by cruising in enemy territory, emitting decoy signals, and jamming the electromagnetic spectrum.[37]

Similarly, Noel Sharkey, a Professor of Artificial Intelligence and Robotics at the University of Sheffield and a current Chair of the International Committee for Robot Arms Control, defines an "automatic" robot as one which "carries out a pre-programmed sequence of operations or moves in a structured environment."[38] In contrast, he defines an "autonomous" robot as "similar to an automatic machine except that it operates in open or unstructured environments. The robot is still controlled by a program but now receives information from its sensors that enable it to adjust the speed and direction of its motors (and actuators) as specified by the program."[39] According to this distinction, the question of a weapon system's autonomy might depend on the environment in which it is employed—and not on its task or, should the task involve lethal force, on the level of human involvement. A stationary weapon system operating in a constrained area would be automatic—but that same weapon operating in an unstructured environment would be autonomous. But what constitutes a "structured" environment in warfare? Additionally, to the extent this definition depends on where a weapon system is deployed, it would make the enforcement of a ban on "autonomous" weaponry impossible. Despite this irrelevant distinction, Sharkey's definition has pervaded discussions regarding what weapon systems should be included in a ban. The authors of *Losing Humanity*, for example, cite Sharkey for their claim that many weapon systems in use today with "a significant degree of autonomy because they can sense and attack targets with minimal human input" nonetheless are "better classified as automatic."[40]

3. Setting the Bar for Autonomy Too Low

There are a few proffered definitions that set the bar for autonomy so low that they lump together wide varieties of existing and potential weapons, and therefore "almost certainly [miss] the essence of what is

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37 *Miniature Air Launched Decoy (MALD)*, RAYTHEON, http://www.raytheon.com/capabilities/products/mald (last visited Apr. 27, 2015).

38 Noel Sharkey, Comment, *Automating Warfare: Lessons Learned from the Drones*, 21 J.L. INFO. & SCI. 140, 141 (2011).

39 *Id.*

40 LOSING HUMANITY, *supra* note 2, at 12.

new about autonomous weapons."[41] Under these definitions, the most rudimentary landmine and Hal 9000 from *2001: A Space Odyssey* are equivalently "autonomous."

Peter Asaro, a Professor of Philosophy who studies the implications of military robotics, defines autonomous weapon systems as "any automated system that can initiate lethal force without the specific, conscious, and deliberate decision of a human operator, controller, or supervisor."[42] Admirably, Asaro is concerned with ensuring meaningful human control over life-and-death decisions. But his definition elides important distinctions between weapon systems with vastly different levels of human involvement in the decision to use lethal force.

Mark Gubrud, a member of the International Committee on Robot Arms Control, argues that "[w]e should . . . seek principles and definitions that point, as directly as possible to a Yes or No answer to the question, 'Is this an autonomous weapon?'"[43] Given the need for a clear definition for autonomy in weapon systems, Gubrud is asking the right question. But his solution—"A system is autonomous if it is operating without further human intervention"[44]—is incomplete. Even assuming that he meant to limit his definition of autonomy to systems capable of using lethal force, Gubrud's definition includes weapon systems with vastly disparate levels of human involvement.

4. Setting the Bar for Autonomy Too High

Notwithstanding the DoD's calm pronouncement that "[h]uman-supervised autonomous weapon systems may be used to select and engage targets,"[45] most legal scholars assume that autonomous weapon systems do not yet exist.[46] This conclusion is usually grounded in alternative definitions of autonomy for weapon systems, which tend to have two complimentary issues: an overly broad definition of non-autonomous (usually termed "automated" or "automatic") weapon systems, and an overly narrow definition of autonomous weapon

41 Paul Scharre, *Autonomy, "Killer Robots," and Human Control in the Use of Force—Part I*, JUST SECURITY (July 9, 2014, 11:17 AM), http://justsecurity.org/12708/autonomy-killer-robots-human-control-force-part [hereinafter Scharre, *Autonomy I*]; *cf.* Michael C. Horowitz & Paul Scharre, *Do Killer Robots Save Lives?*, POLITICO (Nov. 19, 2014), http://www.politico.com/magazine/story/2014/11/killer-robots-save-lives-113010_full.html?print#.VICWzWds2dx (discussing concerns that ban advocates are setting the bar for "killer robots" inappropriately low to encompass life-saving precision-guided munitions).

42 Asaro, *supra* note 4, at 694.

43 Gubrud, *supra* note 18.

44 *Id.*

45 DOD DIR. 3000.09, *supra* note 19, at 3.

46 *See supra* note 2.

systems. Such definitions are problematic, however, insofar as they ignore the fact that weapon systems in use today can make independent determinations regarding the selection and engagement of targets.

The U.K. Ministry of Defence defines "autonomous systems" as

> capable of understanding higher level intent and direction. From this understanding and its perception of its environment, such a system is able to take appropriate action to bring about a desired state. It is capable of deciding a course of action, from a number of alternatives, without depending on human oversight and control, although these may still be present. Although the overall activity of an autonomous unmanned aircraft will be predictable, individual actions may not be.[47]

It continues:

> Autonomous systems will, in effect, be self-aware and their response to inputs indistinguishable from, or even superior to, that of a manned aircraft. As such, they must be capable of achieving the same level of situational understanding as a human. . . . As computing and sensor capability increases, it is likely that many systems, using very complex sets of control rules, will appear and be described as autonomous systems, but as long as it can be shown that the system logically follows a set of rules or instructions and is not capable of human levels of situational understanding, then they should only be considered to be automated.[48]

This position exemplifies the problems inherent in setting the bar for weapon systems' autonomy too high. Robots are unlikely to achieve "the same level of situational understanding as a human"[49] any time soon, rendering any policies based on this definition largely hypothetical. A weapon system that independently selects and engages targets based on gathered data or even on in-field learning would be classified as merely "automated" as long as it didn't have human-level cognitive capabilities. Thus, although the United Kingdom has publicly stated a policy against employing autonomous weapon systems, it has minimal practical impact or import.[50]

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47 U.K. MINISTRY OF DEFENCE, JOINT DOCTRINE NOTE 2/11: THE UK APPROACH TO UNMANNED AIRCRAFT SYSTEMS 2-3 (2011).

48 *Id.* at 2-3 to 2-4.

49 *Id.* at 2-3.

50 *See* Sharkey, *supra* note 38, at 141 (critiquing this definition on the grounds that "no system is capable of 'understanding' never mind 'understanding higher level intent'"); *see also* NICHOLAS MARSH, PEACE RESEARCH INST. OSLO, DEFINING THE SCOPE OF AUTONOMY: ISSUES FOR THE CAMPAIGN TO STOP KILLER ROBOTS 2 (2014) (discussing Sharkey's critique).

C. *A Clarified Definition*

Given the ambiguities and problems attendant upon other definitions, this section suggests a clarified definition of "autonomous weapon system," meant to highlight the unique issues such weaponry poses from a law of armed conflict perspective:

> *An "autonomous weapon system" is a weapon system that, based on conclusions derived from gathered information and preprogrammed constraints, is capable of independently selecting and engaging targets.*

The remainder of this section elaborates upon different aspects of this definition.

1. "An 'autonomous weapon system' is a weapon system that, . . . "

A "weapon system" is "[a] combination of one or more weapons with all related equipment, materials, services, personnel, and means of delivery and deployment (if applicable) required for self-sufficiency."[51] For autonomous weapon systems, this may include varying combinations of physical mechanisms and nonphysical code or software.

A weapon system need not include lethal weapons; certain weapons are "explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment."[52]

It also bears noting that weapon systems are not necessarily embodied entities: computer viruses, worms, and other malware may also operate automatically or autonomously. Although much about Stuxnet, a computer worm discovered in early 2010, is shrouded in secrecy, it was apparently designed to attack industrial Programmable Logic Controllers (PLCs)—specifically, Iranian PLCs controlling centrifuges used for enriching weapons-grade uranium.[53] At some point between late 2009 and early 2010, Iran replaced approximately 1000 centrifuges at its Natanz plant, which has been widely attributed to damage caused by Stuxnet.[54] Whether Stuxnet succeeded in its mission is unknown:

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51 *Weapon System*, DOD DICTIONARY MIL. TERMS, http://www.dtic.mil/doctrine/dod_dictionary/data/w/7965.html (last visited Apr. 27, 2015).

52 *Nonlethal Weapon*, DOD DICTIONARY MIL. TERMS, http://www.dtic.mil/doctrine/dod_dictionary/data/n/11245.html (last visited Apr. 27, 2015).

53 Stuxnet was likely developed by the United States and Israel. David E. Sanger, *Obama Order Sped up Wave of Cyberattacks Against Iran*, N.Y. TIMES, June 1, 2012, at A1.

54 DAVID ALBRIGHT, PAUL BRANNAN & CHRISTINA WALROND, INST. FOR SCI. & INT'L SEC.,

> If Stuxnet's goal was the destruction of all the centrifuges in the [Fuel Enrichment Plants], Stuxnet failed. But if its goal was to destroy a more limited number of centrifuges and set back Iran's progress in operating [Fuel Enrichment Plants] while making detection of the malware difficult, it may have succeeded, at least for a while.[55]

But one thing is clear: Stuxnet was a code-based weapon system, albeit one without lethal effect.[56]

2. ". . . based on conclusions derived from gathered information and preprogrammed constraints, . . . "

This clause attempts to distinguish between "automated" and "autonomous" weapon systems. Both may gather information, both may operate under preprogrammed constraints, and both may engage targets independent of human intervention. But while automated weapon systems merely react to triggers, autonomous weapon systems process information to derive conclusions before responding.[57] For example, a typical landmine is an automated weapon that uses gathered information—such as a tug on a tripwire or pressure on a sensor—to trigger an explosion without human involvement or oversight. A landmine with autonomous capabilities, however, might be triggered to react by a similar tug or pressure, but it would then use algorithms to process data (possibly to determine whether or not the trigger was due to a child or a tank) and, based on its calculations, reach a conclusion about whether or not to explode. More advanced weapon systems with autonomous capabilities might even make probabilistic calculations, deploy different graduated outcomes based on environmental factors, or learn from prior experiences.

This clause might be criticized—with some justification—as attempting to draw an arbitrary line in the sand. From a certain perspective, a landmine that is triggered and then explodes seems to be just a simplistic version of a landmine that evaluates the weight of a trigger before exploding—both operate after activation without further human intervention. Any attempt to distinguish between autonomous and non-autonomous weapon systems based on their complexity will

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DID STUXNET TAKE OUT 1,000 CENTRIFUGES AT THE NATANZ ENRICHMENT PLANT? 1 (2010).

55 *Id.*

56 *See* Oona A. Hathaway, Rebecca Crootof, Philip Levitz, Haley Nix, Aileen Nowlan, William Perdue & Julia Spiegel, *The Law of Cyber-Attack*, 100 CALIF. L. REV. 817, 839–40 (2012) (discussing various types of cyber-attacks, including Stuxnet).

57 In other words, autonomous weapon systems "select among" potential targets; automated ones are simply triggered. Kenneth Anderson, Daniel Reisner & Matthew Waxman, *Adapting the Law of Armed Conflict to Autonomous Weapon Systems*, 90 INT'L L. STUD. 386, 388 (2014).

run into a similar line-drawing problem, which might argue for striking this clause entirely.[58]

That concern being acknowledged, the fact that a weapon system is capable of at least a minimal level of independent analysis does seem to be a relevant distinction. This clause highlights that an autonomous weapon systems, like any robotic or code-based system, is controlled by a program.[59] These programs may be created by human beings or by other programs, and their constraints may include anything from the law of armed conflict to specific parameters of a given mission. Even weapon systems with in-field machine learning capabilities will be constrained in what they can learn and do by their programs. Thus, even though autonomous weapon systems' responses to certain environments or events may be largely predictable—just as the actions of an autonomous human being may be largely predictable—there seems to be an important distinction between deterministic "automatic" or "automated" responses and those based on collected and analyzed information.[60]

3. ". . . is capable of . . . "

The DoD's definition states that a weapon system's autonomy depends on whether it "*can* select and engage targets without further intervention by a human operator," and thus the definition "includes human-supervised autonomous weapon systems" as a subset of autonomous weapon systems.[61] Notwithstanding this clarity, subsequent writers relying on this definition often imply that human-supervised systems are distinct from autonomous weapon systems. To address this frequent misreading, this clarified definition expands the Directive's "can" to "is capable of."

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58 *See* Scharre & Horowitz, *supra* note 15, at 6 ("[T]here are no clear boundaries between these degrees of complexity, from 'automatic' to 'automated' to 'autonomous' to 'intelligent,' and different people may disagree on what to call any given system.").

59 *See* Sharkey, *supra* note 38, at 141.

60 It bears noting that, while the predictability of a weapon system's response to a situation may be a crucial consideration in a commander's decision to deploy the weapon, see *infra* Part II.B, the nature of the environment and the predictability of a weapon system's response to it is irrelevant for determining whether or not the system is autonomous.

61 DOD DIR. 3000.09, *supra* note 19, at 13 (emphasis added). "[H]uman-supervised autonomous weapon systems" are defined as autonomous weapon systems "designed to provide human operators with the ability to intervene and terminate engagements, including in the event of a weapon system failure, before unacceptable levels of damage occur." *Id.* at 14.

4. ". . . independently selecting and engaging targets."

As many have intuited, the fundamental distinction between semi-autonomous and autonomous weapon systems is that the latter are capable of selecting and engaging targets—which may include human beings, objects, or even code—without human intervention, while the former cannot. But what does target selection and engagement entail? Complete freedom to decide who lives or dies? Bounded selection or implementation capabilities based on preprogrammed constraints? Prioritizing one specific preselected target over another?

Under this definition, the distinction turns on whether a weapon system uses its autonomous capabilities to select and engage a target. Thus, an autonomous weapon system could either operate with no constraints or with preprogrammed boundaries—the important fact would be that it gathered and processed information in the course of target selection and engagement. A semi-autonomous weapon system, in contrast, might act autonomously in functions related to target selection or engagement—including acquiring, tracking, prioritizing, or determining when or how to engage specific targets—but a human operator would need to take some affirmative action before it would be capable of both selecting and engaging a target.

a. Specific Versus General Targets

"Specific" is a key word here—as noted above, to the extent targets are preselected by human operators, the selections would need to be quite precise to preserve a meaningful distinction between semi-autonomous and autonomous weapon systems. Thus, semi-autonomous weapon systems might use autonomous capabilities to engage a particular preselected target, while autonomous weapon systems might be charged with engaging targets with certain characteristics.

To grasp this distinction, it helps to consider the Roomba, a popular autonomous vacuum cleaning robot with various cleaning modes. In the "SPOT mode," a human being selects a particular area for focused cleaning and the Roomba "moves in a slow spiral pattern over the soiled area."[62] If it encounters a wall or other object, it "will intelligently keep cleaning in the focused area."[63] In the "CLEAN mode," the Roomba "calculate[s] the room size and maximize[s] coverage-per-room based on information it receives through its sensors."[64] In each of

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62 *Service & Support – FAQs*: *Roomba's Cleaning Modes*, IROBOT, http://uksupport.irobot.com/app/answers/detail/a_id/863/~/roombas-cleaning-modes (last visited Aug. 17, 2014).

63 *Id.*

64 *Id.*

these modes, the Roomba is employing autonomous capabilities to accomplish a human-set task. And its goal in each mode is similar: to clean the floor. However, the human operator is selecting a "target" in the semi-autonomous SPOT mode, while the human operator is essentially charging the Roomba with selecting "targets" in a designated "battlefield" in the autonomous CLEAN mode.

b. Sufficient Time for an Affirmative Action

Some affirmative action from a human operator with regard to the selected target is also necessary to distinguish semi-autonomous from autonomous weapon systems. Where a human being merely has supervisory power, the weapon system is for all intents and purposes autonomously selecting and engaging the target.

But what constitutes an "affirmative action"? Choosing not to exercise veto power can hardly be sufficient—but requiring too much human involvement risks setting the bar for autonomy too low and grouping weapon systems with widely and importantly distinct levels of required human involvement together.

To evaluate the implications of this standard, it helps to consider weapon systems currently in use. The U.S. Phalanx Close In Weapons Systems (CIWS or Sea Whiz)—affectionately called "R2-D2s" by Americans or "Daleks" by Brits because of their barrel-like shape—are mounted on ships and provide a last-ditch defense against incoming high-speed, anti-ship missiles and low-level aircraft.[65] It collects data in real time; identifies potential targets; evaluates whether they pose a threat based on whether they are approaching the ship, capable of maneuvering to hit the ship, and traveling within a certain velocity; and engages them—but allows for a manual override.[66] The CIWS can be employed under the Aegis combat system,[67] which has four modes, ranging from "semiautomatic," where a human operator controls decisions regarding the use of lethal force, to "casualty," which assumes

65 John Pike, *MK 15 Phalanx Close-In Weapons System (CIWS)*, FED'N AM. SCIENTISTS, http://www.fas.org/man/dod-101/sys/ship/weaps/mk-15.htm (last updated Jan. 9, 2003); Robert H. Stoner, *R2D2 with Attitude: The Story of the Phalanx Close-In Weapons System (CIWS)*, NAVWEAPS, http://www.navweaps.com/index_tech/tech-103.htm (last updated Oct. 30, 2009).

66 Pike, *supra* note 65; Stoner, *supra* note 65. The U.S. Navy is currently testing a more advanced CIWS: the SeaRam CIWS Anti-Ship Missile Defense System "automatically detects, evaluates, tracks, engages, and performs kill assessment against [anti-ship missiles] and high speed aircraft threats in an extended self defense battle space envelope around the ship." *United States Navy Fact File:* SeaRam *Close-In Weapon System (CIWS) Anti-Ship Missile Defense System*, U.S. NAVY, http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=456&ct=2 (last updated Nov. 15, 2013).

67 *See* Stoner, *supra* note 65.

that the human operators are incapacitated and therefore permits the system to use defensive force independently.[68]

A land-based variant of the U.S. Navy's CIWS is the Centurion, which was part of the Counter-Rocket, Artillery, Mortar (C-RAM) initiative and was originally deployed in Iraq in 2005.[69] According to reports, C-RAM systems have successfully intercepted over 100 rockets.[70] Similarly, Israel's Iron Dome, which currently is the only dual C-RAM and Very Short Range Air Defense system, intercepted over 150 rockets fired into Israel from the Gaza Strip prior to the July 2014 conflict.[71] In that conflict, the Iron Dome was credited with shooting down ninety-percent of Palestinian rockets it engaged—leading to "'Iron Dome tourism,' where the public, reassured by the system's performance, stay outdoors to watch the shoot-downs rather than taking cover."[72]

Are these semi-autonomous or autonomous weapon systems? If specific target selection and engagement depends on any affirmative action of a human operator, the U.S. C-RAM system and the Israeli Iron Dome would be classified as semi-autonomous. They both identify a threat and send a recommended response to a human operator, who must then decide within seconds whether to give the command to fire.[73] Once provided with authorization, the system then determines when to fire and how to guide the intercepting missile to neutralize the threat. When a defensive system only permits a human supervisor to veto a determination to select and engage a target, however, it would be an autonomous weapon system. Thus, although the U.S. Navy's CIWS/Aegis system allows for a manual override,[74] to the extent it has the capability to select and engage targets with no further human

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68 Gary E. Marchant et al., *International Governance of Autonomous Military Robots*, 12 COLUM. SCI. & TECH. L. REV. 272, 287 (2011).

69 Stoner, *supra* note 65. Because these are used on land, where there is a greater risk to civilians, the C-RAM's rounds explode either on impact or upon tracer burnout. *Id.*

70 *Land-Based Phalanx Weapon System Completes Mission in Iraq*, NAVSEA (Feb. 16, 2012), http://www.navsea.navy.mil/Lists/NewsWires/DispForm.aspx?ID=12. Additionally, having a C-RAM system may have had a deterrent effect. As the system manager noted, "'[w]e have logged numerous successful intercepts, but we don't know how many attacks didn't take place once they realized there was a defense system deployed.'" *Id.*

71 *Iron Dome*, RAFAEL ADVANCED DEF. SYS. LTD., http://www.rafael.co.il/Marketing/186-1530-en/Marketing.aspx (last visited Apr. 27, 2015).

72 Dan Williams, *Israel Says Iron Dome Scores 90 Percent Rocket Interception Rate*, REUTERS, July 10, 2014, *available at* http://www.reuters.com/article/2014/07/10/us-palestinians-israel-irondome-idUSKBN0FF0XA20140710.

73 *See Iron Dome Battle Management Demonstrated*, DEF. UPDATE, http://defense-update.com/photos/iron_dome_bms.html (last visited Apr. 27, 2015) (noting that the system "requests the operator's permission to launch the missiles"); Paul Scharre, *Reflections on the Chatham House Autonomy Conference*, LAWFARE (Mar. 3, 2014, 5:34 PM), http://www.lawfareblog.com/2014/03/guest-post-reflections-on-the-chatham-house-autonomy-conference (stating that C-RAM systems do not have an autonomous mode).

74 Pike, *supra* note 65.

intervention, it is an autonomous weapon system. But is this distinction between the semi-autonomous C-RAM and Iron Dome and the autonomous CIWS/Aegis system sensible?

On one hand, preserving this technical distinction may have some positive policy side effects. It has the benefit of clarity: any given weapon system can be definitively classed as semi-autonomous or autonomous. Militaries anxious to avoid potential restrictions on autonomous weapon systems may favor designs requiring some affirmative human action over designs that merely permit a veto, resulting in a clearer accountability chain for every engagement. Maintaining this distinction may also be useful in the ban debate, as both advocates and skeptics of a ban on autonomous weapon systems seem willing to exclude defensive systems with a human "in the loop" from any potential ban.

On the other hand, requiring an affirmative action from a human operator in these charged circumstances begins to look more like a "rubber stamp" than a considered decision to select a specific target for engagement.[75] To the extent the human supervisor's affirmative action is rendered essentially irrelevant, given the superhuman nature of the required response time to an incoming threat, it seems unfair to hold him accountable for a decision to engage a selected target that was effectively made by the weapon system.

This issue is compounded by psychological factors. First, human beings can place too much faith in computers, to the extent that an operator may trust a machine's conclusion more than her own analysis. Second, while autonomous weapon systems may allow human operators to monitor multiple systems, studies have shown that a monitor's attention declines as the number of monitored systems increases.[76] Stephen Knouse theorizes that when an individual knows her actions will be futile, she will lose the motivation to fulfill the duties of her position.[77] Presumably, then, the operator of a weapon systems subconsciously concludes that her actions are irrelevant and therefore might "automatically" approve the engagement of potential targets.[78]

Although there are regulatory reasons for preserving a technical distinction between semi-autonomous and autonomous weapon

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75 *See* P. W. Singer, *War of the Machines: A Dramatic Growth in the Military Use of Robots Brings Evolution in Their Conception*, 303 SCI. AM. 56, 63 (2010) (noting that, in autonomous defensive systems, "the operator really only exercises veto power, and a decision to override a robot's decision must be made in only half a second, with few willing to challenge what they view as the better judgment of the machine"); *see also* Jeffrey S. Thurnher, *No One at the Controls: Legal Implications of Fully Autonomous Targeting*, 67 JOINT FORCE Q. 77, 83 (2012) (arguing that human oversight should be more than "merely a rubber stamp").

76 Allyson Hauptman, *Autonomous Weapons and the Law of Armed Conflict*, 218 MIL. L. REV. 170, 186 (2013).

77 *Id.* at 186 n.61.

78 *See id.* at 186.

systems based on whether a human being makes any affirmative action, a legal definition should aim to avoid creating distinctions between different weapon systems that operate similarly in practice. Given this, and given that the primary concern with autonomous weapon systems is about when the decision to use lethal force is delegated to a machine, for a weapon system to not be effectively autonomous, the human operator or supervisor must have sufficient time to evaluate the nature of the target, its military significance, and the likely incidental effects of engagement.[79] What constitutes sufficient time for these calculations will vary based on the situation.

c. "Controllable" Versus "Fully" Autonomous Weapon Systems

Understandably, many feel that there is an important distinction between human-supervised and entirely uncontrolled autonomous weapon systems. This intuition leads many to distinguish between weapon systems where human beings are "on the loop"—which many acknowledge are in use today—and "fully" autonomous weapon systems where human beings are entirely "off the loop"—which most conclude do not yet exist.[80]

There are important policy implications to this distinction: it is necessary for constructing different best practices or administrative regulations,[81] and having a human being responsible for supervising the actions of an autonomous weapon system might be critical for assigning responsibility should the system's actions result in a violation of international or domestic law. Just because a weapon system may be capable of selecting and engaging targets without human intervention

79 This standard for distinguishing between semi-autonomous and effectively autonomous weapon systems draws from the International Committee on Robot Arms Control's list of minimum necessary conditions for meaningful human control. *See* Frank Sauer, *ICRAC Statement on Technical Issues to the 2014 UN CCW Expert Meeting*, ICRAC (May 14, 2014), http://icrac.net/2014/05/icrac-statement-on-technical-issues-to-the-un-ccw-expert-meeting. However, the Committee would require that all of their conditions be met in every situation where a target is engaged, which would forbid the usage of many weapon systems currently being used.

80 *See supra* note 2; *see also* Michael N. Schmitt, *Autonomous Weapon Systems and International Humanitarian Law: A Reply to the Critics*, HARV. NAT'L SECURITY J. FEATURES 4–5, 11 (2013), *available at* http://harvardnsj.org/wp-content/uploads/2013/02/Schmitt-Autonomous-Weapon-Systems-and-IHL-Final.pdf (acknowledging that "U.S. forces have operated two human-supervised autonomous systems for many years," but nonetheless concluding that "fully autonomous weapon systems" are not being fielded by the United States); Scharre & Horowitz, *supra* note 15, at 16 (distinguishing between "autonomous weapon system[s]" and "human-supervised autonomous weapon system[s]"); Lawand, *supra* note 8 ("A truly autonomous weapon system would be capable of searching for, identifying and applying lethal force to a target, including a human target (enemy combatants), without any human intervention or control. This definition connotes a mobile system with some form of artificial intelligence, capable of operating in a dynamic environment with no human control.").

81 *See* DOD DIR. 3000.09, *supra* note 19, at 3 (distinguishing when and how autonomous and semi-autonomous weapon systems may be used).

does not mean it will or should be employed in that mode; indeed, there are significant ethical and practical arguments counseling against developing weapons that do not require an affirmative action from a human before employing lethal force.[82]

But while distinguishing between human-supervised and unsupervised weapon systems may be important in developing best practices or regulations, it is irrelevant to the question of whether a given weapon system is autonomous.[83] Such operation does not render the weapon system itself any less autonomous, it just means that its autonomous capabilities are not being fully utilized. If a weapon system has the capacity to independently select and engage targets, whether there is a human supervisor or whether it is operated in a semi-autonomous mode is a question of usage—and thus regulation—and not of autonomy. Returning to the Roomba analogy: even if a human operator were to only use a Roomba in SPOT mode or only permitted it to use the CLEAN mode under active supervision, the Roomba would nonetheless remain an autonomous robot, as it would retain the capability to operate in the CLEAN mode. Accordingly, this definition does not differentiate between "controllable" and "fully" autonomous weapon systems.

d. Lethal Versus Non-Lethal Weapon Systems

"Target engagement" usually entails committing to a violent or disruptive action to destroy or undermine the functioning of a target. It includes the use of lethal force, which consists of any action—bombing, stabbing, infecting, and so on—that is intended to or has a substantial risk of causing death, serious bodily harm, or injury. "Lethal force" may include force directed at human beings or force directed at objects, such

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82 Writers with practical experience tend to argue that militaries are uninterested in developing or deploying autonomous weapon systems that do not have a human operator "on the loop," as doing so "decreases the chances of weapons striking the wrong target, resulting in fratricide or civilian casualties, or that they simply miss their target entirely, wasting scarce and expensive munitions." Paul Scharre, *Autonomy, "Killer Robots," and Human Control in the Use of Force—Part II*, JUST SECURITY (July 9, 2014, 2:30 PM), http://justsecurity.org/12712/autonomy-killer-robots-human-control-force-part-ii [hereinafter Scharre, *Autonomy II*]; *see also* Werner J.A. Dahm, Commentary, *Killer Drones are Science Fiction*, WALL ST. J., Feb. 15, 2012, at A11 (noting that there is currently no military disadvantage in keeping humans involved in decisions regarding engagement and therefore no demand to delegate that step); Charli Carpenter, *US Public Opinion on Autonomous Weapons*, DUCK MINERVA (June 2013), http://www.whiteoliphaunt.com/duckofminerva/wp-content/uploads/2013/06/UMass-Survey_Public-Opinion-on-Autonomous-Weapons.pdf (finding, in a 2013 survey of 1000 Americans, that military personnel, veterans, and individuals with family in the military were more strongly opposed to autonomous weapons than the general public, with the highest opposition coming from active duty troops).

83 Similarly, it is inaccurate to consider an autonomous weapon system that is only operated in semi-autonomous modes, like the CIWS, merely a semi-autonomous weapon system.

as tanks, planes, ships, or buildings, whose destruction has a substantial risk of causing such injury to human beings.

But what of autonomous weapon systems programmed to only target and engage objects whose destruction is unlikely to cause harm to human beings? To the extent that the concern with autonomous weapon systems is that human operators are inappropriately delegating the decision to use lethal force to machines, wouldn't such weapon systems be acceptable? Put another way: Ban proponents aren't concerned with autonomous weapon systems, but rather with *lethal* autonomous weapon systems.

This definition does not, however, distinguish between lethal and non-lethal autonomous weapon systems. When a weapon system is capable of wielding destructive force, what it is preprogrammed to target is a question of how it is used, not of its autonomy. As a result, for the purposes of this definition, it is irrelevant whether a weapon system is engaging human or non-human targets or whether the system is being used for offensive or defensive purposes.[84]

D. *Autonomous Weapon Systems in Use Today*

There is a nearly universal consensus, among both ban advocates and skeptics, that autonomous weapon systems do not yet exist.[85] One of the more influential critiques of the pro-ban argument is that such weapon systems are "inevitable."[86] Under the clarified definition, however, it quickly becomes clear that autonomous weapon systems are not just inevitable—they already exist and have been deployed.

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84 Granted, there are different levels of risks associated with weapon systems that engage only nonhuman targets than those which engage human targets. Such practical distinctions may be quite important in discussing the regulation (as opposed to a complete ban) of autonomous weapon systems. *See infra* Part IV.C.1.b.

85 *See supra* note 2. There are a few writers on the subject who acknowledge that some autonomous weapon systems are in use today. *See* MARSH, *supra* note 50, at 3; Ronald Arkin, *Lethal Autonomous Systems and the Plight of the Non-Combatant*, AISB Q., July 2013, at 6; Gubrud, *supra* note 18; Scharre, *Autonomy II*, *supra* note 82; *see also* Anderson, Reisner & Waxman, *supra* note 57, at 388–89 ("[S]everal modern highly-automated—and some would call them autonomous—weapon systems already exist."); Schmitt & Thurnher, *supra* note 2, at 235 (noting that the United States has operated "two 'human-supervised' autonomous systems for many years—the Aegis at sea, and the Patriot on land").

However, even these writers tend to limit autonomous weapons in use today to a few exceptions to the norm of nonautonomy. *See* MARSH, *supra* note 50, at 3 (discussing the U.K. Brimstone and other fire-and-forget missiles); Gubrud, *supra* note 18 (discussing fire-and-forget or lock-on-after-launch missiles); Scharre, *Autonomy II*, *supra* note 82 (discussing the Israeli Harpy and the PMK encapsulated torpedo mine).

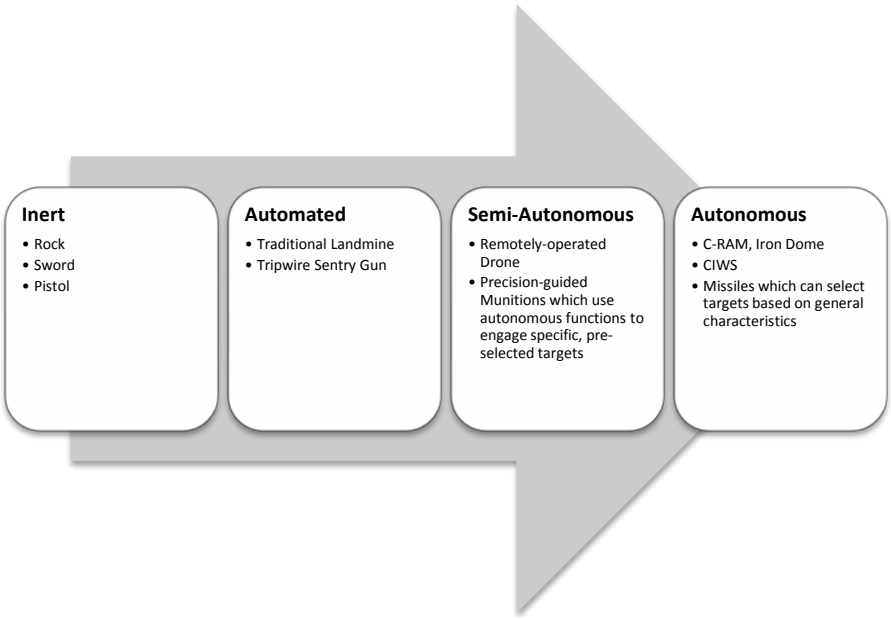
Under the clarified definition, however, it becomes clear that many different types of autonomous weapon systems are currently in use, many of which have not been recognized in the literature as such.

86 Anderson & Waxman, *supra* note 4, at 2, 27.

1. Levels of Autonomy

While there will necessarily be a spectrum of weapons autonomy, ranging from a stone to the Terminator, there are four relevant classifications. As pictured below, from least to most autonomous, there are inert weapon systems, automated weapon systems, semi-autonomous weapon systems, and autonomous weapon systems.

Fig. 1: Levels of Autonomy



If asked to list weapons, most would likely name some variant on "gun," "knife," or "sword."[87] When distinguishing between levels of weapon autonomy, all of these—and everything from a stone to the most advanced handheld firearm—could be classified as an "inert weapon," as they are all objects requiring contemporaneous operation by a human being to be lethal.

"Automated" weapon systems are purely reactive; although they may be deployed long before they engage a target, they merely follow commands or preprogrammed rules, without employing gathered information or algorithmic calculations to draw independent conclusions about how to react. A tripwire sentry gun will fire automatically after being triggered; an autonomous sentry will process data before firing. Thus, while both automated and autonomous

87 One friend responded to this question: "Any object within range at a moment's notice."

weapon systems may react to certain situations in a predictable manner, automated weapons have no "choice" in the matter.

Semi-autonomous weapon systems have some autonomous capabilities, which may include functions relevant to target selection and engagement, but they cannot independently both select and engage targets. Some such systems might identify a potential target and await an operator's approval before exercising lethal force; others might employ autonomy in determining how to carry out a strike against a preselected target. However, a human operator will still need to take some affirmative action to select a specific target for engagement.

Finally, autonomous weapon systems are capable of selecting and engaging targets based on conclusions derived from gathered information and preprogrammed constraints, without any contemporaneous decisional support by a human being. They might operate in structured or unstructured environments; they may be mobile or stationary; they may have rudimentary artificial intelligence, be capable of in-field learning, or even have human-level reasoning; they may be supervised or entirely uncontrollable. While these factors are germane to whether they can be used in compliance with the law of armed conflict and in the construction of regulatory policies, they are irrelevant to the question of whether a particular weapon system is autonomous.

2. Incentives for Development

A host of political, practical, and even ethical incentives appears to favor the development of increasingly autonomous weapon systems. Of course, there are also important considerations counseling against a headlong embrace of such weaponry.[88] The aim of this subsection is not to join the debate as to whether governments should employ autonomous weapon systems, but rather to highlight the numerous reasons states are investing in related research.

First, there are powerful political incentives for a state to replace or augment its human forces with robotic ones. The main one is

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88 *See, e.g.*, DOD DIR. 3000.09, *supra* note 19; HUMAN RIGHTS WATCH & INT'L HUMAN RIGHTS CLINIC, HARVARD LAW SCH., ADVANCING THE DEBATE ON KILLER ROBOTS: 12 KEY ARGUMENTS FOR A PREEMPTIVE BAN ON FULLY AUTONOMOUS WEAPONS (2014) [hereinafter ADVANCING THE DEBATE], *available at* http://www.hrw.org/sites/default/files/related_material/Advancing%20the%20Debate_8May2014_Final.pdf; LOSING HUMANITY, *supra* note 2; Arkin, *supra* note 85, at 4–5; Asaro, *supra* note 4, at 692; *see also* Sarah Knuckey, *Scientists from 37 Countries Call for Ban on Autonomous Lethal Targeting*, JUST SECURITY (Oct. 16, 2013, 11:56 AM), http://justsecurity.org/2013/10/16/scientists-ban-autonomous-weapons-systems (reviewing legal, political, strategic, moral, and ethical arguments for and against autonomous weapon systems).

summarized nicely by a Navy chief petty officer on the loss of his unit's PackBot: "'when a robot dies, you don't have to write a letter to its mother.'"[89] In fact, a common argument for banning autonomous weapon systems is that they will make wars too easy.[90] If politicians don't need to provide reasons for entering a conflict that justify the loss of their constituents' lives, this implicit check on armed conflicts might disappear—along with democratic peace theory.[91] Increasingly autonomous weapon systems are also politically appealing because they make life safer for soldiers: they reduce the number of soldiers exposed to physically and psychologically dangerous situations while simultaneously creating jobs for (and therefore a need to train) highly skilled professionals.

Second, autonomous weapon systems may simply be more effective and efficient weapons. Remotely-operated weapon systems usually require at least a one-to-one match of operators,[92] but as semi-autonomous and autonomous weapon systems proliferate, human operators will be able to monitor larger numbers of systems—possibly rendering individual operators more productive, requiring less total staff, and increasing total force projection.[93] They may also extend the reach of any individual solider, allowing him to "see[] farther or strik[e] further."[94] Additionally, to the extent that remotely-operated systems are vulnerable to jamming or even takeover,[95] increasing the weapons'

89 P. W. Singer, *Robots at War: The New Battlefield*, 33 WILSON Q. 30, 31 (2009).

90 *Id.* at 47–48. Conversely, as "boots on the ground" are removed from the equation, politicians might find it easier to justify humanitarian interventions. *See* Anderson & Waxman, *supra* note 4, at 17–18 (discussing whether there is ever an "optimal" level of force). For a discussion of how autonomous weapon systems might make war politically easier and thereby affect the balance of the U.S. war power, see Rebecca Crootof, *War, Responsibility, and Killer Robots*, 40 N.C. J. INT'L L. & COM. REG. (forthcoming 2015), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2569298.

91 *See* Peter M. Asaro, *How Just Could a Robot War Be?*, *in* CURRENT ISSUES IN COMPUTING AND PHILOSOPHY 50, 56–59 (Adam Briggle, Katinka Waelbers & Philip Brey eds., 2008); Singer, *supra* note 89, at 48.

92 *See* Thurnher, *supra* note 75, at 79 ("It takes scores of people, from pilots to technicians to intelligence analysts, to operate a single tethered UAV.").

93 *See* Marchant et al., *supra* note 68, at 275; Singer, *supra* note 89, at 41 (noting that when human operators control two UAVs at a time, their performance levels decrease by an average of fifty percent—which incentivizes increased autonomy for weapon systems); *see also* DOD ROADMAP, *supra* note 35, at 25 (noting that personnel costs are "the greatest single cost in DoD" and that "strides in autonomy . . . have reduced the number of personnel required, but much more work needs to occur").

94 Marchant et al., *supra* note 68, at 275.

95 In June 2012, a team from the University of Texas at Austin led by Professor Todd Humphreys used "spoofing"—a hacker-created signal that infiltrates a drone's GPS system—to take control of a drone in flight. John Roberts, *EXCLUSIVE: Drones Vulnerable to Terrorist Hijacking, Researchers Say*, FOXNEWS.COM (June 25, 2012), http://www.foxnews.com/tech/2012/06/25/drones-vulnerable-to-terrorist-hijacking-researchers-say. This may be how Iran allegedly captured a U.S. surveillance drone in December 2011. Adam Rawnsley, *Iran's Alleged Drone Hack: Tough, but Possible*, WIRED (Dec. 16, 2011, 6:01 PM), http://www.wired.com/2011/12/iran-

autonomy and eliminating the need for a continuous link between the weapon system and the operator might improve its efficacy. The possibility of autonomous "persistent stare"—longer-term surveillance or independent evaluation of factors on the ground—might also improve precision targeting and reduce collateral damage.[96]

Similarly, autonomous weapon systems may be preferable to human soldiers in certain situations or for certain activities. Werner Dahm, then-Chief Scientist of the U.S. Air Force, stated in 2010 that "by 2030 machine capabilities will have increased to the point that humans will have become the weakest component in a wide array of systems and processes."[97] To a certain extent, this is already occurring: a Defense Advanced Research Projects Agency official has stated that human beings are becoming "the weakest link in defense systems."[98] Additionally, whereas training a soldier in a task might take days, weeks, or even years, weapon systems can share knowledge almost instantaneously.[99] They can quickly collect and integrate information from varied sources. They don't get hungry, tired, bored, or sick. They are immune to biological and chemical weapons. They tackle the dirty, dangerous, and dull work without complaint. They can reach inaccessible areas and survive in inhospitable environments. They follow instructions to the letter. They need not be motivated by self-preservation, and so may "be used in a self-sacrificing manner if needed and appropriate."[100] They are immune from psychological "scenario fulfillment," which causes human beings to process new information in line with their preexisting beliefs and may sometimes result in "distortion or neglect of contradictory information in stressful situations."[101] They don't act out of fear or anger, for vengeance or vainglory.[102] Ronald Arkin, a roboticist and roboethicist working to

drone-hack-gps (reporting on Iranian claims that "Iran managed to jam the drone's communication links to American operators by forcing it to shift into autopilot mode. With its communications down, the drone allegedly kicked into autopilot mode, relying on GPS to fly back to base in Afghanistan. With the GPS autopilot on, the engineer claims Iran spoofed the drone's GPS system with false coordinates, fooling it into thinking it was close to home and landing into Iran's clutches.").

96 *See* Arkin, *supra* note 85, at 1; Reeves & Johnson, *supra* note 4, at 26.

97 WERNER J.A. DAHM, U.S. AIR FORCE, REPORT ON TECHNOLOGY HORIZONS: A VISION FOR AIR FORCE SCIENCE & TECHNOLOGY DURING 2010–2030, at 106 (2010) (Werner J.A. Dahm is the U.S. Air Force Chief Scientist (AF/ST)).

98 *See* Singer, *supra* note 89, at 37 (internal quotation marks omitted).

99 *Id.* at 37–38.

100 RONALD C. ARKIN, GOVERNING LETHAL BEHAVIOR IN AUTONOMOUS ROBOTS 29 (2009).

101 *Id.* at 30–31.

102 However, it is not accurate to claim that autonomous weapon systems would never rape, massacre, or commit other war crimes; it all depends on how they are programmed and used. *See* Charli Carpenter, *"Robot Soldiers Would Never Rape": Un-packing the Myth of the Humanitarian War-Bot*, DUCK MINERVA (May 14, 2014), http://www.whiteoliphaunt.com/duckofminerva/2014/05/robot-soldiers-would-never-rape-un-packing-the-myth-of-the-humanitarian-war-bot.html.

develop algorithms for an "ethical governor" for robots, argues that autonomous weapon systems could eventually comply with the law of armed conflict better than human soldiers.[103] He believes his decisionmaking architecture "could potentially lead to ethically superior robotic warriors within as few as 10 to 20 years."[104]

Based on these and other factors, investments in unmanned technology are expected to grow.[105] The DoD has published its annual "Unmanned Systems Integrated Roadmap," outlining its vision for the "continued development, production, test[ing], training, operation, and sustainment of unmanned systems technology across DoD" for the next twenty-five years.[106] This includes the goal of "[t]ak[ing] the 'man' out of unmanned [systems]"[107] and moving from "autonomous mission *execution* to autonomous mission *performance*."[108] Believing that "[a]utonomy in unmanned systems will be critical to future conflicts that will be fought and won with technology," the DoD has labeled increasing autonomy in unmanned systems a "high priority."[109]

Proponents of a ban regularly highlight states' interest in developing increasingly autonomous weapon systems as a reason for why it is necessary to prohibit them now, and skeptics of a ban often suggest that states' interest renders this a particularly productive time to discuss the legal constraints on the use of autonomous weapon systems. But in their exhortations, both sides generally ignore the fact that there are already a number of autonomous weapon systems in use today.

3. Autonomous Weapon Systems Today

This subsection describes various weapon systems that would be classified as autonomous under the clarified definition. This list is not intended to be all-inclusive, but rather to provide pertinent examples of

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103 ARKIN, *supra* note 100, at 30.

104 Don Troop, *Robots at War: Scholars Debate the Ethical Issues*, CHRON. HIGHER EDUC. (Sept. 10, 2012), http://chronicle.com/article/Moral-Robots-the-Future-of/134240. *But see* Sharkey, *supra* note 4, at 792–96 (critiquing Arkin and others for employing language that encourages the anthropomorphism of robotic processes by inappropriately attributing "ethical" capabilities to them).

105 *See* Jack Browne, *UAV Markets Robust Despite Declining Spending*, DEF. ELECTRONICS (Feb. 15, 2012), http://defenseelectronicsmag.com/electronic-countermeasures/uav-markets-robust-despite-declining-spending.

106 DOD ROADMAP, *supra* note 35, at v; *see also* Thurnher, *supra* note 75, at 79 ("The expectation is that robots on the battlefield will form the bulk of detachments, such as infantry units that would be comprised of 150 human soldiers working alongside 2,000 robots.").

107 DOD ROADMAP, *supra* note 35, at 25.

108 *Id.* at 66.

109 *Id.* at 67.

a variety of types of weaponry with the ability to independently select and engage targets. And this is only a smattering of the publicly available research and development—weapon systems in development or even currently in use might employ greater autonomous capabilities than has been revealed.

a. Autonomous Weapon Systems Operated in Semi-Autonomous or Human-Supervised Modes

Many existing autonomous weapon systems are currently only operated in a semi-autonomous mode—much like a Roomba that is only used in SPOT mode. However, just as that Roomba remains an autonomous cleaning robot, these weapon systems are most accurately classified as autonomous weapon systems.

To monitor the demilitarized zone, South Korea has allegedly installed SGR-A1s: stationary, armed robots which identify potential human targets,[110] voice commands to surrender, "observe" signs of surrender, and react after consultation with human supervisors in nearby command centers.[111] Although it is not clear whether or not they have been deployed, the Super aEgis II has also been designed for use in monitoring the demilitarized zone: it consists of a gun tower that can "find and lock on to a human-sized target in pitch darkness at a distance of up to 1.36 miles," uses anything from a 12.7 mm caliber machine gun to a surface-to-air missile to fire, and can be mounted on the ground or on a moving vehicle.[112] Both the SGR-A1 and Super aEgis II may be set to modes where they can select and engage targets with no human involvement or oversight.[113]

Israel's Guardium Unmanned Ground Vehicle is a boxy, car-like vehicle that patrols the Israel/Gaza border. It can be operated remotely or programmed to act autonomously, "both driving itself and

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110 The SGR-A1 identifies every human being who enters the demilitarized zone as an enemy, on the grounds that the individual has entered a prohibited zone. *Samsung Techwin SGR-A1 Sentry Guard Robot*, GLOBALSECURITY.ORG, http://www.globalsecurity.org/military/world/rok/sgr-a1.htm (last visited Apr. 27, 2015). These robots are reportedly assisted by technology based on Microsoft's Kinect—originally developed for use with the Xbox 360. *See* Brian Ashcraft, *Microsoft's Kinect Is Now Guarding the Korean Border*, KOTAKU (Feb. 3, 2014, 8:00 AM), http://kotaku.com/microsofts-kinect-is-now-guarding-the-korean-border-1514792443?utm_campaign=Socialflow_Kotaku_Facebook&utm_source=Kotaku_Facebook&utm_medium=Socialflow.

111 *See* Jon Rabiroff, *Machine Gun-Toting Robots Deployed on DMZ*, STARS & STRIPES (July 12, 2010), http://www.stripes.com/news/pacific/korea/machine-gun-toting-robots-deployed-on-dmz-1.110809; *Samsung Techwin SGR-A1 Sentry Guard Robot*, *supra* note 110.

112 Loz Blain, *South Korea's Autonomous Robot Gun Turrets: Deadly from Kilometers Away*, GIZMAG (Dec. 7, 2010), http://www.gizmag.com/korea-dodamm-super-aegis-autonomos-robot-gun-turret/17198.

113 *Id.*; *Samsung Techwin SGR-A1 Sentry Guard Robot*, *supra* note 110.

responding to obstacles and events,"[114] and can conduct surveillance and use non-lethal or lethal force.[115] While the Guardium appears to be employed in a semi-autonomous mode, it may also be able to select and engage targets autonomously.[116]

Lastly, as noted above, the U.S. Navy's Aegis control system, used to identify and eliminate incoming ballistic threats, has four modes. When in "casualty" mode, the human operators are assumed to be incapacitated and the system is able to use defensive force independently.[117] Various generations of the CIWS/Aegis systems are now used in the navies of twenty-three U.S.-allied nations.[118] Nor are U.S. allies the only ones with this technology: Russia's AK-630, the Netherlands' Goalkeeper, and Italy's DARDO are similar weapon systems.[119] Germany also employs the NBS MANTIS, a land-based, "fully automated air defence system" that will "detect, track and shoot the projectiles within a close range of the target base."[120]

b. Offensive Autonomous Weapon Systems

Autonomous weapon systems have also been designed for offensive situations—and many currently existing weapon systems might be employed more offensively if states so desire. As Dahm has noted, "[I]t's not technology that has held us back from fully autonomous military strikes—from a purely technical perspective, it has been possible for some time to conduct them."[121]

While many fire-and-forget or lock-on-after-launch missiles are guided by a human deployer, sometimes by radio or lasers, and are therefore merely semi-autonomous, numerous other ones independently select and engage targets. The U.K. Brimstone is touted as "a fully autonomous, fire-and-forget, anti-armour weapon, effective

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114 Adam May, *Phantom on the Fence*, ISR. DEF. FORCES BLOG (Oct. 9, 2012, 5:24 PM), http://www.idf.il/1283-17082-EN/Dover.aspx. Such responsive action is "likely alerting a command center to the presence of something suspicious, not opening fire without notifying a human operator first." John Reed, *Israel's Killer Robot Cars*, FOREIGN POL'Y (Nov. 20, 2012, 5:33 PM), http://foreignpolicy.com/2012/11/20/israels-killer-robot-cars.

115 *Enguard! Introducing the Guardium UGV*, DEF. UPDATE, http://defense-update.com/products/g/guardium.htm (last visited Apr. 27, 2015).

116 *Id.*

117 Marchant et al., *supra* note 68, at 287.

118 Stoner, *supra* note 65.

119 *See also* Scharre & Horowitz, *supra* note 15, at 12 ("At least 30 nations employ or have in development at least one system of this type . . . ."); *id.* app. B (describing autonomous weapon systems in use today).

120 *NBS MANTIS Air Defence Protection System, Germany*, ARMY-TECHNOLOGY.COM, http://www.army-technology.com/projects/mantis (last visited Apr. 27, 2015).

121 Dahm, *supra* note 82.

against all known and projected armoured threats."[122] When in search mode, "Brimstone's mmW seeker searches for targets in its path, comparing them to a known target signature in its memory. The missile automatically rejects returns which do not match . . . and continues searching and comparing until it identifies a valid target."[123] It is unclear whether the operator programs the Brimstone to seek out a specific radar target or ones with certain characteristics; to the extent the latter is true, the Brimstone would be an autonomous weapon system.

The Israeli Harpy Loitering Weapon "detects, attacks and destroys enemy radar emitters."[124] Unlike a semi-autonomous weapon, "[t]he person launching the Harpy does not know[] which particular radars are to be engaged, only that radars that meet the Harpy's programmed parameters will be engaged."[125] Nor is Israel the only country with the Harpy: it has been sold to Turkey, South Korea, India, and China.[126]

The United States is funding research in related technology: in late 2012 the U.S. Air Force Research Laboratory awarded Boeing Phantom Works a $10 million contract for the Dominator, a long-endurance UAV which will be able to autonomously conduct intelligence, surveillance, and reconnaissance missions and would potentially have strike capabilities.[127] It is intended to carry Textron Common Smart Submunitions, warheads which can independently search for and engage targets in a two-acre area after deployment.[128]

There are also sea-based autonomous weapon systems. Unlike other types of mines, which usually detonate automatically, encapsulated torpedo mines "are a type of sea mine that, when activated by a passing ship, instead of exploding, open a capsule which then releases a torpedo that engages a target."[129] The eventual target of the torpedo is entirely unknown by the human deployer; instead, "the mine is selecting and engaging targets on its own."[130] Russia and China are both employing the PMK-2 encapsulated torpedo mine today.[131]

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122 ROYAL AIR FORCE, AIRCRAFT & WEAPONS 87 (Brian Handy ed., 2007) (U.K.), *available at* http://www.raf.mod.uk/rafcms/mediafiles/0186cc2a_1143_ec82_2ef2bffff37857da.pdf.

123 *Id.* There are numerous other missiles with similar autonomous target-selection capabilities. *See* MARSH, *supra* note 50, at 3.

124 *Harpy Loitering Weapon*, ISR. AEROSPACE INDUSTRIES, http://www.iai.co.il/2013/16143-16153-en/IAI.aspx (last visited Apr. 27, 2015).

125 Scharre, *Autonomy I*, *supra* note 41.

126 *Id.*

127 Bill Carey, *Boeing Phantom Works Develops 'Dominator' UAV*, AIN ONLINE (Nov. 2, 2012, 10:30 AM), http://www.ainonline.com/aviation-news/ain-defense-perspective/2012-11-02/boeing-phantom-works-develops-dominator-uav.

128 *Id.*

129 Scharre, *Autonomy I*, *supra* note 41.

130 *Id.*

131 *Id.*

Last but not least, there are autonomous ground units. In addition to the aforementioned Israeli Guardium, Russia has recently unveiled Platform-M, a "universal combat platform."[132] It is a multipurpose weapon system, designed "for gathering intelligence, for discovering and eliminating stationary and mobile targets, for firepower support, for patrolling and for guarding important sites."[133] Its "weapons can be guided, it can carry out supportive tasks and it can destroy targets in automatic or semiautomatic control systems"[134]—which presumably means, under the clarified definition, it can operate in autonomous or semi-autonomous modes.

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This Part proposed a clarified definition for autonomy in weapon systems, which focuses on a weapon system's capability for independently selecting and engaging targets based on conclusions it draws from gathered information and preprogrammed constraints. With this new definition it quickly becomes clear that, contrary to the general consensus, autonomous weapon systems are not weapons of the future: they exist and are in use today. This fact has profound implications for the debate on banning such weaponry. The crucial question is not whether we should ban some imagined Terminator or Hal, but rather how we can best use law to regulate weapons with a proven track record.

II. ARE AUTONOMOUS WEAPON SYSTEMS INHERENTLY UNLAWFUL?

Proponents of a ban make a number of important moral, political, and strategic arguments, but their primary legal claim is that autonomous weapon systems would never be able to comply with the law of armed conflict. More specifically, they argue that autonomous weapon systems will be unable to distinguish between lawful and unlawful targets; will be unable to conduct *in bello* proportionality assessments; and may not accord with the Martens Clause, which, they argue, requires new technology to comply "the principles of humanity" and "the dictates of the public conscience." Some question whether states will be able to hold individuals accountable for war crimes committed by autonomous weapon systems; still others posit that, as a

132 Andrew Tarantola, *Russia's Military Is Getting Killer Wall-E Robot Soldiers in 2018*, GIZMODO (July 15, 2014, 11:40 AM), http://gizmodo.com/russias-military-is-getting-killer-wall-e-robot-soldier-1604674629.

133 *Id.*

134 *Id.*

matter of law, the decision to kill another human being can never be delegated to a machine.

Skeptics of a ban tend to respond to these arguments on their own terms, highlighting controversial or inaccurate interpretations or arguing that the law of armed conflict is sufficiently flexible to address new issues.[135] Skeptics also often dispute advocates' pessimistic conclusions about autonomous weapon systems' future capabilities.[136]

Both sides of the debate take a fundamental, inaccurate assumption—that autonomous weapon systems are not in use today—as true. But given that such weaponry has already been integrated into states' militaries with little critique, many ban advocates' legal arguments lose their force. Autonomous weapon systems are currently being lawfully employed, demonstrating that this class of weaponry is not inherently unlawful.

A. *Compliance with the Distinction Requirement*

One of the most fundamental rules in the law of armed conflict is that of distinction.[137] Parties to a conflict must distinguish between lawful targets—combatants, military objectives, and civilians directly participating in hostilities—and unlawful targets—civilians, civilian objects, and persons *hors de combat*.[138] Accordingly, parties are prohibited from using inherently indiscriminate weapons, which are usually defined either as weapons that cannot be directed at lawful targets or as weapons whose effects cannot be controlled. Additionally, any given attack in an armed conflict cannot be indiscriminate: it must be directed at a lawful target and cannot utilize indiscriminate weapons or methods of warfare.

At present, most agree that autonomous weapon systems are incapable of distinguishing between combatants and civilians. Doing so requires a complicated assessment of various factors, and there are many gray zones that bewilder even well-trained human soldiers. For example, civilians taking direct part in hostilities are lawful targets, but armed civilians acting as law enforcement are not. Robotic systems may

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135 *See, e.g.*, Schmitt & Thurnher, *supra* note 2, at 233.

136 *See, e.g.*, *id.* at 234.

137 This customary rule is codified in multiple treaties, but most notably in Article 48 of the First Additional Protocol. *See* Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), art. 48, adopted June 8, 1977, 1125 U.N.T.S. 3 [hereinafter First Additional Protocol].

138 An individual is *hors de combat* if he "is in the power of an adverse Party"; "clearly expresses an intention to surrender"; or "has been rendered unconscious or is otherwise incapacitated by wounds or sickness, and therefore is incapable of defending himself" so long as the individual "abstains from any hostile act and does not attempt to escape." *Id.* art. 41(2).

be better than humans at certain tasks, but they are notoriously inept at recognizing objects, let alone distinguishing between lawful and unlawful targets.[139] Presumably, autonomous weapon systems will be deemed to be compliant with the distinction requirement whenever their determinations regarding who or what is a lawful target are comparable to non-autonomous systems. But whether autonomous weapon systems will ever be able to make such distinctions is currently a matter of hypothetical debate: Arkin thinks robots may be able to comply with the distinction requirement in as few as ten years;[140] Sharkey is skeptical that they ever will be able to do so, let alone do so in the near future.[141]

But this does not mean, as many pro-ban advocates conclude, that autonomous weapon systems are per se unlawful.[142] First, certain autonomous weapon systems might be used in compliance with the distinction requirement based on what they are capable of targeting. The Israeli Harpy, for example, only "sees" and thus only targets radars. Second, as Michael Schmitt points out, a weapon's inability to distinguish between lawful and unlawful targets simply limits where and when such weaponry may be lawfully deployed. He observes:

> Not every battlespace contains civilians or civilian objects. When they do not, a system devoid of any capacity to distinguish protected persons and objects from lawful military targets can be used without endangering the former. . . . The inability of the weapon systems to distinguish bears on the legality of their use in particular circumstances . . . , but not their lawfulness *per se*.[143]

Therefore, "[a]n autonomous weapon system only violates the prohibition against weapons incapable of being directed at a lawful target if there are no circumstances, given its intended use, in which it can be used discriminately."[144] Schmitt notes the Iraqi use of SCUD missiles against troops in the civilian-free Iraqi desert during the 1990–1991 Gulf War as an example of indiscriminating weapons that were nonetheless used discriminately (and therefore lawfully).[145]

The SCUD example helps clarify Schmitt's point, but his argument—that autonomous weapons can be used in a discriminating

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139 *See* Noel E. Sharkey, *Towards a Principle for the Human Supervisory Control of Robot Weapons*, 2014 POLITICA & SOCIETÀ 305 (2014) (comparing relative strengths and weaknesses of human beings and autonomous systems).

140 Troop, *supra* note 104.

141 *See* Sharkey, *supra* note 4, at 788–89; *see also* ADVANCING THE DEBATE, *supra* note 88, at 5; *The Scientists' Call . . . to Ban Autonomous Lethal Robots*, ICRAC, http://icrac.net/call (last visited Apr. 27, 2015).

142 *See, e.g.*, LOSING HUMANITY, *supra* note 2, at 30.

143 Schmitt, *supra* note 80, at 11.

144 *Id.* at 13.

145 *Id.* at 10.

fashion, notwithstanding their inability to discriminate between combatants and civilians—could have been even stronger had he discussed certain weaponry now being so used. The Korean SGR-A1, for example, is an autonomous weapon system being lawfully used in a semi-autonomous mode to patrol the demilitarized zone. Given the unique characteristics of the zone, where all human beings in certain areas can be presumed to be combatants or civilians directly participating in hostilities, the SGR-A1 might even be lawfully employed in its autonomous mode.[146]

In response, ban advocates fall back to policy reasons for banning autonomous weapon systems, arguing that "[n]arrowly constructed hypothetical cases in which fully autonomous weapons could lawfully be used should not be employed to legitimize the weapons or stand in the way of a ban because the cases do not alter the underlying concerns about the use of such weapons."[147] As a practical matter, it may be difficult to restrict the use of autonomous weapon systems to areas with few civilians, like the Korean demilitarized zone.[148] But this is a policy response to a legal argument, and such cases are far from "hypothetical."

A better legal argument for the per se unlawfulness of autonomous weapon systems would focus not on whether they could distinguish between combatants and civilians, but instead on whether they could distinguish between active and wounded combatants. The former are lawful targets, the latter are not, and both are likely to be found in areas of active hostilities.

While stronger, this argument is only relevant to anti-personnel autonomous weapon systems—not autonomous weapon systems generally. The CIWS, for example, targets only missiles and incoming planes (which can fairly be presumed to be piloted by hale combatants), and thus sidesteps this issue entirely.[149] In short, given that some

146 *See* Jeffrey S. Thurnher, *The Law That Applies to Autonomous Weapon Systems*, 17 ASIL INSIGHTS (Jan. 18, 2013), http://www.asil.org/insights/volume/17/issue/4/law-applies-autonomous-weapon-systems ("There may be situations in which an autonomous weapon system could satisfy this rule with a considerably low level ability to distinguish between civilian and military targets. Examples would include during high intensity conflicts against declared hostile forces or in battles that occur in remote regions, such as underwater, deserts, or areas like the Demilitarized Zone in Korea.").

147 ADVANCING THE DEBATE, *supra* note 88, at 8.

148 *See id.* at 9.

149 In a recent paper, Eliav Lieblich and Eyal Benvenisti imaginatively question whether autonomous weapon systems will impermissibly limit the opportunity for combatants to surrender and violate the prohibition on ordering that no quarter be given. Eliav Lieblich & Eyal Benvenisti, *The Obligation to Exercise Discretion in Warfare: Why Autonomous Weapon Systems Are Unlawful* 35–39 (Oct. 2014) (working paper), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2479808. As they acknowledge, there is currently no requirement under the law of armed conflict to grant enemy combatants an opportunity to surrender. *Id.* at 35–36. However, even if such a requirement existed, as with the discretion argument, this concern is only relevant to anti-personnel autonomous weapon systems.

autonomous weapon systems are capable of being used discriminately and with controllable effects, they are not as a class per se unlawfully indiscriminate.

B. *Compliance with the* in Bello *Proportionality Requirement*

A second foundational customary requirement of the law of armed conflict is that of *in bello* proportionality.[150] As articulated in the First Additional Protocol to the 1949 Geneva Conventions, the proportionality requirement prohibits as indiscriminate "[a]n attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated."[151]

The commander who authorizes an attack is responsible for making the proportionality analysis.[152] Given the difficulty human beings have in making the proportionality analysis, given its inherent subjective and contextual elements,[153] military commanders enjoy a great deal of discretion in subsequent evaluations of their decisions. When assessing whether a military action has met the proportionality standard, evaluators focus on the knowledge available to the commander at the time of the strike, and the "Rendulic Rule" suggests that a "reasonable commander" standard be applied when determining liability.[154]

Ban advocates argue that autonomous weapon systems will likely never be able to qualitatively analyze, let alone weigh, the expected military advantage of a particular attack and the associated potential

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150 *Jus ad bellum* is the law governing the commencement of hostilities; *jus in bello* is the law governing the conduct of hostilities. There are separate *ad bellum* and *in bello* proportionality requirements, but disputes regarding the ability of autonomous weapon systems to be used in compliance with the proportionality requirement generally focus on the *in bello* rule, which requires a proportionality analysis for each individual attack in an armed conflict.

151 First Additional Protocol, *supra* note 137, art. 51(5)(b).

152 Schmitt, *supra* note 80, at 20.

153 *See* John Fabian Witt, *Two Conceptions of Suffering in War*, *in* KNOWING THE SUFFERING OF OTHERS: LEGAL PERSPECTIVES ON PAIN AND ITS MEANINGS 129, 147–50 (Austin Sarat ed., 2014) (noting the difficulty of assigning military objectives and human suffering objective values, particularly given the relevance of the context within which the engagement occurs).

154 *See* Prosecutor v. Galić, Case No. IT-98-29-T, Judgment and Opinion, ¶ 58 (Int'l Crim. Trib. for the Former Yugoslavia Dec. 5, 2003) ("In determining whether an attack was proportionate it is necessary to examine whether a reasonably well-informed person in the circumstances of the actual perpetrator, making reasonable use of the information available to him or her, could have expected excessive civilian casualties to result from the attack."); *see also* Eric Talbot Jensen, Essay, *Unexpected Consequences from Knock-on Effects: A Different Standard for Computer Network Operations?*, 18 AM. U. INT'L L. REV. 1145, 1181–83 (2003) (discussing the history of the Rendulic Rule).

harm to civilians[155]—particularly insofar as the proportionality analysis requires "distinctively human judgement."[156] Nor, they argue, can responsibility for making the proportionality analysis rest with the human deployer, as the proportionality analysis might change between deployment and execution.[157]

In response, ban skeptics suggest that parameters for making *in bello* proportionality analyses could "in theory" be preprogrammed into autonomous weapon systems, allowing them to make basic, conservative proportionality assessments and contact a human operator in more complex situations.[158] The U.S. military already employs a "collateral damage estimate methodology," a procedure "for determining the likelihood of collateral damage to objects or persons near a target," the result of which in turn determines who on the chain of command must authorize an attack causing collateral damage.[159] Presumably, an autonomous weapon system might be preprogrammed to be able to select and engage targets when there is little to no chance of collateral damage, but be required to seek out human approval for attacks with a higher likelihood of collateral damage.[160]

The fact that autonomous weapon systems are already being used with little critique, however, suggests that they can be operated in compliance with the proportionality requirement.[161] But, just like the proportionality analysis itself, when an autonomous weapon system can be so employed is fact-dependent and context-specific.

One lawful possibility involves the use of autonomous weapon systems in semi-autonomous modes. A commander might determine that a specific attack complies with the proportionality requirement and authorizes an autonomous weapon system, operating in a semi-autonomous mode, to engage a given target. This is how some autonomous weapon systems, like the Israeli Guardium and Korean SGR-A1, are reportedly used today. In these situations, the autonomous weapon system is being used lawfully, notwithstanding its inability to make its own proportionality determination.

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155 ADVANCING THE DEBATE, *supra* note 88, at 6.

156 Heyns Report, *supra* note 5, at 14.

157 ADVANCING THE DEBATE, *supra* note 88, at 6–7.

158 Schmitt, *supra* note 80, at 20–21.

159 *Id.* at 19.

160 *See* John S. Canning, *You've Just Been Disarmed. Have a Nice Day!*, 28 IEEE TECH. & SOC'Y MAG. 13, 13–15 (2009) (recommending that autonomous weapon systems primarily target weapons, rather than their wielders, and proposing a "dial-a-level" of autonomy when it is necessary to target human beings).

161 *See* Benjamin Kastan, *Autonomous Weapons Systems: A Coming Legal "Singularity"?*, 2013 J.L. TECH. & POL'Y 45, 62 (2013) (concluding that, in certain situations, autonomous weapon systems may be able to be lawfully used notwithstanding their inability to conduct proportionality analyses).

Another lawful possibility would occur when a commander determines that a variety of potential engagements in a given battlespace and limited temporal span would comply with the proportionality requirement and authorizes an autonomous weapon system to select and engage targets within those preprogrammed constraints. Certain fire-and-forget or lock-on-after-launch weapon systems like the Israeli Harpy or U.K. Brimstone are employed in this manner: although they are autonomously selecting and engaging targets, the limited temporal span between their deployment and potential engagements permits a commander to take responsibility for the proportionality analysis—provided, of course, that the commander takes what may occur during the time between deployment and engagement into account.[162] To do so, of course, the commander must be trained in the weapon system's capabilities, limitations, and destructive potential.

The most difficult question is whether autonomous weapon systems, operating on extended missions or in unforeseen environments, could be adequately preprogrammed to comply with the proportionality requirement. At present, there are no autonomous weapon systems able to engage in such long-range missions, but states are investing in the development of weapon systems with such capabilities. The Energetically Autonomous Tactical Robot (EATR) project, for example, is developing an autonomous robotic platform that could forage for plant biomass to refuel itself over long-range, long-endurance missions, allowing for an attenuated relationship between the deployment of a ground system and its actions (and, incidentally, leading to one of the more entertaining press releases of all time).[163]

Where there is a significant temporal span between deployment and potential engagements or where the weapon system is venturing into unknown territory, a commander could not reasonably take responsibility for conducting the proportionality requirement; too many of the conditions the weapon system might face would be unpredictable.[164] At some point in the future, it may be possible to preprogram autonomous weapon systems with sufficient constraints to satisfy the proportionality analysis requirement—and perhaps even

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162 *Cf.* O'Connell, *supra* note 4, at 234 (arguing that a new norm of international law, requiring a close temporal distance between force deployment and target engagement, is necessary to "keep a human conscience" in the decision).

163 *See* Press Release, Cyclone Power Techs., Cyclone Power Technologies Responds to Rumors About "Flesh Eating" Military Robot (July 16, 2009), *available at* http://www.robotictechnologyinc.com/images/upload/file/Cyclone%20Power%20Press%20Release%20EATR%20Rumors%20Final%2016%20July%2009.pdf (insisting that the robot would be "strictly vegetarian" in response to "the public's concern about futuristic robots feeding on the human population").

164 *See* ADVANCING THE DEBATE, *supra* note 88, at 6–7.

permit more precise analyses than human beings currently make.[165] However, given their current inability to discriminate between lawful and unlawful targets and their inability to weigh the military advantage of a particular engagement against anticipatable harm to unlawful targets, at present autonomous weapon systems cannot now be lawfully deployed on extended missions or in unknown environments.

Autonomous weapon systems are already employed in various ways and in compliance with the *in bello* proportionality requirement. The fact that they cannot be so used in other circumstances is not a legal argument for a complete ban on such weaponry; rather, it is in argument in favor of regulation illuminating when and how autonomous weapon systems can be lawfully used.

C. *The Inapplicability of the Martens Clause*

The Martens Clause appears in the first article of the First Additional Protocol to the 1949 Geneva Conventions. It provides: "In cases not covered by this Protocol or by other international agreements, civilians and combatants remain under the protection and authority of the principles of international law derived from established custom, from the principles of humanity and from the dictates of the public conscience."[166]

The Martens Clause has been described by the International Court of Justice as customary international law, binding on all states, and as "an effective means of addressing the rapid evolution of military technology."[167] But how it is to be understood and applied is still hotly debated. Interpreted narrowly, the Martens Clause implies that, in the absence of positive treaty law, customary international law, the principles of humanity, and public conscience should guide states' actions.[168] Given a broader reading, the Martens Clause elevates compliance with "the principles of humanity" and "the dictates of the public conscience" to additional, independent legal requirements.[169]

Some ban advocates suggest that, given the lack of international law explicitly regulating autonomous weapon systems, the Martens

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165 Schmitt, *supra* note 80, at 20–21. The U.S. Naval Research Laboratory, for example, is currently testing a Cognitive Robot Abstract Machine, which is supposed to be able to process new information and make decisions faster and better than human beings. It can classify and identify objects, run algorithms to test various action-based scenarios, and ultimately adopt the "best" scenario. *See* Hauptman, *supra* note 76, at 185.

166 First Additional Protocol, *supra* note 137, art. 1(2).

167 Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, 257 (July 8) [hereinafter *Nuclear Weapons*].

168 *See* Tyler D. Evans, Note, *At War with the Robots: Autonomous Weapon Systems and the Martens Clause*, 41 HOFSTRA L. REV. 697, 713–19 (2013).

169 *See id.* at 713–14, 716 (discussing the current debate over the scope of the Martens Clause).

Clause is relevant.[170] Favoring the broad reading, they conclude that autonomous weapon systems are only lawful under the Clause if they do not violate "the principles of humanity" and "the dictates of the public conscience."[171] They then question whether autonomous weapon systems meet these standards, noting that robotic systems do not experience compassion—which the International Committee of the Red Cross (ICRC) has stated is vital to the principle of humanity—and citing Charli Carpenter's 2013 study finding that, of those with an opinion, sixty-eight percent of surveyed Americans oppose the use of fully autonomous weapon systems.[172]

Skeptics of a ban, employing a narrowed reading, respond that the Martens Clause is not "an overarching principle that must be considered in every case," but rather is "a failsafe mechanism meant to address lacunae in the law."[173] Even assuming for the sake of argument that the broad reading is the best reading, some question whether there is sufficient public consensus to ban autonomous weapon systems under the Martens Clause.[174]

Arguments for a ban based on the Martens Clause are not very strong, standing alone, not least because the Clause is usually employed to supplement other legal reasoning.[175] Additionally, the commonly cited empirical evidence of public concern regarding autonomous weapon systems (Carpenter's 2013 survey) was based on a definition of autonomy for weapon systems that could be understood as implying that they operated without any restraint. Participants were asked how they felt about "the trend toward using completely autonomous [robotic weapons/lethal robots] in war," which were described as "robotic weapons that can independently make targeting and firing decisions without a human in the loop."[176] Unsurprisingly, most opposed using weapons which had no clear restrictive mechanisms;[177] it remains unknown what percentage of participants would oppose the use of weapons that "can independently make targeting and firing decisions" but are subject to preprogrammed constraints.

Furthermore, the existence and use of autonomous weapon systems further weakens the persuasive power of legal arguments

170 ADVANCING THE DEBATE, *supra* note 88, at 15.

171 *Id.*

172 *Id.*

173 Schmitt & Thurnher, *supra* note 2, at 275.

174 Evans, *supra* note 168, at 727–28 (noting that even the authors of *Losing Humanity* concede that there is currently no consensus regarding whether autonomous weapon systems would violate these principles).

175 *See id.* at 717–18.

176 Carpenter, *supra* note 82, at 1 (the wording was varied to measure the extent the term used affected public sentiment).

177 *Id.*

grounded in the Martens Clause. First, there is some question as to whether the Clause is even applicable, as autonomous weapon systems are governed by both the law of armed conflict and many other treaty and customary international legal regimes.[178] Second, autonomous weapon systems in use today have not drawn criticism on the grounds that they violate the "principles of humanity" and the "dictates of the public conscience."

D. *Extraneous Accountability Issues*

Who is to be held accountable when an autonomous weapon system violates the law of armed conflict? Its operator? Its operator's commander? Its programmer—or, more complicating, its team of programmers? Its manufacturer? The autonomous weapon system itself? Many have concluded that none of these possibilities are satisfactory or fair,[179] and some suggest that this provides an additional reason why autonomous weapon systems would be unlawful.[180]

But while the issue of accountability raises fascinating moral, philosophical, policy, and even domestic and international legal questions, it does not bolster arguments that autonomous weapon systems are inherently unlawful. Whether a weapon is per se unlawful is not, and has never been, based on whether an individual can be held accountable for violations following from its use.[181]

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178 *See* Rebecca Crootof, *The Varied Law of Autonomous Weapon Systems*, *in* NATO ALLIED COMMAND TRANSFORMATION, AUTONOMOUS SYSTEMS: ISSUES FOR DEFENCE POLICY MAKERS (Andrew P. Williams & Paul D. Scharre eds.) (forthcoming 2015), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2569322 (describing other legal regimes—including international human rights law, the law of the sea, the law of outer space, and the law regarding state responsibility for private actors—that provide guidance on the lawful usage of autonomous weapon systems).

179 *See, e.g.*, Robert Sparrow, *Killer Robots*, 24 J. APPLIED PHIL. 62 (2007). Of course, legal regimes regularly make liability determinations that may seem "unfair" from a philosophical standpoint, usually for various policy reasons—as evidenced by any domestic strict liability regime. *Compare id.* (concluding that, because no one can ethically be assigned liability for the actions of an autonomous system, they cannot be used), *with* Kastan, *supra* note 161, at 69 ("[G]eneral philosophical objections to applying accountability either to the humans directing [autonomous weapon systems] or to the systems themselves stand in opposition to long-standing principles of legal accountability.").

180 *See, e.g.*, O'Connell, *supra* note 4, at 236 (concluding that the use of autonomous weapon systems "would conflict with the historical, legal, and moral understanding that killing should be based on a good-faith understanding of real necessity and carried out by someone who may be held accountable for a wrong decision"); Lawand, *supra* note 8 ("If responsibility cannot be determined as required by [international humanitarian law], is it legal or ethical to deploy such systems?").

181 Rather, weapons are only per se unlawful if they cannot be used discriminately, if they cause superfluous injury, or if they are specifically banned (usually by treaty). *See infra* Part III.B.1–2.

Furthermore, autonomous weapon systems in use today have arguably contributed to breaches of the law of armed conflict; that has not prevented states from continuing to use them. The Aegis system, for example, may have played a part in the Flight 655 tragedy.[182] But it is still employed by Australia, Japan, South Korea, Norway, Spain, and the United States, and many other countries use other, similar systems. Significantly, neither states, scholars, nor the most vocal critics of autonomous weapon systems have argued that these ongoing uses are per se unlawful.

Constructing a liability regime may require a more carefully calibrated definition for autonomous weapon systems than the one suggested by this Article. To best assign liability, it will be important to consider the finer distinctions between an Aegis system, operated in its semi-autonomous mode, and a Terminator-like system that enjoys near-full autonomy. Determining how best to assign individual liability for different types of violations will be a regulatory headache—and a project for a different paper.[183] For this Article, it is sufficient to note that while accountability questions undoubtedly pose a challenge, it is neither an insurmountable one nor a strong legal argument for a ban.

E. *The Nonexistent Nondelegation Principle*

Asaro suggests that there is a principle in the law of armed conflict that "the authority to decide to initiate the use of lethal force cannot be legitimately delegated to an automated process, but must remain the responsibility of a human with the duty to make a considered and informed decision before taking human lives."[184] Asaro explicitly casts his argument as a legal one, suggesting that this norm is on par with the requirement that all attacks are discriminating and proportional.[185]

However, Asaro's claim is actually a moral one—or, at best, an argument for the creation of a new legal norm. As a matter of international law, there is no treaty provision requiring that a human

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182 *See* Singer, *supra* note 89, at 40.

183 Many have begun outlining the issues involved in constructing liability regimes. *See, e.g.*, Tim McFarland & Tim McCormack, *Mind the Gap: Can Developers of Autonomous Weapons Systems Be Liable for War Crimes?*, 90 INT'L L. STUD. 361 (2014); Thilo Marauhn, Professor, Justus Liebig Univ., Presentation at the CCW Expert Meeting on Lethal Autonomous Systems: An Analysis of the Potential Impact of Lethal Autonomous Weapons Systems on Responsibility and Accountability for Violations of International Law (May 13–16, 2014), *available at* http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/35FEA015C2466A57C1257CE4004BCA51/$file/Marauhn_MX_Laws_SpeakingNotes_2014.pdf; *see also* Kastan, *supra* note 161, at 65–81 (discussing U.S. domestic issues related to assigning liability for the actions of autonomous weapon systems).

184 Asaro, *supra* note 4, at 689.

185 *Id.* at 687–88.

being make "a considered and informed decision" before taking another human life, and to the extent there is evidence of a customary norm, it points the other direction. Many automated weapons now in use fail to accord with this principle, but they are rarely critiqued on that basis. Although he acknowledges this fact, Asaro never grapples with the blow the current, accepted use of many automated weapons deals to his theory—much less the current, accepted use of autonomous weapon systems.[186]

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The legal arguments made by pro-ban advocates rest on the assumption that autonomous weapon systems do not yet exist—and ban skeptics who respond to these claims tend to take the same assumption for granted. But autonomous weapon systems are currently being lawfully used, demonstrating that this class of weaponry is not inherently unlawful.

Acknowledging this fact fundamentally alters the terms and stakes of the debate. First, proponents of a ban might do well to acknowledge that their strongest arguments for a ban are moral, policy, or strategic ones. Second, rather than debating the inherent lawfulness of autonomous weapon systems, those interested in using legal means to limit the use and development of such weaponry—whose number includes both advocates and skeptics of a ban—could more productively spend their time discussing how best to regulate weapon systems now in use.

III. CAN AUTONOMOUS WEAPON SYSTEMS BE SUCCESSFULLY BANNED?

Human beings are remarkably ingenious at developing new means and methods of killing each other. Throughout history, new weapons have been critiqued for being too ignoble, gruesome, or haphazard—but only some of these weapons have been successfully banned.

Scholars on both sides of the ban debate have mined historical examples for evidence that states will or will not be able to successfully ban autonomous weapon systems. Proponents of a ban point to widely-adhered-to prohibitions on chemical weapons and permanently blinding lasers.[187] Skeptics, noting failed attempts to ban crossbows and

186 *See id.* at 694.

187 *See, e.g.*, ADVANCING THE DEBATE, *supra* note 88, at 24; Memorandum from the Mines Action Can. to Convention on Conventional Weapons Delegates (May 2014) [hereinafter Mines Action Can. Memorandum], *available at* https://bankillerrobotscanada.files.wordpress.com/2014/05/international-piv-memo-final.pdf.

aerial bombardment, respond that weapon bans are generally ineffective.[188] But there is little analysis of which of these historical examples is most aptly analogized to autonomous weapon systems. To the extent scholars do discuss similarities and distinctions between earlier banned weaponry and autonomous weapon systems, they tend to ignore the crucial fact that these weapons are already integrated into states' armed forces.

Based on commonly cited attempted and enacted weapon bans,[189] this Part teases out eight traits which seem to increase the likelihood that a given ban will be successful—which is to say, both enacted and effective at limiting the usage of the banned weapon. Based on these characteristics, it concludes that states are unlikely to negotiate a successful ban on autonomous weapon systems.

A. *Qualities of a Successful Ban*

Every weapon ban success story is the product of a unique combination of factors, including the weapon's inherent traits, its recent usage, prevailing moral and ethical concerns, and the status and interests of concerned states. It is tempting—and not inaccurate—to conclude that each ban is *sui generis*, the product of hard work and happy coincidence.

That being said, successful bans do seem to have certain qualities in common, and failed attempts to ban a class of weapon share a number of contrary characteristics. At the risk of oversimplifying the complex interactions that have resulted in successful bans, this Section attempts to tease out some common qualities.[190]

1. Weapons Causing Superfluous Injury or Unnecessary Suffering

The Saint Petersburg Declaration of 1868, which banned explosive bullets and provided incentive for the eventual banning of expanding bullets, proclaimed that the object of warfare "would be exceeded by the employment of arms which uselessly aggravate the sufferings of disabled men, or render their death inevitable" and that the use of such weapons

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188 *See, e.g.*, Reeves & Johnson, *supra* note 4.

189 The Appendix reviews various attempted and enacted bans on different classes of weaponry and types of warfare, including crossbows, aerial bombardment, submarines, nuclear weapons, cluster munitions, anti-personnel landmines, biological weapons, chemical weapons, and permanently blinding lasers.

190 This list is not intended to be exhaustive, nor does it discuss the likely relative weight of the different factors.

would therefore "be contrary to the laws of humanity."[191] This prohibition has since evolved into a customary rule of armed conflict, reiterated in numerous treaties.[192] Technically, because their use is already forbidden, there should be no need to explicitly ban weapons causing superfluous injuries—they are already per se unlawful.

In practice, states naturally disagree about which weapons qualify as per se unlawful on these grounds, and advocates of nearly all modern attempted and enacted bans have argued that the weapon in question causes superfluous injury or unnecessary suffering. Accordingly, while claims that specific weapons cause superfluous injuries have undergirded weapon bans since the 1868 Declaration, an argument that a given weapon is per se unlawful on this ground does not significantly increase the likelihood of a ban being concluded or of its ultimate effectiveness.

That being said, if injuries caused by a weapon inspire widespread public concern and civil society engagement, they may indirectly contribute to the likelihood of a ban's success.[193] Additionally, a ban might clarify whether or not there is consensus as to whether the use of a given weapon generally causes superfluous injury or unnecessary suffering.

2. Inherently Indiscriminate Weapons

Because indiscriminate attacks are prohibited, inherently indiscriminate weapons—which includes weapons that cannot be directed at a military objective and weapons whose effects cannot be controlled—are per se unlawful. This is both a practical and humanitarian prohibition: to the extent a weapon's effects cannot be directed or controlled, it threatens both the users' troops and nearby civilians.

Ban advocates regularly argue that the weapon in question is inherently indiscriminate. But, like weapons causing superfluous injuries, states can disagree in good faith on this question. For example, many advocates of the Mine Ban Convention argue that anti-personnel landmines are per se unlawfully indiscriminate;[194] the United States has responded that "smart" mines, which could destruct or deactivate

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191 Declaration Renouncing the Use, in Time of War, of Certain Explosive Projectiles, Nov. 29–Dec. 11, 1868, 18 Martens Nouveau Recueil (ser. 1) 474, 138 Consol. T.S. 297.

192 *Rule 70. Weapons of a Nature to Cause Superfluous Injury or Unnecessary Suffering*, INT'L COMMITTEE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule70 (last visited Apr. 27, 2015).

193 *See infra* Part III.B.7.

194 *See, e.g.*, *Why the Ban*, INT'L CAMPAIGN TO BAN LANDMINES, http://www.icbl.org/en-gb/problem/why-the-ban.aspx (last visited Apr. 27, 2015).

automatically after a certain period of time or at the end of active hostilities, would not be.[195] Nor will near-universal recognition that a weapon is inherently indiscriminate ensure that states will be able to conclude a treaty ban, as evidenced by nuclear weapons.

It is worth noting that, just by existing, a ban may contribute to its own effectiveness. In situations where a weapon is not universally recognized as indiscriminate at the time a ban is concluded, the passage of the ban itself may lead to the recognition of the weapon's indiscriminate nature. The Mine Ban Convention is largely credited with the increasing stigmatization of anti-personnel landmines,[196] and advocates of the Convention on Cluster Munitions hope that it will have a similar effect.[197] Similarly, states' military manuals now tend to describe biological weapons as prohibited because they are indiscriminate—not because their use is forbidden by treaty law.[198]

3. Ineffective Weapons

Discussing the Hague Conference's bans of various forms of weaponry, one scholar reflected:

> Such destructive weapons, for instance, as the high explosive shell, the shrapnel, mines or torpedoes, were retained as legitimate means of warfare, whereas the inefficient expanding and explosive bullets were condemned along with the perfectly useless free balloons. The proceedings of the Hague Conference demonstrate rather that a weapon will be restricted in inverse proportion, more or less, to its effectiveness; that the more efficient a weapon or method of warfare the less likelihood there is of its being restricted in action by the rules of war.[199]

This realist analysis has been borne out to some degree in recent practice: many credit the relative success of the biological and chemical

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195 *See* Emily Alpert, *Why Hasn't the U.S. Signed an International Ban on Landmines?*, L.A. TIMES BLOG (Apr. 5, 2012, 4:45 AM), http://latimesblogs.latimes.com/world_now/2012/04/mine-treaty-us-ottawa-convention.html.

196 *See, e.g.*, Rachel Good, Note & Comment, *Yes We Should: Why the U.S. Should Change Its Policy Toward the 1997 Mine Ban Treaty*, 9 NW. J. INT'L HUM. RTS. 209, 210 (2011).

197 *See, e.g.*, HUMAN RIGHTS WATCH, TWELVE FACTS AND FALLACIES ABOUT THE CONVENTION ON CLUSTER MUNITIONS 6 (2009) [hereinafter HRW TWELVE FACTS], *available at* http://www.hrw.org/news/2009/04/14/twelve-facts-and-fallacies-about-convention-cluster-munitions.

198 *See Practice Relating to Rule 71. Weapons That Are by Nature Indiscriminate*, INT'L COMMITTEE RED CROSS, https://www.icrc.org/customary-ihl/eng/docs/v2_cha_chapter20_rule71 (last visited Apr. 27, 2015) (citing sources).

199 M.W. ROYSE, AERIAL BOMBARDMENT AND THE INTERNATIONAL REGULATION OF WARFARE 131–32 (1928); *see also* Bonnie Docherty, *The Time Is Now: A Historical Argument for a Cluster Munitions Convention*, 20 HARV. HUM. RTS. J. 53, 59–61 (2007).

weapon bans with the fact that they are weapons with little military utility for powerful states, especially relative to newer weaponry.[200]

Equally, once a weapon has demonstrated its utility, it will be difficult to convince states to cease using it. Most failed bans share two crucial characteristics in common, one of which is that they attempted to prohibit the use of extremely effective weapons.

However, the conclusion that the law will always bow to effective weapons[201]—which is to say, that effective weapons can never be banned—is not entirely accurate. Chemical weapons have proven their utility in many situations, yet the chemical weapons ban is one of the more effective ones in existence today.[202] The Mine Ban Convention is another possible exception to the general rule: despite its many arguments that anti-personnel mines have military value, the United States has now committed to ceasing to produce or acquire banned mines in the future with an eye toward compliance with the Convention.[203]

4. Other Means Exist for Accomplishing the Same Military Objective

Certain weapons may efficiently accomplish a military objective: permanently blinding lasers, for example, can be used to disable enemy troops. However, when a state may use another weapon—say, temporarily blinding lasers—to accomplish the same military objective by other means, it will be more willing to relinquish the other one.[204]

Again, the converse is also true: states will be less willing to voluntarily surrender a weapon which provides the only means of

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200 *See, e.g.*, Mark J. Osiel, *Obeying Orders: Atrocity, Military Discipline, and the Law of War*, 86 CALIF. L. REV. 939, 992 n.199 (1998). The United States unilaterally renounced its biological weapons research after concluding they were of limited military effectiveness. *See* Docherty, *supra* note 199, at 60.

201 *See* Hays Parks, *Submarine-Launched Cruise Missiles and International Law: A Response*, 103 U.S. NAVAL INST. PROC. 120, 120 (1977) ("In the consideration of any new weapon, technology must yield to the law, or the law to technological change. Where a weapon has proved effective, the latter usually has occurred.").

202 *See* RICHARD M. PRICE, THE CHEMICAL WEAPONS TABOO 5 (1997); Jozef Goldblat, *The Biological Weapons Convention—An Overview*, 318 INT'L REV. RED CROSS 251, 264 (1997) (describing chemical weapons as "predictable, capable of producing immediate effects and, consequently, useful in combat").

203 Press Release, Office of the Press Sec'y, The White House, Fact Sheet: Changes to U.S. Anti-Personnel Landmine Policy (June 27, 2014) [hereinafter Fact Sheet], *available at* http://www.whitehouse.gov/the-press-office/2014/06/27/fact-sheet-changes-us-anti-personnel-landmine-policy. *But see* Docherty, *supra* note 199, at 60 (arguing that the success of the Mine Ban Convention is due in part to the fact that anti-personnel landmines have declining military utility).

204 *See* MARSH, *supra* note 50, at 2; *cf.* Hauptman, *supra* note 76, at 192 ("Laws that focus more on methodology, rather than outcomes, are more likely to gain adherence because state will not feel as if their legitimate options for attaining military victory have been prohibited.").

accomplishing certain goals. The second crucial characteristic most failed weapon bans have in common is that they attempted to ban weapons which, at least at the time, were unique in their ability to wreak a certain type of devastation or accomplish certain goals.

5. Clear and Narrowly Tailored Prohibitions

Bans are more likely to be effective if they clearly describe what weapons are and are not permitted. The Chemical Weapons Convention, for example, has an extensive Annex on Chemicals delineating why and what specific agents are prohibited.[205] Clear descriptions increase the effectiveness of a ban at three critical points in time. First, states want to understand precisely what capabilities they are foregoing at the time of treaty ratification. Second, because states know precisely what is forbidden, they will be less likely to use or invest research monies in developing related weapons. Finally, in most cases, other states will be able to easily identify violations of the ban.[206] For treaty regimes with enforcement mechanisms, this will make formal enforcement easier; for those without, states and civil society can still engage in informal enforcement actions, such as naming and shaming.

Furthermore, many bans owe their existence and success to the fact that they are narrowly tailored. The prohibition on blinding laser weapons does not prohibit the development or use of *temporarily* blinding weapons, such as dazzlers.[207] Additionally, it only forbids the use of weapons where the primary purpose is to cause blinding—it explicitly does not cover blinding which occurs "as an incidental or collateral effect of the legitimate military employment of laser systems, including laser systems used against optical equipment."[208] The Biological Weapons Convention excepts agents that have "justification for prophylactic, protective or other peaceful purposes,"[209] and the Mine

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205 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Annex on Chemicals, Jan. 13, 1993, S. Treaty Doc. No. 103-21, 1974 U.N.T.S. 45 [hereinafter Chemical Weapons Convention].

206 There is reason to believe, however, that this generalization will not hold true for autonomous weapon systems, no matter how precisely they are defined. *See infra* Part III.B.

207 *See* Protocol on Blinding Laser Weapons (Protocol IV) art. 1, Oct. 13, 1995, S. Treaty Doc. No. 105-1, 2024 U.N.T.S. 167. In 2006, the United States employed laser dazzlers in Iraq to temporarily incapacitate drivers who ignored warnings at checkpoints. James Rainey, *A Safer Weapon, With Risks*, L.A. TIMES, May 18, 2006, http://articles.latimes.com/2006/may/18/world/fg-laser18.

208 Protocol IV, *supra* note 207, art. 3.

209 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction art. I, Apr. 10, 1972, 26 U.S.T. 583, 1015 U.N.T.S. 163 [hereinafter Biological Weapons Convention].

Ban Convention excludes anti-tank mines equipped with anti-handling devices from its definition of "anti-personnel mines."[210]

Broader, vague bans have had far less success. The 1907 Hague Declaration's prohibition of "the launching of projectiles and explosives from balloons" may have enjoyed greater ratification rates had it not also banned similar launchings "by other new methods of a similar nature."[211] Additionally, the United States—originally one of the key initiators of a ban on anti-personnel landmines—may have joined the Mine Ban Convention had the other state parties been willing to make certain exceptions that restricted its application.[212]

6. Prior Regulation

The existence of a prior treaty or customary regulation, either on the same form of weaponry or on a similar type or class of weapons, may encourage states to conclude and abide by a later, stronger treaty ban. The success of the chemical weapons ban has been traced to the prohibitions on the use of poison or poisoned weapons,[213] and the relatively effective anti-personnel landmine ban was preceded by a regulatory treaty.

If, however, new technological developments have increased the military utility of a weapon, the existence of a prior, related treaty will not be decisive. States were relatively willing to ban aerial bombardment by balloon; they were far less willing to ban aerial bombardment after the invention of the airplane.

7. Public Concern and Civil Society Engagement

The existence and growing success of the Mine Ban Convention and the Convention on Cluster Munitions has been widely attributed to the active participation of nongovernmental organizations and other civil society representatives, both prior to, during, and after the treaty

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210 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction art. 2, Sept. 18, 1997, 2056 U.N.T.S. 211 [hereinafter Mine Ban Convention] (defining an "anti-handling device" as a device "which activates when an attempt is made to tamper with or otherwise intentionally disturb the mine").

211 Declaration (XIV) Prohibiting the Discharge of Projectiles and Explosives from Balloons, Oct. 18, 1907, 36 Stat. 2439, 1 Bevans 739 [hereinafter 1907 Declaration].

212 *See* David E. Sanger, *U.S., in Shift, Says It May Sign Treaty to Ban Land Mines*, N.Y. TIMES, Sept. 15, 1997, http://www.nytimes.com/1997/09/15/world/us-in-shift-says-it-may-sign-treaty-to-ban-land-mines.html.

213 *See* PRICE, *supra* note 202, at 15.

negotiations.[214] Harold Koh argues that these "transnational norm entrepreneurs" can play an important role in altering states' interests.[215] Some have suggested that such actors will likely play an increasingly influential role in the future.[216]

That being said, this factor is far from decisive. Despite longstanding crusades for a ban on nuclear weapons by a plethora of prominent individuals and international and domestic organizations—including direct action organizations, environmental groups, consumer protection groups, professional associations, and political and religious organizations—a ban on nuclear weapons still seems out of reach.

8. Sufficient State Commitment

All of the aforementioned characteristics will help determine whether a state will be willing to voluntarily renounce its right to use an otherwise lawful weapon. And, ultimately, states' commitment is the best indicator of a weapon bans' success: without it, no ban can be concluded, let alone be effective.

But state commitment to a ban is not purely a product of, say, whether the weapon is uniquely effective or abhorrent to the general public. It may also depend on the number of other states willing to renounce the weapon. Thus, there may be a snowball effect: as more states publically declare their support for a ban, more states may be willing to support it. The status of supporting states is also relevant to a ban's success. If a treaty ban is ratified by the vast majority of states in the international community, but not by states that produce or use the weapon in question, it would be difficult to argue that the ban is successful.[217] Finally, a ban with a small number of initial state parties could potentially become effective over time, if its language evolves into customary international law and thereby becomes binding on all states. However, without widespread subscription or buy-in from the most relevant states, a treaty is unlikely to contribute significantly to the development of relevant customary norms.

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214 *See, e.g.*, Richard Falk & Andrew Strauss, *On the Creation of a Global Peoples Assembly: Legitimacy and the Power of Popular Sovereignty*, 36 STAN. J. INT'L L 191, 199–201 (2000).

215 Harold Hongju Koh, Address, *The 1998 Frankel Lecture: Bringing International Law Home*, 35 HOUS. L. REV. 623, 656–63 (1998) (discussing the role of these norm entrepreneurs with regard to the Mine Ban Treaty).

216 *See* Eric Talbot Jensen, *The Future of the Law of Armed Conflict: Ostriches, Butterflies, and Nanobots*, 35 MICH. J. INT'L L. 253, 282 (2014).

217 *See* Reeves & Johnson, *supra* note 4, at 29 n.55.

B. *Implications for Autonomous Weapon Systems*

The prior section identified eight traits often associated with successful bans. Of these, only one characteristic—civil society engagement—suggests that a ban on autonomous weapon systems would be enacted or effective; the others are inconclusive or currently weigh against the likelihood of a successful ban.

Acknowledging that autonomous weapon systems have already been integrated into states' armed forces affects the analysis of many of these factors. First, there is evidence that autonomous weapon systems can be highly effective in certain circumstances, such as where faster-than-human reaction times are necessary. Second, many of the objectives accomplished by autonomous weapon systems could not be similarly achieved by other means.[218] Because autonomous weapon systems now in use are uniquely effective, it will be difficult to convince states to voluntarily relinquish them.[219] Finally, there has not been any great public outcry over the current deployment of autonomous weapon systems.

Two aspects of the clarity factor undermine the likelihood of a successful ban on autonomous weapon systems. First, because the possibilities for their use is far from understood, let alone exhausted, states are unlikely to agree to prohibit them. Second, even were a ban enacted, autonomous weapon systems are unusual in that it may not be possible to determine if and when the ban is violated. As evidenced by conflicting reports on the Korean SGR-A1, it is difficult for outside observers to determine the autonomous capabilities of any given system. As a result, only those deploying a weapon system will know if it is semi-autonomous or autonomous, supervised or unsupervised.

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218 Because the ban on permanently blinding lasers does not prohibit the use of lasers generally or even the use of temporarily blinding lasers, it does not prevent states from accomplishing similar military objectives. Therefore, contrary to many assertions, this ban provides little precedential value for a ban of autonomous weapon systems. *See* Schmitt & Thurnher, *supra* note 2, at 281 n.158; *see also* Hauptman, *supra* note 76, at 195 n.89. *Contra* Mines Action Can. Memorandum, *supra* note 187 (discussing the relevance of the ban on permanently blinding lasers); *see also* O'Connell, *supra* note 4, at 15; *Q&A on Fully Autonomous Weapons*, HUM. RTS. WATCH (Oct. 21, 2013), http://www.hrw.org/news/2013/10/21/qa-fully-autonomous-weapons.

Additionally, while they had not yet been used in combat, the effects of blinding lasers were fairly predictable, *see* Evans, *supra* note 168, at 721–22, 731, and unnecessarily harmful, *see* ADVANCING THE DEBATE, *supra* note 88, at 17—unlike the potential effects of as-yet-undeveloped autonomous weapon systems.

219 *Cf.* MARSH, *supra* note 50, at 4 ("At the very least, if the Brimstone and other 'fire and forget' missiles are assumed to fall under the definition used by the Campaign, then consider effort may need to be expended on explaining *why* they are not to be considered militarily essential."); *see also* ADVANCING THE DEBATE, *supra* note 88, at 18 (noting that, once autonomous weapon systems technology is developed, "many countries would be reluctant to give it up, especially if their competitors were deploying it").

While states do seem interested in how autonomous weapon systems might be regulated,[220] there is hardly sufficient state commitment at present to suggest a ban would be successful. At the May 2014 Experts Meeting, only a few states called for an outright ban.[221] Nor is there any evidence that the military powerhouses currently investing in autonomous weapon research and development would join such a treaty. In fact, the United Kingdom opposes any such ban.[222]

Other factors do not weigh heavily one way or the other. There is nothing intrinsic to autonomous weapon systems that would cause superfluous injury or unnecessary suffering; a bullet fired by an autonomous sentry robot causes the same amount of injury as one fired by a human sentry.[223] Certainly some autonomous weapon systems could be designed to cause such harm—just as certain bullets could be designed to cause excessive damage—but that does not mean the class of weapons as a whole should be banned. And, as discussed above, even assuming that autonomous weapons cannot discriminate between lawful and unlawful targets does not make them per se unlawfully indiscriminate. As evidenced by autonomous weapon systems in use today, they can be employed in a discriminating manner and with controlled effects.[224] Nor is there any directly relevant prior regulation.

The only characteristic which seems to increase the likelihood of a successful ban is the strong civil society campaign, comprised of a growing coalition of legal scholars, philosophers, human rights activists, scientists, Nobel laureates, and diverse organizations.[225] Due to their efforts, "killer robots" are no longer perceived as the stuff of science

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220 *See* Knuckey, *supra* note 7 (noting that, at the May 2014 Experts Meeting, all thirty states making opening statements welcomed the conversation, many states took an active role in discussions, and no state argued that it was the wrong time or forum to be addressing these issues—instead, some states proposed that the issue be considered additionally in other forums).

221 *See* Bonnie Docherty, *Taking on "Killer Robots,"* JUST SECURITY (May 23, 2014, 11:30 AM), http://justsecurity.org/10732/guest-post-killer-robots (reporting that five states have called for a ban); Knuckey, *supra* note 7 (stating that Ecuador, Egypt, and Pakistan called for a ban on fully autonomous weapon systems).

222 Owen Bowcott, *UK Opposes International Ban on Developing 'Killer Robots,'* THE GUARDIAN, Apr. 13, 2015, http://www.theguardian.com/politics/2015/apr/13/uk-opposes-international-ban-on-developing-killer-robots.

223 *See* George R. Lucas, Jr., *Automated Warfare*, 25 STAN. L. & POL'Y REV. 317, 330 n.24 (2014). *Contra* Mark Gubrud, *The Principle of Humanity in Conflict*, ICRAC (Nov. 19, 2012), http://icrac.net/2012/11/the-principle-of-humanity-in-conflict (suggesting that there "is a human right not to be killed on the decision of machines"); Wendell Wallach, *Terminating the Terminator: What to Do About Autonomous Weapons*, SCI. PROGRESS (Jan. 29, 2013), http://scienceprogress.org/2013/01/terminating-the-terminator-what-to-do-about-autonomous-weapons (arguing that permitting machines to make life-or-death decisions is *mala in se*—evil in itself—like the use of rape or biological weaponry).

224 *See supra* Part II.A.

225 *See* ADVANCING THE DEBATE, *supra* note 88, at 24.

fiction; rather, they are the subject of Special Rapporteur reports,[226] international meetings,[227] and U.S. congressional briefings.[228] These norm entrepreneurs are working to frame the debate on autonomous weapon systems to increase the likelihood of a successful ban.[229] Whether this will be sufficient, especially when balanced against the other factors, has yet to be seen.

Perhaps the most critical determinant of an autonomous weapon system ban's success will be how narrowly tailored the chosen definition is. If the official threshold for autonomy in a weapon system is set excessively high, it will exclude weapon systems with autonomous capabilities currently in use today or likely to be developed in the near future, which would increase the likelihood of state subscription. However, this would grant states wide latitude in using weapon systems capable of independently selecting and engaging targets, which undermines the original impetus for a ban.[230] Additionally, as Nicolas Marsh points out, there is a paradoxical effect to a definition of autonomy that would require machines to engage in human-level reasoning: "A key motivation for the Campaign [to Stop Killer Robots] is that robots cannot make the ethical and contextual assessments that humans can. However, a robot with a decisionmaking capability as advanced as human cognition could presumably make such judgments."[231] Alternatively, if the threshold for autonomy in weapon systems is set too low, states will be extremely unlikely to ratify the treaty, as they will be unwilling to give up what they perceive as necessary technology.

Finally, regardless of how autonomous weapon systems are defined, a ban might exclude certain types or uses no one seems to find objectionable, like autonomous weapon systems now employed for purely defensive purposes or "smart" weapons which better distinguish between lawful and unlawful targets.[232] While such exclusions will likely increase ratification rates, they would also undermine many ban advocates' goals, such as limiting military investment in weapon autonomy and preventing the proliferation of autonomous weapon systems.

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226 Heyns Report, *supra* note 5.

227 Chairperson Simon-Michel Report, *supra* note 6.

228 Tim Starks, *Killer Robots, Outer Space and Defense Spending Bill in Week Ahead*, ROLL CALL (July 14, 2014, 7:30 AM), http://blogs.rollcall.com/five-by-five/killer-robots-outer-space-and-defense-spending-bill-in-week-ahead/?dcz=.

229 *See, e.g.*, ARTICLE 36, KEY AREAS FOR DEBATE ON AUTONOMOUS WEAPONS SYSTEMS (2014); ADVANCING THE DEBATE, *supra* note 88; LOSING HUMANITY, *supra* note 2; MARSH, *supra* note 50; Mines Action Can. Memorandum, *supra* note 187.

230 *See supra* Part I.B.4.

231 MARSH, *supra* note 50, at 3.

232 *See* Horowitz & Scharre, *supra* note 41; Scharre, *supra* note 73.

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Developments in weapons technology often challenge basic precepts of the existing law governing armed conflicts. The crossbow changed the common understanding of who could be a valuable solider; submarines, airplanes, and cyberattacks expanded the scope of potential battlefields; nuclear weapons raised the possibility of total war and even human-caused human extinction. Autonomous weapon systems similarly raise important questions as to the necessary level of human involvement in decisions to use lethal force, leading many to call for their complete prohibition.

But autonomous weapon systems share few qualities with weapons successfully banned in the past. They are not inherently indiscriminate, and they can be designed such that they do not cause superfluous injury or unnecessary suffering. Moreover, as evidenced by autonomous weapon systems in use today, they can be used lawfully, effectively, and carry out tasks that could not be otherwise achieved. As a result, states are unlikely to conclude—let alone comply with—a treaty banning their use, unless the ban is so narrowly tailored that it effectively defines autonomous weapon systems out of existence.

All in all, this analysis suggests that states and other parties interested in the governance of autonomous weapon systems should focus not on banning them, but rather on determining how best to regulate their use.

IV. HOW SHOULD AUTONOMOUS WEAPON SYSTEMS BE REGULATED?

"Killer robots" are here, and they are here to stay. But that does not imply that efforts to galvanize state interest in their governance have been wasted—quite the opposite. All interested parties should take advantage of the current momentum to focus on how best to regulate this new and swiftly-evolving weaponry. Accordingly, after discussing the need for intentional international lawmaking and its myriad benefits, this Part concludes with concrete suggestions regarding the optimal structure and content of regulations for autonomous weapon systems.

A. *Intentional International Regulation Is Needed—Now*

Some ban skeptics suggest that existing international law is currently sufficient to regulate autonomous weapon systems, and so

states need not take any formal action.[233] To a certain degree, this is true. If states do nothing, autonomous weapon systems will continue to be governed by the law of armed conflict, a patchwork of relevant law from other legal regimes, and various types of soft law.[234] To the extent areas of ambiguity remain, international law will evolve to address them.[235]

But a laissez-faire approach sacrifices the current opportunity to channel state practice and direct the emergence of new, relevant international law. In the absence of an international legislative-like body that can weigh ethical, policy, and other considerations to create law proactively, international law evolves in a reactionary way, based retrospectively on state action. Such precedent is based primarily on the specific circumstances of the situation and the state interests at that point in time—not on long-term implications or considerations of how a given action could be construed in the future. Absent some form of intentional law-making focused on the question of how autonomous weapon systems should be employed, law will be relegated to describing how technological innovations are—and thus may be—employed.

Nor is the law of armed conflict set in stone. It provides general guidance on how any weapon may be lawfully used, but aside from requiring states to conduct reviews to prevent the deployment of unlawful weapons,[236] the law of armed conflict imposes few limitations on weapons research or proliferation.[237] In the absence of intentional regulation, the unchecked development of autonomous weapon systems may well pose a significant threat to fundamental humanitarian principles and protections—and, by extension, to human lives. Weapons systems with increasingly autonomous capabilities may allow for an increasingly attenuated temporal and geographic link between a human being's decision to deploy a weapon and the use of lethal force, which in turn may undermine current conceptions about what constitutes compliance with the distinction requirement, the

233 *See, e.g.*, Schmitt & Thurnher, *supra* note 2, at 233.

234 *See* Anderson & Waxman, *supra* note 4, at 22; Crootof, *supra* note 178; Marchant et al., *supra* note 68, at 306–13.

235 *See, e.g.*, Anderson & Waxman, *supra* note 4, at 27.

236 *See* First Additional Protocol, *supra* note 137, art. 36 ("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.").

Many argue that this responsibility is one of customary law, as it "flows logically from the truism that States are prohibited from using illegal weapons, means and methods of warfare or from using weapons, means and methods of warfare in an illegal manner." Int'l Comm. of the Red Cross, *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, 933 (2006).

237 *See* ADVANCING THE DEBATE, *supra* note 88, at 4.

proportionality requirement, and other relevant law.

Autonomous weapon systems are multiplying as governments invest huge sums in relevant research and development. However, we have not yet passed an event horizon such that law is doomed to follow technological innovations in weapons autonomy. It is still possible to proactively employ legal means to channel how this new technology develops and is used, but the window of opportunity is closing. The time to act is now.

B. *Benefits to Intentional International Regulation*

There are a number of benefits to the premeditated regulation of autonomous weapon systems, foremost among which is that it will channel research and state practice by limiting what lawful options are available. Additionally, the very act of setting forth definitions and rules regarding development, usage, or transfer improves the likelihood that autonomous weapon systems will be used in accordance with the law, because states will have a better understanding of what conduct is permissible. Clarified rules may also contribute to the stigmatization of unapproved designs or applications. Finally, while all states are theoretically equals in the international legal order, in reality some are more equal than others. In such an environment, clear rules ensure that different states' actions are evaluated under the same standard.

The negotiation process necessary to creating international regulations can also highlight where the existing law is unclear, increasing the likelihood that legal lacunae are prospectively addressed.[238] Even if states are unable to conclusively determine how to fill such gaps, identifying them encourages future discussion, which in turn furthers the growth of relevant customary norms. Additionally, the regulatory instrument itself can be designed to foster a continued conversation, by creating an interpretive body or by requiring state parties to convene regularly to consider new issues.

Stepping back, state interest and engagement in negotiating a treaty legitimizes the issue as one deserving of international attention.[239] As a result, entities and individuals who might not have otherwise considered potential impacts of autonomous weapon systems will be more likely to do so, and states may be more likely to promulgate national rules and policies on the subject.

Ban advocates argue that a complete ban is preferable to a regulatory instrument, as it would be clearer and easier to enforce, decrease the possibility that autonomous weapon systems will

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238 This process has already begun. *See* Chairperson Simon-Michel Report, *supra* note 6.

239 Marchant et al., *supra* note 68, at 314.

proliferate and be misused, and would enhance the stigma associated with usage by non-state parties.[240] These claims are not necessarily true, however—as Kenneth Anderson and Matthew Waxman have discussed, weapons autonomy will develop incrementally.[241] Bans attempt to divide white from black; regulation will better address the evolving grey zones of weapons autonomy. Additionally, given the low likelihood that states will be able to conclude a treaty ban, let alone an effective one, and given that a regulatory instrument could provide many of the beneficial legal limitations and humanitarian protections associated with a complete ban,[242] even those who would have preferred a complete ban should welcome efforts to create effective regulation.

C. *Options for Intentional International Regulation*

Ideally, autonomous weapon systems would be governed by a comprehensive legal regime, comprised of international, transnational, and domestic laws. While this ideal may not ever be fully realized, states and other parties interested in the governance of this new weaponry can begin working toward it now. Indeed, many relevant entities—states, developers, manufacturers, programmers, et cetera—would likely welcome a clarified ethical and legal framework.

Accordingly, this subsection discusses possible structures and content of a regulatory treaty, as well as other, informal sources of guidance and governance. It concludes that an ideal international legal regime would consist of a framework convention and a thorough collection of associated additional protocols, supplemented by domestic law and other sources of informal governance mechanisms.

1. A Regulatory Treaty

a. Structural Considerations

A regulatory treaty on autonomous weapon systems is most likely to take one of two forms. It might be negotiated as a sixth additional protocol to the Convention on Certain Conventional Weapons (CCW), joining the ranks of restrictions on the use of non-detectable fragments, mines, incendiary weapons, blinding lasers, and explosive remnants. Alternatively, states might negotiate an independent treaty, which would ideally take the form of an easily adaptable framework convention.

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240 *See* ADVANCING THE DEBATE, *supra* note 88, at 22–23.

241 Anderson & Waxman, *supra* note 4.

242 *Cf.* ADVANCING THE DEBATE, *supra* note 88, at 3–4.

Constructing a regulatory treaty as an additional protocol to the CCW is appealing, primarily because there is already a significant impetus toward doing so. The first two international meetings of state representatives to discuss autonomous weapon system occurred under CCW auspices, and such momentum is not to be underestimated.

That being said, should the CCW process falter or result in minimal regulation, state parties interested in constructing a more robust legal regime might attempt to negotiate an independent treaty (as occurred with landmines and cluster munitions). Furthermore, there is some internal inconsistency in drafting regulations for autonomous weapon systems as an additional protocol to the CCW: they are hardly "conventional" weapons at present, and they are unlikely to be so for quite some time.

An independent treaty might take one of three forms: it might attempt comprehensive regulation (like the Chemical Weapons Convention—which, in addition to banning the development, production, acquisition, stockpiling, retention, transfer, and use of certain defined chemical weapons, also outlines enforcement mechanisms), provide piecemeal regulations of specific activities (like the Nuclear Test Ban or nonproliferation treaties), or serve as a framework treaty intended to be augmented by later protocols (like the CCW itself). All of these have associated benefits and drawbacks.

Comprehensive conventions allow states to create an integrated and internally reinforcing regulatory regime. However, precisely because of its grand substantive scope and varied opportunities for disagreement, a comprehensive treaty on autonomous weapon systems is unlikely to be concluded and ratified. The Chemical Weapons Convention was successful in part because chemical weapons were well understood; the possibilities of increasingly autonomous weapon systems are as yet unknown.

Should a comprehensive convention be attempted, drafters will likely favor broad, expansive statements over specific rules, both to accommodate as-yet unimagined innovations and to encourage higher ratification rates. Flexible provisions are certainly to be preferred, as specific ones may quickly be rendered obsolete. However, they also are more subject to interpretative abuse. Any comprehensive treaty on autonomous weapon systems should therefore create or designate an authoritative interpretative body with the power to evaluate whether new applications accord with the treaty's overarching object and purpose.

Piecemeal treaties are useful insofar as they allow states to create law for specific issues where there is consensus and table the more thorny questions that might prevent the widespread ratification of a more comprehensive treaty. Additionally, because any given treaty

within the regime is focused on a specific issue, it will be able to address the subject in greater depth than a more comprehensive treaty—and, in the wake of new innovations, it will be more easily amended, as the alteration of one treaty will not threaten the regime as a whole.

What piecemeal treaty regimes gain in particularity and flexibility, however, they lose in integration and cohesion. Different treaties in the regime will have different objects and aims, which sometimes may conflict with each other. Additionally, different treaties will have different state parties, so the law for one state will rarely be the law for another.

A framework convention marries many of the benefits of comprehensive and piecemeal treaty regimes. The convention itself can clarify definitions and guiding principles, while tabling controversial issues for a later date. Because ratifying such a convention is non-threatening, it is likely to enjoy greater ratification rates than a comprehensive treaty and thereby encourage increased state involvement in the development of additional protocols. Additional protocols can address specific issues and may be amended without threatening the legal regime as a whole, but because they are concluded under the aegis of the guiding principles of the framework convention, there is likely to be more of a focus on integration and internal coherence than piecemeal treaty regimes.

Such an approach is not without problems: the framework convention itself is likely to have little to no teeth and on controversial subjects—it arguably just kicks the can further down the road, as it is only effective to the extent that state parties join the later additional protocols resolving such issues.[243] Ultimately, however, it is the best option.

b. Subject Matter

Any initial regulatory treaty will need to include a definition of "autonomous weapon system" from a law of armed conflict perspective. In constructing such a definition, states will need to determine where to set the bar for autonomy, what qualifiers are pertinent and which are irrelevant, and whether to except certain currently existing but uncontroversial weapon systems. States should also take this opportunity to affirm the applicability of the existing law of armed conflict principles to the development and use of autonomous weapon systems.[244]

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243 *Id.*

244 Anderson, Reisner & Waxman, *supra* note 57, at 406–07.

After a definition is agreed upon, there are myriad other questions for states to consider in evaluating what types and usages of autonomous weapon systems should be permissible based on policy, ethical, and other considerations. For example, the concept of "meaningful human control" has recently emerged as a potential guiding principle for the development and use of autonomous weapon systems—states might clarify what such control would entail,[245] even if that standard is difficult to enforce.[246]

A regulatory treaty or additional protocol might focus on the design or manufacture of autonomous weapon systems, requiring them to incorporate components that decrease the possibility of violations of the law of armed conflict. One possibility would treat ongoing consent as a form of fuel: an autonomous weapon system could be designed to check in with a human operator at regular intervals after deployment and to shut down or self-destruct if it did not receive reiterated approval to continue. Designs that would result in autonomous weapon systems with an inappropriate amount of destructive power could also be forbidden.

Additionally or alternatively, a regulatory treaty or additional protocol might discuss how autonomous weapon systems may be lawfully employed. They might be required to be stationary systems, to increase the likelihood that they will only be used for defensive purposes. Their potential targets might be restricted to non-human entities, or they might be required to be used only for non-lethal purposes—perhaps for surveillance, reconnaissance, or search-and-rescue missions. Their use might be permitted in certain regions, such as outer space and the deep sea, or prohibited in others, such as urban or densely populated areas.

A treaty or additional protocol focused on accountability for law of armed conflict violations would have additional requirements. At the very least, it should reiterate that states are responsible for the actions of their autonomous weapon systems. It might also compel states to adopt certain policies and practices regarding the training of human operators or the human supervision of autonomous weapon systems. It could also

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245 *See* Michael C. Horowitz & Paul Scharre, Meaningful Human Control in Weapon Systems: A Primer (Mar. 2015) (working paper), *available at* http://www.cnas.org/sites/default/files/publications-pdf/Ethical_Autonomy_Working_Paper_031315.pdf (suggesting that "meaningful human control" has three necessary components: (1) human operators make informed decisions; (2) human operators have sufficient information to ensure the lawfulness of their action; and (3) the weapon has been designed and tested and the human operator has been trained to ensure effective control over the use of the weapon); Sarah Knuckey, *Governments Conclude First (Ever) Debate on Autonomous Weapons: What Happened and What's Next*, JUST SECURITY (May 16, 2014, 12:31 PM), http://justsecurity.org/10518/autonomous-weapons-intergovernmental-meeting (discussing state support for "meaningful human control" over autonomous weapon systems).

246 *See* Anderson, Reisner & Waxman, *supra* note 57, at 397–98; Knuckey, *supra* note 245.

mandate that states implement domestic criminal legislation or military procedures to establish individual liability for war crimes committed by autonomous weapon systems.[247] As noted above, however, autonomous weapon systems pose unusual enforcement problems, in that it may be impossible for observers to identify when such weaponry is used inappropriately. Furthermore, there may be attribution issues: should an autonomous weapon system be discovered, independently wreaking havoc, it may be impossible to determine what state is responsible for deploying it. Any enforcement regime would need to tackle these problems.

While an initial framework treaty will be unlikely to address all relevant issues, a comprehensive treaty regime would ideally eventually develop and provide guidance regarding the research and development, testing, production, sale and transfer, acquisition, and use of autonomous weapon systems.

2. Informal Lawmaking

Treaties are often the go-to option for proposals for new law, as their ability to create binding international legal obligations is uncontested. But there simply may not be sufficient state commitment or consensus to conclude a regulatory treaty now. There are also some persuasive reasons to avoid codifying concrete regulations at present: autonomous weapon systems currently in use are not overly controversial, and we do not yet have a full understanding of the possibilities and risks posed by weapons systems with greater levels of autonomy.[248]

But this does not mean we should do nothing. The international legal system has myriad alternative sources of guidance and governance, many of which can be extremely effective in channeling state action, notwithstanding their lack of formal international legal status. These sources include common understandings based on international and transnational dialogue, nonbinding resolutions and declarations, professional guidelines and codes of conduct, civil society reports and policy briefs, industry practice, and even domestic laws and policies.[249] Such sources are likely to be both more narrowly tailored and more

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247 *See also* John Frank Weaver, *Asimov's Three Laws Are Not an International Treaty*, SLATE (Dec. 1, 2014, 9:54 AM), http://www.slate.com/articles/technology/future_tense/2014/12/autonomous_weapons_and_international_law_we_need_these_three_treaties_to.html (proposing multiple new conventions).

248 *See* Marchant et al., *supra* note 68, at 283–84 (discussing the impossibility of anticipating risks inherent in complex new technologies).

249 *See* Crootof, *supra* note 178, at 24.

flexible than treaty provisions, and thus better able to address unanticipated technological breakthroughs.[250]

Two prominent examples of influential, nonformal sources of guidance are the *Tallinn Manual on the International Law Applicable to Cyber Warfare*,[251] which was commissioned by the NATO Cooperative Cyber Defence Centre of Excellence, and the International Committee of the Red Cross's interpretive guidance regarding the legal status of civilians directly participating in hostilities.[252] Each of these publications was spurred by the fact that new technology—cyberwarfare and drones, respectively—raised new questions that were not conclusively addressed by the existing law of war. In each case, experts discussed and debated how the law should evolve both to satisfy state needs and to preserve basic humanitarian protections. Finally, by suggesting rules for permissible state action, they sparked wider, ongoing discussions as their reasoning and conclusions were evaluated by states, civil society, and scholars. States or other interested entities might similarly convene a group of experts to issue a comprehensive publication on the law of autonomous weapon systems.

Some of these sources of guidance, like industry practice and professional guidelines, will likely develop absent state action. To ensure that they do not evolve to undermine fundamental protections of the law of armed conflict, states should provide guidance to developers, manufacturers, and future operators as to what types and usages of autonomous weapon systems are permissible.[253] Nor should this be a top-down exchange: because these groups will likely have the best understanding of actual technical and operational concerns associated with autonomous weapon systems, they should be included in any attempt to create a comprehensive publication.[254]

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While law is often fated to trail unanticipated technological innovations, that need not be the case with autonomous weapon systems. Now is the time for states and other interested parties to take proactive measures toward the development of an intentional regulatory

250 *See* Marchant et al., *supra* note 68, at 306–13.

251 INT'L GRP. OF EXPERTS, NATO COOP. CYBER DEFENCE CTR. OF EXCELLENCE, TALLINN MANUAL ON THE INTERNATIONAL LAW APPLICABLE TO CYBER WARFARE (Michael N. Schmitt ed., 2013).

252 INT'L COMM. OF THE RED CROSS, INTERPRETIVE GUIDANCE ON THE NOTION OF DIRECT PARTICIPATION IN HOSTILITIES UNDER INTERNATIONAL HUMANITARIAN LAW (Nils Melzer ed., 2009), *available at* https://www.icrc.org/eng/assets/files/other/icrc-002-0990.pdf.

253 *See* Anderson, Reisner & Waxman, *supra* note 57, at 408–09.

254 *See id.*

regime for autonomous weapon systems—one which both permits states to explore options for effective weapons and also protects the fundamental humanitarian principles of the existing law of armed conflict.

CONCLUSION

"There are no right answers to the wrong questions."[255]

The space between proponents and skeptics of a ban on autonomous weapon systems is smaller than it may initially appear: all parties are interested in preserving the law of armed conflict's humanitarian protections. But those most concerned about the threats potentially posed by this new form of weaponry have tended to focus on how to ban it, resulting in a spirited debate of the wrong question. Claims that autonomous weapon systems could never comply with the law of armed conflict and inappropriate comparisons to successful weapon bans have succeeded only in further muddying the conversation. Meanwhile, states continue to develop and deploy autonomous weapon systems in the absence of international conversation—much less consensus—on how such weaponry should be used.

In proposing a clarified definition for autonomous weapon systems, this Article has attempted to reframe the legal conversation. The right question going forward is not how to ban autonomous weapon systems, but rather how best to regulate them. We should not squander this opportunity to proactively channel the development of autonomous weapon systems in futile debates over whether to ban a class of uniquely effective weaponry already in widespread use.

255 URSULA K. LE GUIN, PLANET OF EXILE 1 (1966).

APPENDIX: HISTORIC BANS

Independent books could be (and have been) written on the history and circumstances unique to attempted and enacted weapon bans. This appendix aims to provide some background on oft-cited bans in the autonomous weapon systems debate and the common wisdom regarding their successes and failures.

A. *Failed Bans*

Various new technologies have utterly revolutionized warfare, often with catastrophic effects for both combatants and civilians. Despite sometimes strong and ongoing interest from states and civil society, however, attempts to ban certain new weapons have been largely unsuccessful.

1. Crossbows

Although not a treaty, one of the earliest weapon bans was Pope Urban II's proclamation prohibiting the use of crossbows in 1096—at least, in inter-Christian wars.[256] At the time, crossbows were seen as destabilizing new weaponry that undermined traditional assumptions of how warfare was conducted. For the first time in history, a peasant foot soldier with little training could easily kill a high-born, professional knight[257]—an "unequivocal violation of the chivalric code."[258] However, due largely to the crossbow's usefulness, this ban barely outlasted its proclamation.[259]

2. Aerial Bombardment

In 1783 the Montgolfier brothers took the first hot air balloon flight; nearly a century later, a balloon was first used in an armed

256 *The Crossbow—A Medieval Doomsday Device?*, MIL. HIST. NOW (May 23, 2012), militaryhistorynow.com/2012/05/23/the-crossbow-a-medieval-wmd. Pope Innocent II again attempted to ban the crossbow in 1139. Reeves & Johnson, *supra* note 4, at 27 nn.25–36.

257 *The Crossbow*, *supra* note 256 (noting that "an army of peasants could be made proficient with crossbow in weeks, or even days," as it did not require the strength or skill necessary to operate a bow).

258 Reeves & Johnson, *supra* note 4, at 27.

259 W.T. Mallison, Jr., *The Laws of War and the Juridical Control of Weapons of Mass Destruction in General and Limited Wars*, 36 GEO. WASH. L. REV. 308, 316 (1967); Reeves & Johnson, *supra* note 4, at 27.

conflict for military reconnaissance.[260] In recognition of the possibility of balloon-launched bombs, and their likely inaccurate and thus indiscriminate nature, states discussed a potential ban on aerial bombardment at the 1899 Hague Peace Conference.[261] Ultimately, twenty-four states—including powerhouses like Austria-Hungary, China, France, Germany, Italy, Japan, Russia, and Spain[262]—ratified a Declaration prohibiting, for five years, "the launching of projectiles and explosives from balloons, or by other new methods of a similar nature."[263]

The attempt to renew the ban after the Wright Brother's 1903 flight, however, was less successful. At the 1907 Hague Peace Conference, a Declaration with an identical prohibition was drafted, again as a temporary ban intended to last only until the third Peace Conference.[264] France, Italy, Japan, Spain, and Russia did not ratify the new Declaration; Austria-Hungary signed but never ratified; and Germany's ratification was conditional on all other participating parties' ratification.[265] Arthur Kuhn, writing in 1910, suggested that the Declaration's relative lack of success was likely the result of states' interest in exploring the military applications of the new technology.[266]

Recognizing the lack of specific regulations governing air warfare, states appointed a Commission of Jurists to develop rules.[267] The result—the 1923 Hague Rules of Aerial Warfare[268]—prohibited aerial bombardment for "the purpose of terrorizing the civil population or destroying or damaging private property without military character or injuring non-combatants" and clarified that aerial bombardment was lawful only if directed at a military objective.[269] Although the Rules were never ratified, they were recognized as clarifying customary international law and regularly cited by the League of Nations.[270]

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260 Javier Guisándex Gómez, *The Law of Air Warfare*, 323 INT'L REV. RED CROSS 347, 348 (1998).

261 *Id.* at 349–50.

262 The United States signed, but did not ratify, the 1899 Declaration.

263 Declaration (IV, I), to Prohibit, for the Term of Five Years, the Launching of Projectiles and Explosives from Balloons, and Other Methods of a Similar Nature, July 29, 1899, 32 Stat. 1839, 1 Bevans 270.

264 1907 Declaration, *supra* note 211.

265 *See* Matthew Lippman, *Aerial Attacks on Civilians and the Humanitarian Law of War: Technology and Terror from World War I to Afghanistan*, 33 CAL. W. INT'L L.J. 1, 6 (2002).

266 Arthur K. Kuhn, *The Beginnings of an Aërial Law*, 4 AM. J. INT'L L. 109, 119–20 (1910).

267 Gómez, *supra* note 260, at 352.

268 Rules Concerning the Control of Wireless Telegraphy in Time of War and Air Warfare, Dec. 1922–Feb. 1923 (drafted by a Commission of Jurists at the Hague).

269 *Id.* arts. 22, 24. Other articles protected certain civilian buildings, including religious, medical, artistic, scientific, and historic structures. *Id.* arts. 25–26.

270 Lippman, *supra* note 265, at 11, 12–14.

At the beginning of World War II, the parties attempted to avoid using aerial bombardment in urban areas.[271] This ended with the September 1939 German aerial attack on Warsaw; in response, Great Britain (and, eventually, the United States) began targeting civilian population centers as part of their overall aerial strategic plan.[272] The result was devastating: relentless and indiscriminate strikes by both sides led to unprecedented numbers of civilian deaths[273]—and, ultimately, to the bombing of Hiroshima and Nagasaki.

Today, aerial bombardment is governed by a patchwork of treaties relevant to air warfare and by the law of armed conflict generally.[274]

3. Submarines

Although military submarines were never formally prohibited, states concluded agreements which so strictly limited their usage that they amounted to bans. However, these proscriptions proved largely unenforceable in practice.

As an island nation and naval power, Great Britain sensed its vulnerability to submarine warfare.[275] At the Hague Peace Conference of 1899, with Germany's support, it tried and failed to outlaw submarines as a weapon of war.[276]

After Germany used submarines with devastating effect in World War I, during the 1923 Washington Conference Great Britain again tried, and again failed, to completely ban the use of submarines.[277] However, based on a U.S. proposal, the Conference participants adopted a general resolution that prohibited the destruction of a merchant vessel "unless its crew and passengers have been placed in safety."[278] This customary rule, originally applicable to surface warships, was explicitly made applicable to submarines in two later treaties. The 1930 London Naval Treaty prohibited submarines from neutralizing potentially hostile merchant vessels without having first ensured the safety of their

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271 *See id.* at 15.

272 *Id.* at 15–16 & n.143.

273 *Id.* at 15–19.

274 *See, e.g.*, Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III) art. 2(2), Oct. 10, 1980, S. Treaty Doc. No. 105-1, 1342 U.N.T.S. 171.

275 *See* D.P. O'Connell, *International Law and Contemporary Naval Operations*, 44 BRIT. Y.B. INT'L L. 19, 45 (1970).

276 *Id.*

277 *Id.* at 49.

278 *Id.* (quotation marks omitted).

passengers, crew, and ship's papers,[279] prohibitions which were reiterated in the 1936 London Protocol.[280]

But not only was it impossible for Great Britain to ban submarine warfare, the treaties delineating how submarines might be lawfully used proved almost immediately unenforceable. Submarines depend on stealth: they cannot escort captured vessels to ports to ensure the safety of their crew and passengers. Nor, due to space constraints, can they take additional individuals on board, much less potentially hostile ones. As a result, despite the fact that nearly all major naval powers acceded to the Protocol,[281] during World War II all states with submarines (save Japan) engaged in some form of unrestricted submarine warfare in violation of their treaty obligations.[282] As one scholar noted, the Protocol's requirement was "an unworkable ideal couched in ambiguous terms which did not address the practicalities of submarine warfare."[283]

Although the London Protocol still technically states the treaty law relevant to submarines,[284] in reality their military usage is governed largely by the law of armed conflict generally and customary international law specific to submarines.[285]

4. Nuclear Weapons

On August 6, 1945, the United States detonated a uranium bomb over Hiroshima, killing more than 140,000 people within a few months.[286] On August 9, it detonated a plutonium bomb over Nagasaki, resulting in the deaths of approximately 74,000 people by the close of that year.[287] Five months later, in its first resolution, the U.N. General Assembly called for the complete elimination of nuclear weapons.[288] Over the next few decades, states and civil society attempted to address the nuclear weapon threat through a variety of means.

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279 Treaty for the Limitation and Reduction of Naval Armament art. 22, Apr. 22, 1930, 46 Stat. 2858, 112 L.N.T.S. 65 [hereinafter London Naval Treaty].

280 *See* Jane Gilliland, Note, *Submarines and Targets: Suggestions for New Codified Rules of Submarine Warfare*, 73 GEO. L.J. 975, 978 (1985).

281 *Id.* at 978.

282 *Id.* at 985.

283 Parks, *supra* note 201, at 120.

284 London Naval Treaty, *supra* note 279, art. 23 (providing that the treaty would expire on December 31, 1936, with the exception of Article 22, which would "remain in force without limit of time").

285 *See, e.g.*, J. Ashley Roach, *Legal Aspects of Modern Submarine Warfare*, 6 MAX PLANCK ENCYCLOPEDIA OF PUB. INT'L L. 367, 367 (2002).

286 *Nuclear Weapons Timeline*, INT'L CAMPAIGN TO ABOLISH NUCLEAR WEAPONS, http://www.icanw.org/the-facts/the-nuclear-age (last visited Apr. 27, 2015).

287 *Id.*

288 *Id.*

In 1994, the General Assembly requested that the International Court of Justice issue an advisory opinion in response to the question: "Is the threat or use of nuclear weapons in any circumstance permitted under international law?"[289] After extensive arguments and much deliberation, a split court concluded that no treaty or customary international law prohibited the use of nuclear weapons, but

> the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law;
>
> However, in view of the current state of international law, and of the elements of fact at its disposal, the Court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake . . . .[290]

In other words, the court could not find that nuclear weapons were per se unlawful, as a situation could be envisioned in which they could be lawfully used. Such use remains regulated by the law of armed conflict, however, and there remains "the possibility that such a weapon could be unlawful by reference to the humanitarian law, if its use could never comply with its requirements."[291] In the absence of an official pronouncement of per se illegality, the only hope for a complete ban on nuclear weapons is through state action—and states have proven unwilling to enact such a ban.

The 1968 Non-Proliferation Treaty does not ban nuclear weapons outright, but rather aims to limit their proliferation and eventually achieve universal disarmament.[292] The crux of a treaty is an agreement between states with and without nuclear weapons: the latter vow not to acquire nuclear weapon technology, and the former agree to pursue disarmament and to share the benefits of non-military nuclear technology. The 190 states party to the Treaty—more than any other arms limitation or disarmament agreement—include the five original nuclear weapon states (China, France, Russia, the United Kingdom, and

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289 Legality of the Threat or Use of Nuclear Weapons (Request for an Advisory Opinion), G.A. Res. 49/75(K), U.N. GAOR, 49th Sess., Supp. No. 49, U.N. Doc. A/RES/49/75, at 6 (Dec. 15, 1994).

290 *Nuclear Weapons*, *supra* note 167, at 266. However, President Bedjaoui cautioned "that the Court's inability to go beyond this statement of the situation can in no way be interpreted to mean that it is leaving the door ajar to recognition of the legality of the threat or use of nuclear weapons." *Id.* at 270 (declaration of President Bedjaoui).

291 *Id.* at 589 (dissenting opinion of Judge Higgins); *see also id.* at 320 (dissenting opinion of Vice-President Schwebel) ("It cannot be accepted that the use of nuclear weapons on a scale which would—or could—result in the deaths of many millions in indiscriminate inferno and by far-reaching fallout, have profoundly pernicious effects in space and time, and render uninhabitable much or all of the earth, could be lawful.").

292 Treaty on the Non-Proliferation of Nuclear Weapons, July 1, 1968, 21 U.S.T. 483, 729 U.N.T.S. 161 (entered into force Mar. 5, 1970).

the United States).[293] However, of the five states not party to the treaty, four—India, Israel, North Korea, and Pakistan—are the only other states known or suspected of having nuclear weapons. The Treaty has thus been critiqued on the grounds that only slightly over half of the total number of states with nuclear weapons are state parties. On the other hand, the fact that only nine states currently have nuclear weapons might be an indicator of the Treaty's success. The Treaty has also been criticized as benefiting nuclear weapon states at the expense of non-nuclear states, as the former have yet to eliminate their nuclear stockpiles.

The testing of nuclear weapons is also regulated by two treaties. In 1963, the United States, United Kingdom, and Soviet Union concluded the Partial Test Ban Treaty, which banned nuclear tests in the atmosphere, outer space, or underwater.[294] Although an important step forward, the Treaty did not prohibit underground testing. Additionally, neither China nor France became state parties at the time, and North Korea never acceded. In 1996, states attempted to close the underground loophole by concluding the Comprehensive Nuclear-Test-Ban Treaty, which prohibits nuclear explosions in all environments, for military or for civilian purposes.[295] There are currently 163 state parties to the Treaty.[296] However, it cannot enter into force until after all forty-four listed "nuclear weapon possible" states ratify it; at present, eight have not done so.[297] China, Egypt, Iran, Israel, and the United States have signed but not ratified the Treaty; India, North Korea, and Pakistan have not signed it.[298] Since the Treaty opened for signature, India, North Korea, and Pakistan have all tested nuclear weapons.[299]

Currently, nuclear weapons are governed by the various specific treaties regulating their use and by the law of armed conflict generally.[300]

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293 *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, UN OFF. FOR DISARMAMENT AFF., http://www.un.org/disarmament/WMD/Nuclear/NPT.shtml (last visited Apr. 27, 2015).

294 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, Aug. 5, 1963, 14 U.S.T. 1313, 480 U.N.T.S. 43 (entered into force Oct. 10, 1963).

295 Comprehensive Nuclear-Test-Ban Treaty, Sept. 24, 1996, S. Treaty Doc. No. 105-28, 35 I.L.M. 1439.

296 *Comprehensive Nuclear-Test-Ban Treaty*, UN TREATY COLLECTION, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-4&chapter=26&lang=en (last visited Apr. 27, 2015).

297 *Id.*

298 *Id.*

299 *See* Press Release, Security Council, Security Council Condemns Nuclear Tests by India and Pakistan, United Nations Press Release SC/6528 (June 6, 1998), *available at* http://www.un.org/News/Press/docs/1998/sc6528.doc.htm; Press Statement, Security Council, Security Council Press Statement on Nuclear Test Conducted by Democratic People's Republic of Korea, United Nations Press Release SC/10912 (Feb. 12, 2013), *available at* http://www.un.org/News/Press/docs/2013/sc10912.doc.htm.

300 States have also ratified treaties creating wide swaths of "nuclear weapon free zones." *See Nuclear-Weapon-Free Zones*, UN OFF. FOR DISARMAMENT AFF., http://www.un.org/

B. *Un/Successful Bans*

It is easy to determine that an attempted weapon ban has failed: either states are unable to conclude a treaty, or no one can credibly argue that a purported ban actually keeps states from employing a weapon. It is less clear when a ban has been successful. Is success measured by the number of state parties? By the number of relevant state parties—which is to say, the primary producers and users of a weapon or by the major military powers? By state party compliance? By the relative level of state party compliance when compared with other treaties regarding conduct in warfare?[301] By the number of times the weapon in question has been used by any state since the ban was enacted? Or by whether the use of the weapon has become so stigmatized that the ban is recognized as customary international law?

This subsection discusses commonly cited "successful" bans—defined here as bans which are both enacted and effective at limiting the usage of the banned weapon—organized roughly from the least to most obviously effective. Again, a thorough analysis of each ban is beyond the scope of this Article, but these brief descriptions do highlight certain commonalities.

1. Cluster Munitions

Cluster munitions are weapons that disperse or release submunitions or "bomblets." These submunitions tend to be small, unguided explosive devices, designed to detonate just prior to, on, or after impact. Submunitions may not deploy when or as intended, however, leaving unexploded ordnance that can harm civilians long after the armed conflict has concluded. Protocol V to the Convention on Certain Conventional Weapons aimed to minimize their impact by, among other things, obligating member states to remove or destroy unexploded ordnance in their territories when feasible and to take "generic preventive measures aimed at minimi[z]ing the occurrence of explosive remnants of war."[302]

The 2008 Convention on Cluster Munitions prohibits state parties from using, developing, producing, acquiring, stockpiling, retaining, or

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disarmament/WMD/Nuclear/NWFZ.shtml (last visited Apr. 27, 2015) (with links to relevant treaties).

301 *See* James D. Morrow, *When Do States Follow the Laws of War?*, 101 AM. POL. SCI. REV. 559, 567 (2007) (finding that bans on chemical and biological weapons enjoyed higher rates of compliance than other surveyed treaties regulating the conduct of hostilities).

302 Protocol on Explosive Remnants of War (Protocol V to the 1980 CCW Convention) arts. 3, 9, Nov. 28, 2003, S. Treaty Doc. No. 109-10, 45 I.L.M. 1348. China, Russia, and the United States are among the eighty-four state parties.

transferring cluster munitions under any circumstances.[303] It further requires state parties to clear unexploded ordnance and to destroy existing stockpiles of such weapons, save only for those to be used for research and training related to detection, clearance, and destruction techniques.[304] The Convention currently has eighty-nine state parties, which do not include major military powers (China, Russia, or the United States) or many states which have recently used cluster munitions (Eritrea, Ethiopia, Israel, Georgia, Libya, Russia, Thailand, Syria, and the United States).[305]

The success of this ban has yet to be determined. Skeptics of its success suggest that it carries little power, as many major cluster munition producers, stockpilers, and users have not ratified it.[306] Advocates point to the facts that "[a]t least 33 countries that have stockpiled, produced, and/or used cluster munitions have signed" and that "[a]lmost half the world, including states from every region, has signed the Convention" to argue that there is now "widespread international rejection of cluster munitions."[307]

2. Anti-Personnel Landmines

Anti-personnel landmines are explosive devices designed to be triggered by human beings (and are to be distinguished from landmines generally, which include anti-tank or anti-vehicle landmines). Their use was first regulated by the since-amended Protocol II to the Convention on Certain Conventional Weapons, which prohibits the use of mines against the civilian population and set forth various requirements

303 Convention on Cluster Munitions art. 1, May 30, 2008, 48 I.L.M. 357.

304 *Id.* arts. 3–4.

305 *Compare Convention on Cluster Munitions*, UN TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-6&chapter=26&lang=en (last visited Apr. 27, 2015), *with* HUMAN RIGHTS WATCH, TIMELINE OF CLUSTER MUNITION USE (2010), *available at* http://www.hrw.org/sites/default/files/related_material/2010.4.7%20Arms%2C%20Cluster%20Timeline%20of%20FINAL.pdf, *and Use of Cluster Bombs: A Timeline of Cluster Bomb Use*, CLUSTER MUNITION COALITION, http://www.stopclustermunitions.org/en-gb/cluster-bombs/use-of-cluster-bombs/a-timeline-of-cluster-bomb-use.aspx (last visited Apr. 27, 2015).

306 *See, e.g.*, Daniel Joseph Raccuia, Note, *The Convention on Cluster Munitions: An Incomplete Solution to the Cluster Munition Problem*, 44 VAND. J. TRANSNAT'L L. 465, 491–92 (2011); Julian Ku, *Here Comes the Convention on Cluster Munitions*, OPINIO JURIS (Feb. 17, 2010, 12:09 PM), http://opiniojuris.org/2010/02/17/here-comes-the-convention-on-cluster-munitions.

307 *See, e.g.*, HRW TWELVE FACTS, *supra* note 197, at 1.

constraining their use, placement, advertisement, and neutralization.[308] One hundred and two states are party to the Amended Protocol.[309]

The adoption of the 1997 Mine Ban Convention, also called the Ottawa Treaty, "marked the first time in the history of international humanitarian law that States agreed to ban a weapon that was in widespread use throughout the world."[310] The Convention prohibits the use, development, production, acquisition, stockpiling, and direct or indirect transfer of anti-personnel landmines (save for destruction or training in detection, clearance, and destruction).[311] One hundred and sixty-one states are party to the Convention, although these do not include China, Russia, or the United States.[312]

Since the Convention took effect, there has been a dramatic reduction in the production and use of anti-personnel landmines.[313] However, states are still using these landmines, and it is generally agreed that the ban has not (yet) evolved into customary international law.[314]

3. Biological Weapons

Biological weapons include both harmful biological agents and the means of their delivery.[315] Although its primary aim was forbidding the use of poisonous gases in warfare, the 1925 Geneva Gas Protocol also

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308 Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II), Oct. 10, 1980, S. Treaty Doc. No. 105-1, 2048 U.N.T.S. 133 (amended May 3, 1996).

309 *Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices as amended on 3 May 1996*, UN TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-2-b&chapter=26&lang=en (last visited Apr. 27, 2015).

310 *Anti-Personnel Mines: Overview of the Problem*, INT'L COMMITTEE RED CROSS (Nov. 2, 2009), http://www.icrc.org/eng/resources/documents/misc/mines-fac-cartagena-021109.htm.

311 Mine Ban Convention, *supra* note 210, arts. 1, 3.

312 *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction*, UN TREATY COLLECTION, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-5&chapter=26&lang=en (last visited Apr. 27, 2014).

The United States has not joined the Ottawa Treaty, originally in part because it and South Korea have planted banned mines in the Korean demilitarized zone. *See* David Glazier, *Missing in Action? United States Leadership in the Law of War*, 30 U. PA. J. INT'L L. 1335, 1340–41 (2009). However, the United States has recently reconsidered its stance on the treaty. *See* Fact Sheet, *supra* note 203.

313 *See* Ved P. Nanda, *The Contribution of Non-Governmental Organizations in Strengthening and Shaping International Human Rights Law: The Successful Drives to Ban Landmines and to Create an International Criminal Court*, 19 WILLAMETTE J. INT'L L. & DISP. RESOL. 256, 270 (2011).

314 *See, e.g.*, *Chapter 29. Landmines*, INT'L COMMITTEE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v1_cha_chapter29 (last visited Apr. 27, 2015) (noting customary regulation of landmine use, placement, and neutralization).

315 *See* Biological Weapons Convention, *supra* note 209, art. I.

"extend[ed] this prohibition to the use of bacteriological methods of warfare."[316]

This initial ban was strengthened by the 1972 Biological Weapons Convention, the first multilateral disarmament treaty banning the creation of an entire class of weaponry.[317] The Convention does not explicitly ban the use of biological weapons—only their development, production, and stockpiling. A prohibition on their use is an obviously implicit goal, however, and the Convention does note that it is not intended to limit states' obligations under the Geneva Gas Protocol, which does explicitly prohibit the use of biological agents in warfare.[318] There are 171 state parties to the Convention; an additional nine have signed but not yet acceded, and sixteen states are not members.[319]

The success of the Biological Weapons Convention is debatable. While it certainly serves as an example of states' ability to conclude a ban regarding an entire class of weaponry, states' failure to explicitly ban the use of biological weapons and the lack of enforcement mechanisms seem to render it toothless.

Nonetheless, the ICRC has concluded that the prohibition on the use of biological weapons in international and non-international armed conflicts is customary international law.[320] This is a credible conclusion, given the infrequency of violations, that "[v]irtually all allegations of possession by States have been denied," and the near-universal condemnation of Iraq (then not a member state to the Convention) when it was discovered in the mid-1990s that it was pursuing biological weapons research.[321]

4. Chemical Weapons

Chemical weapons include both toxic chemicals and the munitions or devices designed to disperse them. Notwithstanding initial prohibitions against poisons and asphyxiating gases resulting from the

316 Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, June 17, 1925, 26 U.S.T. 571, 94 L.N.T.S. 65 [hereinafter Geneva Gas Protocol].

317 *See* Robert D. Pinson, *Is Nanotechnology Prohibited by the Biological and Chemical Weapons Convention?*, 22 BERKELEY J. INT'L L. 279, 292 (2004).

318 Biological Weapons Convention, *supra* note 209, art. VIII.

319 *Membership of the Biological Weapons Convention*, UN OFF. GENEVA http://www.unog.ch/80256EE600585943/%28httpPages%29/7BE6CBBEA0477B52C12571860035FD5C?OpenDocument (last visited Apr. 27, 2015).

320 *Rule 73. Biological Weapons*, INT'L COMMITTEE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule73 (last visited Apr. 27, 2015).

321 *Id.*

1899 and 1907 Hague Peace Conferences,[322] in World War I both sides used chemical weapons extensively.[323]

Largely in reaction to the horrors of the gas offensive, states concluded the 1925 Geneva Gas Protocol. It states that "the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilized world," and that the state parties therefore accept the prohibition on their use—at least against other member states.[324] There are currently 138 state parties to the Protocol.[325] And, in World War II, neither side made significant use of chemical weapons.[326]

In response to various incidents of chemical weapon usage during the mid-twentieth century, states concluded the comprehensive 1992 Chemical Weapons Convention. It prohibits the development, production, acquisition, stockpiling, retention, transfer, and use of chemical weapons.[327] Among other enforcement mechanisms, it requires state parties to submit to inspections upon the challenge of any other state party.[328] One hundred and ninety states are currently party to the Convention.[329]

Based on treaty law and state practice, the ICRC has determined that the prohibition on the use of chemical weapons in international or non-international armed conflicts is now customary international law.[330] This conclusion is further bolstered by the Rome Statute's prohibition on the use of chemical weapons in international armed conflicts,[331] the limited number of Convention violations, and states'

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322 *See* Jill M. Sheldon, Note, *Nuclear Weapons and the Laws of War: Does Customary International Law Prohibit the Use of Nuclear Weapons in All Circumstances?*, 20 FORDHAM INT'L L.J. 181, 215–17 (1996).

323 *See* PRICE, *supra* note 202, at 44.

324 Geneva Gas Protocol, *supra* note 316.

325 *Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*, UN OFF. FOR DISARMAMENT AFF., http://disarmament.un.org/treaties/t/1925 (last visited Apr. 27, 2015).

326 *See* PRICE, *supra* note 202, at 4.

327 Chemical Weapons Convention, *supra* note 205, art. I.

328 *Id.* art. IX(8). This has sparked a vigorous debate as to how to implement this requirement without violating the Fourth Amendment. *See, e.g.*, Edward A. Tanzman, *Constitutionality of Warrantless On-Site Arms Control Inspections in the United States*, 13 YALE J. INT'L L. 21 (1988); David G. Gray, Note, *"Then the Dogs Died": The Fourth Amendment and Verification of the Chemical Weapons Convention*, 94 COLUM. L. REV. 567 (1994).

329 *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction*, UN TREATY COLLECTION, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-3&chapter=26&lang=en (last visited Apr. 27, 2015). Israel and Myanmar have signed but not yet ratified the Convention; Angola, Egypt, North Korea, and South Sudan have neither signed nor ratified. *Id.*

330 *Rule 74. Chemical Weapons*, INT'L COMMITTEE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v1_cha_chapter24_rule74 (last visited Apr. 27, 2015).

331 Rome Statute of the International Criminal Court art. 8(2)(b)(xviii), July 17, 1998, 2187 U.N.T.S. 90 (banning the use of "asphyxiating, poisonous or other gases, and all analogous liquids, materials or devices").

overwhelmingly negative reaction to Syria's 2013 use of chemical weapons (prior to its September 2013 accession to the Convention).

5. Permanently Blinding Lasers

The 1995 Protocol IV to the Convention on Certain Conventional Weapons prohibits state parties from employing or transferring "laser weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness to unenhanced vision."[332] There are currently 104 state parties to the Protocol,[333] and the ICRC has found that its prohibition has attained the status of customary international law in both international and non-international armed conflicts.[334]

The permanently blinding laser ban has two notable characteristics. First, it is one of the few prospective bans: although in development at the time of the Protocol's conclusion, blinding lasers had not yet been deployed.[335] Second, it may be the most successful ban of all time. Not only is there little controversy over what weapons it forbids and permits,[336] there are no recorded violations.

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332 Protocol IV, *supra* note 207, art. 1.

333 *Additional Protocol to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (Protocol IV, entitled Protocol on Blinding Laser Weapons)*, UN TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-2-a&chapter=26&lang=en (last visited Apr. 27, 2015).

334 *Rule 86. Blinding Laser Weapons*, INT'L COMMITTEE RED CROSS, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule86 (last visited Apr. 27, 2015).

335 Another, less frequently mentioned prospective ban was the 1899 prohibition on the use of projectiles intended to diffuse asphyxiating gases. *See* PRICE, *supra* note 202, at 15–16.

336 This is in stark contrast to other, "successful" bans, such as the prohibition on the use of expanding bullets. Although this ban is technically adhered to by all states, there is significant controversy regarding what modern weapons it encompasses. *See* Robin Coupland & Dominique Love, *The 1899 Hague Declaration Concerning Expanding Bullets: A Treaty Effective for More than 100 Years Faces Complex Contemporary Issues*, 85 INT'L REV. RED CROSS 135, 136 (2003).