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Navigating the Minefield: Meaningful Human Control and the Governance of Lethal Autonomous Weapon Systems

by

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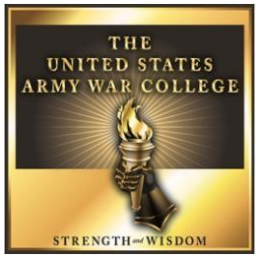

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Abstract

This paper examines the urgent policy challenges posed by Lethal Autonomous Weapon Systems (LAWS) – weapons capable of independently selecting and engaging targets. Drawing on historical precedents, including unrestricted submarine warfare, anti-personnel landmines, and “signature” drone strikes, the analysis reveals recurring risks associated with such technologies: diminished human control, difficulties in ensuring discrimination and proportionality, and challenges to accountability. These case studies demonstrate that unchecked technological advancement in warfare can erode fundamental ethical and legal principles.

The analysis applies a refined Just War Theory framework, incorporating principles of responsible innovation, to assess the ethical implications of LAWS and emphasize the commander's responsibility for ensuring compliance with *jus in bello* principles. Asserting the "human-in-the-loop" versus "human-out-of-the-loop" or “human on the loop” dichotomy is inadequate, the paper proposes a more nuanced framework of graduated autonomy that distinguishes between human-supervised, semi-autonomous, and fully autonomous systems. Increasingly stringent controls, grounded in the principle of Meaningful Human Control (MHC), are applied as the level of autonomy increases; MHC encompasses situational awareness, system interpretability, human intervention capability, and clear accountability. The framework also addresses operations in communication-denied environments, permitting limited autonomous responses only under strict, pre-programmed conditions. While acknowledging concerns about military disadvantage, the paper argues that these do not outweigh the need for such proactive governance.

Based on these historical lessons and a refined Just War Theory framework, the paper proposes specific policy recommendations for the U.S. Department of War and the U.S. Government, including:

- Adopting a clear, operational definition of Meaningful Human Control (MHC).
- Adapting existing Rules of Engagement (ROE) to address LAWS-specific challenges.
- Investing in Explainable AI (XAI) to enhance system transparency and interpretability.

Proactive governance, guided by ethical principles and international cooperation, is essential to harnessing the potential benefits of LAWS while mitigating their inherent risks. This ensures that the use of force remains firmly under meaningful human control.

Navigating the Minefield: Meaningful Human Control and Lethal Autonomous Weapon Systems

The rapid evolution of military technology presents a dilemma: how to integrate advanced capabilities while adhering to the ethical and legal norms of armed conflict. This challenge is acutely present with Lethal Autonomous Weapon Systems (LAWS), weapons that can independently identify, select, and engage targets after activation. Though not yet widespread, the implications of LAWS for future warfare are significant, raising questions about human control, accountability, and the nature of conflict itself. This paper argues that a proactive, historically informed approach is essential for governing their development and deployment.

Unlike futuristic scenarios involving "general" intelligence, this analysis focuses on "narrow" AI designed for specific military tasks within clear parameters. [1,2] The core challenge lies in balancing the operational benefits of LAWS, such as increased precision and reduced risk to soldiers, with the ethical imperative of maintaining human control over life and death decisions. This is particularly relevant in communication-denied environments where the appeal of autonomous systems during conflict is the strongest, yet the risks are also substantial.[3]

This paper examines historical precedents, unrestricted submarine warfare, anti-personnel landmines, and "signature" drone strikes, to identify key insights. These case studies reveal the political, ethical, and legal debates that arise when new military technologies outpace existing norms. By drawing lessons from these past ethical dilemmas, we can shape a responsible innovation framework that ensures LAWS protect national security interests while upholding core humanitarian values. [4] This framework will then inform specific policy recommendations for the ethical and responsible integration of LAWS's into the U.S. military. [5]

Ethical Considerations, the Responsibility Gap, and a Just War Framework

Integrating LAWS into military operations poses numerous ethical and legal challenges. While they offer potential benefits like increased precision and reduced risk, delegating lethal decision-making to machines raises significant concerns about accountability and adherence to International Humanitarian Law (IHL).

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[1] Alexander, Jonathan W. **"Lethal Autonomous Weapon Systems and the Potential of Moral Injury"** (PhD diss., Salve Regina University, 2024), pg 94

[2] Asaro, Peter. "On Banning Autonomous Weapon Systems: Human Rights, Automation, and the Dehumanization of Lethal Decision-Making." *International Review of the Red Cross* 94, no. 886 (Summer 2012): 687–709

[3] Arkin, Ronald C. **Governing Lethal Behavior in Autonomous Robots**. Boca Raton, FL: Chapman and Hall/CRC, 2009

[4] Stilgoe, Jack, Owen, Richard, and Macnaghten, Phil. "Developing a Framework for Responsible Innovation", Research Policy 42, no 9. P 1568-1580. https://doi.org/10.1016/j.respol.2013.05.008

[5] Scharre, Paul. **Army of None: Autonomous Weapons and the Future of War**. New York: W.W. Norton & Company, 2018

A primary concern is the potential "responsibility gap," the difficulty in assigning legal and moral accountability for actions taken by autonomous weapons, particularly if they cause unintended harm.[6] Traditional legal frameworks, which rely on a “reasonable commander” standard, are stressed when algorithms execute lethal force decisions.[7] The question then becomes, who is accountable: the programmer, the commanding officer, or the manufacturer? This ambiguity creates a potential accountability "vacuum," weakening the deterrent effect of IHL.[8]

The Martens Clause, a fundamental component of IHL, addresses scenarios not explicitly covered by treaties. It mandates that even without specific legal restrictions, civilians and combatants remain protected by "the principles of humanity and the dictates of public conscience." [9] This highlights that ethical considerations, not just the absence of a ban, must guide the development and deployment of LAWS. It calls for a comprehensive evaluation of the humanitarian and ethical implications of delegating lethal decisions to machines. [10]

A Refined Just War Framework for Analyzing Policy Decisions:

To address the ethical challenges, this paper adopts a framework based on a refined interpretation of Just War Theory (JWT). Traditional JWT is insufficient on its own, as it was conceived for human moral agents making decisions within the bounds of human cognition. Applying these principles directly to machine processes, which rely on algorithmic decision-making at a speed and scale that far exceeds human capabilities, is problematic. Therefore, this framework adapts JWT by incorporating the principles of "responsible innovation”.[11] This approach fosters a commitment to four integrated dimensions: anticipation of potential second- and third-order impacts; understanding the underlying purposes and motivations driving the technology; inclusion of diverse stakeholder perspectives; and responsiveness to new knowledge and societal values. This lens is essential for grappling with the unique challenges of algorithmic decision-making, ensuring the governance of LAWS is a social and ethical, not just technical, exercise.

Grounded in this approach, the framework first applies the principles of Jus in Bello, or justice in war, to evaluate the ethical conduct of LAWS during combat. This requires

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[6] Docherty, Bonnie. **New Weapons, Proven Precedent: Elements of and Models for a Legally Binding Instrument on Fully Autonomous Weapons**. Human Rights Watch, 2020. https://www.hrw.org/report/2020/08/10/new-weapons-proven-precedent/elements-and-models-legally-binding-instrument-fully

[7] Trumbull IV, Charles P. "Autonomous Weapons: How Existing Law Can Regulate Future Weapons." *Emory International Law Review* 34, no. 2 (2020): 560

[8] Matthias, Andreas. "The Responsibility Gap: Ascribing Responsibility for the Actions of Learning Automata." *Ethics and Information Technology* 6, no. 3 (2004): 175-183

[9] Kiaklayeh, Mahshid Talebian. "International Humanitarian Law and Artificial Intelligence: A Canadian Perspective." 2022. https://core.ac.uk/download/541307011.pdf

[10] *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), June 8, 1977, 1125 U.N.T.S. 3, https://www.ohchr.org/en/instruments-mechanisms/instruments/protocol-additional-geneva-conventions-12-august-1949-and*

[11] Stilgoe, Jack, Owen, Richard, and Macnaghten, Phil. “Developing a Framework for Responsbile Innovation”, Research Policy 42, no 9. P 1568-1580. https://doi.org/10.1016/j.respol.2013.05.008

assessing whether weapon systems can reliably uphold the principle of discrimination by distinguishing between combatants and non-combatants. Furthermore, systems must be capable of weighing proportionality by balancing the anticipated military advantage against potential civilian harm. Finally, the principle of necessity questions whether the use of LAWS is essential to achieving a military objective when less harmful alternatives are available.

The framework also extends to *Jus Post Bellum*, or justice *after* war, to evaluate the long-term consequences of deploying LAWS. This analysis considers whether the design of LAWS facilitates or impedes accountability and whether responsibility for its deployment can be clearly assigned. It also demands a thorough consideration of the potential long-term impacts of their widespread use, such as regional stability or reducing the threshold for war.

Finally, the framework incorporates an additional lens of Responsible Innovation to address the unique challenges of advanced technology. This lens mandates transparency in a system's capabilities, limitations, and decision-making processes. [12] It requires that a system's actions be interpretable to human operators to enable effective human oversight, which necessitates robust mechanisms for observation, intervention, and direction. The framework also applies the precautionary principle, ensuring that LAWS are developed to proactively minimize unintended harm. [13]

This adapted JWT framework serves as a comprehensive tool for assessing the ethical permissibility of LAWS. It moves beyond simply applying existing rules to new technology and acknowledges the need for a structure that addresses the challenges of autonomy and algorithmic decision-making. Its application to the following case studies will provide practical insights for policy development.[14]

Case Study: Unrestricted Submarine Warfare – A Precedent in the Absence of Control

The concept of autonomous weapons evokes concern about delegating lethal decision-making to machines. To understand the policy debates around LAWS, it is essential to examine historical precedents where technological advancements outpaced ethical and legal frameworks. During World War I, unrestricted submarine warfare illustrated the dangers of deploying a novel weapon system without robust international consensus and meaningful human control.

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[12] Räuker, Tilman, Anson Ho, Stephen Casper, and Dylan Hadfield-Menell. "Toward Transparent AI: A Survey on Interpreting the Inner Structures of Deep Neural Networks." Cornell University, 18 August 2023, https://arxiv.org/pdf/2207.13243

[13] Sandin, Per. "Dimensions of the Precautionary Principle." *Human and Ecological Risk Assessment: An International Journal* 5, no. 5 (1999): 889-907

[14] Text generated by OpenAI's ChatGPT 4.0, prompted to "edit Just War Framework" section for grammar and clarity," March 1, 2025.

Background: The U-Boat and the Erosion of Restraint

At the start of World War I, submarines were new to naval arsenals. Initially, naval protocol required them to adhere to "cruiser rules," which mandated that warships stop and search merchant ships, ensuring the crew's safety before sinking them.[15]

Constrained by a crippling British naval blockade and the vulnerability of their submarines on the surface, Germany shifted tactics in February 1915.[16] It declared the waters around the British Isles a war zone and began sinking Allied merchant ships without warning—a significant departure from traditional norms.[17] This decision, driven by strategic necessity, had profound ethical implications. The submarines' technological limitations made precise target identification nearly impossible, increasing the risk to neutral and civilian ships.

The sinking of the Lusitania in May 1915, which resulted in over 1,100 civilian deaths, igniting worldwide condemnation. [18] The event demonstrated the submarines' inability to distinguish between military and civilian targets, breaching the *jus in bello* principle of discrimination and raising issues of proportionality. Despite the German Admiralty's claims of necessity, the international community widely denounced the practice as disproportionate and indiscriminate. [19]

Interwar Treaty Failures and Efforts at Regulation

In response to the *Lusitania* tragedy, the international community sought to regulate submarine warfare. However, the pre-war Hague Conventions struggled to address the challenges posed by submarines, hampered by vague definitions and weak enforcement. [20,21] Even after temporarily curtailing the practice, Germany resumed unrestricted submarine warfare in 1917 due to strategic pressures and the absence of an enforceable international agreement. This resumption contributed to the U.S. entering the war and, ultimately, to Germany's defeat.[22]

The Washington Naval Treaty of 1922 and the London Naval Treaty of 1930 sought to reassert "cruiser rules" and ban unrestricted attacks but faced challenges with ratification and enforcement.[23] The resurgence of unrestricted submarine tactics in World War II, particularly by the U.S. against Japan, underscored the fragility of these

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[15] Horčička, Václav. "Austria-Hungary, Unrestricted Submarine Warfare, and the United States' Entrance into the First World War." *The International History Review*, June 2012, Vol. 34, No. 2 (June 2012), pp. 245-269

[16] Scharre, Paul, and Megan Lamberth. "Artificial Intelligence and Arms Control." Center for a New American Security, 2005

[17] Steffen, Dirk. "The Holtzendorff Memorandum of 22 December 1916 and Germany's Declaration of Unrestricted U-Boat Warfare." *The Journal of Military History*, Vol. 68, No. 1 (Jan., 2004), pp. 215-224. https://www.jstor.org/stable/3397253

[18] Bailey, Thomas A., and Paul B. Ryan. *The Lusitania Disaster: An Episode in Modern Warfare and Diplomacy*. New York: Free Press, 2006.

[19] Offer, Avner. *The First World War: An Agrarian Interpretation*. Oxford: Clarendon Press, 1989. https://www.jstor.org/stable/3788766

"[20] Scharre, Paul, and Megan Lamberth. "Artificial Intelligence and Arms Control." Center for a New American Security, 2005, pg 30

[21] "Convention (IV) Respecting the Laws and Customs of War on Land and its Annex: Regulations Concerning the Laws and Customs of War on Land. The Hague, 18 October 1907," International Committee of the Red Cross, https://ihl-databases.icrc.org/ihl/INTRO/195

[22] May, Ernest R. *The World War and American Isolation, 1914-1917*. Cambridge, MA: Harvard University Press, 1959. https://www.cambridge.org/core/journals/american-political-science-review/article/abs/world-war-and-american-isolation-19141917-by-ernest-r-may-cambridge-mass-harvard-university-press-1959-pp-viii-482-750/40ACB5E825DA28E1972C8A4A9F83D175

[23] *Declaration concerning the Laws of Naval War*. London, February 26, 1909. https://ihl-databases.icrc.org/en/ihl-treaties/london-decl-1909

treaties and the difficulty of regulating new military technologies. [24] This shift by the U.S., initially a proponent of the regulations, highlighted the complexities of balancing military necessity with *jus in bello* principles during intense conflict.[25] It also emphasized how ethical standards can adapt to evolving technologies and strategies.

Analysis within the Just War Theory Framework

At the outset of World War I, international maritime law enforced "cruiser rules" which required warships to ensure the safety of merchant crews before sinking them. The introduction of submarines challenged these norms and stressed the concepts of discrimination and proportionality that were integrated in the existing rules.

From a Jus in Bello perspective, Germany's shift to unrestricted submarine warfare strained the principles of discrimination and proportionality. Constrained by a stringent British naval blockade, Germany justified its unrestricted submarine warfare on several grounds. It argued the policy was a necessary reprisal against the British blockade, which it viewed as a violation of international law. [26] The German command also deemed submarines a military necessity to counter the dominance of the British navy. [27,28] Furthermore, Germany implicitly invoked a fundamental change in circumstances, arguing the submarine's unique capabilities required a reinterpretation of existing laws, a rationale underscored by claims of self-defense against an existential threat. [29,30,31]

Viewed through the lens of Responsible Innovation, the German approach reveals failures in anticipation and oversight. The German leadership failed to anticipate the strategic second order effects of their new policy, primarily the entry of the United States into the war. Technology's capabilities for stealth and surprise outpaced the international community's mechanisms for human oversight and verification. This lack of transparency in submarine operations created an environment where violations of established norms were difficult to monitor or hold accountable. This highlighted the danger of deploying a novel weapon system without a framework that can keep pace with its effects.

Lessons Learned: The Perils of Ambiguity and Military Necessity.

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[24] Schaffer, Ronald. "American Military Ethics in World War II: The Bombing of German Civilians." *The Journal of American History* 67, no. 2 (1980): 318–34. https://doi.org/10.2307/1890411.

[25] Walsh, William R. "The Perfect Enemy." US Naval Institute, February 2015. https://www.usni.org/magazines/naval-history-magazine/2015/february/contact

[26] Bailey, Thomas A., and Paul B. Ryan. The Lusitania Disaster: An Episode in Modern Warfare and Diplomacy. New York: Free Press, 2006

[27] Simpson, Colin. The Lusitania. Boston: Little, Brown, 1972

[28] While Germany justified its actions by claiming the ship carried munitions, the incident highlighted the inherent indiscriminateness of unrestricted submarine warfare.

[29] D'Amato, Anthony A. The Concept of Custom in International Law. Ithaca: Cornell University Press, 1971

[30] *"Vienna Convention on the Law of Treaties, Article 62, May 23, 1969, 1155 U.N.T.S. 331."* *https://legal.un.org/ilc/texts/instruments/english/conventions/1_1_1969.pdf*

[31] The effective yet ambiguous Allied blockade saw Britain extending contraband definitions and enforcing a distant blockade, straying from traditional tactics. This drew protests from neutrals like the USA, which Britain ignored. (Offer, Avner. *The First World War: An Agrarian Interpretation*. Oxford: Clarendon Press, 1989.)

The history of unrestricted submarine warfare offers two critical warnings for the governance of LAWS: first, that the pressures of conflict can compel nations to abandon established norms in the name of military necessity, and second, that vague principles are insufficient to regulate transformative military technology.

The contrast between Germany in WWI and the U.S. in WWII illustrates the first point. While both nations violated international law, the key distinction lay in perceived proportionality; the U.S. campaign was more closely tied to military objectives, whereas Germany's was widely condemned as indiscriminate.[32] This nuance shows that even when rules are broken, the context and parameters of a technology's use heavily influence its perceived legitimacy. This historical precedent is a reminder that any nation developing LAWS will face immense pressure to deploy them with fewer restrictions against a peer adversary.

The failure of the interwar treaties, such as the London Naval Treaty, proves the second point. The inability of these agreements to regulate submarine warfare demonstrates that abstract principles are not enough. A lack of clear, operational definitions, effective accountability mechanisms, and transparency contributed directly to their failure.

The ultimate lesson for LAWS is therefore clear. To avoid repeating the tragic outcomes of the past, any practical framework must be exceptionally robust and unambiguous. It must precisely define permissible actions and establish verifiable constraints to ensure the distinction between a legitimate military action and an unlawful one is not lost in the pressures of war.[33]

Case Study 2: Land Mines – The Enduring Legacy of Indiscriminate Harm

The history of land mines, from battlefield tool to global humanitarian crisis, illustrates the ethical and humanitarian challenges of certain military technologies. Like unrestricted submarine warfare, land mines showcase the consequences of indiscriminate weapons that lack post-deployment control.[34]

Originally used in the 20th century as a cost-effective defense to control enemy movement, land mines became attractive to state and non-state actors for their simplicity and effectiveness. However, their inability to distinguish between combatants and non-combatants and their persistence long after conflicts end have led to extensive civilian casualties and long-term socioeconomic disruption. A land mine cannot distinguish between a soldier and a child.[35]

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[32] Blair, Clay. **Silent Victory: The U.S. Submarine War Against Japan**. Philadelphia: Lippincott, 1975. https://digital-commons.usnwc.edu/nwc-review/vol28/iss4/11/

[33] Text generated by OpenAI's ChatGPT 4.0, prompted to edit “Analysis within JWT” section for grammar and clarity," March 2, 2025.

[34] International Committee of the Red Cross (ICRC). **Anti-personnel Landmines: Friend or Foe? A Study of the Military Use and Effectiveness of Anti-personnel Mines**. Geneva: ICRC, 1996. https://www.icrc.org/sites/default/files/external/doc/en/assets/files/other/icrc_002_0654.pdf

[35] Human Rights Watch. *Landmines: A Deadly Legacy*. New York: Human Rights Watch, 1993. https://www.hrw.org/news/1993/10/01/landmines-deadly-legacy

Long-duration land mines fundamentally breach the *jus in bello* principles of discrimination and proportionality. Their indiscriminate nature means they pose a threat to anyone, regardless of combatant status, often with a disproportionate impact relative to their military utility. The widespread use of land mines, especially in areas with internal conflicts and weak governance, has magnified their humanitarian impact and prompted a significant international response.[36]

The Ottawa Treaty: A Partial Victory and Enduring Challenges

The international community's response to the landmine crisis evolved gradually. Initial efforts, like the 1980 Convention on Certain Conventional Weapons (CCW) and its Amended Protocol II, were largely insufficient. They aimed to regulate landmine use but did not prohibit anti-personnel mines outright or include robust enforcement mechanisms.[37]

The escalating humanitarian crisis, publicized by the International Campaign to Ban Landmines (ICBL), led to a more radical approach. Since 1997, 164 nations have adopted the Ottawa Treaty, which bans the use, stockpiling, production, and transfer of anti-personnel mines. This landmark treaty led to the destruction of millions of stockpiled mines.[38] Despite these achievements, the treaty is limited by the non-ratification of key military powers like the United States, Russia, and China. They cite operational needs and security concerns, highlighting the ongoing tension between military necessity and humanitarian imperatives.

The Positions of Major Powers: A Balancing Act

The non-adherence of these major powers highlights the enduring tension between humanitarian concerns and perceived military necessity. The United States, for instance, cites the strategic necessity of landmines to deter North Korean advances in the Korean Peninsula's Demilitarized Zone. While generally adhering to the treaty's principles outside of Korea and contributing to mine clearance, the U.S. maintains a stockpile of "mixed" mine systems and reserves the right to use them in certain situations. [39] Similarly, Russia argues against a complete ban, pointing to its extensive stockpiles, the high cost of destruction, and a lack of tactical alternatives. Despite expressing support for the treaty's humanitarian goals, Russia considers a total ban premature. [40] Meanwhile, China, a major producer and exporter, emphasizes the utility

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[36] Williams, Jody. "The International Campaign to Ban Landmines – A Model for Disarmament Initiatives." The Nobel Prize, September 3, 1999. https://www.nobelprize.org/prizes/peace/1997/article/

[37] "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, October 10, 1980." https://ihl-databases.icrc.org/en/ihl-treaties/ccwc-1980

[38] "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, September 18, 1997." https://www.un.org/disarmament/convarms/apmine/

[39] White House. "U.S. Policy on Anti-Personnel Landmines". White House Press Office, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/06/21/fact-sheet-changes-to-u-s-anti-personnel-landmine-policy/

[40] Hubert, Don. **"The Landmine Ban: A Case Study in Humanitarian Advocacy."** Occasional Paper #42, The Thomas J. Watson Jr. Institute for International Studies, Brown University, 2000, 38. https://ciaotest.cc.columbia.edu/coursepack/cp06/cp06a.pdf

of landmines for its extensive border defense while also expressing sympathy for the treaty's humanitarian objectives. [41]

Analysis within the Just War Theory Framework:

Historically, landmines were valued for their defensive and protective capabilities. However, their indiscriminate effects challenge this justification. The principles of military necessity and discrimination must be carefully weighed against the humanitarian consequences.[42 ,43, 44] Anti-personnel mines particularly violate the principle of distinction because they cannot differentiate between combatants and civilians. Once activated, they pose a long-term threat to anyone in the area. The CCW's Protocol II seeks to mitigate this by regulating their placement and requiring marking and self-deactivation mechanisms.[45]

From a *jus post bellum* perspective, landmines raise significant questions of **proportionality**. While they may provide a military advantage, the prolonged harm to civilians and the impediment to post-conflict recovery often surpass the immediate tactical benefits.[46] Additionally, the high dud rate of cluster munitions, which function similarly to landmines, leaves behind unexploded ordnance that can harm civilians long after conflicts have ended.[47]

Utilizing a responsible innovation perspective, the landmine crisis represents a failure of anticipation and inclusion. Military planners and designers focused on the immediate tactical benefits of landmines without anticipating their long-term consequences for civilian populations. The development and deployment process lacked inclusion, as the perspectives of non-military stakeholders, such as the farmers and civilians living in post conflict zones, were not considered. It was only after decades of harm that a global movement prompted a responsive international ban. This reactive success emphasizes the need for proactive innovation that integrates these concerns from the beginning.

Lessons for LAWS Governance:

The landmine crisis offers crucial lessons for governing LAWS, particularly regarding weapons that operate without continuous human control. The enduring legacy of landmines is a stark warning against 'fire-and-forget' weapons that escape human control post-deployment. This historical lesson directly informs the need for strict

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[41] Human Rights Watch. China Should Back Words with Action on Landmine Ban. 2006. https://www.hrw.org/news/2006/11/08/china-should-back-words-action-landmine-ban

[42] Plaw, Avery, and Matthew Fricker. "Practice Makes Perfect?: The Changing Civilian Toll of CIA Drone Strikes in Pakistan." Terrorism Research Initiative, December 2011, 55

[43] This humanitarian principle is clearly articulated in Article 57 of the First Additional Protocol to the Geneva Conventions (1977). It requires that parties in conflict avoid launching attacks that are expected to cause incidental civilian casualties, injuries, or damage to civilian objects if the harm would be excessive compared to the anticipated direct military advantage. (Plaw, Avery)

[44] Trumbull IV, Charles P. "Autonomous Weapons: How Existing Law Can Regulate Future Weapons." *Emory International Law Review* 34 (2020): 556

[45] Scharre, Paul, and Megan Lamberth. "**Artificial Intelligence and Arms Control**." Center For a New American Security, 38.

[46] Scharre, Paul, and Megan Lamberth. "Artificial Intelligence and Arms Control." Center for a New American Security, 40. Artificial Intelligence and Arms Control | CNAS

[47] Rosert, Elvira, and Frank Sauer. "How (Not) to Stop the Killer Robots: A Comparative Analysis of Humanitarian Disarmament Campaign Strategies." Contemporary Security Policy, May 30, 2020. https://doi.org/10.1080/13523260.2020.1771508

temporal and geographic constraints and robust fail-safe mechanisms in any autonomous system.

Just as landmines inflict indiscriminate harm long after conflicts end, LAWS without these safeguards could pose an unacceptable risk, creating severe *jus post bellum* challenges like lasting civilian casualties and hindered development. The history of landmines, therefore, underscores the imperative for proactive, rather than reactive, policymaking for military technology. Effective governance for LAWS must incorporate lessons from this crisis to prevent indiscriminate harm and ensure accountability.

Drone Signature Strikes:

Opacity, Accountability, and the Precedent of Delegated Lethal Authority

The use of drone strikes, especially "signature strikes," provides a critical case study in the evolving relationship between technology, warfare, and the delegation of lethal authority.[48] While distinct from fully autonomous weapon systems, signature strikes highlight key challenges pertinent to the LAWS debate: reduced human oversight, difficulty in ensuring accountability, and ethical concerns about algorithm-based targeting decisions.

Background: The Rise of Drone Warfare and Signature Strikes

Since the early 2000s, the use of Unmanned Aerial Vehicles (UAVs) for targeted killings has surged in counterterrorism operations. Initially targeting high-value individuals, strikes expanded to include "signature strikes" that target individuals based on behavioral patterns indicative of militant activity, even without knowing their identity. [49] This shift marks a significant delegation of authority to algorithmic data analysis, raising issues about the validity of "signatures," potential misidentification, civilian harm, and erosion of due process.[50]

The Ethical and Legal Challenges:

Signature strikes raise several ethical and legal concerns that mirror issues in the LAWS debate. Relying on behavioral patterns increases the risk of targeting non-combatants, violating the *jus in bello* principle of discrimination.[51] Additionally, determining the proportionality of these strikes is complicated when targets are selected

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[48] Becker, Jo, and Scott Shane. "**Secret 'Kill List' Proves a Test of Obama's Principles and Will**." *The New York Times*, May 29, 2012. https://www.nytimes.com/2012/05/29/world/obamas-leadership-in-war-on-al-qaeda.html

[49] *Bergen, Peter, and Jennifer Rowland. "Decade of the Drone." New America, February 24, 2013. https://www.newamerica.org/international-security/reports/decade-drone/*

[50] *Wall, Tyler, and William Glaberson. "A Tangle of Ethics and Warfare." The New York Times, July 16, 2012. https://www.nytimes.com/2012/07/17/us/a-tangle-of-ethics-and-warfare.html*

[51] *The Bureau of Investigative Journalism, Drone Warfare. https://www.thebureauinvestigates.com/projects/drone-war*

based on potentially flawed data. [52] The classified nature of signature strikes also contribute to a "responsibility gap," making it difficult to hold anyone accountable for errors or unlawful actions. [53]

Policy Responses and the Obama Administration's PPG-28:

The Obama administration, which expanded drone use, introduced guidelines to enhance oversight and reduce civilian casualties. Presidential Policy Guidance (PPG-28) and a 2016 Executive Order aimed to increase transparency by setting a "near certainty" standard for avoiding civilian harm and requiring high-level approval for strikes outside of active war zones.[54,55,56] These policies also mandated annual reporting of drone strike data, though the reports were criticized for undercounting civilian casualties. [57] Critics argue these measures were insufficient and vulnerable to broad interpretation. The Trump administration later relaxed some of these restrictions, lowering authorization thresholds and reducing transparency.

Critics of signature strikes argue they erode human control over lethal decisions by relying on behavior patterns rather than confirmed identities, thus increasing the risk of unintended consequences. Using algorithmic calculations instead of positive identification highlights a potential responsibility gap, creating questions about who is accountable for civilian casualties. [58] The argument against signature strikes, therefore, focuses on the erosion of human control and the increased risk of unintended consequences. Using patterns of behavior as justification for a lethal strike, rather than positive identification, reduces human judgment in targeting decisions. [59,60]

Analysis of Signature Strikes

Signature strikes present complex ethical and legal challenges under international law, revolving around the *jus in bello* principles of discrimination, proportionality, and military necessity.

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[52] *Scharre, Paul. Army of None: Autonomous Weapons and the Future of War. New York: W. W. Norton & Company, 2018.*

[53] *Gregory, John. "The Bureau of Investigative Journalism's drones project: monitoring covert US air strikes." Journal of War & Culture Studies 8, no. 4 (2015): 323-341.*

[54] White House" Presidential Policy Guidance – Procedures for Approving Direct Action Against Terrorist Targets Located Outside the United States and Areas of Active Hostilities", White House, 22 Mary, 2013, https://www.aclu.org/sites/default/files/field_document/presidential_policy_guidance.pdf

[55] White House "Executive Order – U.S. Policy on Pre- and Post-Strike Measures to Address Civilian Casualties in U.S. Operations Involiving the Use of Force", White House Office of the Press Secretary, 1 July, 2016, https://obamawhitehouse.archives.gov/the-press-office/2016/07/01/executive-order-United-states-policy-pre-and-post-strike-measures

[56] White House "PPD-28; Signal Intelligence Activities", White House Office of the Press Secretary, 17 January, 2014, https://obamawhitehouse.archives.gov/the-press-office/2014/01/17/presidential-policy-directive-signals-intelligence-activities

[57] White House" Presidential Policy Guidance – Procedures for Approving Direct Action Against Terrorist Targets Located Outside the United States and Areas of Active Hostilities", White House, 22 Mary, 2013, https://www.aclu.org/sites/default/files/field_document/presidential_policy_guidance.pdf

[58] *Savage, Charlie. "Trump Poised to Drop Some Limits on Drone Strikes and Commando Raids." The New York Times, September 21, 2017. https://www.nytimes.com/2017/09/21/us/politics/trump-drone-strikes-commando-raids-rules.html*

[59] Byman, Daniel "Why Drones Work" Foreign Affairs, July/August, 2013 https://www.jstor.org/stable/23526906?seq=1

[60] Manjikan, Mary "A Typology of Arguments about Drone Ethics", Strategic Studies Institute, 2017, http://www.jstor.com/stable/resrep11357

From a *jus in bello* perspective, these strikes present complex challenges. The principle of discrimination, essential for distinguishing between combatants and non-combatants, is significantly tested. Relying on behavioral patterns increases the risk of misidentifying civilians and complicates determining direct participation in hostilities. This uncertainty directly impacts the assessment of proportionality, as it is problematic for commanders to evaluate military advantage against potential harm to civilians when the target's identity is not confirmed. [61] Finally, while strikes might be justified under military necessity to preempt threats, the broad application of this rationale can dilute the principle's strictness.

Under the principles of *Jus Post Bellum*, signature strikes present significant challenges to accountability and responsibility. These challenges are most acute when operations result in civilian casualties, as the complex decision-making chain complicates determining who is responsible—the operator, commander, analyst, or political leader. This "responsibility gap" is exacerbated by the lack of transparency in the targeting process and the classified criteria used to define 'signatures'.[62]

From a responsible innovation perspective, signature strikes highlight the critical need for greater transparency and robust human oversight in both the technological process and the chain of command. There is a pressing need for more clarity on the criteria for defining "signatures" and the decision-making processes themselves. Establishing transparent, independent oversight mechanisms is essential to ensure accountability and adherence to legal standards. [63] This need extends to the delegation of authority, as concerns arise when authorization for strikes is delegated to lower levels without stringent control.

Conclusion:

The use of drone signature strikes provides a critical modern lesson for the governance of LAWS, particularly concerning the challenges of accountability and transparency when lethal authority is delegated to algorithms. The reliance on opaque "signatures" rather than positive identification erodes meaningful human control and creates a significant "responsibility gap".

This practice is a stark warning against "black box" systems where the reasoning behind a targeting decision is unclear to the human commander. This lesson directly informs the need for transparency through Explainable AI (XAI) and robust auditability mechanisms in any autonomous system. To avoid the accountability vacuums and

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[61] Lewis, John "The Case for Regulating Fully Autonomous Weapons" The Yale Law Journal, vol 124,No4, 2015, p 1311. https://www.jstor.org/stable/43617052

[62] Scharre, Paul, and Horowitz, Michael "Meaningful Human Control in Weapon Systems", CNAS, March 2015 https://www.cnas.org/publications/reports/meaningful-human-control-in-weapon-systems-a-primer

[63] Keene, Shima "Lethal and Legal? The Ethics of Drone Strikes", Strategic Studies Institute, 2015, pg 20, http://www.jstor.com/stable/resrep11765

ethical ambiguity inherent in signature strikes, any framework for LAWS must prioritize system interpretability and create a clear, auditable trail for every engagement

A LAWS Framework– Operationalizing Control and Defining Boundaries

Building upon these historical lessons, this section proposes elements of a proactive policy framework for governing LAWS. Proactive governance involves anticipating future challenges to establish policies that prevent problems before they occur, rather than reacting to crises after the fact. The central focus is operationalizing meaningful human control (MHC) to ensure human judgment remains the principal factor in decisions involving lethal force.

Graduated Autonomy and Precise Definitions:

The traditional "human-in-the-loop" versus "human-out-of-the-loop" dichotomy fails to capture the complexities of LAWS. A more nuanced approach is required, one that recognizes a spectrum of autonomy and clearly defines categories for systems like UAVs. This graduated framework begins with Human-Supervised UAVs, which have autonomous capabilities but require explicit human authorization for each engagement, representing the lowest-risk and preferred approach. Further along the spectrum are Semi-autonomous UAVs, authorized to engage targets within pre-defined parameters set by human operators who maintain oversight. This category requires clear, restrictive, and digitally encoded rules of engagement.

At the highest level are Fully Autonomous UAVs, which select and engage targets without further human input after activation. [64] Given the significant risks, there should be a strong presumption against their use except under the most strictly defined conditions. This graduated approach provides commanders with flexibility while managing the risks associated with increasing levels of autonomy. It also acknowledges that risk varies by function; autonomous navigation is a relatively low risk, while target selection and engagement demand the highest levels of human oversight to ensure a clear understanding of the AI's decision-making process.

Meaningful Human Control (MHC):

Meaningful Human Control (MHC) is a multidimensional concept essential for the ethical and legal operation of LAWS. It begins with situational awareness, requiring that commanders and operators thoroughly understand the operational environment and the system's capabilities and limitations. This is complemented by interpretability; the

[64] Griffith, Nia. Debate at the House of Commons, June 17, 2013. https://www.theyworkforyou.com/debates/?id=2013-06-17a.729.0

decision-making processes of the LAWS must be transparent to the operators. The use of "black box" AI systems, where the rationale for an action is unclear, fundamentally undermines MHC, making investment in Explainable AI (XAI) crucial for effective management.[65]

Beyond understanding, MHC requires a robust intervention capability, meaning the system must be designed to allow timely and effective human action, such as overriding decisions or aborting missions. This control is predicated on the system's predictability and reliability across a range of scenarios. Ultimately, MHC is grounded in accountability, which necessitates clear command structures to ensure humans remain responsible for the deployment and actions of LAWS in accordance with the Law of Armed Conflict.

Operational Context: A Defining Variable

The permissible level of autonomy for LAWS is not static; it depends entirely on the specific operational context. Key factors include the type of conflict, as constraints vary significantly between counterterrorism operations and large-scale combat operations (LSCO). LSCO, with clearer combatant distinctions, may justify greater autonomy, whereas operations in densely populated urban areas demand stricter human oversight.

The geographic environment also significantly impacts risk. Operations in remote deserts or open seas pose different challenges than those in crowded urban centers, where the risk of collateral damage is markedly higher. Finally, the type of target is a crucial variable. A system tasked with engaging high-value military assets involves different ethical and operational considerations than one used for targeting individuals or employing signature strikes.

Commander Responsibility: The Unwavering Principle

The principle of commander responsibility must be the bedrock of any LAWS framework. Commanders who authorize the deployment of LAWS bear the ultimate accountability for ensuring compliance with *jus in bello* principles. This is not simply a matter of legal formality but a fundamental ethical obligation. [66]

This obligation encompasses the core principles of *jus in bello*. It begins with discrimination; based on all available intelligence the commander must be satisfied that the LAWS can reliably distinguish between combatants and non-combatants within its authorized operational parameters. [67] Furthermore, the commander must rigorously assess proportionality, carefully weighing the anticipated military advantage against the

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[65] *Gunning, David, and David Aha. "DARPA's explainable artificial intelligence (XAI) program." AI Magazine 40, no. 2 (2019): 44-58. https://ojs.aaai.org/aimagazine/index.php/aimagazine/article/view/2850*

[66] Alexander, Jonathan, "LAWS and the Potential for Moral Injury", Salve Regina University, October, 2024, pg 190 https://digitalcommons.salve.edu/doctoral_dissertations/206/

[67] Alexander, Jonathan, "LAWS and the Potential for Moral Injury", Salve Regina University, October, 2024, pg. 200 https://digitalcommons.salve.edu/doctoral_dissertations/206/

risk of civilian harm. [68] Finally, the commander must determine that using the LAWS is a military necessity to achieve a legitimate objective and that less harmful alternatives are not reasonably available.

A commander cannot delegate these responsibilities to a machine. While LAWS may assist in decision-making, the ultimate judgment and accountability rest with the human commander.

Addressing Operations in Communications Denied Environments:

The operation of LAWS in communication-denied environment presents an acute challenge to MHC and is a scenario in which full autonomy may be most desired. While a complete loss of communication might generally require a default to non-engagement, strictly limited autonomy may be permissible under certain circumstances, provided several safeguards are in place.

Autonomy must be limited to specific, pre-programmed contingencies that have been rigorously vetted by commanders before deployment. This operational envelope must be limited by strict geographic and temporal constraints to avoid extended "fire-and-forget" scenarios. [69] The system must also be equipped with robust fail-safe mechanisms, such as return-to-base protocols or self-deactivation capabilities. Crucially, even within these constraints, the system's targeting directives must remain compliant with *jus in bello* principles, with the commander bearing an increased responsibility for ensuring compliance.

International Enforcement: From Principles to Practice

A robust framework for LAWS must include international enforcement mechanisms to ensure adherence to established standards. To be effective, this framework must prioritize transparency, auditability, and interpretability. Drawing from the lessons of submarines and landmines, states must be willing to disclose their LAWS programs, including system types and intended uses. Transparency is crucial for building international trust and enabling oversight. This must extend to the operational level through auditability. The challenges in assigning responsibility for signature strikes underscore the need for systems that can meticulously document their decision-making processes. This "audit trail" is vital for post-incident analysis and ensuring accountability. Finally, effective enforcement requires interpretability, ensuring the system's decision-making logic is comprehensible to commanders, which is critical for both operational trust and legal accountability.

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[68] "Autonomous Weapons – How Existing Law Can Regulate Future Weapons", Emory International Law Review, Vol 34, Issue 2, 2020, https://scholarlycommons.law.emory.edu/eilr/vol34/iss2/2, 559

[69] Scharre, Paul "Autonomous Weapons and Human Control", Center for New American Security, 2016, http://www.jstor.com/stable/resrep06309 pg. 7

Bridging the Gap: Existing DoW Policy and the future of LAWS

The current U.S. Department of War policy framework for autonomous weapon systems, outlined in the DoW Law of War Manual and DoDI 3000.09, provides foundational guidelines for their regulation. This framework is necessary but insufficient. DoDI 3000.09 provides a crucial starting point and a permissive framework for innovation, requiring senior review and mandating "appropriate levels of human judgment over the use of force". However, the ambiguity within these guidelines creates an unacceptable level of strategic and ethical risk, a danger highlighted by historical cases where new technologies outpaced vague regulations. The more specific recommendations proposed in this paper are designed to mitigate this risk by transforming broad principles into clear, actionable standards.

The Law of War Manual emphasizes jus in bello principles and underscores the commander's responsibility to ensure the lawful use of force.[70] DoDI 3000.09 extends this by mandating senior review and requiring the system be "readily understandable by trained operators."[71] However, as experiences with signature strikes demonstrate, these general guidelines do not suffice to avoid the ethical and legal issues inherent in delegating lethal decision-making to machines.

The main distinction between the current DoW policy and this paper's recommendations lies in the specificity and depth of requirements for human control and system transparency. While DoDI 3000.09 calls for "appropriate levels of human judgment," it does not precisely define Meaningful Human Control (MHC).[72] In contrast, this paper defines MHC as encompassing situational awareness, the capacity for timely human intervention, and critically, system interpretability. Although DoDI 3000.09 mandates systems be "readily understandable," it primarily addresses operational proficiency rather than transparency in the system's decision-making processes.[73] This paper advocates for Explainable AI (XAI) to ensure transparency in the reasoning behind a system's decisions, a crucial aspect not adequately covered in current policy.

Additionally, DoDI 3000.09 does not explicitly require a graduated autonomy approach, nor does it specify guidelines for operating in communication-denied environments beyond broad parameters. By providing recommendations for a formalized MHC definition, explicit XAI requirements, and a graduated autonomy framework, this paper aims to fill these gaps, transforming the current framework from one that sets general principles to one that offers concrete, actionable guidance. Enhancing governance

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[70] Department of Defense, *Autonomy in Weapon Systems*, DoDD 3000.09 (Washington, DC: Department of Defense, January 25, 2023) https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf

[71] U.S. Department of Defense, *Law of War Manual* (Washington, DC: Office of General Counsel, Department of Defense, December 2016, updated 2023), 4. https://media.defense.gov/2023/Jul/31/2003271432/-1/-1/0/DOD-LAW-OF-WAR-MANUAL-JUNE-2015-UPDATED-JULY%202023.PDF

[72] Department of Defense, *Autonomy in Weapon Systems*, DoDD 3000.09 (Washington, DC: Department of Defense, January 25, 2023), 6. https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf

[73] Department of Defense, *Autonomy in Weapon Systems*, DoDD 3000.09 (Washington, DC: Department of Defense, January 25, 2023), 11. https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf

based on these recommendations is critical. By refining existing DoW policy with specific, actionable steps, the Department of War can proactively ensure that LAWS operate in alignment with ethical principles, legal obligations, and the fundamental need for meaningful human control. The next section addresses key counterarguments.

Addressing Key Counterarguments: Military Effectiveness, Technology, and Existing Law

The proposed framework for governing LAWS prioritizes human control, transparency, and international cooperation. However, several key counterarguments frequently arise.

The "Military Disadvantage" Argument:

- **Objection:** Restricting LAWS development, especially fully autonomous systems, puts the U.S. at a disadvantage against adversaries who may not adopt similar constraints, ceding a crucial technological edge. [74]
- **Response:** This argument oversimplifies military advantage and overlooks significant strategic risks. A race to the bottom on autonomy without ethical guardrails leads to unpredictable, brittle, and easily spoofed systems that could become a source of disadvantage. Unfettered autonomy could increase the likelihood of unintended escalation and spur a destabilizing global arms race.[75,76,77]

The most effective and resilient military AI will be the one that optimizes human-machine teaming, which requires the very trust and transparency your framework advocates. The proposed framework does *not* advocate for a ban but for *regulated* autonomy that allows for potential benefits while emphasizing meaningful human control. This approach seeks a *sustainable* advantage, not a momentary and risky one.

The "Only humans can ethically make a decision to kill" Argument:

- **Objection:** Critics argue that only humans can make IHL judgments, claiming technology limits LAWS' ability to discriminate, assess proportionality, and ensure accountability. They maintain that delegating these decisions to machines is inherently illegal because a machine cannot adequately differentiate between combatants and civilians or accurately weigh military benefits against potential harm. [78]

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[74] Robert O. Work, "The Third U.S. Offset Strategy and Its Implications for Partners and Allies" (speech, Washington, D.C., January 28, 2015), https://www.defense.gov/News/Speeches/Speech/Article/606641/the-third-us-offset-strategy-and-its-implications-for-partners-and-allies/.

[75] *Scharre, Paul. Army of None: Autonomous Weapons and the Future of War. New York: W. W. Norton & Company, 2018;*

[76] *Horowitz, Michael C. "Artificial Intelligence, International Competition, and the Balance of Power." Texas National Security Review 1, no. 3 (2018): 36-57 https://tnsr.org/2018/05/artificial-intelligence-international-competition-and-the-balance-of-power/*

[77] *Altmann, Jürgen, and Frank Sauer. 2017. "Autonomous Weapon Systems and Strategic Stability." Survival 59 (5): 117–42. doi:10.1080/00396338.2017.1375263.*

[78] Rosert, Elvira & Sauer, Frank "How(Not) to Stop Killer Robots: A Comparative analysis of humanitarian disarmament campaign strategies" Contemporary Security Policy, 30 May 2020. https://doi.org/10.1080/13523260.2020.1771508

- **Response:** The development path indicates autonomous processes could sometimes manage complex information more efficiently than humans.[79] Despite lacking human empathy, automated functions like target identification might reduce collateral damage and handle combat decisions more ethically than some human operators. [80] By mandating these ethical considerations be part of development, the DoW can mitigate the risk of increased levels of autonomy in a transparent manner.

The framework incorporates technological safeguards but insists on complementary ethical and legal constraints, ensuring human responsibility for the use of force.

3. The "LAWS will lower the threshold for war" Argument:

- **Objection:** The argument suggests LAWS could lower the threshold for war by reducing casualty risks, potentially leading to more frequent conflicts. Political leaders might feel less reluctant to use force if they don't face the consequences of soldier and civilian casualties. [81]
- **Response:** While some analysts warn that diminished risks could prompt states to engage in warfare more readily, this concern extends to any technology that lessens soldiers' exposure to violence. This worry may be overstated; despite an increase in UAV strikes, there has not been a corresponding rise in broader conflicts. If the use of force is justified and LAWS can make operations more precise and humane, their use is arguably permissible.[82]

The proposed framework seeks to ensure that enduring ethical principles are upheld in the face of evolving technology. Existing Law of Armed Conflict constitutes the minimum ethical standard, not the maximum.

Conclusion: A Call for Proactive Governance and Continued Dialogue

This analysis shows that the challenges of LAWS echo reoccurring challenges in the history of military technology. The case studies highlight the dangers of unrestrained technological development: the erosion of human control, challenges in ensuring discrimination and proportionality, and difficulties in attributing responsibility. These historical examples provide a foundation for developing a proactive policy framework for LAWS.

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[79] Caton, Jeffrey "Autonomous Weapon Systems: A brief survey of Developmental, Operational, Legal and Ethical Issues" Strategic Studies Institute, 2015, http://www.jstor.com/stable/resrep11227

[80] Trumbull, Charles P. "Autonomous Weapons: How Existing Law can Regulate Future Weapons" Emory International Law Review, Vol 34, Issue 2, 2020, P. 547 https://scholarlycommons.law.emory.edu/eilr/vol34/iss2/2

[81] Rosert, Elvira & Sauer, Frank "How(Not) to Stop Killer Robots: A Comparative analysis of humanitarian disarmament campaign strategies" Contemporary Security Policy, 30 May 2020. https://doi.org/10.1080/13523260.2020.1771508

[82] Pfaff, Anthony "The Ethics of Acquiring Disruptive Technologies, Artificial Intelligence, Autonomous Weapons, and Decision Support Systems" PRISM, Vol 8, No 3, 2019, pg 139, https://www.jstor.org/stable/10.2307/26864280

The proposed framework, built upon a modified interpretation of Just War Theory and the principles of responsible innovation, emphasizes Meaningful Human Control as the cornerstone of ethical LAWS development. Graduated autonomy, with increasingly rigorous controls as autonomy increases, is essential. The responsibility of the commander remains paramount; they must be accountable for ensuring compliance with *jus in bello* principles, regardless of the level of autonomy delegated to a LAWS. To enable this, it is necessary to develop and require auditability and interpretability standards that are crucial for oversight in combat.

By prioritizing human control, transparency, and accountability, the U.S. can navigate this technological transition responsibly. The ultimate goal is to harness the potential benefits of emerging technologies while mitigating their inherent risks, ensuring the use of force remains firmly aligned with ethical principles and the enduring rule of law. This is more than a policy or technological choice; it is a decision about the future character of warfare and America's role in shaping it. Failure to act proactively risks a future where unaccountable algorithms escalate conflicts, the moral and legal foundations of warfare erode, and the very nature of human command is rendered obsolete. By leading this effort, the United States can champion a future where technology serves, rather than subverts, human judgment, ensuring that even the most advanced weapons remain instruments of a just and responsible peace.[83]

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[83] The following are recommended areas of further study.

The Psychological Impact of LAWS on Operators and Commanders: Research is needed to understand the potential for moral injury, burnout, and other psychological effects.

The Dynamics of Human-Machine Teaming: Explore optimal models for human-machine collaboration in the context of LAWS, maximizing the strengths of human judgment and AI.

Verification Technologies and Methodologies: Develop practical and reliable methods for verifying compliance with international agreements on LAWS, addressing the challenges of inspecting software and algorithms.

The Long-Term Strategic Implications of LAWS Proliferation: Analyze the potential impact of widespread LAWS deployment on international stability, arms races, and the likelihood of conflict.

The Ethical and Legal Implications of Artificial General Intelligence (AGI) in Military Applications: While this paper focuses on narrow AI, ongoing research and dialogue on the potential risks of AGI are essential.

Algorithmic Bias: LAWS, trained on data, are susceptible to reflecting and amplifying existing societal biases. These biases could lead to discriminatory targeting, disproportionately harming certain groups and violating the *jus in bello* principle of discrimination.