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Lethal Autonomous Weapon Systems (LAWS): Legal and Operational Considerations, Constraints, and Concerns

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ABSTRACT

This paper explores the legal and operational considerations, constraints, and concerns of Lethal Autonomous Weapon Systems (LAWS). The author does not advocate the banning of these weapon systems as have some treaty members of the United Nations Convention on Certain Conventional Weapons, some members of European Parliament, some human rights organizations, several countries, scientists, and academics. Rather, it takes a proactive approach and attempts to create an actionable framework for legal and operational considerations. The analysis suggests possible modes of operation to help all those involved in the approval process and use of LAWS. Furthermore, current weapons review processes are examined, and some suggestions are provided on how to improve them as an artificial intelligence / machine learning weapon system evolves. The paper provides recommendations for operational modes to assist both the warfighter and the civilian authorities in managing LAWS under international law, the law of armed conflict and national laws. Finally, a list of six archetypes is presented summarizing a way to mitigate the considerations, constraints, and concerns of LAWS.

KEYWORDS

archetype · chain of command · chain of responsibility · international law · law enforcement · legal mode · lethal autonomous weapon system · machine learning · mode · operational mode · targeting cycle

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INTRODUCTION

Despite the growth in the development and proliferation of Lethal Autonomous Weapon Systems (LAWS) over the last few years, a lack of clarity exists in international law and norms guiding their development and use. LAWS create new legal and operational considerations, constraints, and concerns. This paper proposes legal and operational modes for developing and employing LAWS. It does not attempt to propose a comprehensive solution, rather it provides paths to employ legal and operational modes for LAWS. First, some terminology will be provided to assist in understanding the various terms used. Once discussing the legal framework and legal constraints of LAWS, we will explore the operational implication of LAWS. This is not an exhaustive analysis, rather it is illustrative of the challenges with new weapon systems. Finally, it concludes with a proposed solution to the legal challenges of the operational uses of LAWS by proposing to build into LAWS different mode settings aligned with relevant international law to mitigate the legal concerns that could arise from their use and also operational modes that enable military objectives to be met.

TERMINOLOGY

A lethal autonomous weapon system, sometimes referred to as an autonomous weapon system (lethal is redundant), has several definitions (Lailari, 2021, June 27). The (ICRC) definition of autonomous weapon systems is "Any weapon system with autonomy in its critical functions. That is, a weapon system that can select (i.e. search for or detect, identify, track, select) and attack (i.e. use force against, neutralize, damage or destroy) targets without human intervention" (Autonomous Weapon Systems, 2016) will be used. Autonomous systems are usually described as having a human-in-the loop, human-on-the-loop and/or human-out-of-the-loop capability. The US Department of Defense (DOD) has three categories of autonomous weapons systems: (1) semi-autonomous weapon system, (2) human -supervised autonomous weapon system, and (3) autonomous weapon system (DOD Directive 3000.09, 2017). These definitions correspond to the following: human-in-the-loop weapons are semi-autonomous weapon systems; human-on-the-loop weapons are human-supervised autonomous weapon systems; and human-out-of-the-loop weapons are autonomous weapon systems (or also called fully autonomous weapon systems) (Lailari, 2021, June 27). Pictured below is a matrix visualizing the similarities and differences.

Semi-Autonomous	**Human-Supervised**	**Autonomous**
Human ***in*** the Loop	Human ***on*** the Loop	Human ***out*** of the Loop
The machine stops and waits for human approval before continuing after each task is accomplished.	Once activated, the machine performs a task under human supervision, and will continue performing the task until the operator intervenes.	Once activated, the machine performs its task without any assistance on the part of the human operator, who neither supervises the operation nor has an ability to intervene.

Table 1
(Artificial Intelligence and National Security, p. 25)

A framework for LAWS development and utilization is proposed that abides by international law and military rules of engagement through the use of modes. A mode is defined as a distinct way of operating or using a system. Specifically, by using legal and operational modes for developing and employing LAWS, the author aims to provide legal and operational clarity to the various military and law enforcement LAWS operators and ensure that LAWS do not violate international nor national laws and to enable operational employment.

LEGAL FRAMEWORK

The law constrains and the law defines boundaries of behavior. A legal constraint prevents someone from doing something because if they do the act, there will be negative consequences. In the case of US military legal constraints, they are derived from the US Constitution, US Congressional legislation (i.e. Title 10 United States Code (USC) Armed Forces and Title 50 USC War and National Defense), international law such as the UN Charter, the Laws of Armed Conflict (LOAC), and arms control treaties. Other laws define what is acceptable behavior and/or encourages behavior. For example, there are Internal Revenue Service (IRS) tax benefits for being married in the United States. The law does not state that two adults can't live together, but it does provide benefits if the adults are legally married. Therefore, in this case the tax law encourages couples to get married.

International laws and national laws affecting weapons and weapons use should guide development and uses of a weapon system. In the case of LAWS, legal mechanisms currently in place should at a minimum guide current weapon systems development. In the future, new laws or laws adapted for autonomous weapons might be needed due to unknown capabilities that would be created in the future.

Legal Constraints

State actors in conflicts are constrained by their national laws and international laws that govern their conduct. International law recognizes two kinds of armed conflicts: international armed conflict (IAC) between state actors and non-international armed conflict (NIAC) between state actors and organized armed groups (The Operation in Gaza, Factual and Legal Aspects, 2009). Non-state actors, such as Hamas, Hezbollah, ISIS, Al Qaeda, and other armed groups, are still obligated by international humanitarian law to uphold relevant NIAC international law according to International Humanitarian Law. In other words, if one of these groups developed their own LAWS or captured a LAWS, they would still be held accountable for its use, misuse and/or abuse.

In addition to IAC and NAIC, there are also law enforcement (LE) legal frameworks inside of each country that would affect the employment of LAWS, especially legal constraints. For example, some countries would require an exceptional situation to use any lethal force against its population. Under this condition, LAWS would not be employed lethally. But if it also had non-lethal features ("weapons, devices, and munitions that are explicitly designed and primarily employed to incapacitate targeted personnel or materiel immediately, while

minimizing fatalities, permanent injury to personnel, and undesired damage to property in the target area or environment… intended to have reversible effects on personnel and materiel" DOD Directive 3000.03E, 2018) as an option, then it could be used to provide support in many LE roles such as riot control, prisoner control, crowd control, refugee control, self-defense and other challenges based on a LE mode.

In summary, there are at least three different legal dimensions where LAWS use would be constrained to different legal rules: IAC, NAIC and national level LE and/or security for each country. Private companies employing LAWS would be constrained even further based on the laws of nation they intend to operate in. LAWS should have different "modes" designed into their hardware and software based on the legal framework they will operate under. Some LAWS will have singular uses such as missile defense, but other LAWS could have multiple functions. Even LAWS, such as the Iron Dome Defense System missile defense system, would have different modes not only for legal reasons, but also operational reasons such as human-in-the-loop, human-on-the-loop and even human-out-of-the-loop with a kill switch. In other words, LAWS would not only align with legal modes, LAWS would also have operational modes based on operational needs such as safety for the users and for their own forces and allies such as avoiding fratricide.

There are many international laws that affect the use of weapons including LAWS. According to a 2005 study of Customary International Law by the International Committee of the Red Cross (ICRC), there are at least 161 rules associated with customary international humanitarian law (IHL) under six main categories: (1) The Principle of Distinction, (2) Specifically Protected Persons and Objects, (3) Specific Methods of Warfare, (4) Weapons, (5) Treatment of Civilians and Persons Hors De Combat, and (6) Implementation (Customary IHL Database). The list of legal principles based on IHL, other international and national laws agreed to by the US military are summarized as the principles of military necessity, humanity, proportionality, distinction, and honor (Joint Publication 3-60, 2018). We will focus on the key issues surrounding LAWS: customary IHL (Geneva and Hague Conventions) and specified international laws.

The three key areas concerning customary IHL most applicable to LAWS are (a) distinction principle, (b) principle of proportionality, and (c) precautions principle. The distinction principle states that "parties to an armed conflict must 'at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives.' This implies that indiscriminate attacks and the use of indiscriminate means and methods of warfare are prohibited" (Distinction, ICRC). If the LAWS users, legal advisors, commander, or higher authority *trust* that LAWS cannot distinguish between civilians and combatants and their respective objects, then employment of LAWS would violate this principle. In other words, a subjective judgement would have to be made about the use of LAWS.

The principle of proportionality "prohibits attacks against military objectives which are '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.' In other words, the principle of proportionality seeks to limit damage caused by military operations by requiring that the effects of the means and methods of warfare used must not be disproportionate to the military advantage sought" (Proportionality, ICRC). The exact definition of disproportionate is not clearly stated which would allow for a subjective judgement within reason. Finally, the principle of precautions is defined as having

> two interrelated components, one concerning military operations and the other concerning attacks. First, in the conduct of military operations, IHL obliges parties to take constant care to spare the civilian population, civilians and civilian objects. Second, IHL obliges parties to take several sets of precautions regarding specific attacks. In particular, the obligation to take precautions in attacks entails a requirement to: (a) do everything feasible to verify that the objectives to be attacked are neither civilians nor civilian objects, and are not subject to special protection but are military objectives; (b) take all feasible precautions in the choice of means and methods of attack to avoid, and in any event minimize, incidental loss of civilian life, injury to civilians and damage to civilian objects; (c) refrain from deciding to launch an attack if it may be expected to violate the principle of proportionality; and (d) cancel or suspend an attack if it becomes apparent that the objective is not a military one, that the objective is subject to special protection, or that the attack may be expected to violate the principle of proportionality. (Boulanin, Vincent, et al., 2021)

To comply with the principle of precautions' "feasible precautions" caveats, subjective judgement could be required to intervene in the targeting process. Therefore, at least some human-on-the-loop capability should exist for weapon systems where this principle would be applicable, such as a kill switch.

A concern regarding LAWS is that should it make a mistake, the consequence could be much more severe than a mistake by a human because it is envisioned that the LAWS will continue to fire until it runs out of ammunition, and it will be functioning with human-out-of-loop (Scharre Paul, 2016). For example, during the 2003 Gulf War, there were several incidents of fratricide because automatic targeting systems shot at friendly aircraft. In an air defense case with the Patriot system on 24 March 2003, the following occurred:

> The Patriot was operating in a semi-autonomous mode and required human approval for each engagement. However, the human operator accepted the Patriot's (incorrect) identification of the aircraft as an anti-radiation missile and authorized the engagement…According to Army researchers, Patriot operators, while nominally in control, exhibited automation bias: an "unwarranted and uncritical trust in automation. In essence, control responsibility is ceded to the machine (Scharre Paul, 2016)."

The second Patriot fratricide occurred on 2 April 2003 when the Patriot operator forgot or did not know that the system had changed from standby mode to prevent automated engagements to

> a "ready" status to prepare for an engagement. However, the Patriot battery was in an auto-fire, not a semi-autonomous, mode. This meant that once it came to ready, it was authorized to engage any active threats… Once the system came to ready, the Patriot battery fired (Scharre Paul, 2016).

In other words, the system was human-out-of-the-loop and once the radar detected a threat, it fired without needing approval from the operator. As a result of these events, the military and industry have corrected them: "the problems that led to the fratricides have since been corrected in the Patriot systems and operator training (Scharre Paul, 2016)." However, according to one study, had the Patriot been fully autonomous (human-out-of-the-loop) and "with no human to halt the system's operation could have resulted in far more fratricides (Scharre Paul, 2016)."

Additionally, LAWS will have larger hardware and software packages that adversaries could possibly hack into and create the same kind of results against friendly forces and/or against civilians blaming friendly forces for war crimes. In effect, LAWS also need to be designed with rigorous anti-cyber tampering capability to avoid disastrous results. For example, imagine if someone were able to gain cyber access to and control of a country's national nuclear command and control system. These kinds of scenarios help frame the fratricide and cyber challenges for LAWS as well as demonstrate how LAWS could also violate LOAC against civilians and civilian objects.

To ensure the employment of LAWS comply with the distinction principle, principle of proportionality and the precaution principle, subjective judgement is key during all phases of a weapon system lifecycle. In each of these cases, decision-makers need to define the limits of the LAWS and where subjective judgement must be used. This prevents accidental injuries, unnecessary suffering, war crimes, and helps the users and the commanders keep in line with operational and legal rules of engagement. In effect, there is a "chain of custody" or a "chain of responsibility" throughout the process.

In addition to the three most common customary IHL, other specific laws would be pertinent to LAWS. Some international legal examples include the ban on biological and chemical weapons, incendiary weapons, blinding laser weapons and restrictions on the use of landmines, and others. Depending on how LAWS are used, certain international agreements could be applicable. For example, the *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction*, referred to as the Ottawa Convention or Mine Ban Treaty has applicability when LAWS is used for area denial which is what land mines are used for (The Ottawa Convention at a Glance, 2018). Specifically, South Korea developed the Samsung SGR-A1, a military robot sentry, used along the Korean demilitarized zone (DMZ) and Israel has developed several border systems such as the Sentry Tech system Roeh-Yoreh (Sees-Fires) and the Jaguar unmanned ground vehicle (UGV) deployed along the Gaza border (Lailari, 2021, June 27). Jaguar is unique in that it has the following capabilities:

Figure #1 Photo of Jaguar
('Jaguar': The IDF's Newest, Most Advanced Robot, 2021)

The 'Jaguar' is equipped with a 7.62 mm MAG machine gun which operates both while stationary and on the move. The robot utilizes high-resolution cameras, transmitters, powerful headlights, and a remote-controlled PA system. Additionally, it has the ability to self-destruct if it falls into enemy hands. The most unique aspect of the 'Jaguar' is its semi-autonomous system—the robot possesses the ability to self-drive to a set destination, knows how to spot and bypass obstacles and bumps using sensors and an advanced driving system, all while IDF observers and commanders have full operational control ('Jaguar': The IDF's Newest, Most Advanced Robot, 2021).

The SGR-A1 and Roeh-Yoreh are sentry (non-movable) systems that reportedly have different modes of operation. However, for the system to function like a land mine / area denial system, at a minimum they should follow similar rules as the Ottawa Convention. According to the 1907 Hague Convention VIII (Hague VIII), mine location should be confined to a specified and delineated area or they will be deactivated after a specified period of time; they should be detectable by normal minesweeping systems (they must have metal in them to be detected); and they cannot be disguised as harmless objects (Lailari, 2021, June 27). In the case of the South Korean and the Israeli sentry systems, its area of coverage should be specified for anyone nearing the area of coverage. The sentry systems should be able to be deactivated, it should be detectable for removal after the conflict and not disguised as a harmless object. This example provides a practical way to apply an international legal framework on LAWS.

The many legal modes that constrain LAWS are useful for developers, users, decisionmakers, policymakers, and the public to understand. These legal modes should be integrated from the beginning of concept development to deployment and throughout all upgrades. Without these legal parameters being implemented throughout the system's lifecycle, the users could become fouled with accusations of war crimes and other serious charges. By maintaining the legal modes under which LAWS will be operated, legal reviews of the weapon

system will be made easier as well as efficient, effective, and transparent. Furthermore, users will also be more cognizant of the rules of engagement they are operating under and will make them more attuned when initiating or changing modes during a conflict. In effect, these legal modes should be transformed into operational modes.

Legal Review Process for Weapons

Article 36 of Additional Protocol 1 (1977) of the Geneva Convention (1949) requires: "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 (Protocol Additional to the Geneva Conventions, 1977)." Note the reference in Article 36 to "study, development, acquisition or adoption." This reference means that a legal review should be conducted *prior* to even the study of the weapon system. However, the US DOD Directive (DODD) 3000.9 states that legal reviews of a weapon applies to "the design, development, acquisition, testing, fielding, and employment of autonomous and semi-autonomous weapon systems, including guided munitions that can independently select and discriminate targets" (DOD Directive 3000.09, 2017). Note that the DODD does not include "study" from Article 36 but DOD adds the terms "design" and "testing, fielding, and employment" where Article 36 only uses the word "adoption." In other words, DOD does not see the need to have a legal review on a new weapon study but adds more layers of review from four steps in the Article 36 review to six steps in the DOD review focusing the legal review towards the end of the weapons development process. Table 1 displays these differences visually between the two legal reviews.

Legal Review	Article 36	DOD 3000.9
1	study	
		design
2	development	development
3	acquisition	acquisition
4	adoption	testing
5		fielding
6		employment

Table 2: Legal review comparison of Article 36 & DODD 3000.9

Article 36 directs countries developing weapon systems to ensure that these systems do not *in some or all circumstances violate any rule of international law*. Additionally, Article 82 from the same protocol reinforces that use of legal advisers in armed forces "to advise military commanders at the appropriate level on the application of the Conventions and this Protocol and on the appropriate instruction to be given to the armed forces on this subject." Article 82 encourages legal advice to military commanders, including advice about the use of weapon systems during war. Consequently, *legal reviews* are conducted during the study, development,

acquisition or adoption of a new weapon and *legal advice* is provided during military operations (Boulanin, Vincent, et al., 2021).

During a DOD legal review, the following three questions are typically asked to ensure the weapon system complies with the laws of war also referred to as the law of armed conflict (LOAC): (1) [Is] a specific rule, whether as a treaty obligation or viewed as customary international law, prohibiting or restricting the use of the weapon?; (2) [Is] in its normal or intended circumstances of use, the weapon is of a nature to cause superfluous injury or unnecessary suffering?; (3) [Is] the weapon …capable of being used in compliance with the rule of discrimination (or distinction) (Noone & Noone, 2015)? A legal advisor to the US Department of State suggested adding two more questions: (4) Whether the weapon is intended, or may be expected, to cause *widespread, long-term and severe damage to the natural environment*? and (5) Whether there are any likely future developments in the law of armed conflict that may be expected to affect the weapon subject to review (Noone & Noone, 2015)? Some of these five questions appear to be derived from Article 35 of AP I, which states "Basic rules… 2. It is prohibited to employ weapons, projectiles and material and methods of warfare of a nature *to cause superfluous injury or unnecessary suffering*; 3. It is prohibited to employ methods or means of warfare which are intended, or may be expected, to *cause widespread, long-term and severe damage to the natural environment* (Protocol Additional to the Geneva Conventions, 1977)."

The importance of these two additional questions is evident in the following example. Poseidon, the Russian 100 megaton undersea nuclear weapon, appears to conflict with Article 35 section 3 regarding widespread, long-term and severe damage to the natural environment since, when it explodes, it is "designed to come into direct contact with water, marine animals, and the ocean floor, *kicking up a radioactive tsunami that could spread deadly radiation over hundreds of thousands of miles of land and sea and render it uninhabitable for decades*" and is also called a continent killer (Lockie, 2019). Yet, Russia is not sanctioned for having developed and manufactured this type of weapon. The purpose of bringing up this point is to demonstrate that legal reviews by each country are not consistent and not all countries appear to have the same rigor as others (Boulanin et al., 2017). Some of the flaws of Article 36 are: the interpretation is left to the countries, "the relevant standards to be applied, or designate any specific form of review methodology…neither AP I, nor LOAC more broadly, define the terms 'weapons, means and methods of warfare'. Furthermore, there appears to be no international consensus on defining these terms" (Tattersall & Copeland, 2021).

ARTIFICIAL INTELLIGENCE / MACHINE LEARNING

Machine Learning (ML) is a field within Artificial Intelligence (AI) that focuses on the ability of computers to learn on their own without being programmed. If machine learning is part of LAWS, then this means the system is constantly changing, adapting, and learning over time. So, LAWS is not necessarily the same weapon system when it was last tested especially if it was used during operations, training or exercises. As a result, each time that the LAWS learns, it could perform actions that are not predictable because it has changed, and the action could no

longer follow international law and/or operational rules of engagement. Therefore, countries should consider adding legal reviews above and beyond the UN's minimum standards. For example, legal reviews could be added prior to LAWS testing and fielding and frequently throughout the operational life cycle of the system to ensure that LAWS continues to conform to international law and operational constraints. The reviews help enhance reliability, reduce the possibility of the LAWS conducting actions that could result in unintentional harm to civilians, adversary forces or even friendly forces. Some suggestions could be to add a legal review after each engagement or a specified timeframe or even to develop an automated continuous review process. These enhanced reviews might need to be implemented to ensure that commanders, users, politicians, and the public will have confidence to *trust* (Lailari, 2021, September) that the system will perform as designed and not have an unintended engagement (DOD Directive 3000.09, 2017).

> In general, trust involves risk because it involves depending on another: When a person uses an autonomous system, the individual assumes the system will perform as designed and not have an unintended engagement. In other words, the system has expected results: positive outcomes and negative avoidance…Interestingly, the DODD 3000.09 does not refer to positive out-comes as a design criterion. DoDD 3000.9 defines the goal of autonomous systems as to avoid negative outcomes ("unintended engagement" or experience a "loss of control"). The lack of a reference in the DODD for a positive outcome for LAWS could be a weakness in the directive and should be reviewed to emphasize administration intent to ensure the weapon system performs as designed. (Lailari, 2021 September)

Ultimately, in the DOD, the Component heads are responsible for ensuring "that the intended acquisition, procurement, or modification of weapons or weapon systems by the component is reviewed for consistency with the law of war" (DOD Directive 2311.01, 2020). The DOD components heads are as follows: Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, Combatant Commands, Office of Inspector General of the Department of Defense, Military Departments, Defense Agencies, DoD Field Activities, and other organizational entities, which includes the National Guard Bureau (DOD and OSD Component Heads, 2021).

Furthermore, some have suggested that an international standard should be created so that all countries agree to a common method for the Article 36 review process, especially for LAWS (Poitras, 2018). For example, the document, Code of Conduct for AI-enabled Military Systems (CoC), was collaboratively written by a group of Chinese, American, and international experts convened by the Centre for Humanitarian Dialogue (CHD) and published in August 2021 (Code of Conduct, 2021). The ideas in this CoC are non-binding and the authors suggest using the document as a starting point for a dialogue for a future international Code of Conduct. The document should have been called "Considerations for AI-enabled Military Systems" to allow more flexibility in a country's acceptance and not to be constrained by its title nor its contents. The CHD web page calls it a *draft* CoC and this "draft" caveat should have been maintained on the final title.

Nevertheless, the CoC has an impressive list of *recommendations to consider.* One of the most important is for states to implement a legal review process for new weapons. Unfortunately, the recommendation is placed in the test and evaluation section of the document and not earlier such as during the design or study phase per Article 36. The document does recommend an iterative process after deployment but does not mention the challenge of continuous learning and adaptation of machine learning and the need for a more frequent legal review process:

> States should ensure that test and evaluation, including legal reviews, is an ongoing and iterative process which should be initiated at the earliest possible time in the development and/or acquisition and adoption phase and repeated throughout the life cycle of the system, to include accounting for continuous deployment, such as when fielded systems receive regular AI algorithm or model updates (Code of Conduct, 2021).

Additionally, the CoC encourages weapons review process information sharing between countries while protecting their national security: "States should, to the extent consistent with their national security, share procedures for and the outcomes of (a) their legal reviews and (b) their testing and evaluation of AI-enabled military systems (Code of Conduct, 2021)." Although the CoC does mention the need for states to have a legal review process in accordance with Article 36, it does not indicate the paucity of implementation by states.

The greatest current challenge with weapons review appears to be simply the implementation of Article 36 by countries that have signed the Additional Protocol 1:

> Deplorably, even 40 years after Article 36 was adopted, the number of states consciously and conscientiously carrying out weapons reviews remains insignificant, perhaps around 30 at best. With the exception of the United States and Israel, which are known to have weapons review mechanisms in place, 22 states are yet to ratify AP I. This group includes such advanced military powers as India, Indonesia, Iran, Malaysia, Pakistan, Singapore and Turkey (Jevglevskaja, 2017).

According to the ICRC, there are 174 State parties and 3 State signatories to the AP I in 2021 which means that *about 137 countries do not have a weapons review process* (Protocol Additional to the Geneva Conventions, 1977). Even more concerning is the fact that only four countries developing LAWS (China, Russia, Japan, South Korea) acknowledge that they conduct weapons reviews and two countries (UK and Australia) acknowledge cyber weapons review (Tattersall & Copeland, 2021)." The US and Sweden conducted weapons reviews for all types of weapon systems since they were conducting weapons legal reviews as of 1974 before AP I (1977) existed (A Guide to the Legal Review, 2006). Getting all signatories to conduct legal reviews of their current and planned weapon systems should be an easy goal to achieve.

OPERATIONAL CONSTRAINTS AND CONCERNS

Operational Terminology

The current way of describing the battlefield and defining the use of weapon systems is currently necessary and sufficient to employ LAWS. However, as technology and AI systems develop, new terminology might need to be created to keep LAWS usage legal according to international law which may be used in unusual or different ways then current weapon systems are currently conceived.

Many of the current terms or phrases defined by the DOD Dictionary of Military and Associated Terms (Joint Publication 1-02) are relevant to LAWS:

- **counterfire (**fire intended to destroy or neutralize enemy weapons)
- **final protective fire** (an immediately available prearranged barrier of fire designed to impede enemy movement across defensive lines or areas)
- **fires (**the use of weapon systems or other actions to create specific lethal or nonlethal effects on a target)
- **free-fire area (**a specific region into which any weapon system may fire without additional coordination with the establishing headquarters)
- **kill box** (a permissive fire support coordination measure with an associated airspace coordinating measure used to facilitate the integration of fires in a defined three-dimensional space)
- **no-fire area** (an area or three dimensional space designated by the appropriate commander into which fires or their effects are prohibited)
- **on-call** (a term used to signify that a prearranged concentration, air strike, or final protective fire may be called for. 2. Preplanned, identified force or materiel requirements without designated time-phase and destination information)
- **on-call target** (planned target upon which fires or other actions are determined using deliberate targeting and triggered, when detected or located, using dynamic targeting
- **weapons free zone** (an air defense zone established for the protection of key assets or facilities, other than air bases, where weapon systems may be fired at any target not positively recognized as friendly) (DOD Dictionary, 2021)

This small sample of military terms and their respective definitions are possible operational modes or settings that could be used for LAWS by authorized military decision-makers during combat operations. In this way, LAWS continues to operate under the same rubric that military and civilians currently understand contemporary weapons' functions and purposes. LAWS could also be tasked for several modes in combination since a weapon system can be used for multiple tasks including defensive and offensive operations.

Policy Approval

A serious review of policy approvals should be undertaken for employing any weapon system especially LAWS since policymakers and military commanders need to define what level

of authority should be required to employ a weapon system that could potentially have severe effects on the battlefield.

In the most extreme example, weapons such as nuclear weapons or very large bombs could cause great harm. For illustrative purposes, an example could be the GBU-43 Massive Ordnance Air Blast (MOAB) that weighs 22,600 pounds, has 18,700 pounds of explosives, and has a blast radius that is one mile in diameter, similar to a yield of 11 tons, or 22,000 pounds of TNT. In comparison, the Little Boy nuclear bomb used against Hiroshima in 1945 was 15,000 tons or over 1,363 times more powerful than the conventional MOAB. Using a MOAB or in extremis a nuclear weapon should require the highest levels of policy approval in any country. For this analogy, LAWS should also have a hierarchy of approval in a military-political chain of command. At the lowest level, deploying soldiers, marines, sailors, and airmen know that there are always rules of engagement based on IHL, LOAC, local laws and other reasons. US deployed forces know that they always have the inherent right of self-defense following the requirements of necessity and proportionality in accordance with the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) Standing Rules of Engagement for U.S. Forces and LOAC (CJCSI 3121.01B, 2005).

Targeting and Targeting Cycle

The use of any weapon should require the appropriate command level approval along with legal advice. For example, using a 2,000-pound air dropped unguided bomb in a densely populated area against a suspected weapons storage site would have to be weighed very carefully with respect to the law of proportionality and military necessity. Using the same legal framework, a GBU-39/B Small Diameter Bomb (SDB) that is a 250-pound precision-guided glide bomb or even an AGM-114 Hellfire with a 20-pound warhead would have a stronger legal argument to use for the same target due to its precision, its size and small blast radius if it is available. There are also operational considerations that must considered when assigning a specific weapon to a target. This process is part of the targeting cycle used in the military. In the US military, Joint Publication (JP) 3-60, Joint Targeting is a "six-phase iterative process that is not time-constrained nor rigidly sequential, as some steps in various phases may be conducted concurrently" shown below (Joint Publication 3-60, 2018).

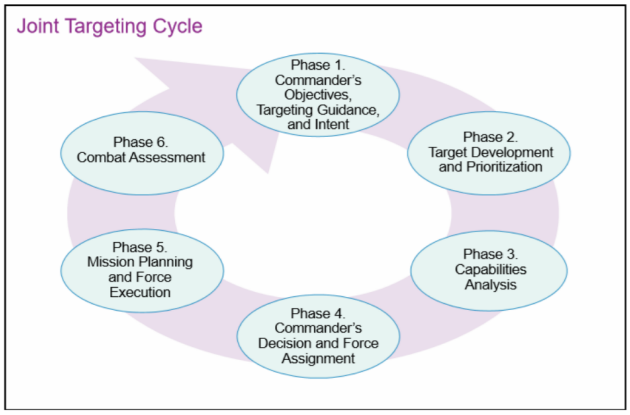

Figure #2: Joint Targeting Cycle

The six-phase process is not trivial and requires many skills and information regarding the adversary's targets and the capabilities of friendly forces. Without rehashing the details of the entire process, LAWS is a weapon system and is not a replacement (LAWS can act as an adjunct) for the targeting cycle since the cycle currently depends on human-decision-making throughout all the steps. Legal advice in every step of the target process is described in detail under Legal Considerations in Target in Appendix A of JP 3-60:

> Due to the complexity and extent of international law considerations involved in the joint targeting cycle, the SJA [Staff Judge Advocate] or their representative must be immediately available and should be consulted at all levels of command to provide advice about law of war compliance during planning and execution of exercises and operations. Early involvement by the SJA will improve the targeting process and can prevent possible violations of international or domestic law (Joint Publication 3-60, 2018).

The SJA provides legal consultations are based on JP 1-04, Legal Support to Military Operations and the Department of Defense Law of War Manual.

Highlighting a few important and relevant areas, for example, target development during Phase 2 would require an operational justification to be included in target development and prioritization. Also, during this phase, the target would require a legal review to ensure that it conforms to a military target under LOAC. During Phase 3, capabilities analysis provides the opportunity for a decision to made regarding assigning the best weapon against the target. Just as legal reviews and advice (a human endeavor) is provided throughout the entire lifecycle of a weapon system, human decision-making should be clearly delineated in the targeting cycle especially as weapon systems become more automated including LAWS. For example, weaponeering is used in Phase 3 and it determines "the quantity of a specific type of lethal or nonlethal means required to create a desired effect on a given target" (Joint Publication 3-60, 2018). Weaponeering also involves determining collateral damage based on the various options available. Once Phase 3 is completed, Phase 4's Commander's Decision and Force Assignment would need legal advice that would include all aspects of the laws of war and the principles of military necessity, humanity, proportionality, distinction, and honor.

Drilling deeper into the subject of targeting, according to Joint Publication 3-60 Joint Targeting (redacted 28 September 2018), "targeting is grouped into two categories: deliberate and dynamic. Each category is associated with a different grouping of targets, 'planned targets' or 'targets of opportunity,' respectively." In the case of deliberate or planned targets, specified classes of weapon systems could be assigned or permitted to be used after a careful analysis of considerations. For example, planned targets could be stored in a LAWS and, when approval from a competent authority is given that has gone through a necessary and sufficient legal review, the LAWS could be employed to achieve the desired effects according to a deliberate campaign plan. A more challenging targeting environment would be during dynamic planning execution where most of the planned targets have been mitigated and targets of opportunity present themselves throughout the area of operation. The commander, the military planners,

targeteers, weaponeers, and others involved in the targeting process should incorporate rules of engagement that include legal considerations for LAWS employment. Depending on the possible severity of destruction that the LAWS could inflict, the higher in command echelon the approval should be requested. For example, the use of a single LAWS drone with only a few small diameter bombs would need a far lower command level approval authority attacking a military position than a swarm of 1,000 LAWS drones attacking a main enemy military base. Severity of destruction is only one consideration in the targeting process. According to Air Force Doctrine Publication (AFPD) 3-60 Targeting, the following considerations are used in the weaponeering process for approved targets:

- Target identification and description.
- Recommended aim points/joint desired point of impact (JDPI) and nonlethal reference points (NLRP).
- Desired scope, level(s) and duration of damage, destruction, degradation, denial, disruption, deterrence, suppression, corruption, usurpation, neutralization, delaying, influence, exploitation, or other planned effects.
- Weapon system and munitions recommendations.
- Fuzing requirements (if required).
- Probability of achieving desired direct effect(s).
- Target area terrain, weather, and threat considerations for the operational environment, including its physical, electromagnetic spectrum, and information (including cyberspace) components.
- Collateral damage considerations.
- Collateral effects (AFPD 3-60, 2019).

An excellent example of involving a higher command authority decision- making process is described in the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3122.06E Sensitive Target Approval and Review (STAR) Process (redacted 30 April 2018). The purpose of this instruction is to communicate to the supported Combatant Commander (COCOM), Secretary of Defense (SECDEF) or the President of the US (POTUS) the reasons it is necessary to strike specific targets and why these targets warrant COCOM, SECDEF or POTUS review. The STAR process is used for the following reasons (italics are author's):

> Commanders, or their designees, will conduct all operations in compliance with the *law of war principles of military necessity, humanity (unnecessary suffering), distinction, proportionality, and honor and with due regard for the protection of innocent human life, and also follow this guidance when authorizing strikes or deciding whether to elevate a targeting decision to a higher level of command… The decision to authorize a strike or to elevate a targeting decision when there is potential for civilian or noncombatant loss of life or injury, or loss of property*, will not be determined solely through a mechanistic or numeric process, nor will it be based on quantified casualty estimates alone… *For example, it may be prudent in some circumstances to elevate a targeting decision involving high risk of undesirable incidental effects if a higher-level commander is better positioned to evaluate the risk against the expected advantage of conducting the strike, or the higher-level commander can implement*

additional precautions to help reduce risks to civilians and noncombatants due to greater resources under his or her control (CJCSI 3122.06E, 2018).

A specific example of this concept is the relationship between the President of the United States (POTUS) and his control over the US military nuclear triad. POTUS has the sole authority to order the use of nuclear weapons via the nuclear command and control system – no one else has this authority and no one else can prevent him from ordering their use. More precisely, according to the Congressional Research Service, "The President, however, does not need the concurrence of either his military advisors or the U.S. Congress to order the launch of nuclear weapons. In addition, neither the military nor Congress can overrule these orders" (Defense Primer: Command and Control of Nuclear Forces). In the future, the use of certain types of LAWS might need this level of approval due to the level of destruction that could ensue or other reasons.

CONCLUSION

This paper attempted to provide LAWS developers, various users including military and LE personnel, policymakers and the public various ways that LAWS can be employed in accordance with the laws of war and in accordance to standard methods of operationally employing weapon systems. In effect, LAWS can conform to the laws of war such as the distinction principle, principle of proportionality, and the precaution principle as long as LAWS developers, users and military commanders provide the appropriate mode(s) to comport with these international laws. These modes would consist of the following archetypes:

(1) *The legal review certification of the LAWS should be conducted through all phases of development to deployment and should consider the legal review challenges associated with Artificial Intelligence / Machine Learning*.

(2) *Developers, military and law enforcement operators and approving authorities should be able to define/determine which legal modes the LAWS can operate under*.

(3) *The military chain of command and the operators should understand and know the operational modes that will be allowed during a specific operation.*

(4) *The level of military command and/or civilian leadership approval should be pre-determined and known to use LAWS in specified operational modes*.

(5) If used for Law Enforcement, the modes would be driven by national / state laws that would not contradict international law. Similar to military use, law enforcement use would also need civilian levels of approval authority for certain types of engagements.

(6) Non-state violent actors in possession of LAWS also would also need to ensure they comply with international legal and operational considerations, constraints and concerns.

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