

Building Blocks for a Regulation of LAWS and Human Control - Updated Recommendations to the GGE on LAWS (2021)

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Building Blocks for a Regulation on LAWS and Human Control

Updated Recommendations to the GGE on LAWS

July 2021

International Panel on the Regulation of Autonomous Weapons (iPRAW)

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ABOUT IPRAW

Setting and Objectives: The International Panel on the Regulation of Autonomous Weapons (iPRAW) was founded in March 2017 and will run until June 2022. iPRAW is an independent group of experts from different nation states and scientific backgrounds.

The mission of iPRAW is to provide an independent source of information and consultation to the Group of Governmental Experts (GGE) within the framework of the United Nations CCW (*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*) during the ongoing process toward a possible future regulation of LAWS (lethal autonomous weapon systems). This work includes, but is not limited to, the provision of expertise on the military, technical, legal, and ethical basis for practical and achievable policy initiatives regarding LAWS. The mandate of the CCW's open-ended GGE on LAWS will guide the work of iPRAW.

iPRAW seeks to prepare, support, and foster a frank and productive exchange among participants, culminating in perspectives on working definitions and recommendations on a potential regulation of LAWS for the CCW GGE. iPRAW is independent from the GGE and does not function in any official capacity regarding the CCW.

Funding, Organization, and Participants: iPRAW is financially supported by the German Federal Foreign Office. The views and findings of iPRAW do not reflect the official positions of the German government or any other government. *Stiftung Wissenschaft und Politik – The German Institute for International and Security Affairs* (SWP) is organizing the panel. The participants have been selected on the basis of their expertise and the perspectives they bring from a wide range of professional and regional contexts. iPRAW represents a broad variety of views on the topic of autonomy in weapon systems. Its members have backgrounds in natural science, engineering, law, ethics, political science, and military operational analysis.

Scope: The panel acknowledges that LAWS may pose a number of considerable legal, ethical and operational challenges and that they might change the security environment in a fundamental way. The full potential of these weapon systems is yet unknown and a mutually agreed definition on LAWS does not exist.

In order to support the CCW GGE process, iPRAW works on approaches towards a potential regulation of LAWS. In this context approaches to regulations are construed broadly and can include both the application of existing international law as well as new legal instruments. This includes various issues, like requirements for human control over the use of force.

Procedure: The participants commit themselves to actively engage in and contribute to the meetings and the scientific dialogue related to iPRAW's activities. Papers with agreed upon recommendations on relevant issues will be published via the project's website (www.ipraw.org).

Communication and Publication: The participants discuss under the Chatham House Rule: participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed. As a matter of confidentiality, photographs, video or audio recordings are not allowed during iPRAW meetings.

The results of the panel discussions will be published. iPRAW members will strive to reach consensus on their recommendations and to reflect that in the panel's publications. Media inquiries with regard to official iPRAW positions should be directed to the steering group. Apart from that, the panel members are free to talk about their personal views on participation and the topics of the panel.

Learn more about iPRAW and its research topics on www.ipraw.org. Please direct your questions and remarks about the project to mail@ipraw.org.

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EXECUTIVE SUMMARY

The International Panel on the Regulation of Autonomous Weapons (iPRAW) is an independent, interdisciplinary group of scientists working on the issue of lethal autonomous weapon systems (LAWS). It aims at supporting the current debate within the UN Convention on Certain Conventional Weapons (CCW) – looking at a potential regulation of LAWS from different perspectives. iPRAW has identified three larger buildings blocks that can guide the creation of the normative and operational framework for a regulation of LAWS. These blocks are (1) challenges to be addressed by a regulation, (2) the human element at the core of any regulation of LAWS, and (3) actual elements of the framework. iPRAW maintains the approach that a future regulation of LAWS should focus on the human element, especially human control in the use of force. iPRAW defines human control as situational understanding and options for intervention enabled both by design and in use, considering both the life cycle of a weapon system and the targeting process.

Block I – Challenges: The development and use of LAWS raises several challenges that need to be addressed, ranging from technological aspects to military, legal, and ethical considerations. But also questions relating to international security and stability play a pivotal role, deserving greater attention. Most cross-cutting topics, like gender issues, should be considered as well but are not further discussed in this report. Depending on the challenges it addresses, the regulation will look differently.

First, understanding the **technology** behind LAWS is imperative. By integrating, processing, and analyzing large amounts of data quickly, AI-enabled technologies can offer useful decision support and might furthermore allow for new operational options. At the same time, however, due to their brittleness and opaque nature, they could increase unpredictability and escalation risks and perpetuate biases.

However, a new international regulation shall focus on the human element over the use of force instead of technological aspects. The latter may thwart efforts of creating a new regulation due to the atypical nature of LAWS and may prevent it from standing the test of time. Likely, new inventions will quickly outpace the diplomatic efforts that have been hitherto achieved. A new commonly agreed regulation must be future-proof.

Second, **military** decision-making processes and the role of humans and ‘machines’, i.e. automated processes, are the centerpiece of any considerations on LAWS. In order to discuss the issue of LAWS and human control, a sufficient understanding of the military targeting process is crucial – various steps regarding human control in the targeting cycle may be taken at earlier stages in military operations, special attention should be given to the final step of the targeting cycle.

Third and probably most relevant to the CCW, LAWS are **legally challenging**, especially the use against humans and against military targets by use. A regulation of LAWS could take these aspects into consideration, for example, by prohibiting or strictly regulating the deployment of LAWS against humans. Even though IHL does not address LAWS explicitly yet, an obligation to maintain human control and other limitations and constraints can arguably be derived from the IHL principles by implication. An international regulation would help to establish and strengthen that norm and to create a common understanding.

Fourth, it is arguable that the concept of **human dignity** entails a moral obligation to maintain human agency and therefore the necessity of human control over the use of force. These considerations could influence the way a future regulation of LAWS looks like and how it could be structured.

Finally, the use and deployment of LAWS bears risks for **security and international instability**. A major benefit of applying autonomous functions for military purposes is the possibility of accelerating information processing, decision-making, and command and control cycles. A faster tempo of warfare however also runs risk of overwhelming human operators and undermining human judgment, especially in crisis situations. In addition, containing proliferation and maintaining international stability are major objectives when elaborating a normative and operational framework for LAWS, even though these factors might not become part of a CCW Protocol. There are other avenues in order to take these aspects into account, such as the adoption of soft-law documents.

Block II – Human Control: The challenges discussed above are mostly caused by a lack of human control in the use of force. Accordingly, a regulation of LAWS should focus on that. iPRAW defines human control as situational understanding and options for intervention enabled both by design and in use. To account for the context-dependency of human control, a future regulation of LAWS (e.g. a CCW Protocol) will probably have to consist of rather abstract stipulations regarding the concept of human control. The supplementary adoption of further agreements – legally or politically binding – could be useful to delineate human control in further detail.

Block III – Elements of the Regulatory Framework: iPRAW recommends a technology-agnostic approach when it comes to LAWS and a focus on the human element in the use of force rather than a categorical definition of LAWS. iPRAW considers it advisable to focus on the obligation to maintain human control over the use of force instead of a definition of LAWS. This obligation would apply to all conventional weapons, but could be established beyond the scope of the CCW, too.

The GGE Guiding Principles of 2019 are a suitable starting point for further discussions on a normative and operational framework on LAWS, but they are not sufficient. For example, a more detailed account of human-machine interaction is necessary. In addition, other principles that were not explicitly mentioned in the Guiding Principles could also find entry into a future CCW Declaration or Protocol,

such as predictability, reliability and transparency. Solely one international treaty might not suffice to tackle all the aspects and challenges that are presented by LAWS. The adoption of additional treaties or even soft-law documents, such as codes of conduct and best practices, are highly recommended to supplement a potential treaty on LAWS.

1 INTRODUCTION

In 2019, the CCW States Parties agreed to build on the GGE Guiding Principles, the previous work on legal, technological and military aspects on LAWS, and the conclusions drawn by the CCW Group of Governmental Experts on LAWS (GGE)'s work to develop a normative and operational framework on emerging technologies in the area of LAWS. Even though this effort sounds promising, the concrete manifestation, implementation, and structure of such a framework remains unclear. This report aims to support the GGE States Parties in establishing such a framework by providing ideas and concepts on a regulatory framework on LAWS. Given the fact that LAWS are a highly complex and challenging issue, the report provides “digestible pieces” that are easily accessible – the building blocks for a regulation of LAWS.

The report proposes three building blocks. Building Block I introduces specific technological, military, legal, ethical, and security challenges related to LAWS. Building Block II presents iPRAW's understanding of human control and addresses how the concept – understood as the requirement of situational understanding and options to intervene enabled both by design and during use – could be implemented in a regulation. And lastly, Building Block III discusses the different regulatory avenues that are available for GGE States Parties ranging from legally binding to soft-law documents. iPRAW as a consensus-based group does not favor a specific approach but rather highlights the different possibilities and regulatory options. The different measures that could be taken are not mutually exclusive and a combination thereof could be a viable option for States in the CCW and beyond.

The report is accompanied by an interactive infographic that highlights the most relevant aspects: https://www.ipraw.org/?da_image=642

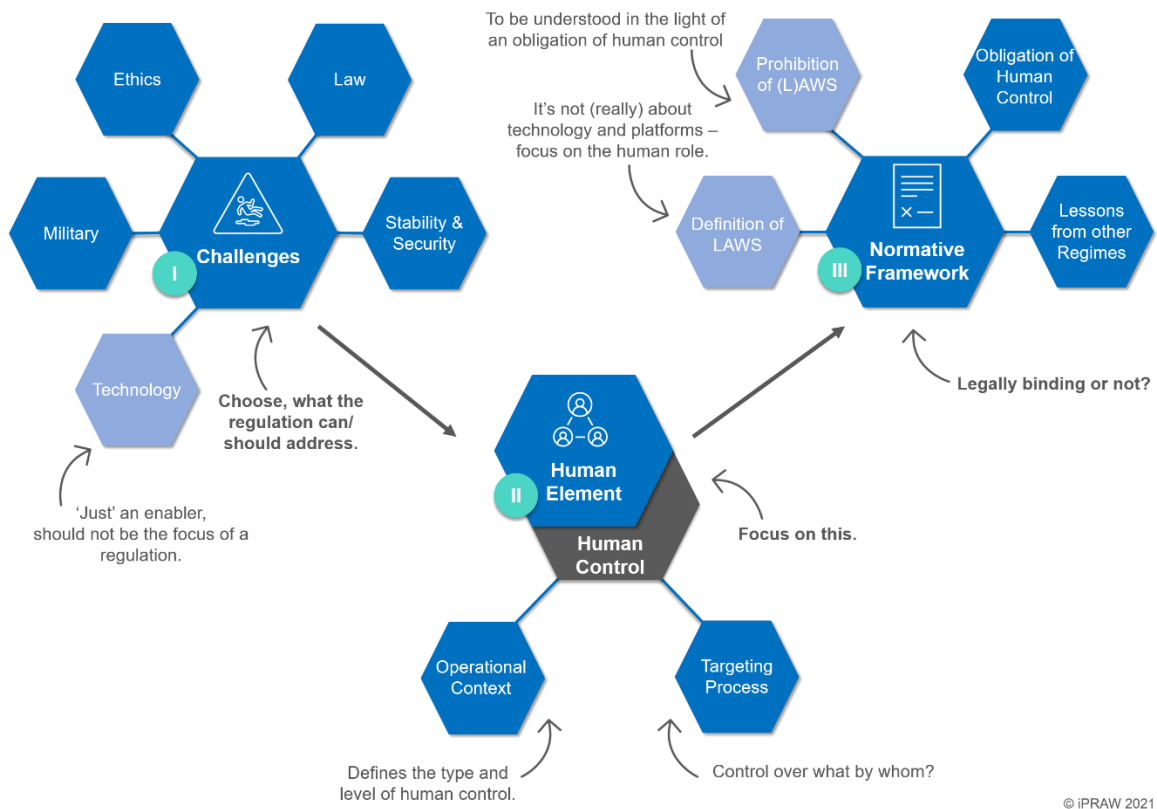


Figure 1: Building Blocks for a Normative and Operational Framework of LAWS and Human Control

2 BUILDING BLOCK I: UNDERSTANDING THE CHALLENGES

In order to establish a normative and operational framework aimed at tackling the challenges posed by LAWS, it is imperative to understand the technological, military, legal, ethical, and security aspects. In fact, a profound grasp of the technological aspects, especially with regard to computational methods, like artificial intelligence (AI) and machine learning, is the starting point of any discussion on a regulatory framework on LAWS. By the same token, it is of pivotal importance to bear military considerations in mind and to comprehend the nature and structure of military operations, in particular the targeting cycle. The same holds true for legal considerations. International law, especially international humanitarian law (IHL) constitutes the fulcrum of the debate on LAWS. Furthermore, human dignity needs to be taken into account properly, as emerging technologies in the military realm threaten to touch upon or even violate human rights. Last but not least, security aspects should be considered thoroughly. The increased resort to autonomous functions in combat operations will have repercussions on conflict escalation and international stability and may even lead to an AI arms race, potentially having devastating consequences.¹

2.1 TECHNOLOGICAL ASPECTS

Autonomous functions in weapon systems are based on various enabling technologies including sensors, processors, and software.² Most prominent are data-driven techniques, like AI and machine learning. Even though a regulation of LAWS should focus on the human role, understanding the options and limitations of enabling technologies is crucial. **By integrating, processing, and analyzing large amounts of data quickly, AI-enabled technologies can offer useful decision support and might furthermore allow for new operational options. At the same time,**

¹ See Garcia 2021.

² This part is based on iPROAW 2017.

however, due to their brittleness and opaque nature, they could increase unpredictability and escalation risks and perpetuate biases.

In some instances, the application of computational methods in the targeting process can lead to better outcomes than human performance alone would. Nevertheless, our discussions and scenario-based workshops showed the limitations of computational methods as enabling technologies in the military domain and highlighted that they most likely cannot replace the unique judgment of human decision-makers, understood as “the ability to evaluate and combine numerous contextual sources of information”³. Furthermore, any complex computational system consists of modular subsystems, each of which has inherent limitations and points of failure. Applying multiple computational systems across each step of the targeting cycle may result in cumulative failures that can be hard to anticipate and lead to hazardous and undesired outcomes. Any system that executes sequential processes, such as selecting and engaging targets, can be subject to path dependencies where errors or decisions, in any step, can propagate and reverberate throughout the rest of the targeting process.⁴

In order to avoid misleading impressions and expectations, iPRAW recommends using the term computational methods to address mathematical techniques such as AI and machine learning. When mentioning algorithms that sense, recognize, plan, decide, or act autonomously, we do not mean to anthropomorphize machines.

The deployment of weapons with autonomous functions can increase uncertainty and unpredictability of the machines' actions and their effects, especially when they are based on computational methods. Machine learning can be executed with data collected before the use of the system (off-line) or in real-time during the application (online). The latter might yield interesting outcomes due to a dynamic adaptation to the environment, but it comes with challenges. To effectively learn online, a system would need a high level of on-board computational power, which may impose tactically relevant performance limitations, such as latency. In addition, performance depends on the environment and the way the system senses it. Its unpredictability can increase the uncertainty of the operational outcome.

Biased or erroneous **training data** can lead to unexpected outcomes arising from the learning process. In military uses, such biases could decrease predictability and deliver catastrophic effects. The challenge of detecting and eliminating these biases is significant in the field of machine learning, regardless of the application. More broadly, such computational techniques are fundamentally applied statistics, which inherently have limitations. Optimization is not perfection, and there will be always be limitations and vulnerabilities.

2.2 MILITARY PERSPECTIVES

Ultimately, military decision making processes and the role of humans and ‘machines’, i.e. automated processes, are the centerpiece of any considerations on LAWS.⁵ In order to discuss the issue of LAWS and human control, a sufficient understanding of

³ See Sauer 2019, p. 88.

⁴ For further discussions on the role of data in military AI see UNIDIR 2019 and Arthur Holland 2021.

⁵ This chapter is based on: iPRAW 2018a. For further information on the broader targeting process, see UNIDIR 2020.

the military targeting process is crucial, as the type and level of human control during attacks can depend on steps and decisions taken much earlier.

Militaries utilize a range of mechanisms to achieve and maintain control over the use of force in order to guarantee that military operations are in line with both domestic and international law. It is the aim of military powers to achieve operational ends effectively and to prevent unintended engagements, which are all based on precision, predictability, and lethal efficiency. The weighing of military necessity, risk, and priorities all rely on the judgment of human commanders. This kind of control is exercised through military decision-making processes that include mechanisms such as targeting cycles and the broader targeting process.

2.3 LEGAL PERSPECTIVES

The legal perspective and especially IHL constitutes the most prominent strand in the CCW debate since the framework convention and its protocols are closely tied to IHL. However, other fields of international law are relevant as well, such as human rights law. International law considerations are often linked to and combined with ethical considerations, as the concept of human dignity illustrates.

IHL's Main Principles

The principle of distinction: The principle of distinction requires parties to a conflict to distinguish at all times between military and civilian objectives and to direct attacks only against combatants and military objects, whereas civilians and civilian objects must not be attacked. Evolving technology, such as decision-support systems based on computational methods could be a helpful instrument for human operators to distinguish even more accurately between military and civilian objectives. However, in case LAWS are deployed, the distinction between combatants and civilians as well as military and civilian objects would be undertaken by the weapon system.

In certain situations, the distinction between **combatants and civilians** could be drawn by qualifying persons wearing an enemy uniform and carrying arms openly as combatants. But this would entail the risk that enemy combatants could simply dispose of their uniforms or apply other obfuscation techniques in order to escape detection by a LAWS. Machines would also have to be able to identify combatants *hors de combat*, who must not be made the object of attack. In some circumstances, LAWS would have to ascertain whether the legal requirements are met and would thus have to interpret human behavior. While humans are cognitively capable of understanding even slight nuances in human behavior and the relevant context of an operation including scenarios where circumstances abruptly change, it is questionable whether LAWS would be able to do the same (with the same results). One solution to this problem could be to prohibit the use of LAWS against humans in a future regulation,⁶ while air-to-air combat or attacks on tanks would still be permissible within certain, predefined parameters. At least, the use of LAWS should be restricted to a very limited set of specific operations where parameters can be controlled adequately in order to guarantee that their use is in compliance with IHL principles.

⁶ As advised by ICRC 2021.

The situation is equally challenging when it comes to **military objects** as there are different categories of military objects according to IHL: military objects by nature and military objects by use. Examples of military objects by nature are military bases. Military objects by use are often civilian objects that are being used by adversary parties (as hideout, for example), meaning that such objects can make an effective contribution to military action. Military objects by use can be made the object of attack if their total or partial destruction would constitute a definite military advantage. It is hardly conceivable that a LAWS would be able to properly identify such targets and distinguish them from civilian objects, which must never be made the object of attack. Furthermore, it is questionable how a LAWS would be able to determine under which circumstances and according to what parameters the destruction of a military object by use would constitute a definite military advantage. However, account should also be taken of the fact that especially in deliberate targeting operations, human operators plan attacks in advance and are thus able to decide at an earlier point in time which targets are considered military targets by use and whether the destruction thereof would constitute an effective contribution to military action. Still, especially in operations where the time span between final human decision and engagement of the target is rather long, circumstances could change significantly. Therefore even though IHL does not explicitly regulate or prohibit the use of LAWS against combatants or military targets in use, iPROAW recommends States Parties to pay particular attention to this issue.

The principle of proportionality: According to the principle of proportionality, parties to a conflict must abstain from launching an attack on a legitimate military target if this attack is 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”⁷. It is often argued that proportionality assessments are usually made before an attack, especially in case of deliberate targeting operations. Thus, LAWS would not have to undertake proportionality assessments during an attack themselves but their mode of action would depend on the parameters previously set by human operators. The situation becomes more complex in case of dynamic targeting operations where unforeseen circumstances are more likely to arise requiring weapon systems to react adequately and in a timely manner. The LAWS would have to ‘react’ to all types of unforeseen circumstances potentially arising on the battlefield, and at the same time being able to weigh potential harm to civilians and civilian objects against the concrete and direct military advantage anticipated. Setting operational constraints, such as limiting attacks to specific targets – especially those, which are clearly identifiable as military targets (such as a military base) – would be an important step to guarantee that LAWS are deployed in line with IHL. Other operational constraints include the operational environment as well as human-machine interaction (see *The Role of the Operational Context* below).

The precautionary principle: The obligation to take precautions is not limited to attacks but the principle applies – at least to a certain extent – to military operations in general. The notion of “military operations” has a broader meaning encompassing “any movements, maneuvers and other activities whatsoever carried out by the armed

⁷ See Article 51 para. 5 lit. b AP I GC.

forces with a view to combat.”⁸ Parties to a conflict have to take all feasible measures to verify the target and to avoid excessive damage to civilians. Weapon systems based on computational methods could be a helpful instrument to support humans in their decision-making processes, especially with regard to target verification.

However, in case LAWS are deployed, it would be questionable whether such weapon systems are able to obtain reliable information to distinguish adequately between legitimate and illegitimate targets. As adumbrated above, the distinction between combatants and civilians and between military and civilian objects respectively is challenging, often requiring the cognitive capacity to detect slight nuances in human behavior and changes of circumstances.

Furthermore, the principle of precautions in attack requires parties to a conflict to take feasible measures to avoid excessive harm to civilians. This entails the obligation to deploy weapons with predictable effects which, in turn, necessitates an adequate understanding of the weapon system and its operating principles by the human operators and the military commanders. Furthermore, the use of weapon systems based on computational methods may oblige parties to a conflict to apply even higher standards of precaution. It is also important to bear in mind that the principle of precautions requires parties to a conflict to abort a mission in case the military objective turns out to be civilian. A LAWS would have to be able to autonomously abort a mission in case of doubt regarding the respective target. One way to address the risk of legal violations posed by the employment of LAWS is to regulate *how* these systems are used, i.e. with human control, rather than to regulate the systems, that is, their numbers or capabilities, themselves.

Human Control as a Consequence of IHL? The obligation to maintain human control arguably derives from IHL, at least by implication. However, IHL does not indicate how human control should be operationalized. It is arguable that the principles of distinction, proportionality, and precautions in attack imply a requirement for the user to have sufficient situational understanding but also options for intervention. Accordingly, the operator/commander must be able to review legal assessments and translate human decision-making into the system’s action during attack prior to the actual engagement. One option to exert control is to impose operational constraints on LAWS, for example, by not using them in anti-personnel mode or against military objects by use.

2.4 ETHICAL PERSPECTIVES

Even if some of those legal issues were to be solved by technological achievements in the future, certain ethical challenges would still call for human control in the use of force, especially if used against human targets. Therefore, iPRAW’s ethical considerations focus on the concept of human dignity.⁹ Based on the work of Peter

⁸ ICRC 1987, para. 2191.

⁹ This chapter is based on: iPRAW 2018b.

Asaro¹⁰ and Christof Heyns,¹¹ we defined a set of three minimum requirements for human dignity in the use of force as the ability to:

- **Recognize** a human being as a human, not just distinguish it from other types of objects and things but as a being with rights that deserve respect;
- **Understand** the **value of life** and the significance of its loss; and
- **Reflect** upon the reasons for taking life and reach a rational conclusion that killing is justified in a particular situation.

Depending on the moral position, one would assume or deny that autonomous functions in weapon systems break the link to moral agency. In the first case, it would be necessary to safeguard moral agency through human control, in the latter case one would want to safeguard the ability to use a weapon system lawfully at the current state of technology. In consequence, both positions would require human control in both the design of the system and in its use. Inherent in both views is an acknowledgment – tacit or explicit – of the principle of human control.

2.5 SECURITY PERSPECTIVES

Albeit not being at the center of the CCW debate on LAWS, military AI and machine autonomy could also have manifold implications for international security and strategic stability. **A major benefit of applying autonomous functions for military purposes is the possibility of accelerating information processing, decision-making, and command and control cycles. A faster tempo of warfare however also runs risk of overwhelming human operators and undermining human judgment, especially in crisis situations.** This could be aggravated by the fact that AI-enabled systems are often not entirely comprehensible for humans, especially those relying on machine or deep learning. Automation bias, meaning human overreliance and over-trust in the effectiveness of machine autonomy, has already caused various accidents in the civilian domain and could be particularly acute if human operators were not aware of the limits of AI and autonomy. Therefore, technical errors, coupled with unpredictable, opaque systems and automation bias could lead to a situation where humans might lose the ability to control escalation and manage war termination.¹²

Furthermore, already existing threat perceptions and an increasing speed of warfare could spur arms competition towards greater levels of autonomy that again increases the speed of conflicts, leading to a vicious circle.¹³ Similarly, while sophisticated AI-enabled systems might not be easily built or acquired, rather "crude" LAWS and their components could diffuse rather rapidly, potentially falling into the hands of illegitimate or irresponsible actors.¹⁴ Export controls might be able to mitigate this issue to a certain extent.¹⁵

¹⁰ Asaro 2016.

¹¹ Heyns 2017.

¹² See Horowitz and Scharre 2021.

¹³ Scharre 2021.

¹⁴ See Altmann and Sauer 2017.

¹⁵ See iPRAW 2020.

Whether AI-enabled systems and machine autonomy will strengthen or undermine strategic stability will to a large extent depend on their application and the human role. In many cases, AI technologies could aid human operators and strengthen strategic stability.¹⁶ For example, by enabling the integration of heterogeneous data and rapid information processing, AI methods could improve situational awareness of human operators and commanders. This however presupposes that technical risks and limitations as well as risks in relation to human-machine interaction are taken into account and that safety measures and adequate training of human operators ensure reliable systems and their responsible use. Ultimately, the focus should be on aiding rather than replacing the unique judgment of humans.

KEY TAKEAWAYS I



Depending on the challenges it addresses, a future regulation of LAWS will look differently.

- **Technology:** Understanding the technology behind LAWS is imperative when identifying a normative and operational framework on LAWS. However, such a framework should not overly focus on the technical details but rather on the human element in the use of force.
- **Military:** Ultimately, military decision-making processes and the role of humans and 'machines', i.e. automated processes, are the centerpiece of any considerations on LAWS. In order to discuss the issue of LAWS and human control, a sufficient understanding of the military targeting process is crucial. Even though various steps regarding human control – by design and in use – in the targeting cycle may be taken at earlier stages in military operations, special attention should be given to the final step of the targeting cycle.
- **IHL:** It is arguable that human control emanates from various provisions of IHL, at least by implication. An international agreement – whether legally binding or not – would be a viable option to strengthen the concept of human control and to regulate its implementation in more detail.
- **Ethics:** It is arguable that the concept of human dignity entails a moral obligation to maintain human agency and the necessity of human control over the use of force. These considerations could influence the way a future regulation of LAWS looks like and how it could be structured.
- **Security:** The deployment of LAWS bears the risk of creating international instability and of triggering an arms race. Aspects regarding proliferation and international stability should also be borne in mind when elaborating a normative and operational framework for LAWS, even though these factors might not become part of a CCW Protocol. There are other avenues to take these aspects into account, such as adopting soft-law documents, strengthening export control regimes, and addressing the interaction between military AI and autonomy and international stability in other international fora.

¹⁶ See Cox and Williams 2021.

3 BUILDING BLOCK II: FOCUS ON THE HUMAN ELEMENT

3.1 HUMAN CONTROL BY DESIGN AND IN USE

At the core, the considerations discussed above call for a definition of the human role in relation to the machine. This requires a focus on the tasks humans genuinely have to fulfill instead of a focus on the capabilities of the technology. That perspective does not only cover single platforms (i.e. closed-loop systems) but also assisting systems, e.g. algorithms sorting through data and leaving more time and cognitive resources to the human operator(s), and possibly battlefield management systems. Human control understood as a step at the end of the targeting process, offering a mere, brief veto option to the operator while everything else has been filtered by ‘assisting systems’, would most probably not be in compliance with international law. Even worse, such a set-up could attribute false accountability to the operators, making them responsible for aspects they have no influence on.

Minimum Requirements: The ‘human element’ can be conceptualized as human control, meaning that there is a need to fulfill a requirement for situational understanding by the human and the option to intervene that is built-in by design and available any time during use.

	Situational Understanding	Intervention
Control by Design (Technical Control)	Design of systems that allows human commanders the ability to monitor information about environment and system	Design of systems with modes of operation that allow human intervention and require their input in specific steps of the targeting cycle based on their situational understanding
Control in Use (Operational Control)	Appropriate monitoring of the system and the operational environment	Authority and accountability of human operators, teammates and commanders; abide by IHL

Table 1: iPRAW's Minimum Requirements for Human Control

The concept of human control applies to the entire life cycle of a weapon system, but ultimately the design and all other steps of the life cycle are enablers to allow for human control during target selection and engagement. **To be sure, human control does not necessarily equal direct manipulation. Furthermore, control should not be misconstrued as a singular event during or at the end of the targeting process but as an entire process.** To allow for predictability and to abide by legal requirements, the human operator must be aware of the state of the system as well as its environment. Therefore, the system’s design must allow the operator to monitor both. This could be achieved through frequent (technical or operational) points of inquiry throughout the targeting cycle. In addition to this situational understanding, the human operator needs options to interact with the system.

3.2 THE ROLE OF THE OPERATIONAL CONTEXT

While it is possible to develop abstract minimum requirements for human control in the use of force, the appropriate level or implementation of human control depends on the details of the operational context. A ‘one-size-fits-all’ control solution that addresses all concerns raised by the use of LAWS will most likely not be achievable because it cannot account for the multitude of combinations of environmental factors, operational requirements, and weapons capabilities. Instead a regulation would be more useful if it included general approximations to be specified in each case along the lines of existing IHL considerations. iPRAW encourages CCW States Parties to develop and share specific examples of how control by design and control in use can be implemented in weapon systems used in different operational contexts.¹⁷

3.3 THE TARGETING PROCESS

iPRAW’s approach to human control is focused on the necessity of humans making targeting decisions. Aspects that need to be taken into consideration are the design of a weapon system: **control by design**, as well as operational considerations, i.e. the procedures to maintain control over the weapon systems: **control in use**. Both incorporate measures earlier in the life cycle of a weapon system to ensure that e.g. research and development, programming and testing of systems, and components, already provide for the application of human control in operation. While responsible innovation and research are key elements that should be taken into account by weapon developers, it is the primary responsibility of States to ensure that a future regulation on LAWS entails explicit rules on human control.

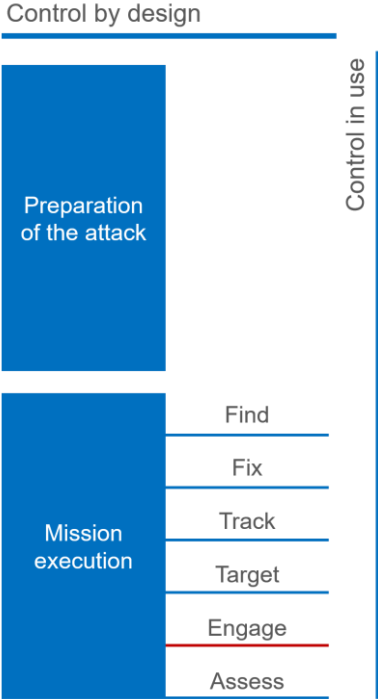


Figure 2: The Targeting Process and Human Control

¹⁷ Also, of course: Boulanin et al. 2020.

3.4 FURTHER CONSIDERATIONS

The notion of attack: Defining what constitutes the start of an attack can be useful in clarifying the concept of human control. The most relevant point in the mission thread is not defined by the launch or activation but by the final necessary decision on target selection and engagement by a human. Weapon systems with autonomous functions potentially move the final human decision to a very early stage of the operation. In terms of IHL compliance, this aspect could be challenging, mainly for two reasons: First, it can increase the level of abstraction in the target selection process (i.e. class of targets instead of specific target). Second, the environment might change during the timespan between targeting decision and engagement, e.g. outdating the initial proportionality assessments.

The underlying notion of attack will therefore influence the understanding of the principle of human control in a regulation of autonomous weapon systems. This is because IHL principles, such as distinction, proportionality and precautions in attack also have relevance during the planning and not only during the execution phase. This would alter the need or necessary level of human control in attack.

Implications for a regulation: The requirements presented above remain quite abstract. The exact implementation of these factors depends primarily on the specific context of a military operation. Translated into a regulation, this calls for rather wide-ranging rules addressing human control in more general terms, ideally supplemented by a set of more specific documents to elucidate and further expound the concept of human control and to operationalize it.

KEY TAKEAWAYS II



- A future regulation of LAWS should focus on the human element in the use of force.
- iPRAW defines human control as situational understanding and options for intervention, enabled both by design and in use. Therefore, both the life cycle of a weapon system and the targeting process should be taken into consideration when implementing and operationalizing human control; special attention should be given to the final step of the targeting cycle.
- iPRAW finds that the normative and operational framework *could* be developed in the form of a CCW Protocol entailing an abstract norm on/ a requirement for human control. The concrete operationalization of these principles could be articulated in more dynamic, non-binding documents.

4 BUILDING BLOCK III: CREATING THE FRAMEWORK

A normative and operational framework on LAWS and human control would entail a number of regulatory elements. This might include a CCW Declaration or Protocol to cover i.e. definitions, prohibitions and obligations, and transparency measures as well as additional documents to add necessary details.

4.1 A DEFINITION OF LAWS – OR OF THE HUMAN ROLE?

iPRAW recommends using the term LAWS as shorthand for various weapon platforms as well as systems of systems with machine ‘autonomy’ in the **functions** required to complete the targeting cycle. This stands in contrast to a categorical definition of LAWS. A categorical definition drawing on technical characteristics in an effort to separate “LAWS” from “non-LAWS” is unable to account for the already existing plethora of systems with autonomous/automated functions. In addition, it could, as technology progresses further, never be future-proof because almost every conceivable future weapon system can optionally be endowed with various autonomous functions. Most importantly, in the CCW context, a technical definition of a category of weapons would miss the point: While technologies like data-driven computational methods (i.e. artificial intelligence, machine learning) do enable many autonomous functions, the operational, legal, ethical, and security challenges ascribed to LAWS arise not (just) from particular technologies but especially from a potential **lack of human involvement**. Hence, if CCW States Parties want to define LAWS, a technology-agnostic conceptualization with a focus on functions instead of specific units or platforms and human-machine-interaction will be the most suitable and prudent approach. The ICRC presented a definition in this vein already:

“Any weapon system with autonomy in its critical functions—that is, a weapon system that can select (search for, detect, identify, track or select) and attack

(use force against, neutralize, damage or destroy) targets without human intervention.”¹⁸

This rather broad understanding includes several existing weapon systems. If included in a regulation, it would require a list of exceptions that might create gray areas and loopholes. To a certain extent, this has been remedied by a more recent notion of AWS by the ICRC defining the specifics of human-machine interaction more clearly:

“AWS are weapons that fire themselves when triggered by an object or person, at a time and place that is not specifically known, nor chosen, by the user. Indeed, the distinction between a non-AWS and an AWS can be understood by asking whether a person chooses the specific target(s) to strike or not.”¹⁹

4.2 NORMATIVE FRAMEWORK TO ESTABLISH AN OBLIGATION FOR HUMAN CONTROL

iPRAW recommends that the principle of human control should be internationally recognized within the CCW and possibly other documents of international law and be the basis from which requirements can be developed as part of a norm-shaping process. **The elements presented below could be helpful to shape a regulation, be it legally binding or not. What is important though is to create a normative framework and operational guidance around the (development and) use of weapon systems with autonomous functions.** For example, the ICRC presented one approach to such a framework by calling for a prohibition of unpredictable and anti-personnel AWS and a regulation of other AWS that considers the specific operational context.²⁰

As iPRAW’s scenario-based discussions about the adequate type and level of human control illustrated,²¹ a definition of human control that adequately considers the operational context requires many details about technical capabilities and indicators for the targets. Hence, a ‘one-size-of-control-fits-all’ solution does not exist. Rather, a combination of minimum requirements and individual solutions is necessary. Individual solutions based on a case-by-case assessment will ultimately lead to different levels of granularity when it comes to formulating human control in a regulatory framework, e.g. a rather abstract declaration or treaty and more granular best practices and manuals.

These could inform a regulation of LAWS and human control by creating the normative baseline and align with recommendations from other actors. As for example the ICRC discussed, it is crucial to link specific regulatory elements to the challenges raised by LAWS. Within the CCW such a regulation could cover:

¹⁸ ICRC 2016, p. 1.

¹⁹ See ICRC 2021.

²⁰ See ICRC 2021.

²¹ Find the notes and graphic recordings of the workshop series here: <https://www.ipraw.org/events/series-of-scenario-based-workshops/>.

- **military considerations:** fulfilling the operational objective and translating the commanders intent to the battlefield,
- **legal concerns:** abide by IHL principles, especially the principle of precaution by avoiding unpredictable effects, ensure human judgment to take legal decisions,
- **ethical concerns:** retain moral agency.

A CCW regulation entailing an obligation to maintain human control may also mitigate **security challenges**, such as conflict escalation, even though the CCW does not address them explicitly. Further important aspects, such as technology diffusion, will most likely not be addressed in a future regulation on LAWS but would have to be addressed in other fora. iPRAW’s model discussed below is not meant to read in opposition to the ICRC propositions on a prohibition and regulation of AWS but rather as an additional perspective with the same objective to keep human control in the use of force.

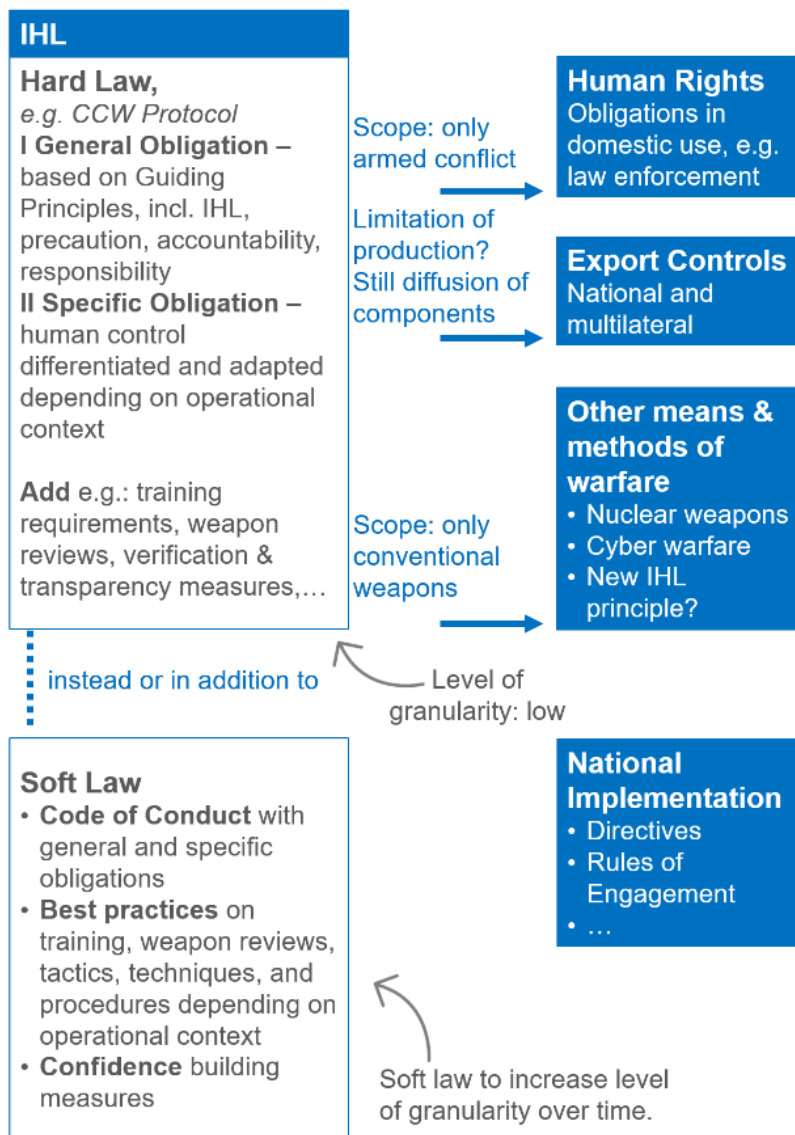


Figure 3: Model for a Normative and Operational Framework for LAWS and Human Control

HARD LAW

General Obligations: A regulation of LAWS, e.g. a CCW Protocol, could consist of a general obligation to maintain human control over the use of force when deploying conventional weapons. The GGE Guiding Principles adopted in 2019 could lay the groundwork to further shape a future regulation.²²

The Guiding Principles emphasize that IHL continues to fully apply to LAWS. Furthermore, they stress that human responsibility for the decision to use LAWS must be retained since accountability cannot be transferred to machines. This aspect should be considered throughout the entire life-cycle of a LAWS. They also stipulate that human-machine interaction must be in compliance with international law and refer, among others, to questions relating to accountability, weapon reviews, and risk assessments, including the development stage of weapon systems.

In addition, other principles that were not explicitly mentioned in the Guiding Principles but found entry into other documents adopted by the GGE could also supplement a future regulation. Examples are the principle of predictability, reliability, and transparency.

Specific Obligations: Specific obligations and more nuanced rules on the concept of human control could play a pivotal role in a future treaty focusing on human control. It could entail concrete rules stipulating that human control encompasses both situational understanding and the option to intervene, enabled by design and in use. The term *situational understanding* could be elaborated in more detail by stipulating that it refers to the ability to monitor information about the environment, the target and the weapon system. The human operator shall monitor the system and the operational environment to the extent necessary in a specific operation. Furthermore, the different modes of operation should allow the human operator to intervene if necessary. All people in the chain of command are equally obliged to abide by the rules of international law and should be held accountable for any violations of the law. These and other obligations could be an integral part of “specific obligations” in a future treaty on LAWS.

The ICRC mentions two specifics that would call for tighter restrictions, namely AWS with unpredictable effects and the anti-personnel use of AWS.

Scope of application: Since human control is to be understood as a feature of the design as well as use, the regulation would cover the development and deployment of weapons – effectively prohibiting the development of weapons without sufficient options for human control, i.e. LAWS. Nevertheless, it is important to bear in mind that the CCW and the Protocols related thereto merely apply in armed conflict and not in peacetime. This would also hold true in case another Protocol within the CCW framework was adopted, regulating LAWS. Thus, the use of LAWS in policing scenarios would not be covered by a future Protocol. However, human rights law and other (international) legal regimes would still be applicable.

²² See UN Office at Geneva 2019.

Furthermore, a CCW regulation would only apply to conventional weapons and would not cover autonomous cyber or nuclear capabilities.

Training: Thorough training of military personnel is key when it comes to the adequate deployment and use of weapon systems with autonomous functions. Thus, provisions on the training of military personnel are imperative. It should account for humans' cognitive limitations, especially when it comes to understanding LAWS and predicting their effects. Furthermore, it is important to inform military personnel about the technical limitations of autonomous weapon systems, raising awareness of the possible ways in which information is being fused and filtered and the implications thereof for a human operator's situational understanding. States Parties could also share information regarding the training of military personnel.

Weapon Reviews: Weapon reviews (see Art 36 AP I GC) are often considered as key elements in order to regulate all types of conventional weapons. Yet, weapon reviews entail the risk of being unable to sufficiently consider technological advancements in the field of robotics and AI. Weapon reviews are not applied universally and merely a few States have a dedicated review process in place. Given the increased innovation of weapon systems, it may become more and more difficult for a commander to understand how a system works and evaluate whether it will be lawful to use it in a given situation absent a supplemental review process.

Moreover, the testing and evaluation of systems with computational methods is costly and presents several other challenges, which may translate into reviews that are incomplete or cannot quantify the reliability of the system. Nonetheless, Article 36 reviews remain important. Additional processes and guidance could make the review more robust and increase the likelihood of compliance with international law. The challenge, however, is to universalize the practice of weapon reviews and make it more transparent.

Hence, a future regulation requiring States Parties to maintain human control over the use of force should entail an explicit provision establishing clear standards for an adequate weapon review. The GGE Guiding Principles e) and f) already shape and restrain the research, development, and acquisition of autonomous weapons.

Verification and Transparency Measures: Verification is a challenging technical *and* political issue when it comes all types of weapons, but a regulation of AWS might add some specific hurdles. With military processes as the subject of regulation, it would take a different approach than counting the number of drones or measuring their range. If States wanted to establish a verification regime, the verification measures would probably differ depending on the weapon system in question as well as the operational context. However, as it may be difficult to find consensus on such mixed forms of verification, it might be more feasible to favor a general obligation for States to be as transparent as possible regarding their deployment of unmanned weapons/ weapons with autonomous functions and their compatibility with IHL and other legal rules. A similar approach has been used for previous CCW Protocols as well.²³

²³ For a more detailed discussion of a verification regime see: iPRAW 2019.

SOFT LAW

Best Practices: States Parties to a CCW Protocol (or any other regulatory instrument) could meet regularly with the specific purpose of sharing experiences that were already made at the domestic level regarding the design, development, acquisition, deployment, and use of weapon systems with autonomous functions (under the assumption that the use of such weapons is lawful, meaning that human control is maintained). Especially States with significant experience in this area could provide knowledge and information about regulating LAWS and could show how human control is maintained in practice. Such experiences could serve as exemplary model for other States.

Best practices are also a helpful instrument to establish additional standards on the design, development, acquisition, deployment, and use of LAWS based on cooperation, transparency, trust, and confidentiality. The sharing of best practices could promote the adoption of domestic laws on LAWS, ensuring that human control is maintained as required by military, legal, and ethical considerations.

Code of conduct for the industry: A treaty on LAWS might not be the ideal format to address the role of industry in the development of LAWS. States will probably remain the key addressees of a regulation. However, a future treaty could oblige States to establish specific safeguards and quality standards for industry when developing and designing LAWS at the national level similar to the exclusion of funding for AWS in the European Defence Fund.²⁴ The GGE Guiding Principle g) explicitly stresses the importance of risk assessments and mitigation measures in the design, development, testing, and deployment of emerging technologies and could be used as a blueprint provision for any future regulation. Furthermore, industry itself could adopt a (legally non-binding) Code of Conduct and voluntarily commit to adhere to certain standards and principles when designing and developing LAWS and elements thereof.²⁵

4.3 LESSONS FROM OTHER LEGAL REGIMES

Creating a legal regime addressing LAWS and human control will require innovative thinking due to the nature of the technologies involved and the way they impact human interaction. It might be worthwhile to investigate existing regulations of international law that may offer guidance for a new instrument. Five features and attributes seem particularly relevant to instruct the formation of a new regulation:

- the human element to prevent bodily harm,
- the dual-use aspect,
- the description of a general principle,
- the regulation of technology that is harmful and needs to be substituted,
- and the challenge of paradigmatic technological transformations.

These five essential features make these treaties successful and resilient. These attributes also offer an incentive for a new international treaty and call on States to

²⁴ See European Parliament 2021; Brzozowski 2021.

²⁵ See e.g. Bloch et al.

transcend the technical dimensions on the discussion on human-machine interactions and consider the normative perspectives given the ethical and legal questions raised.²⁶

Legal regimes that could serve as examples of success are the Chemical Weapons Convention, the Biological Weapons Convention, and the Ozone Protocol (known as the Montreal Protocol). Some of their elements could inform a CCW regulation, e.g. a scientific board to monitor technological developments, and provide guidance for implementing the norm and the prominent role of the principle of precaution.²⁷

KEY TAKEAWAYS III



- A categorical definition of LAWS might not be advisable. If a definition becomes part of a CCW Declaration or Protocol nonetheless, such a definition should not focus on technical details but should rather be technology-agnostic with a focus on functions and the human role.
- Regarding the possibility of a CCW Declaration or Protocol, it might be more advisable to focus on the obligation to maintain human control over the use of force instead of a definition of LAWS. This obligation could apply to all conventional weapons.
- The GGE Guiding Principles of 2019 are a good starting point for further discussions on a normative and operational framework on LAWS, but they are not yet sufficient. For example, details on the human-machine interaction are necessary. In addition, other principles that were not explicitly mentioned in the Guiding Principles could also find entry into a future CCW Declaration or Protocol, such as the principles of predictability, reliability, and transparency.
- Solely one document, e.g. a treaty, might not suffice to tackle all the challenges that are being raised by LAWS. The adoption of additional soft-law documents, such as best practices, is recommended to supplement a potential treaty on LAWS.

²⁶ See Amoroso 2020.

²⁷ See Garcia 2016.

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