

ACADEMY BRIEFING No. 8

Autonomous Weapon Systems under International Law

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Introduction

Academy Briefings are intended to inform government officials, officials working for international organizations, nongovernmental organizations (NGOs), and legal practitioners, about the legal and policy implications of important contemporary issues. This Academy Briefing addresses the legality under international law of autonomous weapon systems, an issue that is growing swiftly in importance as technology advances and machines acquire the capacity to operate without human control.

Developments in civilian technology, including improved sensor recognition, processing speeds, and artificial intelligence (or ‘machine learning’), allow machines to perform increasingly complex tasks,¹ such as driving and performing surgery, with limited human involvement.

In parallel, certain states are developing weapon systems that will not rely on human intervention for certain functions. The following potential features are driving the interest of certain states in developing autonomous weapon systems:

- They would not depend on communications links and, unlike remotely-piloted systems, would not be vulnerable to jamming and cyber-attacks.
- They could operate at increased range for extended periods.
- Fewer humans would be needed to support their operations.
- Their higher processing speeds would suit the increasing pace of combat.²

While the development of autonomous weapon systems undoubtedly raises serious societal³ and ethical concerns, this Briefing focuses on the international legal implications of developing and using such systems. Section A considers

autonomous weapon systems with respect to the law that governs inter-state use of force (*jus ad bellum*). Section B considers their legality under the international law of law enforcement. Section C assesses their use in armed conflicts under international humanitarian law, notably in regard to the rules on distinction, proportionality, and precautions in attack. Section D examines the international obligation to conduct a legal review of autonomous weapon systems. Section E considers the issue of accountability. A final section offers brief concluding remarks.

The remainder of this introduction reviews the state of current technology, summarizes international discussions of autonomous weapons, including state policies and positions, and defines the term ‘autonomous weapon systems’.

Current technology

Military technology has already incorporated important elements of autonomy. For example, the United States (US) Navy Phalanx system⁴ automatically defends ships against incoming missiles and rockets, as do air-defence systems such as the Patriot Missile system⁵ and Israel’s ‘Iron Dome’.⁶ United Kingdom (UK) ‘fire and forget’ Brimstone missiles are said to be able to identify tanks, cars, and buses and find ‘targets’ in a pre-determined region without further human involvement.⁷

New aircraft are extending this autonomy. ‘K-MAX’ helicopters,⁸ developed for the US Army and Marines, can fly along pre-programmed routes. The X-47B (a US Navy combat aircraft) can take off and land itself on an aircraft carrier.⁹ The US Defense Advanced Research Projects Agency (DARPA) is working on techniques for autonomous mid-air refuelling. A Taranis attack aircraft, in development

¹ See J. Thurnher, ‘Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective’, in H. Nasu and R. McLaughlin (eds.), *New Technologies and the Law of Armed Conflict*, TMS Asser Press, 2014, pp. 213–18.

² *Ibid.*

³ See, for example, N. Bilton, ‘Artificial Intelligence as a Threat’, *New York Times*, 5 November 2014. At: <http://www.nytimes.com/2014/11/06/fashion/artificial-intelligence-as-a-threat.html>.

⁴ ‘MK 15 - Phalanx Close-In Weapons System (CIWS)’, US Navy Fact File. At: http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=487&ct=2.

⁵ See, for example, ‘Patriot Missile Long-Range Air-Defence System, United States of America’. At: <http://www.army-technology.com/projects/patriot/>.

⁶ A. Gatopoulos, ‘How successful was Israel’s Iron Dome?’, *Aljazeera*. At: <http://www.aljazeera.com/news/middleeast/2014/08/israel-iron-dome-gaza-rockets-201481712494436388.html>.

⁷ J. Markoff, ‘Fearing Bombs that Can Pick Whom to Kill’, *New York Times*, 11 November 2014. At: <http://www.nytimes.com/2014/11/12/science/weapons-directed-by-robots-not-humans-raise-ethical-questions.html?hp&action=click&pgtype=Homepage&module=second-column-region>.

⁸ Lockheed Martin, ‘K-MAX’. At: <http://www.lockheedmartin.co.uk/us/products/kmax.html>.

⁹ Northrop Grumman, ‘X-47B UCAS’. At: <http://www.northropgrumman.com/Capabilities/X47BUCAS/Pages/default.aspx>.

for the British Royal Air Force, is expected to be capable of autonomous supersonic flight.¹⁰ At present, none of these weapons is believed to be equipped to select and engage targets autonomously (without human intervention); but weapon systems will gain increasingly autonomous features over time.¹¹

International debate and state practice

Governments and civil society are actively debating the degree to which it is useful, legal, and desirable to develop and use autonomous weapon systems for purposes of law enforcement and, especially, for use in the conduct of hostilities in armed conflict. Governments and independent experts have explored technical, military, ethical, and legal aspects of the issue in discussions hosted by the United Nations (in the context of the Convention on Certain Conventional Weapons¹²) and under the auspices of the Human Rights Council,¹³ UNIDIR,¹⁴ the International Committee of the Red Cross (ICRC),¹⁵ academic institutions,¹⁶ and think-tanks.¹⁷ At one end of the debate it is believed that

autonomous technology can improve performance and therefore limit harm; at the other, that no machine should be given discretion to take human life.

Autonomous weapon systems are perceived to have several advantages:

- They will be much faster at sensing and processing information.¹⁸
- They will increase the flexibility, speed, and precision of decision-making and targeting.¹⁹
- By replacing human fighters, they will spare lives.²⁰
- By lacking emotion they will be able to undertake dull, dirty, and dangerous tasks.²¹
- The absence of emotions such as fear, vengeance, or self-interest may lead to outcomes that overall are less harmful.²²

Equally, it is perceived that their use will generate a number of threats.

- The value of human life will be diminished if decisions to kill people are taken by machines.²³

10 Thurnher, 'Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', pp. 213–18.

11 *Ibid.*, pp. 226–7.

12 Chairperson's Report, 2014 informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS), Advanced version, 16 May 2014. At: [http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/350D9ABED1AFA515C1257CF30047A8C7/\\$file/Report_AdvancedVersion_10June.pdf](http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/350D9ABED1AFA515C1257CF30047A8C7/$file/Report_AdvancedVersion_10June.pdf).

13 Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, 9 April 2013, at: http://www.ohchr.org/documents/hrbodies/hrcouncil/regularsession/session23/a-hrc-23-47_en.pdf.

14 UNIDIR, 'The Weaponization of Increasingly Autonomous Technologies: Implications for Security and Arms Control', Research Project, at: <http://www.unidir.org/programmes/security-and-society/the-weaponization-of-increasingly-autonomous-technologies-implications-for-security-and-arms-control>.

15 ICRC, Expert Meeting on 'Autonomous weapon systems: technical, military, legal and humanitarian aspects', 26–28 March 2014, Report of 1 November 2014. At: <https://www.icrc.org/en/document/report-icrc-meeting-autonomous-weapon-systems-26-28-march-2014#VG6fz9aO71x>.

16 Geneva Academy of International Humanitarian Law and Human Rights and UNIDIR, 'Summary Report of Experts Meeting on Armed Drones and Robots under International Law', 3–5 December 2013, at: <http://www.geneva-academy.ch/policy-studies/special-projects/drones-and-robots-under-international-law>; and the European University Institute, Academy of European Law and Fritz Thyssen Foundation, Conference on Autonomous Weapon Systems – Law, Ethics, Policy, at: <http://www.eui.eu/Documents/DepartmentsCentres/AcademyofEuropeanLaw/Projects/ProgrammeAWS2014.pdf>.

17 Chatham House, Conference on Autonomous Military Technologies, 24–25 February 2014. At: <http://www.chathamhouse.org/Autonomous>.

18 W. H. Boothby, *Conflict Law: The Influence of New Weapons Technology, Human Rights and Emerging Actors*, TMC Asser Press, 2014, pp. 104–7; and M. Sassòli, 'Autonomous Weapons and International Humanitarian Law: Advantages, Open Technical Questions and Legal Issues to be Clarified', *International Law Studies*, Naval War College, Vol. 90 (2014), p. 310.

19 Boothby, *Conflict Law: The Influence of New Weapons Technology*, pp. 104–7; Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 310.

20 ICRC, Expert Meeting on 'Autonomous weapon systems: technical, military, legal and humanitarian aspects', p. 9.

21 Boothby, *Conflict Law: The Influence of New Weapons Technology*, pp. 104–7.

22 ICRC, 'International Humanitarian Law and the Challenges of Contemporary Armed Conflicts', Official Working Document of the 31st International Conference of the Red Cross and Red Crescent (28 November – 1 December 2011), 2011; K. Anderson, D. Reisner and M. Waxman, 'Adapting the Law of Armed Conflict to Autonomous Weapon Systems', *International Law Studies*, Naval War College, Vol. 90 (2014), p. 393; Boothby, *Conflict Law: The Influence of New Weapons Technology*, pp. 104–7. Sassòli notes that 'it seems more reasonable to expect (and to ensure) a person who devises and constructs an autonomous weapon in a peaceful workplace to comply with IHL than a soldier on the battlefield or in a hostile environment' ('Autonomous Weapons and International Humanitarian Law', p. 310).

23 Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 109, p. 20; P. Asaro, *Ethical questions raised by military applications of robotics*, Presentation in the context of CCW informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS), May 2014, p. 9, at: [http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/79F6199F74DC824CC1257CD8005DC92F/\\$file/Asaro_LAWS_ethical_2014.pdf](http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/79F6199F74DC824CC1257CD8005DC92F/$file/Asaro_LAWS_ethical_2014.pdf).

- Any technology may proliferate, and be misused or abused.²⁴
- Autonomous weapons may be imperfect and may malfunction.²⁵
- A technology that creates little risk for the party that deploys it, but real risk for the fighters and civilians of an enemy that does not possess it, is asymmetrical and unfair.²⁶
- Autonomous weapon systems lack positive human emotions, such as compassion or mercy.²⁷
- The physical and emotional distance between the persons programming or deploying such weapon systems and the target may generate affective indifference (the so-called 'video game mentality').²⁸

Governments, civil society organizations, and academics have developed or adopted various policies and positions in response to these perceived advantages and disadvantages.

In Joint Doctrine Note 2/11, the UK Ministry of Defence has stated that it 'currently has no intention to develop systems that operate without human intervention in the weapon command and control chain, but it is looking to increase levels of automation where this will make systems more effective'.²⁹

The policy of the US Department of Defense establishes an approval process for acquiring or developing autonomous weapon systems and requires safety measures to be part of future designs. 'Autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force'.³⁰

The European Parliament has called on European Union (EU) member states, the EU High Representative for Foreign Affairs and Security Policy, and the Council, to 'ban the development, production and use of fully autonomous weapons which enable strikes to be carried out without human intervention'.³¹

The UN Special Rapporteur on extrajudicial, summary or arbitrary executions has called for 'pause, to allow serious and meaningful international engagement with this issue',³² and a moratorium on the 'testing, production, assembly, transfer, acquisition, deployment and use' of autonomous weapon systems until a framework to regulate their future has been agreed.³³

The NGO Campaign to Stop Killer Robots has called for a 'comprehensive, pre-emptive prohibition on fully autonomous weapons'. It insists on human control of every weapon technology, to ensure 'both humanitarian protection and effective legal control'.³⁴ Article 36, a member of the Campaign's Steering Committee, has argued that the principles of humanity 'require deliberative moral reasoning, by human beings, over individual attacks', and has called for a new legal instrument that explicitly prohibits weapons that do not allow 'meaningful human control'.³⁵

The ICRC has stated that 'major concerns persist over whether a fully autonomous weapon could make the complex, context-dependent judgements required by international humanitarian law' and that this 'represents a monumental programming challenge that may well prove impossible to achieve'. It has called for a thorough legal review of any new weapon with autonomous features to ensure that all use can comply with international humanitarian law (IHL), and has questioned whether such weapon systems can conform to the principles of humanity.³⁶

²⁴ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 310.

²⁵ See Report of the ICRC Expert Meeting on 'Autonomous weapon systems: technical, military, legal and humanitarian aspects', p. 8.

²⁶ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 310.

²⁷ *Ibid.*

²⁸ *Ibid.*

²⁹ UK Ministry of Defence, 'Development, Concepts and Doctrine Centre, The UK Approach to Unmanned Aircraft Systems', Joint Doctrine Note 2/11, 30 March 2011, at para. 508. At: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33711/20110505JDN_211_UAS_v2U.pdf.

³⁰ US Department of Defense, Directive 3000.09; see also Thurnher, 'Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', pp. 213–18.

³¹ European Parliament, Resolution on the use of armed drones, No. 2014/2567(RSP), 25 February 2014, para. H(2)(d). At: <http://justsecurity.org/wp-content/uploads/2014/02/European-Parliament-Resolution-Drones.pdf>.

³² Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 33, p. 7.

³³ *Ibid.*, para. 113, p. 21.

³⁴ Campaign to Stop Killer Robots. At: <http://www.stopkillerrobots.org/learn/>.

³⁵ Article 36, statement at the CCW informal Meeting of Experts on LAWS, 15 May 2014. At: [http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/26033D398111B4E8C1257CE000395BBB/\\$file/Article36_Legal+Aspects_IHL.pdf](http://www.unog.ch/80256EDD006B8954/%28httpAssets%29/26033D398111B4E8C1257CE000395BBB/$file/Article36_Legal+Aspects_IHL.pdf).

³⁶ ICRC, 'Autonomous weapons: What role for humans?', News Release, Geneva, 12 May 2014. At: <https://www.icrc.org/eng/resources/documents/news-release/2014/05-12-autonomous-weapons-ihl.htm>.

Three scholars have proposed a three-tier approach to autonomous weapon systems.

1. Adopt an international instrument that elaborates on the application of IHL to autonomous weapon systems and incorporates guidelines for their development.
2. Promulgate national rules and policies on developing and applying IHL to autonomous weapon systems and encourage states to publish general policies and share best practices.
3. Involve both the defence industry and military forces in these processes.³⁷

Definitions

Several definitions of ‘autonomous weapon system’ have been proposed, including the following.

The US Department of Defense Directive considers a weapon system to be autonomous if, once activated, it ‘can select and engage targets without further intervention by a human operator’.³⁸

According to the UN Special Rapporteur on extrajudicial, summary or arbitrary executions: ‘Lethal Autonomous Robotics (LARs) refers to robotic weapon systems that, once activated, can select and engage targets without further intervention by a human operator. The important element is that the robot has an autonomous “choice” regarding selection of a target and the use of lethal force.’³⁹

Human Rights Watch defines ‘human-out-of-the-loop’ weapons as those ‘capable of selecting targets and delivering force without any human input or interaction’, while ‘human-on-the-loop’ weapons can ‘select targets and deliver force under the oversight of a human operator who can override the robots’ actions’. Both types can be considered ‘fully autonomous weapons’ when supervision is so limited that the weapon can be considered ‘out-of-the-loop’.⁴⁰

The ICRC has focused its attention on ‘autonomy in critical functions rather than autonomy in the overall weapon system’, and has said that the critical functions are target acquisition, tracking, selection, and attack.⁴¹

For the purpose of this Briefing, the term ‘autonomous weapon systems’ refers to weapon systems that can select and engage targets without a human override.

Discussions in the Convention on Certain Conventional Weapons framework

In May 2014, states parties to the Convention on Certain Conventional Weapons (CCW) held a four-day informal meeting of experts to discuss, for the first time, the question of ‘lethal autonomous weapons systems’ (LAWS). Though many delegations underlined the preliminary nature of the discussion, the meeting raised several key issues and concerns. (See Table 1.) It enabled states to start shaping their positions on several proposals, including exchange of information, development of best practice, and a moratorium or ban on research.⁴²

On 14 November 2014, states parties to the CCW agreed to continue informal discussion of questions related to emerging technologies in the area of ‘lethal autonomous weapons systems’, and to hold further meetings in Geneva on 13–17 April 2015. Several states acknowledged the potential impact that such weapons might have on human rights in situations that fell outside the CCW’s mandate. Some took note of the complementary debates on autonomous weapon systems that are taking place in other UN fora, such as the Human Rights Council.⁴³

³⁷ Anderson, Reisner and Waxman, ‘Adapting the Law of Armed Conflict to Autonomous Weapon Systems’, pp. 407–9.

³⁸ Department of Defense, Directive 3000.09, 21 November 2012, pp. 13–14.

³⁹ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 38.

⁴⁰ B. Docherty, *Losing Humanity: The Case against Killer Robots*, Human Rights Watch (November 2012), p. 2. At: <http://www.hrw.org/reports/2012/11/19/losing-humanity-0>.

⁴¹ ICRC, Report of an expert meeting on ‘Autonomous weapon systems: technical, military, legal and humanitarian aspects’, Geneva (26–28 March 2014), November 2014.

⁴² Report of the 2014 informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS), Geneva, 13–14 November 2014’, UN doc. CCW/MSP/2014/3, 11 June 2014, §16.

⁴³ See the statements of Austria, Ireland, South Africa and Sierra Leone. At: <http://reachingcriticalwill.org/disarmament-fora/others/ccw/2014/meetings-states-parties/statements>.

Table 1. State positions and issues raised at the CCW Experts Meeting, May 2014 (excerpts)⁴⁴

Austria	<p>‘Austria would, at this stage, make a plea for a real joint international effort to look for common responses to the concerns mentioned. This effort would benefit greatly from increased transparency by States currently engaged in the development of lethal autonomous weapons. Austria would also make a plea for great caution, at this stage, to push technological developments forward the implications of which seem yet not to be sufficiently understood.</p> <p>As an interim measure Austria calls on all currently engaged in the development of such weapon systems to freeze these programmes and those deliberating to start such development not to do so.’</p>
Brazil	<p>‘Taking into account the rapid pace of scientific development regarding the autonomous systems, it is critical to ensure that all these emerging technologies are employed in the military field in conformity with Human Rights and International Humanitarian Law. Nevertheless, we would like to highlight that discussions within the CCW should not preclude other UN bodies, like the Human Rights Council, to consider and take action on this issue, in conformity with their respective mandate.’</p>
Czech Republic	<p>‘We believe that LAWS despite their complexity will become an important part of CCW as an international humanitarian law tool with the potential to effectively prevent a negative impact of these weapons on civilian populations.’</p>
France*	<p>‘It is necessary to bear in mind that the technologies in question are of a dual nature, and that they may have many civil, peaceful, legitimate and useful applications. There must be no question of limiting research in this field.’</p>
Germany	<p>‘Germany does not intend to have any weapon systems that takes away the decision about life and death from men. We firmly believe that there should be a common understanding in the international community that it is indispensable to maintain human control over the decision to kill another human being. For Germany, this principle of human control is the foundation of the entire international humanitarian law. It is based on the right to life, on the one hand, and on the right to dignity, on the other. Even in times of war, human beings cannot be made simple objects of machine action.</p> <p>As there are no lethal autonomous weapon systems to date, we have the time to consider whether we want to accept this change, whether we deem it necessary to take action and if we do so how we could regulate such systems.</p> <p>Germany recognizes the strategic imperative to demonstrate that new weapons adhere to existing legal standards.’</p>
India	<p>‘High Contracting Parties also reaffirmed the need to continue the codification and progressive development of the rules of international law applicable in armed conflict. These include the ending of the arms race and pursuing every effort which may contribute to progress towards general and complete disarmament under effective international control.’</p>
Ireland	<p>‘...although outside the scope of the CCW, the potential use and abuse of autonomous weapons beyond the battlefield, in law enforcement for instance, is also deserving of consideration.’</p>

44 At: <http://www.unog.ch/80256EE600585943/%28httpPages%29/6CE049BE22EC75A2C1257C8D00513E26?OpenDocument>.

Japan	‘In this regard, I would like to point out that if we consider LAWS as “fully” lethal autonomous weapons systems, which once activated, can effectively select and engage a target without human intervention, we believe, at this stage, it is questionable such autonomous weapons could comply with international humanitarian law, and therefore, should be highlighted in our discussion. Also, while we may continue researching and developing non-lethal autonomous technology for defence purposes, we are not convinced of the need to develop “fully” autonomous weapon systems which is completely out of control of human intervention.’
Mexico*	‘We also recognize the applicability, in this matter, of the principles of the boundaries and preventive obligations laid down under international humanitarian law. Among others, the obligation of legal review under Article 36 of the 1977 Additional Protocol I to the Geneva Conventions (...) We also recognize the applicability, in this area, of the principle of humanity and the dictates of public conscience under the Martens clause. There is no doubt that any development of new technologies must comply with these principles.’
Pakistan	‘LAWS would, therefore, undermine international peace and security. Their introduction would affect progress on disarmament and non-proliferation. Faced with the prospect of being overwhelmed by LAWS, states possessing WMD capabilities would be reluctant to give them up, while others would feel encouraged to acquire them.’
South Africa	‘Of primary concern to my delegation are the humanitarian implications of their use and related ethical considerations. One of the key questions in this regard that should be of concern to all of us is whether these new technologies of warfare would be compliant with the rules of International Humanitarian Law, including those of distinction, proportionality and military necessity, as well as their potential impact on human rights.’
Sweden	‘As a starting point, Sweden believes that when it comes to decisions on the use of force against persons, humans should never be “out of the loop”. It is important to underline that even if LAWS are referred to as “autonomous”, states are legally responsible for their use. If violations occur that are attributable to a particular State, that state is responsible according to the rules of State responsibility and international humanitarian law.’
Switzerland*	‘Second, we must take into account the ethnical dimension of the militarisation of increasingly autonomous technologies. It appears clear that the potential development and use of lethal autonomous weapons systems to select and attack targets without meaningful human control raises significant ethical concerns. We hope that the group will be able to draw on the work of ethicists who have considered the impact of technologies in other areas of fundamental importance, such as the right to life and the preservation of human dignity.’
United Kingdom	‘The discussions have also underlined to us that for the subject of LAWS a conventional weapons forum is highly appropriate. As such, we remain of the view that the CCW is the right place for such discussions.’
United States	‘In order to assess risk associated with the use of any weapons system, states need a robust domestic legal and policy process and methodology. We think states may also need to tailor those legal and policy processes when considering weapons with autonomous features. For that reason, as you know, after a comprehensive policy review, the United States Department of Defense issued DoD Directive 3000.09, “Autonomy in Weapon Systems,” in 2012.’

* Unofficial translation.

A. Autonomous weapon systems and *jus ad bellum*

The potential impact of autonomous weapon systems on international peace and security should not be underestimated. One concern is that because the forces of a state that deployed autonomous weapon systems would be at lower immediate risk, states might more easily resort to force. Thus, possession of such weapons might prompt states to lower the threshold for using force, and consequently increase the incidence of attacks.⁴⁵ This could, in turn, cause an escalation in armed violence between states that can deploy such weapons.

In the light of these concerns, it is important to recall *jus ad bellum*, which governs use of force between states. Any resort to armed force on the territory of a foreign state, without its express consent,⁴⁶ violates Article 2(4) of the UN Charter (Box 1), which requires every state to refrain from threatening or using force against the territorial integrity or political independence of another state. The widely accepted interpretation of Article 2(4) is that even short and swift actions violate the provision, unless one of two specific exceptions applies.⁴⁷

These exceptions are:

- When armed force is authorized by the UN Security Council (under Chapter VII of the UN Charter) in order to maintain or restore international peace and security.

- When force is used in exercise of the right of individual or collective self-defence, recognized in Article 51 of the UN Charter.

Under Article 24 of the UN Charter, the UN Security Council is responsible for the 'maintenance of international peace and security'. Under Chapter VII, it may authorize 'action by air, sea or land forces as may be necessary to maintain or restore international peace and security'.⁴⁸

With respect to the right of self-defence, because Article 51 of the Charter (see Box 2) does not describe the nature of the party launching an armed attack, it does not necessarily limit the right to self-defence to armed attacks only by states.

It has traditionally been assumed that the right to self-defence only arises *after* an 'armed attack' has occurred. However, there has been growing support for the idea that states may use force in advance of an 'imminent' armed attack.⁴⁹ More controversially, the difficulty of foreseeing attacks by non-state actors has inspired a doctrine of pre-emptive or preventive self-defence, far less widely agreed, that does not require specific foreknowledge of an imminent attack.

Box 1. Prohibition of the threat or use of force under Article 2(4) of the UN Charter

'All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations.'

Article 2(4) addresses armed force rather than political or economic coercion.

⁴⁵ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 58, p. 11. See also B. Docherty, 'Losing Humanity: The Case against Killer Robots', Human Rights Watch, November 2012, p. 4.

⁴⁶ See International Law Commission (ILC), Draft Articles on the Responsibility of States for Internationally Wrongful Acts, Art. 20. According to the ILC commentary on this provision, consent to resort to force can only be granted by the highest government authorities, and must be given freely, clearly, and in advance of or at the time of the relevant operation. See also International Court of Justice (ICJ), *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, Judgment (Merits), 1986, para. 246. A state's consent to a use of force on its territory does not absolve either state of the obligation to comply with IHL or international human rights law.

⁴⁷ N. Lubell, *Extraterritorial Use of Force Against Non-State Actors*, OUP, 2010, p. 28.

⁴⁸ Article 42, UN Charter.

⁴⁹ See Lubell, *Extra-Territorial Use of Force Against Non-State Actors*, pp. 55–63.

Box 2. The right of self-defence under Article 51 of the UN Charter

'Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain international peace and security. Measures taken by Members in the exercise of this right of self-defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace and security.'

Not every use of force constitutes an armed attack in the sense of Article 51 of the UN Charter. In the case of *Military and Paramilitary Activities in and Against Nicaragua*, the International Court of Justice (ICJ) set a high threshold. It stated that the right to self-defence would be triggered in response to 'a most grave form of the use of force' in terms of its 'scale and effects'.⁵⁰ A border skirmish or incident would probably not meet this criterion.

Under customary international law, any resort to force in self-defence must comply with the conditions of necessity and proportionality.⁵¹ Necessity requires that force should only be used

when other, non-forcible measures are not effective, or feasible, or have been exhausted. The principle of proportionality requires that the state using force should respond in a manner that is proportional to the need to repel the threat.⁵² This is generally understood to mean that the force used must not exceed what is required to thwart the attack and prevent continuing attacks.⁵³

In sum, any state that deployed autonomous weapon systems on the territory of another state would need to comply fully with *jus ad bellum*, the international legal framework that governs the use of force by one state against another.

⁵⁰ *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, Judgment (Merits), 1986 (hereafter, *Nicaragua case*), paras. 191, 195.

⁵¹ ICJ, Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, 8 July 1996, para. 41; see also, *Nicaragua case*, para. 176.

⁵² See, for example, Lubell, *Extraterritorial Use of Force Against Non-State Actors*, pp. 63–8.

⁵³ Robert Ago, Eighth Report on State Responsibility to the International Law Commission, UN doc. A/CN.4/318/Add.5-7, 1980, para. 121. At: http://legal.un.org/ilc/documentation/english/a_cn4_318_add5-7.pdf.

B. Autonomous weapon systems and law enforcement

With respect to law enforcement, crowd control is one possible use of autonomous weapon systems. They might be used to launch tear gas, rubber bullets or paint markers, deliver electric shocks, or discharge firearms. They could also be used to apprehend poachers or escaping prisoners, secure prison or pipeline perimeters, or identify hostage-takers using facial recognition.⁵⁴

Their use in law enforcement would potentially affect a number of human rights, including the right to life, the right to dignity, the rights to liberty and security, and the prohibition of torture and other forms of cruel, inhuman, or degrading treatment.⁵⁵ In the context of law enforcement, international human rights law aims to limit the use of force in a manner that safeguards the above (and other) rights. A number of criminal justice instruments also govern the use of lethal force in law enforcement: they include the 1979 Code of Conduct for Law Enforcement Officials, and the 1990 Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.⁵⁶

The international law of law enforcement defines when use of force by a state's law enforcement officials is lawful: in self-defence, to prevent crime, to effect or assist in the lawful arrest of offenders or suspected offenders, to prevent the escape of offenders or suspected offenders, and to maintain public order and security.⁵⁷ Its rules generally prescribe capture, rather than resort to lethal force, unless individuals pose an immediate threat to life (the protect life principle). (See Box 3.)

Any use of force in the course of law enforcement must meet the principles of necessity, proportionality, and precaution. The necessity standard requires that force should be employed only when necessary, and that the minimum necessary amount of force should be used. Intentional lethal force should be employed only as a last resort in order to protect life. If there is no imminent threat to life, measures short of lethal force must be employed.⁵⁸ As Marco Sassòli has noted, 'outside an armed conflict, lethal robots could only be used if they were able to arrest a person, which is, as opposed to the use of lethal force, always the solution preferred by human rights law'.⁵⁹ Killing any person other than the target would

Box 3. The use of firearms in law enforcement

According to Principle 9 of the 1990 Basic Principles on the Use of Force and Firearms:

'Law enforcement officials shall not use firearms against persons except in self-defence or defence of others against the imminent threat of death or serious injury, to prevent the perpetration of a particularly serious crime involving grave threat to life, to arrest a person presenting such a danger and resisting their authority, or to prevent his or her escape, and only when less extreme means are insufficient to achieve these objectives. In any event, intentional lethal use of firearms may only be made when strictly unavoidable in order to protect life.'

⁵⁴ C. Heyns, 'Autonomous weapons systems and human rights law', Presentation to the informal CCW expert meetings, Geneva, 13–16 May 2014.

⁵⁵ *Ibid.*

⁵⁶ Law enforcement officers include 'all officers of the law, whether appointed or elected, who exercise police powers, especially the powers of arrest or detention. In countries where police powers are exercised by military authorities, whether uniformed or not, or by State security forces, the definition of law enforcement officials shall be regarded as including officers of such services.' 1979 Code of Conduct for Law Enforcement Officials, adopted by UN General Assembly Resolution 34/169, 17 December 1979, Art. 1 Commentary; see also, 1990 Basic Principles, footnote 1.

⁵⁷ Principle 9, 1990 Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, adopted by the 8th UN Congress on the Prevention of Crime and the Treatment of Offenders, Havana, 7 September 1990 (hereafter, 1990 Basic Principles). (See Box 3.)

⁵⁸ D. Kretzmer, 'Use of Lethal Force against Suspected Terrorists', in A. M. Salinas de Frias, K. L. H. Samuel and N. D. White (eds.), *Counter-Terrorism, International Law and Practice*, OUP, 2012, p. 640.

⁵⁹ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 318.

constitute an ‘arbitrary deprivation of life under international human rights law and could result in State responsibility and individual criminal liability’.⁶⁰

To comply with the principle of necessity, therefore, an autonomous weapon system would need to be able to judge the degree to which life was at risk, and be able to select and implement alternatives to lethal force, such as negotiation and capture. Human Rights Watch has observed that the ‘individual might respond differently to a robot than to a human and as a result unintentionally appear threatening. A robot’s misinterpretation of the necessity of force could trigger an arbitrary killing in violation of the right to life.’⁶¹

Even when use of lethal force is necessary, the actions of law enforcement officials must be proportionate, relative to the seriousness of the offence and the objective to be achieved; they should minimize damage and injury, and respect and preserve human life.⁶² Here, too, an autonomous weapon system would need to be able to assess a situation in real time and adjust its behaviour and objectives accordingly.

The principle of precaution aims to protect both the person targeted and bystanders. An operation must be planned, organized, and controlled in a manner that minimizes the recourse to lethal force to the greatest extent possible. Law enforcement agents must be provided non-lethal means and equipment, and decisions on whether to use lethal force must be taken with very great care.⁶³ In situations that are predictable, it may be assumed that humans could programme the response of autonomous weapon systems to some extent. They would find it much more challenging to satisfy the principle of precaution in dynamic, unpredictable environments.

There is also a duty to conduct an investigation when death, serious injury, or other grave consequences result from the use of force.⁶⁴ To be effective, an investigation must be independent and impartial, expeditious, and carried out with due diligence. Next-of-kin should be allowed to participate in the process, and all possible steps must be taken to gather evidence. The nature and extent of an investigation will vary according to circumstances.⁶⁵ If autonomous weapon systems are equipped with recording devices, the evidence these provide might be useful to investigations.

⁶⁰ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston, Addendum, ‘Study on targeted killings’, UN doc A/HRC/14/24/Add.6, 28 May 2010, para. 86. At: <http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf>.

⁶¹ Human Rights Watch, ‘Shaking the Foundations: The Human Rights Implications of Killer Robots’, May 2014, p. 11. At: <http://www.hrw.org/reports/2014/05/12/shaking-foundations>.

⁶² 1990 Basic Principles, Principle 5.

⁶³ N. Melzer, *Targeted Killing in International Law*, OUP, 2008, p. 235.

⁶⁴ 1990 Basic Principles, Principle 22; 1979 Code of Conduct, Art. 3, Commentary. The Special Rapporteur on extrajudicial, summary and arbitrary executions has recommended that an effective investigation should be carried out whenever a person is killed or a violation of the right to life is alleged. See Report of the Special Rapporteur on extrajudicial, summary and arbitrary executions, Philip Alston, UN doc. E/CN.4/2006/53, 2006, paras. 35–6.

⁶⁵ *Ibid.*, para. 36.

C. Autonomous weapon systems and the conduct of hostilities in armed conflict

Despite the perceived advantages of autonomous weapon systems (speed of processing and reaction, lowered risks for soldiers and civilians, capacity to do dull, dirty, and dangerous tasks), experts have argued that their usefulness will depend on the nature of operations (air, sea, land) and the complexity of the environment (populated, unpopulated) in which they are deployed. Some governments have shown little interest in replacing humans in military operations with autonomous weapon systems precisely because they would lose the ability to control them and because of the complication of interoperability with allies. It is recognized at the same time that autonomous weapon systems could carry out a range of useful functions alongside human soldiers (gathering intelligence, carrying out rescues, providing force and civilian protection, fulfilling logistics and transport tasks).⁶⁶

If autonomous weapon systems were deployed in armed conflicts they would need to be able to evaluate and make judgements that comply with IHL. As Sassòli has observed, ‘there are many elements that make a human being understand what is/is not a legitimate target, and those factors must be reproduced in a computer program’.⁶⁷

The rule of distinction in attack

One of the fundamental rules of IHL requires parties to an armed conflict to distinguish between civilian persons and civilian objects on one hand, and combatants and military objectives on the other: they must direct their operations only against combatants and military objectives.⁶⁸ In case of doubt, a person or object is to be considered civilian.⁶⁹

An object is a military objective if, by its nature, location, purpose or use, it contributes effectively to the military action of the enemy and if its partial or total destruction, capture or neutralisation offers a definite military advantage in the circumstances ruling at the time. Any object that does not fall under the definition of a military objective is a civilian object and must not be attacked.⁷⁰

In an international armed conflict, it is generally lawful to target members of the armed forces of a party to the conflict. In non-international armed conflict, it is generally lawful to target members of state armed forces, and, according to the ICRC, to target members of an organized armed group that is a party to the conflict when they have a ‘continuous combat function’.⁷¹

Persons who do not fall in these categories are civilians and are entitled to protection against direct attack unless (and for such time as) they directly participate in hostilities. The ICRC’s (controversial) 2009 Interpretive Guidance⁷² says that, to directly participate in hostilities, a civilian must act on a spontaneous, sporadic, or unorganised basis and meet the following three cumulative criteria:

- The act must be likely to adversely affect the military operations or military capacity of a party to an armed conflict or, alternatively, to inflict death, injury or destruction on persons or objects protected against direct attack.
- There must be a direct causal link between the act and the harm likely to result, either from that act, or from a coordinated military operation of which that act constitutes an integral part.

⁶⁶ See Chairperson’s Report, 2014 informal Meeting of Experts on LAWS, Advanced version, 16 May 2014. See also ICRC, Report of the Expert Meeting on ‘Autonomous weapon systems: technical, military, legal and humanitarian aspects’.

⁶⁷ Sassòli, ‘Autonomous Weapons and International Humanitarian Law’, p. 327.

⁶⁸ Art. 48, 1977 Additional Protocol I. See also Arts. 51(2) and 52(1); and ICRC, *Customary International Humanitarian Law*, Volume I: Rules, CUP, 2005 (hereafter, ICRC Customary IHL Study), Rules 1 and 7.

⁶⁹ Arts. 50(1) and 52(3), 1977 Additional Protocol I, respectively.

⁷⁰ Article 52(2), 1977 Additional Protocol I.

⁷¹ ICRC, *Interpretive Guidance on the Notion of Direct Participation in Hostilities under International Humanitarian Law*, ICRC, Geneva, 2009, pp. 33–4. Some commentators take the position that any military member of an organized armed group can be targeted at any time, while others argue that such individuals may only be targeted if, and for such time as, they are directly participating in hostilities.

⁷² ICRC, *Interpretive Guidance on the Notion of Direct Participation in Hostilities under International Humanitarian Law*, ICRC, Geneva, 2009.

- The act must be specifically designed to directly cause the required threshold of harm in support of one party to the conflict and to the detriment of another.

Measures taken to prepare for a specific act that qualifies as direct participation in hostilities, and deployment to and from the location of the act are also part of the act. When civilians cease to participate directly in hostilities, they recover full civilian protection against direct attack.

IHL rules prohibit attacks on persons who are *hors de combat* (in other words, effectively defenceless).⁷³ Article 41 of the 1977 Additional Protocol I states that a person is *hors de combat* if:

- (a) he is in the power of an adverse Party;
- (b) he clearly expresses an intention to surrender; or
- (c) he has been rendered unconscious or is otherwise incapacitated by wounds or sickness, and therefore is incapable of defending himself;

provided that in any of these cases he abstains from any hostile act and does not attempt to escape.⁷⁴

The ability of an autonomous weapon system to comply with the above rules will depend on its recognition technology and the environment in which it is used. Certain objects (tanks or combat aircraft) will consistently meet the definition of a military objective. The UK's Joint Doctrine Note 2/11 asserts that, 'for operating environments with easily distinguished targets in low clutter environments, a degree of autonomous operation is probably achievable now....'⁷⁵ However, the rules will be far harder to apply in other environments. Moreover, individuals who are clearly *a priori* legitimate military targets may be surrendering or be *hors de combat* for other reasons.⁷⁶

In cluttered, dynamic, and populated areas where civilian objects are close to military objectives and fighters are intermingled with civilians and potentially dressed in non-military attire, an autonomous

weapon system would need to have highly sophisticated recognition abilities. To determine whether an object is a legitimate target, it would need to be able to assess the effective contribution that object makes to the enemy's military action, and the definite military advantage that would be obtained by attacking it, taking account of all the circumstances at the time.⁷⁷ The system would need to be receiving constant updates on the circumstances of the military operation and its evolution.⁷⁸ It would need to be able to evaluate a person's membership in the state's armed forces (distinct from an armed police officer, for instance), his or her membership in an armed group (with or without a continuous combat function), whether or not he or she is directly participating in hostilities, and whether or not he or she is *hors de combat*.

Limitations of technology provide no excuse for failing to comply with IHL. Writing about the recognition of persons who are *hors de combat*, for example, Boothby has noted that, if 'more conventional and generally available methods of attack would permit such recognition, the "should have been recognized" criterion is made out, such that if the autonomous system nevertheless proceeds with the attack, the rule is broken'.⁷⁹

The weapon system would also need to be able to, first, recognize situations of doubt that would cause a human to hesitate before attacking and, second, refrain from attacking objects and persons in those circumstances. As Mike Schmitt has written, developing an 'algorithm that can both precisely meter doubt and reliably factor in the unique situation in which the autonomous weapon system is being operated will prove hugely challenging'.⁸⁰

The rule of proportionality in attack

Civilians and civilian objects are often incidentally harmed when a military objective is attacked. Under IHL, it is accepted that civilian persons and objects may be incidentally harmed, but the rule of proportionality dictates that the incidental

⁷³ ICRC, Commentary on Art. 41, 1977 Additional Protocol I, para. 1630.

⁷⁴ See also ICRC, Customary IHL Study, Rule 47.

⁷⁵ UK Ministry of Defence, Development, Concepts and Doctrine Centre, 'The UK Approach to Unmanned Aircraft Systems', Joint Doctrine Note 2/11, 30 March 2011, p. 6-1.

⁷⁶ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 327. Faced by persons *hors de combat*, it is unclear whether an autonomous weapon system would have the capacity to fulfil additional IHL obligations that the party to whom it belongs would owe towards such persons.

⁷⁷ Thurnher, 'Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', p. 221.

⁷⁸ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 328.

⁷⁹ Boothby, *Conflict Law: The Influence of New Weapons Technology*, p. 109.

⁸⁰ M. Schmitt, 'Autonomous Weapon Systems and International Humanitarian Law', pp. 16-17.

loss of civilian life, injury to civilians or damage to civilian objects (or combination thereof) that may be expected from an attack must not be excessive in relation to the concrete and direct military advantage anticipated. Attacks that fail to comply with the rule of proportionality are forbidden.⁸¹

According to a judgment of the International Criminal Tribunal for the Former Yugoslavia (ICTY), ‘in determining whether an attack was proportionate it is necessary to examine whether a reasonably well-informed person in the circumstances of the actual perpetrator, making reasonable use of the information available to him or her, could have expected excessive civilian casualties to result from the attack’.⁸² This assessment must be based on information reasonably available at the time of attack.

As Boothby has explained, the ‘inability to measure these notions can render the required evaluations challenging for human decision makers, particularly in close cases. While considerable research effort is being devoted to trying to mechanize the process, the evaluative nature of the decision and the dissimilarity of the notions being compared means that autonomous evaluation of proportionality decisions is unlikely to be achieved in the near term.’⁸³ In effect, humans would need to carry out a proportionality evaluation before the launch of an autonomous weapon system; and the assessment would need to remain valid throughout the weapon’s deployment. This might be achievable in remote, open, unpopulated areas, but would be a challenging task in populated areas where the situation changed rapidly.⁸⁴

Even if a weapon system could be programmed to anticipate and evaluate the incidental harm that an attack caused to civilian persons and objects (using, for example, the ‘Collateral Damage Estimation Methodology’ adopted by some military forces⁸⁵), assessing the anticipated military advantage and weighing it against the expected collateral harm would be difficult to programme.⁸⁶ As mentioned above (in relation to the identification of military objectives), military advantage may change rapidly

as military operations and plans evolve. In order to ensure a correct application of the rule on proportionality, the timing, location, direction, or axis of an attack may need to be restricted. It has been suggested that certain conservative estimates could be pre-programmed into autonomous weapon systems, alongside geographic and time restrictions.⁸⁷ Sassòli has suggested that the need to programme for the proportionality rule using clear criteria is an opportunity to identify objective indicators and make assessments objectively. ‘The need to program autonomous weapons to respect proportionality ... may have the advantage of obliging States to agree on how exactly proportionality must be calculated and also which parameters influence this calculation.’⁸⁸

The rule of precautions in attack

Article 57 of the 1977 Additional Protocol I, as well as customary IHL,⁸⁹ affirm that those who conduct military operations must constantly take care to spare the civilian population, individual civilians, and civilian objects. IHL requires parties in an armed conflict to take ‘feasible’ precautions when they carry out attacks, to avoid and minimize incidental loss of civilian life, injury to civilians, and damage to civilian objects. While the 1977 Additional Protocol I does not define the notion, ‘feasible precautions’ has been defined in the 1996 Amended Protocol II to the Convention on Certain Conventional Weapons as ‘those precautions which are practicable or practically possible taking into account all circumstances ruling at the time, including humanitarian and military considerations’.⁹⁰

Article 57(2)(a) lists several precautionary measures. Those who plan or decide on an attack must:

- Do everything feasible to verify that the objectives to be attacked are lawful military objectives and that it is not prohibited to attack them.

⁸¹ Art. 51(5)(b), 1977 Additional Protocol I; ICRC, Customary IHL Study, Rule 14.

⁸² ICTY, *Prosecutor v. Stanislav Galić*, Judgment (Trial Chamber) (Case No. IT-989-29-T), 5 December 2003, para. 58.

⁸³ Boothby, *Conflict Law: The Influence of New Weapons Technology*, p. 110.

⁸⁴ *Ibid.*, pp. 110–11.

⁸⁵ According to Schmitt, ‘there is no question that autonomous weapon systems could be programmed to perform CDEM-like analyses to determine the likelihood of harm to civilians in the target area’. Schmitt, ‘Autonomous Weapon Systems and International Humanitarian Law’, p. 19.

⁸⁶ Thurnher, ‘Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective’, p. 221. See also Sassòli, ‘Autonomous Weapons and International Humanitarian Law’, pp. 331–2; M. Schmitt, ‘Autonomous Weapon Systems and International Humanitarian Law’, p. 20; Docherty, ‘Losing Humanity: The Case against Killer Robots’, p. 33.

⁸⁷ Thurnher, ‘Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective’, p. 222.

⁸⁸ Sassòli, ‘Autonomous Weapons and International Humanitarian Law’, p. 331.

⁸⁹ ICRC, Customary IHL Study, Rule 15.

⁹⁰ Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices as amended on 3 May 1996, Art. 3(10).

- Take all feasible precautions, when they choose the means and methods of attack, to avoid and in any event to minimize incidental loss of civilian life, injury to civilians, and damage to civilian objects.
- Refrain from deciding to launch an attack that may be expected to cause incidental loss of civilian life, injury to civilians, or damage to civilian objects (or a combination of these harms), which is excessive in relation to the concrete and direct military advantage anticipated.

An attack must be cancelled or suspended if it becomes apparent that the objective is not a military one or is subject to special protection or that it would violate the rule on proportionality. Effective advance warning must be given of attacks that may affect the civilian population 'unless circumstances do not permit'. Furthermore, when it is possible to make a choice between several military objectives that would lead to a similar military advantage, the objective selected for attack must be the one on which the attack is expected to cause the least danger to civilian lives and civilian objects.

The obligation to take feasible precautions applies to many individuals who have responsibilities in relation to a weapon system, including 'campaign planners, mission planners, navigation equipment programmers, personnel who feed data into the mission control software, load the ordnance, monitor and/or control the operation of the platform, programme the recognition and decision-making software that determines whether an observed object or person is to be autonomously attacked and those who provide, collate, interpret, communicate or present the information on which target decisions are based'.⁹¹

Even if humans take feasible *planning* precautions with respect to an autonomous weapon system, their plans will need to remain relevant when the system makes the decision to launch an attack. This might be achievable in static environments, but is unlikely to be realistic in dynamic environments and in the absence of human override. In practice, it would require sensors that, in circumstances that might change rapidly, could reliably distinguish between civilian and military objects and persons, assess military advantage, choose appropriate weapons and tactics, anticipate incidental harm to civilian persons and objects, and give warnings.

Programming a weapon system to perform such qualitative evaluations reliably and at speed is manifestly challenging, not least because technological limitations do not constitute an excuse for failure to comply with IHL. 'Whether a certain precautionary measure is feasible has to be measured against the alternatives available to those who plan and decide upon an attack or who execute it, and not against the possibility for a machine to take a certain measure.'⁹²

Conversely, in practice certain precautions may prove feasible only with autonomous weapon systems.⁹³ There may be circumstances in which these systems offer greater protection to civilians than more conventional military resources.⁹⁴ While the obligation to take feasible precautions does not require parties to acquire modern technology, it does require that 'the most effective and reasonably available means be used systematically in order to obtain the most reliable information possible before an attack'.⁹⁵

⁹¹ Boothby, *Conflict Law: The Influence of New Weapons Technology*, p. 115.

⁹² Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 336. Thurnher (in 'Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', p. 222) has written: 'Under some circumstances, this precaution may prohibit the use of AWS if instead a different system could feasibly perform the mission and better protect civilians without sacrificing military advantage'.

⁹³ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 336.

⁹⁴ Thurnher, 'Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', p. 222.

⁹⁵ J.-F. Quéguiner, 'Precautions under the Law Governing the Conduct of Hostilities', *International Review of the Red Cross*, Vol. 88, No. 864 (2006), pp. 797–8.

D. Legal reviews of autonomous weapon systems

It is widely agreed that international law applies to the use of new and emerging weapons. IHL recognizes this in Article 36 of the 1977 Additional Protocol I, which states:

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.

It has been suggested that this provision aims to 'prevent the use of weapons that would violate international law in all circumstances and to impose restrictions on the use of weapons that would violate international law in some circumstances, by determining their lawfulness before they are developed, acquired or otherwise incorporated into a State's arsenal'.⁹⁶ As explained in the ICRC's *Guide to the Legal Review of New Weapons, Means and Methods of Warfare*, all states have an interest in carrying out such if they want to ensure that use of new weapons and means and methods of warfare complies with their international legal obligations.⁹⁷

Moreover, according to Schmitt, 'the obligation to conduct legal reviews of new *means* of warfare before their use is generally considered reflective of customary international law'.⁹⁸ The two states known to have policies on autonomous weapon

systems (the UK and the USA) acknowledge that such systems should be subject to legal review.⁹⁹

Interestingly, the ICRC's Commentary on the 1977 Additional Protocol I was already sensitive to developments in weapon technology that would decrease the role of humans on the battlefield.

The use of long distance, remote control weapons, or weapons connected to sensors positioned in the field, leads to the automation of the battlefield in which the soldier plays an increasingly less important role. ... In short, all predictions agree that if man does not master technology, but allows it to master him, he will be destroyed by technology.¹⁰⁰

A legal review applies to both methods and means; it includes all weapons and how they are used.¹⁰¹ Boothby has defined a weapon as 'an object, device, munition, or equipment used to apply an offensive capability'.¹⁰²

Legal reviews should equally consider all a state's treaty and customary obligations under international law, including IHL and international human rights law.¹⁰³ The fundamental rules of IHL to be considered include prohibitions on the use of means and methods of warfare that:

- Are 'of a nature' to cause superfluous injury or unnecessary suffering.¹⁰⁴
- Are by nature indiscriminate.¹⁰⁵

⁹⁶ K. Lawand et al., *Guide to the Legal Review of New Weapons, Means and Methods of Warfare*, 2006, ICRC, Geneva, p. 4.

⁹⁷ *Ibid.*

⁹⁸ M. Schmitt, 'Autonomous Weapon Systems and International Humanitarian Law: A Reply to the Critics', *Harvard National Security Journal*, Features Online (2013), p. 28, (emphasis added). Experts involved in drafting the 2013 Tallinn Manual on the International Law Applicable to Cyber Warfare were divided as to whether the rule is customary with respect to methods of warfare. See also Boothby, who has suggested that it is 'decidedly arguable that the obligation to conduct such a review is customary and binds all States' (*Conflict Law: The Influence of New Weapons Technology*, p. 171). The ICRC Customary IHL Study did not find that the rule was of a customary nature. See, Experts Meeting on the Review of Weapons Under International Law, Geneva Academy, 23–24 June 2014, Summary of Discussions. At: <http://www.geneva-academy.ch/policy-studies/ongoing/weapons-law>.

⁹⁹ US Department of Defense, Directive 3000.09; UK Ministry of Defense, Development, Concepts and Doctrine Centre, Joint Doctrine Note 21, para. 503.

¹⁰⁰ ICRC, Commentary on Art. 36, 1977 Additional Protocol I, para. 1476. At: <https://www.icrc.org/applic/ihl/ihl.nsf/1a13044f3bbb5b8ec12563fb0066f226f095453e41336b76c12563cd00432aa1>.

¹⁰¹ Lawand et al., *Guide to the Legal Review of New Weapons, Means and Methods of Warfare*, p. 9.

¹⁰² W. H. Boothby, *Weapons and the Law of Armed Conflict*, OUP, 2009.

¹⁰³ With respect to law enforcement, Principle 3 of the 1990 Basic Principles sets out a narrower rule. It states that: 'The development and deployment of non-lethal incapacitating weapons should be carefully evaluated in order to minimize the risk of endangering uninvolved persons, and the use of such weapons should be carefully controlled'.

¹⁰⁴ Art. 35(2), 1977 Additional Protocol I; and Rule 70, ICRC, Customary IHL Study. In its 1996 *Nuclear Weapons Advisory Opinion* (para. 78), the ICJ has recognized that this is a cardinal principle of IHL.

¹⁰⁵ Art. 51(4)(c), 1977 Additional Protocol I; and Rule 71, ICRC, Customary IHL Study. In its *Nuclear Weapons Advisory Opinion*, the ICJ has recognized that this is a cardinal principle of IHL.

- Are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.¹⁰⁶

Additional prohibitions and restrictions can be found in other treaties to which states may be a party, including the 1997 Anti-Personnel Mine Ban Convention, the 2008 Convention on Cluster Munitions (see Box 4), and the 1980 Convention on Certain Conventional Weapons. It is the normal, expected use of the weapon that must be evaluated, rather than any possible misuse.¹⁰⁷ The Commentary to Article 36 adds: 'If these measures are not taken, the State will be responsible in any case for any wrongful damage ensuing'.¹⁰⁸

When assessing whether a weapon system causes superfluous injury or unnecessary suffering by its nature, it is most relevant to assess the weapon rather than the guidance system. When assessing whether a weapon system is inherently indiscriminate, by contrast, it is most relevant to examine its target recognition performance. If a technology can only distinguish between civilian and military objects in certain circumstances, the legal review must 'draw attention to the restricted circumstances in which its employment would be legitimate and should set out the actions that will be required in order to seek to ensure that when the weapon system is used the discrimination principle will be complied with'.¹⁰⁹ If the weapon system is incapable of implementing precautions in attack as required by IHL, a legal review should set out the consequent limitations on its lawful use.¹¹⁰

Schmitt has argued that, 'while it is true that some autonomous weapon systems might violate international humanitarian law norms, it is categorically not the case that all such systems will do so. Instead, and as with most other weapon systems, their lawfulness as such, as well as the lawfulness of their use, must be judged on a

case-by-case basis'.¹¹¹ In reality, however, it may be arduous to review the legality of a complex autonomous weapon system whose functioning is difficult to test and therefore unpredictable.¹¹²

Legal reviews should also be guided by the principles of humanity and the dictates of public conscience, as set out in the Martens Clause in the preamble to the 1899 Hague Convention II, the preamble to the 1907 Hague Convention IV, and Article 1(2) of the 1977 Additional Protocol I. The clause states:

In cases not covered by this Protocol or by any other international agreements, civilians and combatants remain under the protection and authority of the principles of international law derived from established custom, from the principles of humanity and from dictates of public conscience.

The ICJ wrote in its 1996 Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons (though without adducing evidence) that the Martens clause had proved to be 'an effective means of addressing rapid evolution of military technology'.¹¹³

In addition to assessing new weapons, means or methods of warfare they plan to study, develop, acquire, or adopt, states should examine modifications of old weapons or munitions when their capabilities or effects could be new.¹¹⁴ Evaluation should take place at various stages of development: before a weapon system enters the production phase; before it is acquired; and at the earliest possible stage of modifications.¹¹⁵ As Sassòli has noted: 'there is a risk that once the technology has been developed at great expense, vested interests will make it nearly impossible politically to conclude that the result is unlawful. The solution may be to accompany the development process with constant reviews'.¹¹⁶ The USA has

¹⁰⁶ Art. 35(3), 1977 Additional Protocol I.

¹⁰⁷ Lawand *et al.*, *Guide to the Legal Review of New Weapons*, s. 1.1; ICRC, Commentary on Art. 36, 1977 Additional Protocol I, para. 1466, at: <https://www.icrc.org/applic/ihl/ihl.nsf/1a13044f3bbb5b8ec12563fb0066f226/f095453e41336b76c12563cd00432aa1>.

¹⁰⁸ ICRC, Commentary on Art. 36, 1977 Additional Protocol I, para. 1466. At: <https://www.icrc.org/applic/ihl/ihl.nsf/1a13044f3bbb5b8ec12563fb0066f226/f095453e41336b76c12563cd00432aa1>.

¹⁰⁹ Boothby, 'Conflict Law: The Influence of New Weapons Technology', p. 175.

¹¹⁰ *Ibid.*, pp. 175–6.

¹¹¹ Schmitt, 'Autonomous Weapon Systems and International Humanitarian Law', p. 8.

¹¹² US Chief Air Force Scientist, *Report on Technology Horizons: A Vision for Air Force Science & Technology During 2010-2030*, Vol. 1 (15 May 2010) p. 105. At: <http://www.flightglobal.com/assets/getasset.aspx?ItemID=35525>.

¹¹³ ICJ, Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996, para. 78. Human Rights Watch has argued that 'any review of fully autonomous weapons should recognize that for many people these weapons are unacceptable under the principles laid out in the Martens Clause' (Docherty, *Losing Humanity: The Case against Killer Robots*, p. 36).

¹¹⁴ ICRC, *Guide to the Legal Review of New Weapons*, s. 1.1.

¹¹⁵ *Ibid.*, s. 2.3.1.

¹¹⁶ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 322.

Box 4. The Convention on Cluster Munitions and Autonomous Weapons Systems

Article 2, paragraph 2 of the Convention on Cluster Munitions defines a cluster munition for the purposes of the treaty. Sub-paragraph (c) excludes from the definition:

A munition that, in order to avoid indiscriminate area effects and the risks posed by unexploded submunitions, has all of the following characteristics:

- (i) *Each munition contains fewer than ten explosive submunitions;*
- (ii) *Each explosive submunition weighs more than four kilograms;*
- (iii) *Each explosive submunition is designed to detect and engage a single target object;*
- (iv) *Each explosive submunition is equipped with an electronic self-destruction mechanism;*
- (v) *Each explosive submunition is equipped with an electronic self-deactivating feature.*

Sub-paragraph (iii) (referring to explosive submunitions ‘designed to detect and engage a single target object’) appears to be the only treaty provision to date that effectively sets out conditions for legitimate use of an autonomous weapon system.

stated that it will subject autonomous weapon systems to two stages of legal review: before a decision is taken to begin development, and before fielding.¹¹⁷ To cover relevant areas (technical characteristics, performance, effects on health and the environment), reviews should involve experts from various disciplines.¹¹⁸

Domestic procedures will be required to enable legal reviews of new weapons, but there is no obligation to publish their results. According to the ICRC Commentary on Article 36 of the 1977 Additional Protocol I:

This reservation is quite understandable, as modern strategy very often relies not on deployment of military means in the traditional ways, but on new possibilities resulting from research and which consists of creating an imbalance of military strength vis-à-vis the enemy precisely by means of superior technology in the form of new weapons.¹¹⁹

Anderson, Reisner, and Waxman have recommended that general policies for the development of autonomous weapon systems should be published and that best practices should be shared.¹²⁰

¹¹⁷ US Department of Defense, Directive 3000.09, p. 7.

¹¹⁸ ICRC, *Guide to the Legal Review of New Weapons*, s. 1.3.

¹¹⁹ ICRC, Commentary on Art. 36, 1977 Additional Protocol I, para. 1470. At: <https://www.icrc.org/applic/ihl/ihl.nsf/1a13044f3bbb5b8ec12563fb0066f226/f095453e41336b76c12563cd00432aa1>.

¹²⁰ Anderson, Reisner, and Waxman, ‘Adapting the Law of Armed Conflict to Autonomous Weapon Systems’, p. 408.

E. Accountability

It is well understood that states should establish accountability for wrongful acts committed with any type of weapon. As Christof Heyns has observed, 'Without the promise of accountability, deterrence and prevention are reduced, resulting in lower protection of civilians and potential victims of war crimes'.¹²¹ As Heyns has also pointed out, the 'modern concept of human rights is based on the fundamental principle that those responsible for violations must be held to account. A failure to investigate and, where applicable, punish those responsible for violations of the right to life in itself constitutes a violation of that right'.¹²²

A range of persons associated with the production and deployment of autonomous weapon systems might be held accountable for violations of IHL or international human rights law: they include software programmers, manufacturers and sellers of hardware, political leaders, military commanders, and their subordinates.¹²³ US Department of Defense Directive 3000.09 states that 'persons who authorize the use of, direct the use of, or operate autonomous and semi-autonomous weapon systems must do so with appropriate care and in accordance with the law of war, applicable treaties, weapon system safety rules, and applicable rules of engagement'.¹²⁴ Joint Doctrine Note 2/11 on the UK approach to Unmanned Aircraft Systems holds that legal responsibility for a military activity lies with the person who issued the last command authorizing that activity.¹²⁵ The different bodies of law that can serve to hold such persons accountable are explored below.

Individual criminal responsibility

Under IHL and international criminal law, individuals are criminally responsible for war crimes they commit.¹²⁶ They may also be held responsible under different modes of liability: for attempting, assisting in, facilitating, aiding, abetting, planning or instigating the commission of a war crime.¹²⁷

Individuals who deploy an autonomous weapon system that carries out acts amounting to crimes under domestic or international law could therefore be criminally liable. Other individuals in the chain of command or production might also be considered criminally liable, including commanders, programmers or manufacturers.¹²⁸ As discussed below, it would nevertheless be hard to prosecute such individuals successfully, because it would be necessary to prove that they intended to commit the crimes in question, or knew that they would be committed.

Commanders and other superiors are criminally responsible for war crimes committed or attempted by subordinates who follow their orders.¹²⁹ They may also be held criminally responsible for war crimes committed by their subordinates if they knew, or had reason to know, that the subordinates were about to commit or were committing such crimes and did not take all necessary and reasonable measures in their power to prevent their commission, or (if the crimes have already been

¹²¹ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 75, p. 14; Docherty, *Losing Humanity: The Case against Killer Robots*, pp. 42–5.

¹²² Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/68/382, 13 September 2013, para. 95. See also Human Rights Committee, General Comment No. 31 (2004), para. 15: 'A failure by a State Party to investigate allegations of violations could in and of itself give rise to a separate breach of the Covenant'.

¹²³ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 77, p. 14.

¹²⁴ US Department of Defense Directive 3000.09, para. 4b.

¹²⁵ UK Ministry of Defence, Development, Concepts and Doctrine Centre, 'The UK Approach to Unmanned Aircraft Systems', Joint Doctrine Note 2/11, para. 510.

¹²⁶ Rule 151, ICRC, Customary IHL Study. At: https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule151.

¹²⁷ See for instance, 1998 Statute of the International Criminal Court, Art. 25; ICTY Statute, Art. 7; Statute of the International Criminal Tribunal for Rwanda (ICTR), Art. 6; Statute of the Special Court for Sierra Leone (SCSL), Art. 6.

¹²⁸ According to Sassòli: 'As for the manufacturer and the programmer, domestic criminal laws often hold criminally responsible those who deliberately, recklessly or negligently construct defective buildings or machines that lead to the loss of human life' ('Autonomous Weapons and International Humanitarian Law', p. 324). By contrast, Schmitt and Thurnher argue that to hold persons who design autonomous weapon systems criminally responsible 'would be spurious, at least to the extent that the system is not specifically designed to commit a war crime' ('"Out of the Loop": Autonomous Weapon Systems and the Law of Armed Conflict', *Harvard National Security Journal*, Vol. 4 (2013) p. 278). Thurnher has argued that a person who intentionally programmes an autonomous weapon system to commit acts amounting to war crimes would be liable ('Examining Autonomous Weapon Systems from a Law of Armed Conflict Perspective', p. 10).

¹²⁹ Rule 152, ICRC Customary IHL Study. At: https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule152. See also, 1949 Geneva Convention I, Art. 49; 1949 Geneva Convention II, Art. 50; 1949 Geneva Convention III, Art. 129; 1949 Geneva Convention IV, Art. 146; 1954 Hague Convention for the Protection of Cultural Property, Art. 28; 1999 Second Protocol to the Hague Convention, Art. 15; ICC Statute, Art. 25(3); ICTY Statute, Art. 7(1); ICTR Statute, Art. 6(1); SCSL Statute, Art. 6.

committed) to punish the persons responsible.¹³⁰ An equivalent rule for situations of law enforcement is set out in the 1990 Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.¹³¹ It has been suggested that a similar principle of accountability could be applied, by analogy, to commanders who knew, or had reason to know, that an autonomous weapon system was about to commit or was committing an offence and who did not take all necessary and reasonable measures in their power to prevent it.¹³²

The 2005 Basic Principles and Guidelines on the Right to a Remedy and Reparation require states to investigate gross violations of international human rights law that constitute crimes under international law, to prosecute suspects, and punish perpetrators.¹³³ The UN Human Rights Committee has concluded that the 1966 International Covenant on Civil and Political Rights (ICCPR) requires states to investigate all violations of the treaty, as well as prosecute individuals responsible for gross violations or international crimes.¹³⁴ Article 12 of the 1984 Convention against Torture requires investigation of persons who are alleged to have committed torture and prosecution of offenders. A number of other serious violations of international human rights law are also international crimes,¹³⁵ including, it has been argued, enforced disappearances and extrajudicial killings.¹³⁶

When war crimes, genocide, or crimes against humanity have been committed, international law foresees that victims should receive reparations. Article 75(2) of the 1998 Rome Statute of the International Criminal Court (ICC Statute), on 'Reparations to victims', allows the Court to 'make an order directly against a convicted person specifying appropriate reparations to, or in respect of, victims, including restitution, compensation and rehabilitation'.

A country's domestic laws can hold an individual criminally responsible for the act of an autonomous weapon system and also order reparation for victims.

Corporate criminal responsibility

A more innovative approach to ensuring accountability for the acts of autonomous weapon systems would be to make companies that manufacture, sell or distribute such systems, and their components and auxiliary systems, criminally liable.

While not all jurisdictions have adopted a regime of corporate criminal liability, a number of countries that have the potential to develop autonomous technology do have domestic laws that impose criminal sanctions on corporate entities.¹³⁷ Many of these regimes extend corporate criminal liability to serious crimes requiring proof of *mens rea*, such as manslaughter.¹³⁸ Penalties can include fines, debarment, loss of licence, restitution, forfeiture, and other measures.

It is important to note, however, that certain jurisdictions will only allow the behaviour of high-level executives to be imputed to the corporation, so that convictions would not be possible if the activities at issue were carried out by lower-level employees without the knowledge or sanction of senior executives.¹³⁹ In addition, some jurisdictions do not allow claims that relate to military activities, or selected public functions that raise wider questions of public policy.¹⁴⁰

¹³⁰ ICRC, Customary IHL Study, Rule 153. At: https://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule153. See also 1977 Additional Protocol I, Arts. 86(2) and 87; ICC Statute, Art. 28; ICTY Statute, Art. 7(3); ICTR Statute, Art. 6(3); SCSL Statute, Art. 6(3).

¹³¹ 1990 Basic Principles, Principle 24.

¹³² Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 78, p. 15.

¹³³ 2005 Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law, Art. 4.

¹³⁴ Human Rights Committee, General Comment No. 31, paras. 15 and 18.

¹³⁵ A. Cassese, *International Law*, 2nd edition, OUP, 2005, p. 445.

¹³⁶ See: http://www.geneva-academy.ch/RULAC/international_criminal_law.php.

¹³⁷ They include the USA, the UK, France, and Israel. See M. Pieth and R. Ivory (eds.), *Corporate Criminal Liability: Emergence, Convergence and Risk*, Springer, 2011, pp. 7–14.

¹³⁸ For England and Wales: *ibid.*, 92.

¹³⁹ *Ibid.*, pp. 17, 21.

¹⁴⁰ See, for example, the 2007 UK Corporate Manslaughter and Corporate Homicide Act.

State responsibility

A state that deploys an autonomous weapon system that violates international law can be held responsible for that violation. The International Law Commission's Draft Articles on the Responsibility of States for International Wrongful Acts (2001 Draft Articles) state that 'Every internationally wrongful act of a State entails the international responsibility of that State'.¹⁴¹ A state commits an internationally wrongful act when the conduct in question is attributable to it and breaches one of its international obligations.¹⁴² The conduct of any state organ will be considered an act of that state under international law, whether the organ exercises legislative, executive, judicial, or any other functions.¹⁴³ Acts by a state's military or police forces are therefore attributable to the state, and any violation of the state's international obligations will engage its international responsibility. This is true for violations of IHL or international human rights law.

This general rule is explicitly applied to violations of IHL in Article 3 of the 1907 Hague Convention IV and Article 91 of the 1977 Additional Protocol I. The ICRC's 2005 Study of Customary IHL found that the rule applies specifically to all IHL violations as a matter of customary law in both international and non-international armed conflicts: Rule 149 states that a state is responsible for violations of IHL attributable to it, including violations committed by its organs and by persons or entities it has empowered to exercise elements of governmental authority.

These rules on responsibility generate a duty to make reparations for violations. The general rule requiring reparation for violations of international law was set out by the Permanent Court of International Justice, in its 1928 decision in the *Chorzow Factory* case:

It is a principle of international law, and even a general conception of the law, that any breach of an engagement involves an obligation to make reparation. ... Reparation is the indispensable complement of a failure to apply a convention, and there is no necessity for this to be stated in the convention itself.

The rule is reflected in Article 31 of the 2001 Draft Articles, which provides that 'The responsible State is under an obligation to make full reparation for the injury caused by the internationally wrongful act'.

It is also mirrored in Rule 150 of the ICRC's 2005 Study of Customary IHL, while Article 3 of the 1907 Hague Convention IV and Article 91 of the 1977 Additional Protocol I also provide that a party that commits violations of the law shall be liable to pay compensation (if the case demands). The ICCPR requires that states parties ensure that an effective remedy is available to victims of violations.¹⁴⁴

Similarly, the 1984 Convention against Torture requires each state party to ensure that victims of torture obtain redress and have an enforceable right to fair and adequate compensation.¹⁴⁵ The duty to make reparation is also captured in the 2005 Basic Principles and Guidelines on the Right to a Remedy and Reparation, which recognize that states have an obligation to provide effective remedies to victims of serious violations of IHL and gross violations of international human rights law, including reparation for harm suffered.¹⁴⁶ The Basic Principles distinguish five forms of reparation: restitution, compensation, rehabilitation, satisfaction, and guarantees of non-repetition.¹⁴⁷

Under the regime of state responsibility, reparations have traditionally been made by one state to another. However, more and more countries are acknowledging the right of individuals to seek reparations directly from a state. Article 33(2) of the 2001 Draft Articles declares that those provisions that govern the content of the international responsibility of a State (Part II) are 'without prejudice to any right, arising from the international responsibility of a State, which may accrue directly to any person or entity other than a State'. The commentary on this provision adds:

When an obligation of reparation exists towards a State, reparation does not necessarily accrue to that State's benefit. For instance, a State's responsibility for the breach of an obligation under a treaty concerning the protection of human rights may exist towards all the other parties to the treaty, but the individuals concerned should be regarded as the ultimate beneficiaries and in that sense as the holders of the relevant rights.

141 Art. 1.

142 Art. 2.

143 Art. 4.

144 ICCPR, Art. 2(3).

145 CAT, Art. 14.

146 See Arts. 3, 11.

147 See Art. 18.

The right of individual victims to seek reparations from a state is also implicit in Article 75(6) of the ICC Statute: ‘Nothing in this article shall be interpreted as prejudicing the rights of victims under national or international law’.

Civil responsibility

Under the domestic legislation of many states, victims can bring claims for compensation before national civil courts. Such claims could conceivably be brought against state agents who deploy or order the deployment of autonomous weapon systems, and against persons involved in the production chain, such as manufacturers or programmers. In such cases, the reasonableness of their actions, and the foreseeability of the outcome, would be relevant. The approach therefore faces a number of challenges, which are discussed below.

Challenges and solutions to possible gaps in accountability

Although many options appear to provide accountability for violations of international law, for several reasons it may be difficult to establish accountability in practice.

First, the complexity of autonomous weapon systems means that those who deploy them cannot easily understand their functioning.¹⁴⁸ In this context, Sassòli has argued that an operator ‘need not understand the complex *programming* of the robot, but must understand the *result*, that is, what the robot is able and unable to do’.¹⁴⁹ Even so, the interaction of autonomous weapon systems with the environment will not always be predictable. UK Joint Doctrine Note 2/11 notes that it is an ‘implicit

assumption that a system will continue to behave in a predictable manner after commands are issued; clearly this becomes problematical as systems become more complex and operate for extended periods’.¹⁵⁰

Reports suggest that it is currently possible to test the behaviour of autonomous systems only in an ‘insignificantly small fraction’ of the situations that they would face in the real world, making it hard to predict and effectively control their actions.¹⁵¹ If this is true, it would be difficult to show clearly that a person intended to commit a crime, or that the outcome was foreseeable. It has been suggested that ‘States may be tempted to plead force majeure in order to evade international responsibility for an armed robot’s unforeseen “decision”, for example, to attack civilians’.¹⁵²

With regard to civil law suits, ‘product liability laws are largely untested in robotics’¹⁵³ and ‘it is also questionable whether putting the onus of bringing civil suits on victims is equitable, as they would have to bring suit while based in a foreign country, and would often lack the resources’.¹⁵⁴

As a result of these real challenges, what Christof Heyns has called a potential ‘accountability gap or vacuum’ may exist with respect to the use of autonomous weapon systems.¹⁵⁵ In the view of Human Rights Watch, ‘there is no fair and effective way to assign legal responsibility for unlawful acts committed by fully autonomous weapons’. Heyns argues:

If each of the possible candidates for responsibility identified above is ultimately inappropriate or impractical, a responsibility vacuum will emerge, granting impunity for all LAR use. If the nature of a weapon renders responsibility for its consequences impossible, its use should be considered unethical and unlawful as an abhorrent weapon.¹⁵⁶

¹⁴⁸ Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 78, p. 15.

¹⁴⁹ Sassòli, ‘Autonomous Weapons and International Humanitarian Law’, p. 324 (added emphasis), citing Schmitt and Thurnher, ‘“Out of the Loop”’, p. 267: ‘This requires an understanding not only of the physical capabilities and limitations of the system (the maximum range, the effectiveness of the weaponry, the blast radius of its weapons, etc.), but also the subjective values embedded in it’.

¹⁵⁰ UK Ministry of Defence, Development, Concepts and Doctrine Centre, *The UK Approach to Unmanned Aircraft Systems*, Joint Doctrine Note 2/11, para. 510.

¹⁵¹ US Chief Air Force Scientist, *Report on Technology Horizons: A Vision for Air Force Science & Technology During 2010-2030*, p. 105. At: <http://www.flightglobal.com/assets/getasset.aspx?itemID=35525>.

¹⁵² N. Melzer, ‘Human Rights Implications of the Usage of Drones and Unmanned Robots in Warfare’, European Parliament Directorate-General for External Policies, 2013, p. 39. At: http://www.europarl.europa.eu/RegData/etudes/etudes/join/2013/410220/EXPO-DROI_ET%282013%29410220_EN.pdf.

¹⁵³ P. Lin, ‘Introduction to Robot Ethics’ in Lin et al. (eds.), *Robot Ethics: The Ethical and Social Implications of Robotics*, MIT Press, 2012, p. 8.

¹⁵⁴ See Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 79, p. 15.

¹⁵⁵ *Ibid.*, para. 77, p. 14.

¹⁵⁶ See Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 80, p. 15.

Prohibiting the deployment of autonomous weapon systems if their behaviour is neither foreseeable nor subject to effective human control would remove any accountability gap. If they are deployed in the absence of such safeguards, however, alternative solutions have been proposed.¹⁵⁷ They include: acknowledging responsibility before the system is used;¹⁵⁸ dividing responsibility between persons in the production and the command chains;¹⁵⁹ drafting standards of due diligence for manufacturers and commanders;¹⁶⁰ and installing recording devices that would reconstruct events and make it possible to investigate instances of lethal force and allegations of war crimes.¹⁶¹

¹⁵⁷ *Ibid.*, para. 81, p. 15.

¹⁵⁸ R. Arkin, 'The Robot didn't do it', Position Paper for a Workshop on Anticipatory Ethics, Responsibility and Artificial Agents, p. 1.

¹⁵⁹ See Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 81, p. 15. His approach has been criticized for violating the fundamental principle that no penalty may be inflicted on a person for an act for which he or she is not responsible. See 1907 Hague Regulations, Art. 50; 1949 Geneva Convention IV, Art. 33(1); 1977 Additional Protocol I, Art. 75(4)(b); 1977 Additional Protocol II, Art. 6(2)(b); ICRC Customary IHL Study, Rule 102.

¹⁶⁰ Sassòli, 'Autonomous Weapons and International Humanitarian Law', p. 325.

¹⁶¹ See Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, UN doc. A/HRC/23/47, para. 81, p. 15.

Concluding remarks

While it is clear that autonomous weapon technology is progressing at an extremely rapid pace and that such weapon systems may have uses in law enforcement and warfare, it is equally clear that they should not be used unless and until they demonstrably comply with international law.

Certain autonomous weapon systems may be able to operate lawfully in low-clutter and static environments where complex judgements are rarely required. In dynamic and populated settings, it will be much more challenging to meet the requirements of IHL and international human rights law because of the continuous qualitative assessments that such situations demand. Rigorous legal reviews and reliable accountability mechanisms must be put in place to ensure that autonomous weapon systems comply effectively and consistently with international law. Important societal and ethical concerns must also inform decisions about the development and lawfulness of autonomous weapon systems.

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