

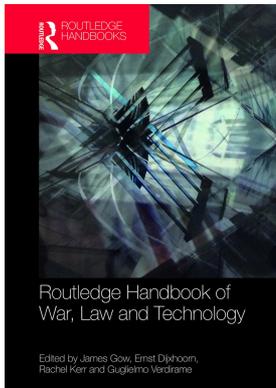
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Publisher: *Routledge*

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## **Routledge Handbook of War, Law and Technology**

James Gow, Ernst Dijkhoorn, Rachel Kerr, Guglielmo Verdirame

### **Weapons law, weapon reviews and new technologies**

Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9781315111759-3>

Bill Boothby

**Published online on: 31 May 2019**

**How to cite :-** Bill Boothby. 31 May 2019, *Weapons law, weapon reviews and new technologies from:* Routledge Handbook of War, Law and Technology Routledge

Accessed on: 18 Jan 2020

<https://www.routledgehandbooks.com/doi/10.4324/9781315111759-3>

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### 3

# WEAPONS LAW, WEAPON REVIEWS AND NEW TECHNOLOGIES

*Bill Boothby*

New weapons technologies are not developed, procured and fielded in a legal vacuum. International law includes rules that prohibit certain weapons entirely in armed conflict, while others are the subject of restrictions as to the circumstances in which they can lawfully be employed. Critical to this body of weapons law are the two established, customary legal notions, namely humanity and military necessity. These principles do not constitute rules in their own right but are best seen as the mutually counterbalancing principles that underpin the whole of the law of armed conflict, and thus the law relating to weapons. The rules of the law regulating weapons represent the balance that states have struck between conflicting interests; a balance that will vary from weapon to weapon depending on how states perceive the military need associated with the weapon and how they interpret the humanitarian concerns that have motivated the legal provision in question.

Several of the legal rules we are about to discuss refer to ‘weapons’, ‘methods’, and ‘means’ of warfare and it is important to understand the meaning of these terms, none of which is defined in any treaty. The ordinary meaning of a ‘weapon’ is ‘a thing designed or used for inflicting bodily harm or physical damage; a means of gaining an advantage or defending oneself’.<sup>1</sup> One commentator referred to ‘an offensive capability that can be applied to a military object or enemy combatant’;<sup>2</sup> so it seems sensible to conclude that a weapon is a device, munition, implement, substance, object, or piece of equipment that is used, designed, or intended to be used for these purposes.

That notion will extend to all arms, munitions, materiel, instruments, mechanisms, or devices that have an intended effect of injuring, damaging, destroying, or disabling personnel or property. This implies that a weapon system comprises the weapon or munition itself and associated elements required for its operation having a directly injuring or damaging effect on people or property. Examples include all munitions and technologies such as projectiles, small arms, mines, explosives, and all other devices and technologies that are physically destructive or injury-producing.<sup>3</sup>

‘Methods’ and ‘means’ include ‘weapons in the widest sense, as well as the way in which they are used’.<sup>4</sup> So, methods and means of warfare mean, respectively, tactics, whether lawful or unlawful, and weapons and weapon systems.

This means that the legal rules that will shortly be considered prohibit or limit the use of things that are designed, intended, or used to harm persons or to damage property. If the purpose in

acquiring weapons is to gain a military advantage or to enable certain kinds of attack to be undertaken, such as killing or injuring enemy personnel or damaging or destroying his property, weapon systems will also include platforms and equipment which will not as such cause damage or injury, but which form an essential part of the system that does have that effect.

### **How weapons law emerged**

Dr Francis Lieber<sup>5</sup> prepared a Code issued to the Union side in the American Civil War in which he explained military necessity as the necessity of those measures which are indispensable for securing the ends of the war. He considered that military necessity should not permit cruelty, such as the infliction of suffering for its own sake, or the use of poison.<sup>6</sup> Although the Lieber Code was never adopted by states and is therefore not regarded as a source of international law as such, it does represent an informed assessment of law as it then existed. The prohibition of the use of poison is also reflected in Article 23(a), Hague Regulations 1907,<sup>7</sup> and is certainly a rule that applies to all States and in all armed conflicts, international and non-international.

The idea that the infliction of suffering for its own sake is prohibited later developed into one of the two core principles of the law of weaponry which prohibits weapons that by nature cause superfluous injury or unnecessary suffering. We will discuss this principle in a later section of this chapter.

A Declaration adopted in St Petersburg in 1868 prohibited 'the employment ... of any projectile of a weight below 400 grammes, which is either explosive or charged with fulminating or inflammable substances'.<sup>8</sup> It is fair to say that the weight limit prescribed by the treaty no longer reflects the law.

Customary law does, however, continue to prohibit the use of explosive or incendiary bullets designed exclusively for use against personnel. This is because a solid round would achieve the relevant military purpose, so using an explosive round against such targets will cause injury for which there is no military necessity.<sup>9</sup>

The Peace Conferences conducted in The Hague in 1899 and 1907 took the development of weapons law further. Declaration II prohibited the use of 'projectiles the sole object of which is the diffusion of asphyxiating or deleterious gases',<sup>10</sup> but only applied to the states party in the case of a war between two or more of them and would not apply if a state that was not a party took part in the conflict, and the Declaration did not prohibit weapons which combined gas diffusion with some other object, such as blast or fragmentation. The Declaration did not therefore prevent the gas attacks on the trenches during the First World War that resulted in so many casualties and so much suffering. It was in the aftermath of this experience that the Geneva Protocol of 1925 was adopted. Many decades later, the Chemical Weapons Convention of 1993 and the Biological Weapons Convention of 1972 addressed these mass casualty weapons in an altogether more comprehensive way.

The third Declaration of 1899 prohibited 'the use of bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions'.<sup>11</sup> It also only applied in the case of a war between two or more states that are party to the treaty and would not apply if a non-contracting state entered the conflict. The prohibition now has customary law status, meaning that it binds all states whether or not they are party to the treaty. The customary rule prohibits the use in armed conflicts between states of bullets that are designed, in the intended circumstances of use, to expand or flatten easily in the human body.

The position in relation to armed conflicts within a state is more complex. Consider, for example, a hostage situation in which a hostage-taker must be instantly disabled for the protection

of civilians, or consider a situation in which the ricochet to be expected from a high velocity round will imperil civilians in the vicinity of the target. The use of expanding ammunition in such relatively limited non-international armed conflict situations would cause the target additional suffering for which there is a military purpose, namely the protection of the relevant civilians, so the superfluous injury/unnecessary suffering rule would not, arguably, be breached in those limited kinds of circumstance and, therefore, neither would international law.<sup>12</sup>

### **Superfluous injury and unnecessary suffering**

At this point we should conclude our brief account of the early emergence of the law of weaponry and start to get to grips with its two core principles. The first of these prohibits injury that lacks military utility, an idea first expressed in the modern era in the Preamble to the St Petersburg Declaration 1868:

Considering that the progress of civilisation should have the effect of alleviating as much as possible the calamities of war;

That the only legitimate object which states should endeavour to accomplish during war is to weaken the military forces of the enemy;

That for this purpose it is sufficient to disable the greatest possible number of men;

That this object would be exceeded by the employment of arms which uselessly aggravate the sufferings of disabled men, or render their death inevitable;

That the employment of such arms would therefore be contrary to the laws of humanity.<sup>13</sup>

The Brussels Declaration and the Oxford Manual contain similar statements,<sup>14</sup> but it was in Article 23(e) of the Hague Regulations of 1907 that the notion was first expressed as a substantive rule of law, as follows: 'It is especially forbidden to employ arms, projectiles or material calculated to cause unnecessary suffering.'

Seventy years later, in API, the modern formulation of the rule provides:

It is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering.<sup>15</sup>

This customary rule, which binds all states in all types of armed conflict, is central in importance to the law of weaponry. The practical application of the rule, however, involves a comparison of inherently dissimilar phenomena. The elements to be compared are, it is suggested, the degree and relative extent of the suffering or injury that the use of the weapon will inevitably occasion and the generic military advantage or utility to be anticipated from the employment of the given weapon in its intended circumstances of use. The terms 'superfluous' and 'unnecessary' confirm the comparative nature of the test that is to be applied, leading to the conclusion that a weapon is likely to breach the rule if it may be expected to cause injury on a scale significantly greater than that to be expected of alternative weapons that yield the same generic military advantage or utility.

Such a comparison process only makes sense if it is the employment of the weapon in its normal, designed circumstances of use that is evaluated.<sup>16</sup> Perfectly lawful weapons are capable of being misused and of having unacceptable or even unlawful effects as a result of such misuse. The proper basis for judgement is therefore how the weapon behaves when used in its normal

circumstances, within its designed range, employing its intended power setting or velocity, and when being directed at its intended category of target.

So the principle can be expressed as follows:

the legitimacy of a weapon, by reference to the superfluous injury and unnecessary suffering principle, must be determined by comparing the nature and scale of the generic military advantage to be anticipated from the weapon in the application for which it is designed to be used, with the pattern of injury and suffering associated with the normal intended use of the weapon.<sup>17</sup>

It is for states to evaluate which weapons breach the rule and to assess new weapons and weapon technologies accordingly.

### **Indiscriminate weapons rule**

The second fundamental customary principle of the law of weaponry prohibits weapons whose nature it is to be indiscriminate. During the period before 1974 a rule that indiscriminate attacks are prohibited certainly existed, but there was no treaty text specifically addressing weapons that by nature are indiscriminate. An authoritative commentator noted in 1975 that when the negotiations of what was to become API commenced, not all experts were prepared to acknowledge that a rule prohibiting identifiable 'indiscriminate weapons' had 'acquired the status of a rule of positive international law'.<sup>18</sup> API prohibited indiscriminate attacks<sup>19</sup> which it defined as including attacks 'which employ a method or means of combat which cannot be directed at a specific military objective; or ... which employ a method or means of combat the effects of which cannot be limited' as required by the Protocol and which consequently are of a nature to strike military objectives and civilians or civilian objects without distinction. The clear references in the rule to means of combat render the pre-existing indiscriminate attacks rule into a rule that applies specifically and explicitly to weapons.

The V2 rocket used to attack Southern England from September 1944,<sup>20</sup> its predecessor the V1 rocket, and some Scud rockets have been cited as examples of weapons that would have breached the rule.

### **Geneva Gas Protocol 1925**

The perceived inadequacies of the Hague Declaration IV of 1899 were addressed in 1925 with the adoption of the Geneva Gas Protocol.<sup>21</sup> This treaty prohibited the use in war of asphyxiating, poisonous, or other gases and of all analogous liquids, materials, or devices, and it extended the prohibition to the use of bacteriological methods of warfare. The 'sole object' language, which had provided the loophole in the 1899 text, was not repeated in the 1925 Protocol.

France, the UK and US became party to the Protocol on the stated understanding that they would only remain bound by the prohibitions so long as the adverse party in an armed conflict did not use the prohibited weapons. These 'no first use' arrangements remained relevant until the adoption of the Chemical and Biological Weapons Conventions.<sup>22</sup>

### **Weapons and the environment**

The next relevant piece of conventional law came some 50 years later with the adoption of the Environmental Modification Convention of 1976 (ENMOD).<sup>23</sup> This treaty prohibited military

or other hostile use of environmental modification techniques if these would have widespread, long-lasting or severe effects as the primary means of destruction, damage or injury to another state party.<sup>24</sup> This provision will therefore need to be considered if a weapon uses the environment as an instrument for causing the stated degree of damage to another state that is party to the treaty.

The other environmental protection rule within the law of armed conflict is to be found in Articles 35(3) and 55 of API. Article 35(3) prohibits the employment of methods or means of warfare which are intended, or may be expected, to cause widespread, long-term, and severe damage to the natural environment. Article 55 builds on this rule by imposing a requirement to take environmental care and by expressly prohibiting methods or means that are intended or may be expected to cause the prohibited damage and thereby to prejudice the health or survival of the population. Such a requirement to take care will clearly apply to the selection and design of weapons. The API rules are, however, concerned with collateral damage to the environment, as opposed to its use as a weapon.

### **Conventional Weapons Convention of 1980**

Further progress in developing the law of weaponry was achieved with the adoption of the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, which we shall refer to as the CCW.<sup>25</sup> This Convention facilitates the negotiation and adoption of Protocols that address particular types of weapon. Some of the provisions in these Protocols merely restate the customary principles that we have already discussed or apply to the particular kind of weapon the established targeting rules that apply as a matter of law to all attacks. The following summary will focus on the provisions that seem to develop the law of weaponry.

CCW Protocols prohibit the following specific weapons:

Protocol 1 prohibits the use of ‘any weapon the primary effect of which is to injure by fragments which in the human body escape detection by x-rays’.<sup>26</sup>

Protocol II<sup>27</sup> and Amended Protocol II<sup>28</sup> address the use in armed conflict of mines,<sup>29</sup> booby-traps, and other devices.<sup>30</sup> Protocol II defines booby-traps as ‘any device or material which is designed, constructed or adapted to kill or injure and which functions unexpectedly when a person disturbs or approaches an apparently harmless object or performs an apparently safe act’.<sup>31</sup> Under Article 6 of Protocol II it is prohibited to use booby-traps in the form of an apparently harmless portable object if they are specifically designed and constructed to contain explosive material and to detonate when they are disturbed or approached.<sup>32</sup> The use of booby-traps is also prohibited if they are in any way attached to or associated with:

- internationally recognised protective emblems, signs or signals;
- sick, wounded or dead persons;
- burial or cremation sites or graves;
- medical facilities, medical equipment, medical supplies or medical transportation;
- children’s toys or other portable objects or products specially designed for the feeding, health, hygiene, clothing or education of children;
- food or drink;
- kitchen utensils or appliances except in military establishments, military locations or military supply depots;
- objects clearly of a religious nature;

- historic monuments, works of art or places of worship which constitute the cultural or spiritual heritage of peoples;
- animals or their carcasses.<sup>33</sup>

Amended Protocol II prohibits:

- mines, booby-traps or other devices which employ a mechanism or device specifically designed to detonate the munition by the presence of commonly available mine detectors as a result of their magnetic or other non-contact influence during normal use in detection operations;<sup>34</sup>
- a self-deactivating mine equipped with an anti-handling device that is designed in such a manner that the anti-handling device is capable of functioning after the mine has ceased to be capable of functioning;<sup>35</sup>
- anti-personnel mines that do not incorporate in their construction a material or device that enables the mine to be detected by commonly available technical mine detection equipment and provides a response signal equivalent to a signal from 8 grammes or more of iron in a single coherent mass;<sup>36</sup>
- remotely delivered anti-personnel mines which do not comply with the following requirements:<sup>37</sup> their design and construction must be such that no more than ten percent of activated mines will fail to self-destruct within 30 days after emplacement, and each mine must have a back-up self-deactivation feature designed and constructed so that, in combination with the self-destruction mechanism, no more than one in 1000 activated mines will function as a mine 120 days after emplacement;<sup>38</sup>
- remotely delivered mines other than anti-personnel mines, unless, to the extent feasible, they are equipped with an effective self-destruction or self-neutralisation mechanism and have a back-up self-deactivation feature, which is designed so that the mine will no longer function as a mine when the mine no longer serves the military purpose for which it was placed in position;<sup>39</sup>
- and booby-traps or other devices in the form of apparently harmless portable objects which are specifically designed and constructed to contain explosive material.<sup>40</sup>

Protocol IV to CCW, which owes much to the general disapproval of blinding as a method of warfare, provides:

It is prohibited to employ laser-weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness to unenhanced vision, that is, to the naked eye or to the eye with corrective eyesight devices.<sup>41</sup>

At the time of writing, it can be concluded that a customary rule in the terms of Protocol I to CCW is in the process of emerging and that a customary rule in the precise terms of article 1 of Protocol IV has emerged.

### **Bacteriological or biological weapons**

The 1925 Geneva Gas Protocol only prohibited the use of bacteriological or biological weapons. Article I of the Biological Weapons Convention<sup>42</sup> takes matters considerably further, in that the states party undertakes never in any circumstances to develop, produce, stockpile, or otherwise acquire or retain:

- 1 Microbial or other biological agents or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;
- 2 Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

The Convention does not explicitly prohibit ‘use’, but at the Fourth Review Conference in 1996 it was agreed among the States party that Article 1 has the effect of prohibiting the use of such weapons.<sup>43</sup>

The comprehensive terms of the prohibitions mean that they apply to all classes of conflict. Very many states are party to the treaty, including almost all militarily significant states, and the consistent practice of states supports the conclusion that the prohibition on use of such weapons is now a customary rule of international law which therefore binds all states, whether or not they are party to this treaty.<sup>44</sup> It is also probably the case that the treaty’s prohibition on the possession, stockpiling, transfer and development of such weapons is also customary in nature. So it is unlawful for any state, whether it is party to the Biological Weapons Convention or not, to plan, prepare for, equip itself for, or undertake a biological attack.

While attempts have been made at two Review Conferences to agree upon a verification mechanism for the Convention, it has not, to date, proved possible to adopt such a provision.

### Chemical weapons

The possession of chemical weapons was also not prohibited by the 1925 Gas Protocol. The adoption in 1993 of the Chemical Weapons Convention,<sup>45</sup> which applies to all classes of conflict, therefore takes the law forward by providing that the participating states agree never under any circumstances:

- To develop, produce, otherwise acquire, stockpile or retain chemical weapons or transfer, directly or indirectly, chemical weapons to anyone;
- To use chemical weapons;
- To engage in any military preparations to use chemical weapons;
- To engage in any military operations to use chemical weapons;
- To assist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State party under the Convention.<sup>46</sup>

‘Chemical weapons’ means, together or separately:

- a Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes;
- b Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals ... which would be released as a result of the employment of such munitions and devices;
- c Any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in sub-paragraph (b).<sup>47</sup>

A toxic chemical is any chemical which, through its chemical action on life processes, can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all such

chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions, or elsewhere.<sup>48</sup>

A 'precursor' is any chemical reactant which takes part, at any stage, in the production, by whatever method, of a toxic chemical, including any key component of a binary or multi-component chemical system.<sup>49</sup>

If the chemical is intended for purposes which are not prohibited under the Convention and if the amount held is consistent with such innocent purposes, its possession is lawful. Purposes not prohibited under the Convention are:

- a Industrial, agricultural, research, medical, pharmaceutical or other peaceful purposes;
- b Protective purposes, namely those purposes directly related to protection against toxic chemicals and to protection against chemical weapons;
- c Military purposes not connected with the use of chemical weapons and not dependent on the use of the toxic properties of chemicals as a method of warfare;
- d Law enforcement, including domestic riot control purposes.<sup>50</sup>

The net effect of these provisions is, quite simply, to prohibit chemical warfare as that term is colloquially understood. The treaty applies in all classes of conflict and the prohibition on use of chemical weapons is clearly now a rule of customary law,<sup>51</sup> with the result that all states, irrespective of their participation in the Convention, are prohibited from using such weapons.

Riot control agents may not be used as a method of warfare, but they may be used for law enforcement, including domestic riot-control purposes. Riot control agents are 'chemicals not listed in a Schedule to the Treaty which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure'.<sup>52</sup> In the context of modern armed conflict, it is not of course always clear where law enforcement ends and armed conflict begins.

### **Anti-personnel landmines**

Consensus is required before a CCW Protocol can be adopted,<sup>53</sup> and no consensus could be achieved in favour of an Anti-Personnel Landmine (APL) ban. It was therefore an ad hoc process that led to the adoption of the Ottawa Convention,<sup>54</sup> which provides:

Each state party undertakes never under any circumstances:

- a To use anti-personnel mines;
- b To develop, produce, otherwise acquire, stockpile, retain or transfer to anyone, directly or indirectly, anti-personnel mines;
- c To assist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State party under this Convention.

An anti-personnel mine is a mine designed to be exploded by the presence, proximity, or contact of a person and that will incapacitate, injure or kill one or more persons. Mines designed to be detonated by the presence, proximity, or contact of a vehicle as opposed to a person and that are equipped with anti-handling devices are not considered anti-personnel mines as a result of being so equipped.<sup>55</sup>

The treaty prohibitions apply in all classes of conflict, but have not yet achieved customary law status; they are therefore binding only on states party to the treaty.

## Cluster munitions

The Convention on Cluster Munitions, adopted at a meeting in Dublin in 2008, obliges states party never under any circumstances:

- to use cluster munitions,
- to develop, produce, otherwise acquire, stockpile, retain or transfer to anyone, directly or indirectly, cluster munitions,
- to assist, encourage or induce anyone to engage in any activity prohibited to a State party under the Convention.<sup>56</sup>

A cluster munition means a conventional munition that is designed to disperse or release explosive sub-munitions each weighing less than 20 kilograms and includes those explosive sub-munitions. It does not mean the following:

- a A munition or sub-munition designed to dispense flares, smoke, pyrotechnics or chaff, or a munition designed exclusively for an air defence role;
- b A munition or sub-munition designed to produce electrical or electronic effects;
- c A munition that, in order to avoid indiscriminate area effects and the risks posed by unexploded sub-munitions, has all of the following characteristics:
  - i Each munition contains fewer than 10 explosive sub-munitions;
  - ii Each explosive sub-munition weighs more than 4 kilograms;
  - iii Each explosive sub-munition is designed to detect and engage a single target object;
  - iv Each explosive sub-munition is equipped with an electronic self-destruction mechanism;
  - v Each explosive sub-munition is equipped with an electronic self-deactivating feature.<sup>57</sup>

‘Explosive sub-munitions’,<sup>58</sup> ‘self-destruction mechanism’, and ‘self-deactivating mechanism’ are defined terms. Article 21 addresses the interoperability issues that may arise for states party engaging in military cooperation and operations with states not party to the Convention.

The rules in the Convention apply to states party only, but in all classes of conflict.

## Non-international armed conflict

The scope of application of the Conventional Weapons Convention and its annexed Protocols was extended in 2001<sup>59</sup> to ‘situations referred to in Article 3 common to the Geneva Conventions of 12 August 1949’.<sup>60</sup> The Protocols have that extended scope in relation to states that ratify that extension of 2001. APII always did apply to such conflicts.<sup>61</sup>

The Biological Weapons, Chemical Weapons, Ottawa, and Cluster Munitions Conventions apply to all classes of conflict, as do the customary law on superfluous injury/unnecessary suffering and indiscriminate weapons principles and the customary rules of weapons law, such as the prohibition of poisons or poisoned weapons. The position in relation to expanding bullets was discussed earlier.

## Treaty law restrictions on the use of certain weapons

Protocol II and Amended Protocol II to the CCW include restrictions on the use of mines, booby-traps and other devices the details of which lie outside the scope of this chapter. Protocol IV<sup>62</sup> also placed restrictions on the use of certain weapons that are not specifically prohibited.

Protocol III<sup>63</sup> to the CCW defines an incendiary weapon as

any weapon or munition which is primarily designed to set fire to objects or to cause burn injury to persons through the action of flame, heat, or a combination thereof, produced by a chemical reaction of a substance delivered on the target.<sup>64</sup> [It is prohibited] in all circumstances to make any military objective located within a concentration of civilians<sup>65</sup> the object of attack by air-delivered incendiary weapons.<sup>66</sup>

It is also prohibited to make military objectives located within a concentration of civilians the object of attack using incendiary weapons other than air-delivered incendiary weapons

except when such military objective is clearly separated from the concentration of civilians and all feasible precautions are taken with a view to limiting the incendiary effects to the military objective and to avoiding, and in any event to minimizing, incidental loss of civilian life, injury to civilians and damage to civilian objects.<sup>67</sup>

The Protocol also prohibits making forests or other kinds of plant cover the object of attack using incendiaries except when such natural elements are used to cover, conceal, or camouflage combatants or other military objectives or have themselves become military objectives.<sup>68</sup>

### **Non-lethal weapons**

NATO policy refers to non-lethal weapons as ‘weapons which are explicitly designed and developed to incapacitate or repel personnel, with a low probability of fatality or permanent injury, or to disable equipment with minimal undesired damage or impact on the environment’.<sup>69</sup>

The important point to note is that the ‘non-lethal’ character of a weapon does not affect the applicability to it of the principles and rules discussed so far in this chapter.

### **Weapon reviews**

States that are party to API<sup>70</sup> are required

[i]n the study, development, acquisition or adoption of a new weapon, means or method of warfare [...] to determine whether its employment would, in some or all circumstances, be prohibited by th[e] Protocol or by any other rule of international law applicable to the High Contracting Party.<sup>71</sup>

If, therefore, a weapon, means or method is being studied, then the weapons review duty applies. It will be a matter for national judgement when general technology research becomes the study of a weapon.<sup>72</sup>

‘Development’ involves the application of materials, equipment, and other elements to form a weapon and includes the improvement, refinement, and probably the testing of the prototype weapons with a view to achieving optimal performance.<sup>73</sup> ‘Acquisition’ involves obtaining weapons from commercial undertakings and/or from other states and ‘adoption’ involves a state or its armed forces deciding to use a weapon or method of warfare in military operations.

Customary law requires all states to review new weapons to determine whether they comply with the law that applies to the relevant state. The final paragraph of the 1868 St Petersburg

Declaration, Article 1 of Hague Convention IV of 1907, the AMW Manual,<sup>74</sup> and the *Tallinn Manual* all lead to this conclusion.<sup>75</sup> The ICRC concludes that '[t]he requirement that the legality of all new weapons, means and methods of warfare be systematically assessed is arguably one that applies to *all* States, regardless of whether or not they are party to Additional Protocol 1.'<sup>76</sup> However, relatively few states are known systematically to ensure the review of all new weapons.<sup>77</sup>

The law is not prescriptive as to the form that a weapon review must take, does not lay down any required procedure, and does not oblige states to disclose the contents of their reviews. Advice to an appropriate commander may be sufficient.<sup>78</sup>

The legal review must apply the rules of weapons law that apply to the state in question. These will be the two customary principles discussed in sections 3 and 4, the customary rules that have been identified, and the treaty prohibitions and restrictions to which the relevant state is party. The important point to note is that it is the principles and rules of current law that must be applied to new weapons and weapon technologies. The peculiarities of a new weapon technology are, therefore, no basis for arguing that an established weapons law rule does not have to be complied with.

### Autonomous weapons

We have discussed the principles and rules of the law of weaponry and the obligation legally placed on all States to review new weapons. This section considers how these principles and rules apply to an emerging novel technology, namely autonomous weapons.

A weapon system is 'man on the loop' if it is capable of automated or autonomous operation but is supervised by an operator who has the capability to intervene and override an attack decision that the automated or autonomous decision-making process makes. Contrast that to 'man in the loop' weapon systems in which the human operator decides which target is to be engaged and undertakes the attack by initiating the firing mechanism using the remote-control facility built into the weapon system.<sup>79</sup>

The weapon reviewer is concerned with the law applicable to the weapon system as such and not with the legality of a particular attack. He will therefore want to know whether a 'man on the loop' weapon system is capable of use in compliance with targeting law, including the distinction, discrimination, and proportionality principles and the precautions rules. If an individual empowered to countermand unsatisfactory machine-made attack decisions is enabled properly to supervise the autonomous or automated attack decision-making and to intervene when it is appropriate to do so, the autonomous or automated nature of the initial decision-making facility is unlikely to raise international weapons law concerns;<sup>80</sup> i.e., such a weapon system is capable of being employed in compliance with the targeting rules.

It seems clear that the ultimate goal of much contemporary research is complete autonomous decision-making in attack.<sup>81</sup> There is, however, no internationally agreed legal definition of what automated and, respectively, autonomous attack decision-making means.<sup>82</sup>

Current UK doctrine refers to highly automated systems that 'are constrained by algorithms that determine their responses by imposing rules of engagement and setting mission parameters which limit their ability to act independently'.<sup>83</sup> Such a system is not remotely controlled, but functions in a self-contained and independent manner once deployed. It independently verifies or detects a particular type of target and then fires or detonates.<sup>84</sup> Such technologies are not new, having been employed for example in the past in mines and booby-traps.<sup>85</sup>

Autonomous systems differ from automated ones in that they can understand higher-level intent and direction; and 'from this understanding and its perception of its environment, such a

system is able to [take] appropriate action to bring about a desired state'.<sup>86</sup> So autonomous systems independently identify and decide to engage targets. They are not pre-programmed to target a specified object or person. It is the software that decides which target to prosecute, how and when.

For the foreseeable future, autonomous attack decision-making is most unlikely to be capable of employment in conformity with targeting law principles and rules, particularly the distinction, discrimination, and proportionality principles and the rules as to precautions in attack.<sup>87</sup> At a Chatham House Conference on autonomous weapons systems, there was broad agreement that 'except in very unique battle spaces (where the likelihood of civilians was nonexistent), deployment of autonomous weapon systems today would not be consistent with the requirements of International Humanitarian Law'.<sup>88</sup> Accordingly, a legal review will generally reject the entirely autonomous use of weapon systems employing such technology.

Human Rights Watch has called for a legally binding instrument and national laws banning fully autonomous attack technologies, a notion which it describes as 'robots that are capable of selecting targets and delivering force without any human input or interaction' or that, although they operate under the oversight of a human operator who can override the robot's actions, are subject to such limited supervision that there is no effective human input or interaction.<sup>89</sup>

A UNIDIR discussion paper argues that there might be a difference in the acceptability of an autonomous but static system that is a 'last line of defence' to counter an incoming attack versus a system that employs superhuman decision-making speed to carry out an attack.<sup>90</sup> Such a last line of defence system, similar perhaps to Israel's Iron Dome or the Phalanx system, would be programmed to engage only inbound threats that are by definition military objectives in a defensive operational context in which collateral damage is unlikely to be a prohibitive consideration. Such systems are already in operational use and are likely to be more discriminating than human decisions made in the stressful, high speed, and potentially overwhelming conditions that necessitate the employment of the autonomous/highly automated system.

There has been criticism of the Human Rights Watch report<sup>91</sup> and its definition of 'fully autonomous weapons' which seems to include automated as well as autonomous systems. For the reasons discussed in the previous paragraph, states are likely to consider a prohibition of these technologies premature or inappropriate; so highly automated decision-making, informed certainly by human input before mission commencement, may increasingly become the norm.<sup>92</sup>

Improvement of artificial intelligence enabling a weapon system to learn and base its decisions on what it has learned seems likely to be the basis on which autonomy will emerge. Such learning systems might apply lessons learned in the battlespace to develop their own criteria against which to recognise a target; or they may observe and record the pattern of life in the target area and subsequently apply its observations and pre-learned lessons to decide what to attack. Perhaps a future ALI system could detect that a planned attack would no longer comply with the discrimination rule, for example because it detects that hostages have entered the target area.

More realistically, a weapon system might be able to detect whether the previous pattern of life in the target area that it has been observing has changed materially, such that the search for targets by the automated system should not proceed.

States are likely also to consider the ethical issues arising from the acquisition of autonomous weapons, such as whether the decision to initiate the use of lethal force can be legitimately delegated to an automated process.<sup>93</sup> As noted previously, however, it is existing law that should be applied to decide the legal acceptability of such technology in warfare<sup>94</sup> and this involves applying the normal weapons law criteria. Thereafter, the weapon review should

assess whether the targeting law rules can be complied with despite the absence of a person from target decision-making.

We will start, therefore, by considering the normal weapons law criteria. The superfluous injury and unnecessary suffering principle is likely to be irrelevant, concerned as it is with the nature of the injury caused by the weapon as opposed to the automated or autonomous nature of its targeting decision-making. For similar reasons, the environmental protection rules are unlikely to be relevant to the automated or autonomous aspect of the weapon system.

When applying the indiscriminate weapons rule, the performance of the autonomous or automated target recognition technology, whether during tests or in the course of previous actual hostilities, should be evaluated with care. A weapon system only breaches the indiscriminate weapons rule, however, if it cannot be directed at a specific military objective or if its effects cannot be limited as required by international law and if the result in either case is that the nature of the weapon is to strike military objectives and civilians or civilian objects without distinction. So if attack technology is designed to recognise the particular characteristics of, say, a tank, and if the recognition software performs satisfactorily in tests that realistically reflect the intended circumstances of use the indiscriminate weapons rule is likely to be satisfied. If, however, such software does not perform satisfactorily in such tests and thus the weapon strikes civilian objects and military objectives without distinction, the system will breach the rule. In some cases it may be necessary in the text of the weapon review to draw attention to restricted circumstances in which the weapon system will comply with the indiscriminate weapons principle,<sup>95</sup> and to explain what action is required in order to ensure that use of the weapon system does not result in indiscriminate attacks. There are no specific prohibitions or restrictions on the use of autonomous or automated attack technology in customary or treaty law.<sup>96</sup>

The weapon reviewer should then consider whether the automated or autonomous weapon system is capable of being used in accordance with the targeting rules. This will involve consideration of all targeting rules that seem to be relevant to the particular weapon system. The precautions required of an attacker by article 57 of API illustrate clearly some of the relevant challenges. Article 57(1), to which the reviewer should draw attention, requires that constant care be taken to spare the civilian population, civilians and civilian objects, and this provides the context for what follows.

Those who 'plan or decide upon an attack' and thus have obligations under Article 57(2) would seem to include those who prepared the mission, programmed the automated or autonomous software, reviewed available information, prescribed the areas to be searched and the times of such searches, set the target identification criteria for the weapon control software and so on.

The weapon reviewer will need to be satisfied that the characteristics of the weapon system and the arrangements that are being made for its employment are such that the decisions to attack made by the automated or autonomous weapon system apply these provisions, whether by virtue of action taken by the equipment itself or because of what personnel operating the weapon systems, supervising them, or planning the sortie are enabled to do in advance of, or during, the sortie.

Everything 'feasible' must be done to fulfil the obligations in Article 57(2)(a)(i) and (ii). If a manned mission would be capable of fulfilling an Article 57 obligation which the automated or autonomous mission cannot fulfil, then the manned mission should be employed, or some other method should be found of achieving the desired military purpose. This may become a difficult issue if an autonomous or automated weapon system cannot be programmed to recognise when its employment would preclude the taking of sub-paragraph (i) or (ii) precautions that, in contrast, could be taken if some other weapon system, such as a manned one, were to be employed. The mere fact that an autonomous or automated system cannot fulfil an obligation does not

render the obligation non-feasible if it can be fulfilled using an alternative weapon system traditionally used for the relevant purpose.

The Article 57(2)(a)(i) requirements to do everything feasible to verify that the object of the attack is a military objective and that it is not entitled to special protection<sup>97</sup> are likely to be complied with by using algorithm-based technologies, for example, that are found in tests satisfactorily to differentiate between the objects they are programmed to identify and those they are not, and thus between military objects and civilian objects.<sup>98</sup>

Shifting the focus of attention from targeting objects to targeting persons, the challenge for autonomous or automated target recognition technology under the first element of article 57(2)(a)(i) would be to show that it can satisfactorily distinguish between lawful targets, namely able-bodied combatants and able-bodied civilians directly participating in the hostilities, and persons whom the law protects, such as combatants who are *hors de combat*, non-combatants, and civilians who do not directly participate.

Article 57(2)(a)(i) also requires that attackers do everything feasible to verify that it is not prohibited by the Protocol to attack the intended targets. Prohibited attacks include those which would breach Article 51(4) (discrimination principle), 51(5)(a) (separate and distinct military objectives treated as one), 51(5)(b) (proportionality), 53 (cultural objects), 54 (objects indispensable to the survival of the civilian population), 35(3) and 55 (protection of the natural environment), 56 (works and installations containing dangerous forces and military objectives in their vicinity), 41 (safeguarding of persons *hors de combat*), 12 and 15 (protection of medical units and personnel), and 21 to 28 (protection of medical transports).

To the extent that these rules simply prohibit attacks directed at specified objects or persons, the weapon reviewer will be concerned to establish that the automated or autonomous weapon system, in the manner in which it is intended to be used, will detect that a person or object comes within one of these protected categories and will accordingly refrain from attacking it. It remains to be seen whether, for example, software can be developed that distinguishes between an able-bodied combatant and one who comes within article 41 as being *hors de combat*.<sup>99</sup>

The precautionary requirements of Article 57, however, go beyond target recognition so an autonomous or automated weapon system must also be able to comply, for example, with the evaluative judgements involved in Article 51(5)(a), in the proportionality assessment referred to in Articles 51(5)(b) and 57, and in the tests in Article 57(2)(a)(ii) and 57(3) of API. Taking Article 57(2)(a)(ii) as an example, the weapon system will have to be able to decide whether an attack should be undertaken using an operator-controlled, automated, or autonomous platform with a view to minimising incidental civilian injury and damage. The weapon reviewer will need to be satisfied that the available technology facilitates the making of each of these evaluative assessments.

The difficulty may, however, be overcome if human planners or operators are enabled to make the necessary evaluations and thus take the required precautions<sup>100</sup>; but, if there is no such human involvement, the weapon reviewer will need to be satisfied that the weapon system itself can discharge the complex decision-making that has been discussed.

For the foreseeable future, therefore, autonomous or automated attack capabilities can only be used lawfully if required precautions are taken by personnel, probably in advance of the sortie. Appreciating, however, that technology will develop with time and that autonomous or automated weapon systems will tend to be used in conjunction with other support systems, the reviewer's task will be to determine whether the method of warfare as a whole can comply with the legal rules we have discussed. Current technology requires a person to be in a position to cancel autonomous and some automated attack operations if the need should arise. That person will need to remain sufficiently engaged, suitably located, and appropriately tasked to know what is taking place and, if necessary, to override the system's attack decisions.

## Notes

- 1 *Concise Oxford English Dictionary*, 11th edn, 2006.
- 2 J. M. McClelland, 'The Review of Weapons in Accordance with Article 36 of Additional Protocol I', *International Review of the Red Cross*, No. 850, 2003, p. 397.
- 3 ICRC Guide at p. 8, Note 17 referring to a presentation by W. Hays Parks to the Expert Meeting on Legal Reviews of Weapons and the SIrUS Project, Jongny sur Vervey, 29–31 January 2001.
- 4 AP I Commentary, paragraph 1402. *The Manual on International Law Applicable to Air and Missile Warfare* (Program on Humanitarian Policy and Conflict Research, Harvard University, 15 May 2009) (hereafter AMW Manual) refers to 'methods of warfare' as the various general categories of operations, rule 1v on p. 43, and 'means of warfare' as weapons, weapon systems or platforms employed for the purposes of attack; rule 1(t) on p. 41.
- 5 'Instructions for the Government of Armies of the United States in the Field', 24 April 1863.
- 6 Lieber Code, Article 16.
- 7 Regulations Respecting the Laws and Customs of Wars on Land, Annexed to Hague Convention IV, 1907.
- 8 'St Petersburg Declaration renouncing the use, in time of war, of explosive projectiles under 400 grammes weight', 1868.
- 9 *The Manual of the Law of Armed Conflict* (Oxford: Oxford University Press, 2004) (hereafter UK Manual), para 6.10.1. While the prohibition is likely based on the customary superfluous injury and unnecessary suffering principle, discussed above, as opposed to the application of the treaty, the prohibition on the use of exploding ammunition against personnel is nevertheless now a customary rule in its own right.
- 10 1899 Hague Declaration II, para 2.
- 11 1899 Hague Declaration III, para 2.
- 12 UK Manual (see note 9 above), para 6.9 and Note 32. A resolution adopted on 10 June 2010 by the First Review Conference for the Rome Statute of the International Criminal Court amended article 8 of the Statute by adding to the list of war crimes in armed conflicts not of an international character, *inter alia*, the offence of 'employing bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions'; RC/Res 5 adopted at the 12th Plenary Meeting. A preambular paragraph to the Resolution and one of the Elements of the crime make it clear that the crime is only committed in connection with a non-international armed conflict 'if the perpetrator employs the bullets to uselessly aggravate suffering or the wounding effect upon the target of such bullets, as reflected in customary international law'; preambular paragraph 9. It is therefore not a crime under the Statute to use such bullets in connection with such conflicts if there is a good military reason for doing so, such as may arise in, for example, the kinds of circumstance discussed in the main text.
- 13 Preamble to the St Petersburg Declaration, 1868 (see note 8 above), tirets 2 to 6.
- 14 Project of an International Declaration concerning the Laws and Customs of War, Brussels, 27 August 1874, article 12, and The Laws of War on Land, Oxford, 9 September 1880, article 9; US Field Manual 27–10, paragraph 34 on p. 18 explains that weapons breaching the rule include 'lances with barbed heads, irregular shaped bullets, projectiles filled with glass, substances on bullets tending unnecessarily to inflame the wound, scoring the surface or filing off the ends of the hard cases of bullets'.
- 15 API, Article 35(2).
- 16 'A weapon causes unnecessary suffering when in practice it inevitably causes injury or suffering disproportionate to its military effectiveness. In determining the military effectiveness of a weapon, one looks at the primary purpose for which it was designed', W. J. Fenrick, 'The Conventional Weapons Convention: A modest but useful treaty', *International Review of the Red Cross*, Vol. 30, Issue 279 (1990), p. 500.
- 17 W. H. Boothby (2016) *Weapons and the Law of Armed Conflict*, Oxford: OUP, p. 63, where the criteria prepared by E. R. Cummings, W. A. Solf and H. Almond as the basis for the original United States Department of Defense weapons review directive are discussed. The UK

- Manual (see note 9 above) explains that the current practice is to regard the principle as 'a guiding principle upon which specific prohibitions or restrictions [in the law of weaponry] can be built'; UK Manual, paragraph 6.1.5.
- 18 F. Kalshoven, 'Arms, Armaments and International Law', Extract from (1985-II) 191 *Hague Recueil des Cours*, p. 236.
  - 19 API, Article 51(4).
  - 20 J. M. Spaight, *Air Power and War Rights*, 3rd edn (Gale, 1947), p. 215; Spaight notes that such a weapon was not 'banned in terms by any international convention'.
  - 21 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, 1925.
  - 22 States have in practice withdrawn their 'no first use' reservations as they have become party to the Chemical Weapons Convention of 1993 and to the Biological Weapons Convention of 1972.
  - 23 United Nations Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques (ENMOD), adopted on 2 September 1976.
  - 24 ENMOD, Article 1(1).
  - 25 The Convention was adopted on 10 October 1980 in Geneva.
  - 26 Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons, Protocol I, adopted in Geneva on 10 October 1980.
  - 27 Ibid.
  - 28 Adopted in Geneva on 3 May 1996.
  - 29 'Mine means any munition placed under, on or near the ground or other surface area and designed to be detonated or exploded by the presence, proximity or contact of a person or vehicle.' Protocol II, article 2(1). The equivalent definition in Amended Protocol II, article 2(1) is broadly similar.
  - 30 'Other devices means manually-emplaced munitions and devices designed to kill, injure or damage and which are actuated by remote control or automatically after a lapse of time.' Protocol II, article 1(3). Under Amended Protocol II, 'Other devices means manually-emplaced munitions and devices including improvised explosive devices designed to kill, injure or damage and which are actuated manually, by remote control or automatically after a lapse of time.' Amended Protocol II, article 2(5).
  - 31 Protocol II, article 1(2).
  - 32 Protocol II, article 6(1)(a).
  - 33 Protocol II, Article 6(1), APII article 7(1).
  - 34 APII, article 3(5).
  - 35 APII, article 3(6).
  - 36 APII, article 4 and Technical Annex, paragraph 2(a), but note that some technical requirements depend on the date of construction, see paragraph 2(b).
  - 37 APII, article 6(2).
  - 38 APII, Technical Annex, para 3(a) taken with (b).
  - 39 APII, article 6(3).
  - 40 APII, article 7(2).
  - 41 CCW, Protocol IV, Article 1. Blinding as an incidental or collateral effect of the legitimate use of laser systems is not prohibited; article 3. Equally, laser systems which are not specifically designed to cause permanent blindness are also not prohibited by this provision. Permanent blindness means irreversible and uncorrectable loss of vision which is seriously disabling with no prospect of recovery, and serious disability is equivalent to visual acuity of less than 20/200 Snellen measured using both eyes. Protocol IV, article 4. Under article 2, when using laser weapons not prohibited by the Protocol, States party must take 'all feasible precautions to avoid the incidence of permanent blindness to unenhanced vision'.
  - 42 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction 1972, opened for signature on 10 April 1972 (Biological Weapons Convention).
  - 43 UK Manual (see note 9 above), p. 104, Note 8.
  - 44 ICRC Customary Humanitarian Law Study, Vol. 1, Rule 73, p. 256.
  - 45 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Paris, 13 January 1993 (Chemical Weapons Convention).

- 46 Chemical Weapons Convention, Article I(1).  
 47 Chemical Weapons Convention, Article II(1).  
 48 Chemical Weapons Convention, Article II(2).  
 49 Chemical Weapons Convention, Article II(3).  
 50 Chemical Weapons Convention, Article II(9).  
 51 ICRC Customary Humanitarian Law Study Report, Rule 74; Boothby, *Weapons and the Law*, p. 137 (see note 17 above), and note that there are now 190 States party to the Chemical Weapons Convention, [www.opcw.org/about-opcw/](http://www.opcw.org/about-opcw/) (accessed 22 May 2015).  
 52 Chemical Weapons Convention, 1993, Article II(7).  
 53 CCW, Article 8(2)(b).  
 54 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction, Oslo, adopted on 18 September 1997.  
 55 Ottawa Convention, article 2(1).  
 56 Cluster Munitions Convention, Article 1(1). See also the discussion by Brian Rappert in Chapter 5.  
 57 Cluster Munitions Convention, Article 2(2).  
 58 Cluster Munitions Convention, Article 2(3).  
 59 CCW Review Conference, December 2001.  
 60 CCW, Article 1(2) as amended.  
 61 CCW, APII, Article 1(2).  
 62 Consider article 2.  
 63 Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III) adopted in Geneva 10 October 1980.  
 64 Protocol III article 1(1). The definition excludes from the Protocol munitions with incidental incendiary effects, such as tracers or illuminants, and combined effects munitions in which the incendiary effect is designed to be used against objects not persons.  
 65 A ‘concentration of civilians’ may be permanent or temporary, and can include inhabited parts of cities, towns, villages, camps, columns of refugees or groups of nomads; Protocol III article 1(2).  
 66 Protocol III, article 2(2).  
 67 Protocol III, article 2(3).  
 68 Protocol III, article 2(4).  
 69 NATO Policy on Non-Lethal Weapons dated 27 September 1999.  
 70 At the time of writing there were 174 states party to API. Source: <https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/INTRO/470> (accessed 20 July 2018).  
 71 API, article 36; for a discussion of weapon reviews, see Geoffrey S. Corn et al., *The Law of Armed Conflict: An Operational Approach* (New York: Wolters Kluwer Law and Business, 2012), pp. 203–4.  
 72 Boothby, *Weapons and the Law*, p. 345.  
 73 Consider I. Daoust, R. Coupland and R. Isoheoy, ‘New Wars, New Weapons? The Obligation of States to Assess the Legality of Means and Methods of Warfare’, *International Review of the Red Cross*, No. 846, pp. 345, 348, 2002.  
 74 AMW Manual (see note 4 above), Rule 9.  
 75 Schmitt, Michael N. (Gen. ed.) (2013). *Tallinn Manual on the International Law Applicable to Cyber Warfare*, New York: Cambridge University Press, Rule 48(a). The Commentary to this Rule also cites article 1 common to the Geneva Conventions of 1949. References in military manuals include the UK Manual, paragraphs 6.20–6.20.1; the United States Naval Commanders’ Handbook on the Conduct of Naval Operations, NWP 1–14, paragraph 5.3.4; the Canadian Manual paragraph 530; and the German Manual paragraph 405. See also W. Hays Parks, ‘Conventional Weapons and Weapons Reviews’, *Yearbook of International Humanitarian Law*, Vol 8 (2005), pp. 55–7.  
 76 K. Lawand, *A Guide to the Legal Review of New Weapons, Means and Methods of Warfare: Measures to Implement Article 36 of Additional Protocol I of 1977*, ICRC, 2006, p. 4.  
 77 *Ibid.*, p. 5.  
 78 *Tallinn Manual* (see note 75 above), commentary accompanying Rule 48, paragraph 3.  
 79 See N. Melzer, ‘Human Rights Implications of the Usage of Drones and Unmanned Systems in Warfare’, Geneva Papers 11–2013, 8.

- 80 Report of ICRC Meeting on Autonomous Weapon Systems: technical, military, legal and humanitarian aspects, Geneva, 26–28 March 2014, pp. 4–5 (ICRC Report).
- 81 For systems with autonomous features already in use, consider the maritime Phalanx system in service with the Royal Navy and described at [www.royalnavy.mod.uk/The-Fleet/Ships/Weapons-Systems/Phalanx](http://www.royalnavy.mod.uk/The-Fleet/Ships/Weapons-Systems/Phalanx); the United States Navy MK 15 – Phalanx Close-In Weapons System, described at [www.navy.mil/navydata/fact\\_display.asp?cid=2100&tid=487&ct=2](http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=487&ct=2); the Russian Arena-E Active Protection System; the Mutual Active Protection System; the Diehl BGT Mutual Active Protection System described at [www.defense-update.com/20110112\\_maps.html](http://www.defense-update.com/20110112_maps.html), South Korean border security arrangements discussed in ‘South Korea deploys robot capable of killing intruders along border with north’, *Daily Telegraph*, 13 July 2010 available at [www.telegraph.co.uk/news/worldnews/asia/southkorea/7887217/South-Korea-deploys-robot-capable-of-killing-intruders-along-border-with-North.html](http://www.telegraph.co.uk/news/worldnews/asia/southkorea/7887217/South-Korea-deploys-robot-capable-of-killing-intruders-along-border-with-North.html) and the Israel Aircraft Industries Harpy autonomous anti-radar SEAD system as to which see [www.iai.co.il/2013/16143-16153-en/IAI.aspx](http://www.iai.co.il/2013/16143-16153-en/IAI.aspx).
- 82 ICRC Report, p. 1 (see note 80 above).
- 83 UK Ministry of Defence, UK Air and Space Doctrine, JDN 0.30, para 215. Automated systems ‘do not involve a human operator during the actual deployment but rather the necessary data is fed into the system prior to deployment of the system’, and WW2 V-1 and V-2 rockets, automated sentry guns and sensor-fused ammunition are examples.
- 84 J. Kellenberger, ‘International humanitarian law and new weapon technologies’, 34th Round Table on Current Issues of International Humanitarian Law, San Remo, 8–10 September 2011, p. 5.
- 85 A. Backstrom and I. Henderson, ‘New capabilities in warfare: an overview of contemporary technological developments and the associated legal and engineering issues in Article 36 weapons reviews’, *International Review of the Red Cross*, No. 886, 2012, pp. 488–90.
- 86 JDN 0–30 Lexicon-5; note the UK view that autonomous systems are self-governing and set their own rules, that this is neither welcome nor useful in the military context and that the UK is committed to maintaining human oversight over weapons release decisions; *ibid*, para. 215.
- 87 E. Quintana, ‘The Ethics and Legal Implications of Military Unmanned Vehicles’, (2008) RUSI available at [www.rusi.org/downloads/assets//RUSI\\_ethics.pdf](http://www.rusi.org/downloads/assets//RUSI_ethics.pdf).
- 88 See ICRC Report (note 80 above), p. 5. Current UK policy ‘is that the operation of weapon systems will always be under human control’; *ibid*, pp. 10–11.
- 89 Human Rights Watch, *Losing Humanity: The Case Against Killer Robots* (2012) available at [www.hrw.org/sites/default/files/reports/arms1112ForUpload\\_0\\_0.pdf](http://www.hrw.org/sites/default/files/reports/arms1112ForUpload_0_0.pdf), 2, 5.
- 90 UNIDIR, Framing Discussions on the Weaponisation of Increasingly Autonomous Technologies (2014), available at [www.unidir.org/files/publications/pdfs/framing-discussions-on-the-weaponization-of-increasingly-autonomous-technologies-en-606.pdf](http://www.unidir.org/files/publications/pdfs/framing-discussions-on-the-weaponization-of-increasingly-autonomous-technologies-en-606.pdf), 6.
- 91 M. N. Schmitt and J. S. Thurnher, “‘Out of the Loop’: Autonomous Weapon Systems and the Law of Armed Conflict’, *Harvard National Security Journal*, Vol. 4, 2013, pp. 231–81.
- 92 K. Anderson and M. Waxman, *Law and ethics for autonomous weapon systems, why a ban won't work and how the law of war can*, Hoover Institution, Stanford University (2013) available at [www.hoover.org/taskforces/national-security](http://www.hoover.org/taskforces/national-security), 5 and footnote 16.
- 93 P. Asaro, ‘On banning autonomous weapon systems: human rights, automation, and the dehumanization of lethal decision-making’, *International Review of the Red Cross* Vol. 94, Issue 886, p. 689 and see for example *Losing Humanity* (see note 89 above).
- 94 See Anderson and Waxman, *Law and ethics* (note 92 above), M. N. Schmitt, ‘Autonomous Weapon Systems and International Humanitarian Law: A Reply to the Critics’, *Harvard National Security Journal* Feature, 2013, available at: <http://ssrn.com/abstract=2184826> or <http://dx.doi.org/10.2139/ssrn.2184826>. See also Schmitt and Thurnher, “‘Out of the Loop’” (see note 91 above).
- 95 See Schmitt and Thurnher, “‘Out of the Loop’”, pp. 245–50, 271–6 (note 91 above).
- 96 S. S. ‘Lotus’ (Fr. v. Turk.), 1927 P.C.I.J. (ser. A) No. 10 (Sep. 7), 18; the absence of specific reference to such technologies implies that they are not the subject of a prohibition.
- 97 See AMW Manual (see note 4 above), Rule 32(a).
- 98 The reference here to ‘military objects’ is intentional; the technology is likely to be configured so as to distinguish, for example, between an artillery piece or a tank on the one hand

and a civilian vehicle of comparable size on the other; see M. Lewis et al., 'Scaling up Wide-area-search Munition Teams', *IEEE Intelligent Systems*, Vol. 24, Issue 3 (May-June 2009), p. 10.

- 99 As to relevant engineering challenges, see Backstrom and Henderson, 'New capabilities in warfare' (see note 85 above), pp. 510–13.
- 100 Performance of the system cannot be determined in advance with certainty. These matters must however be considered; and appropriate limitations on circumstances of planned use must be developed to ensure that the discrimination and precautions rules will likely be complied with.