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Precision Air Warfare and
the Law of Armed Conflict

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I. INTRODUCTION

Precision attacks dominate contemporary aerial warfare. The centrality of precision operations derives not only from their military utility, but also from the international community's evolving expectations with respect to the avoidance of collateral damage. As technological developments in the field proceed apace, the emphasis on precision can only be expected to grow.

This article examines the synergistic relationship between precision air-strikes and the law of armed conflict. It defines precision, briefly reviews the history of its rise to prominence in aerial warfare, examines the application of the law of armed conflict to precision attacks and considers several new precision weapon systems. In sum, the article explores both how the

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law of armed conflict governs the use of precision capabilities and how advances in precision capabilities are likely to shape the law of armed conflict.

II. THE DEFINITION OF “PRECISION” AND A BRIEF HISTORY

A. “Precision” Defined

“Precision” refers to the “ability to locate and identify a target, strike it accurately in a timely fashion, and determine whether desired effects have been achieved or restrike is needed.”¹ In discussing precision, many scholars address only accuracy. “Accuracy” refers to a weapon’s capacity to strike a specific aimpoint² and is an integral aspect of any precision airstrike.

But accuracy alone is insufficient to render a strike “precise.” Precision is just as dependent on command, control, communications, computers, intelligence, surveillance, and reconnaissance (known as C4ISR) capabilities. In fact, on a complex battlefield, ISR,³ not accuracy, often proves the key aspect of a precision airstrike. For example, during Operation Enduring Freedom U.S. aircraft twice mistakenly attacked International Committee of the Red Cross warehouses.⁴ Weapons accuracy played no role in the attacks—the missiles landed exactly where they were aimed. Instead, the problem was a failure in the targeting process, which is C4ISR driven.

It is likewise important to recognize that the environment in which an airstrike takes place can affect the accuracy of a weapon system and the quality of the associated C4ISR. For instance, nighttime or inclement

1. Michael N. Schmitt, *Precision Attack and International Humanitarian Law*, 87 INTERNATIONAL REVIEW OF THE RED CROSS 445, 446 (2005).

2. An “aimpoint” is “[a] point associated with a target and assigned for a specific weapon impact. [It] may be defined descriptively (e.g., vent in center of roof), by grid reference, or geolocation. More specific classifications of aimpoint include desired point of impact, joint desired point of impact, and desired mean point of impact.” Joint Chiefs of Staff, Joint Publication 1-02, DoD Dictionary of Military and Associated Terms (Nov. 8, 2010), as amended through July 15, 2012, http://www.dtic.mil/doctrine/dod_dictionary [hereinafter DoD Dictionary].

3. “[I]ntelligence, surveillance, and reconnaissance” is “[a]n activity that synchronizes and integrates the planning and operation of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations. This is an integrated intelligence and operations function.” *Id.*

4. For a discussion of these incidents, see Sean D. Murphy, *Contemporary Practice of the United States Relating to International Law*, 96 AMERICAN JOURNAL OF INTERNATIONAL LAW 247 (2002).

weather limits the effectiveness of certain weapon systems. Fire can diminish the usefulness of infrared equipment and smoke may prevent visual target identification, as was demonstrated during coalition airstrikes in the 1990–1991 Gulf War after Kuwaiti oil wells were set ablaze by Iraqi forces. If a target is heavily defended, an attacker may be forced to launch from a greater-than-optimal weapons release altitude or range or conduct evasive maneuvers that make the launch platform unsteady. And, of course, human error is always possible in the heat of battle.

B. Rise of Precision Airstrikes

Airpower played no significant role in armed conflict until World War I, when it was initially employed for surveillance and reconnaissance; the first aerial attacks took the form of close air support for ground forces. Later in the conflict, belligerents began to use aircraft for strategic strikes, most notably in the zeppelin raids against London.⁵ By 1918, the U.S. Air Service and the American Expeditionary Force had drafted a strategic bombing plan which involved “drop[ping] aerial bombs upon commercial centers and the lines of communications in such quantities as will wreck the points aimed at and cut off the necessary supply lines.”⁶ The war ended before the plan could be executed.

In the aftermath of World War I, most air forces engaged in comprehensive doctrine reviews. The United States, for example, conducted the U.S. Bombing Survey, which concluded that the “successful application of airpower requires a predetermined plan calculated to destroy the enemy’s will and war sustaining capability. Achieving this goal requires systematic analysis to determine which targets, if destroyed, would do the greatest damage to the enemy.”⁷ In a sense, the Bombing Survey argued for what would at the end of the century come to be known as “effects-based operations.”⁸ Conducting operations to achieve particular results, rather than simply wearing down the enemy’s fielded forces, requires that an attacker

5. For an in-depth history of airpower, see STEPHEN BUDIANSKY, *AIR POWER: THE MEN, MACHINES, AND IDEAS THAT REVOLUTIONIZED WAR, FROM KITTY HAWK TO GULF WAR II* (2004).

6. U.S. Air Force, AF Pamphlet 14-210, *Intelligence Targeting Guide*, AF Pamphlet 14-210, attachment 2 (Feb. 1, 1998). See this attachment generally for a summary of airpower theory development.

7. *Id.*

8. See, e.g., Joint Chiefs of Staff, *Joint Publication 3-60, Joint Doctrine for Targeting*, I-1 (Jan. 17, 2002).

deconstruct enemy systems in order to identify those objectives the destruction of which will achieve specific desired effects. Precision makes this possible.⁹

At the time of the U.S. Bombing Survey, the precision technology capable of accomplishing such missions was years from development. During World War II, for example, a B-17 had a circular error probable¹⁰ of roughly 3,300 feet. This meant that at 6,500 feet, approximately 9,000 bombs from 1,500 aircraft would have to be dropped to achieve a high probability of destroying a point target.¹¹ Complicating matters was the fact that missions often were flown at night and at high altitude to avoid enemy air defenses, thereby further diminishing the precision of the attacks.

Air operations during the Vietnam conflict marked a sea change in precision warfare. A new generation of laser-guided weapons finally enabled a single aircraft to destroy a target in one attack. Since the Vietnam conflict, dramatic technological advances have continued with respect to both precision weapons and C4ISR capabilities. The result has been a sharp rise in the percentage of airstrikes that employ precision systems. For example, precision munitions were used in only 8.8 percent of attacks during Operation Desert Storm (1991).¹² By the initial phases of Operation Enduring

9. Michael N. Schmitt, *Effects-Based Operations and the Law of Aerial Warfare*, 5 WASHINGTON UNIVERSITY GLOBAL STUDIES LAW REVIEW 265, 276 (2006).

10. “[C]ircular error probable” is “[a]n indicator of the delivery accuracy of a weapon system, used as a factor in determining probable damage to a target. It is the radius of a circle within which half of a missile’s projectiles are expected to fall. Also called CEP.” DoD Dictionary, *supra* note 2.

11. Colonel Gary L. Crowder, Chief of Strategy, Concepts, and Doctrine, Department of Defense Air Combat Command, *Effects Based Operations Briefing* (Mar. 19, 2003), <http://www.defenselink.mil/Transcripts/Transcript.aspx?TranscriptID=2067>. As another example,

during Operation Cobra, the breakout from Normandy, U.S. air forces dropped 14,600 500-pound bombs on one German division, destroying 66 tanks and 11 heavy guns. During Operation Desert Storm, the U.S. dropped 9,800 precision-guided munitions, destroying 2,500 tanks, heavy artillery pieces, and armoured personnel carriers—a ratio of bombs to destruction of equipment 50 times greater than in Operation Cobra.

Robert A. Pape, *Hit or Miss: What Precision Air Weapons Do, Precisely*, FOREIGN AFFAIRS, Sept./Oct. 2004, at 162, 163.

12. WILLIAM M. ARKIN ET AL., GREENPEACE, ON IMPACT: MODERN WARFARE AND THE ENVIRONMENT, A CASE STUDY OF THE GULF WAR 78 (1991).

Freedom (2001) and Operation Iraqi Freedom (2003), those figures were at 65 percent and 68 percent, respectively.¹³

Technology has progressed to the point where a basic precision strike capability is within the reach of even less advanced militaries. A prime example is the Joint Direct Attack Munition (JDAM), which is simply an unguided bomb to which a guidance tail kit has been attached. At \$22,000 per kit, the JDAM is relatively uncomplicated and cheap.¹⁴ JDAMs are also fairly accurate, allowing for a precision airstrike with a circular error probable of less than twenty feet from as far away as fifteen miles.¹⁵

Beyond their obvious utility in conventional warfare, precision airstrikes are particularly useful in air campaigns where the objective is not mere attrition of the enemy's armed forces. The best example is compellance (or coercive) warfare, in which the objective is to induce an adversary to engage in, or desist from, particular behavior. NATO adopted this approach during Operation Allied Force, the 1999 air campaign against the Federal Republic of Yugoslavia. The goal of that campaign was to force President Slobodan Milosevic to resume negotiations and end the mistreatment of the Kosovar-Albanian population by his forces.¹⁶ To achieve these objectives, NATO relied on precision airstrikes to attack specific targets, the destruction of which it believed would convince Milosevic to return to the bargaining table and stop the slaughter. The campaign succeeded in seventy-eight days.¹⁷

Counterinsurgency conflicts, such as those in Afghanistan and Iraq, also necessitate precision military operations that go beyond destroying the enemy's fielded forces.¹⁸ Modern counterinsurgency operations aim to safeguard the State's government, infrastructure and civilian population,

13. U.S. CENTRAL COMMAND AIR FORCES, OPERATION IRAQI FREEDOM: BY THE NUMBERS 11 (2003).

14. U.S. Air Force, Factsheet on Joint Direct Attack Munition, GBU-31/32/38, <http://www.af.mil/information/factsheets/factsheet.asp?id=108>.

15. *Id.*

16. *See* Press Release, North Atlantic Treaty Organization, The Situation In and Around Kosovo: Statement Issued at the Extraordinary Ministerial Meeting of the North Atlantic Council (Apr. 12, 1999), <http://www.nato.int/docu/pr/1999/p99-051e.htm>.

17. DEPARTMENT OF DEFENSE, KOSOVO/OPERATION ALLIED FORCE AFTER-ACTION REPORT xvii (2000).

18. *See generally* HEADQUARTERS, DEPARTMENT OF THE ARMY & HEADQUARTERS, MARINE CORPS COMBAT DEVELOPMENT COMMAND, FM 3-24/MCWP 3-33.5, COUNTERINSURGENCY (2006).

while waging war against a discrete group within that State.¹⁹ As a result, counterinsurgency air operations emphasize limiting collateral damage, especially civilian casualties, usually at a level far below law of armed conflict requirements. Moreover, airstrikes often target particular insurgents within a group's command and control structure in order to weaken that group's ability to operate cohesively. Since these insurgents often operate among the civilian population, their targeting is operationally challenging and usually only accomplishable through air operations when advanced precision capabilities are available.

Looking toward the future, precision airstrikes will play an ever-increasing role in warfare. Beyond their military utility in terms of finding, fixing, and destroying enemy forces, airstrikes also reduce the risk to the attacker's forces. New weapon systems such as unmanned aerial vehicles, air-based cyber-attack platforms and autonomous systems will further those goals. Of course, as precision attack takes center stage in twenty-first-century warfare, so too will issues as to the law of armed conflict that governs such operations.

III. THE LAW OF ARMED CONFLICT GOVERNING PRECISION AIRSTRIKES

The development of precision airstrike capabilities occurred as the law of armed conflict governing the conduct of hostilities, especially the protection of civilians and civilian objects, began to achieve maturity. Of particular note is the 1977 Protocol Additional I to the 1949 Geneva Conventions, which represented the first codification of such key principles and rules as distinction, proportionality, and precautions in attack.²⁰ Although the Protocol does not encompass all aspects of air warfare, it expressly applies to "attacks from . . . the air against objectives on land."²¹ Among States possessing robust precision attack capabilities, the United States and Israel stand out as non-parties to the treaty. However, both States recognize the

19. *Id.* at 5-1 ("Successful counterinsurgents support or develop local institutions with legitimacy and the ability to provide basic services, economic opportunity, public order, and security. The political issues at stake are often rooted in culture, ideology, societal tensions, and injustice. As such, they defy nonviolent solutions.").

20. Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts arts. 48, 51 and 57, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter Additional Protocol I].

21. *Id.*, art. 49(3).

core targeting principles and rules set forth therein as generally reflective of customary international law.²²

In 2010, a major multiyear research effort sponsored by Harvard University's Program on Humanitarian Policy and Conflict Research and led by Professor Yoram Dinstein produced the *Manual on International Law Applicable to Air and Missile Warfare (AMW Manual)*.²³ The work, authored by a group of distinguished international law experts and practitioners, represents an unofficial, yet authoritative, restatement of the principles and rules governing aerial operations. In its examination of the key legal issues surrounding precision aerial warfare, this article relies heavily on both the *AMW Manual* and Additional Protocol I as key repositories of the applicable law.

A. Prohibited Weapon Systems

Certain weapon systems and individual weapons are prohibited in aerial warfare irrespective of how they are used or the results their use generates. First, only military aircraft may be used to conduct airstrikes; airstrikes by civilian aircraft are unlawful regardless of how precise they might be.²⁴ Second, the law of armed conflict forbids the employment of particular weapons on military aircraft even when they are capable of striking a lawful target with great precision and without risk to civilians and civilian objects. These include the following:

- (a) Biological, including bacteriological, weapons[;]
- (b) Chemical weapons[;]
- (c) 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[;]

22. See, e.g., U.S. Navy, U.S. Marine Corps & U.S. Marine Corps, NWP 1-14M/MCWP 5-12.1/COMDTPUB P5800.7A, *The Commander's Handbook on the Law of Naval Operations* ch. 8 (2007) (reiterating most of the Additional Protocol I targeting rules).

23. PROGRAM ON HUMANITARIAN POLICY AND CONFLICT RESEARCH, *MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE* (2009) [hereinafter *AMW MANUAL*]. Professor Schmitt served as one of the members of the drafting team for the manual.

24. *Id.*, rule 17(a) (“Only military aircraft, includingUCAVs, are entitled to engage in attacks.”).

- (d) Poison, poisoned substances and poisoned weapons[;]
- (e) Small arms projectiles calculated, or of a nature, to cause explosion on impact with or within the human body[; and]
- (f) Weapons the primary effect of which is to injure by fragments which in the human body escape detection by x-ray.²⁵

B. *The Principle of Distinction*

The principle of distinction was set forth as early as the 1868 St. Petersburg Declaration,²⁶ adopted in the 1899 and 1907 Hague Regulations,²⁷ and codified in Article 48 of Additional Protocol I. The International Court of Justice has described it as one of the two “cardinal” principles of the law of armed conflict.²⁸ The International Committee of the Red Cross has labeled it the “foundation on which the codification of the laws and customs of war rests.”²⁹

By the principle, parties to a conflict must distinguish between combatants and military objectives on the one hand and civilians and civilian objects on the other.³⁰ Once this distinction has been made, they may only attack those targets that qualify as military objectives, combatants, or civilians directly participating in hostilities.³¹ In case of doubt as to the targetability of an individual under the law of armed conflict, an individual must be treated as a civilian immune from attack.³² Precision lies at the heart of

25. *Id.*, rule 6(a)–(f).

26. Declaration Renouncing the Use, in Time of War, of Explosive Projectiles under 400 Grammes Weight pmbl. ¶ 2, Dec. 11, 1868, 138 Consol. T.S. 297 (“That the only legitimate objects which States should endeavor to accomplish during war is to weaken the military forces of the enemy.”).

27. Convention [II] with Respect to the Laws and Customs of War on Land, with annex of regulations arts. 22, 29, 32, July 29, 1899, Stat. 1803, 32 Stat. 1803, 1 Bevans 247; Regulations Respecting the Laws and Customs of War on Land, annexed to Convention No. 4 Respecting the Laws and Customs of War on Land art. 22, Oct. 18, 1907, 36 Stat. 2277, 1 Bevans 631.

28. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 78 (July 8).

29. COMMENTARY ON THE ADDITIONAL PROTOCOLS OF 8 JUNE 1977 TO THE GENEVA CONVENTIONS OF 12 AUGUST 1949 ¶ 1863 (Yves Sandoz, Christophe Swinarski & Bruno Zimmermann eds., 1987) [hereinafter ICRC COMMENTARY].

30. Additional Protocol I, *supra* note 20, art. 48.

31. AMW MANUAL, *supra* note 23, rule 10. *See also* Additional Protocol I, *supra* note 20, arts. 51(2), 51(3) and 52(1).

32. Additional Protocol I, *supra* note 20, art. 50(1); *see also* AMW MANUAL, *supra* note 23, rule 12; PROGRAM ON HUMANITARIAN POLICY AND CONFLICT RESEARCH, COMMEN-

the principle of distinction because, as noted, precision involves more than simply striking a particular point (accuracy); it involves hitting the right target in the right way. Therefore, target identification is of paramount importance for both precision warfare and the principle of distinction.

Military objectives, the first category subject to lawful attack, are those “objects which by their nature, location, purpose or use, make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.”³³ This definition has two express criteria. First, the object must make an “effective contribution” to enemy operations. While this criterion by no means requires that the contribution be “significant,” the object “must in fact contribute to the enemy’s military action.”³⁴ Second, the military advantage gained by targeting the object must be “definite.” This requires that the advantage not be “merely potential, speculative or indeterminate.”³⁵ ISR is often a necessary component in determining whether these two criteria have been satisfied. If they are not satisfied, then the operation in question is neither a precision strike nor a lawful attack.

Despite universal acceptance of the textual definition of “military objective” set out above, controversy persists over its parameters. Clearly, “war-fighting” targets qualify, as do those that are “war-supporting,” such as factories producing munitions or military equipment. However, the United States has taken the position that the term also encompasses “economic targets of the enemy that indirectly but effectively support and sustain the enemy’s war-fighting capability.”³⁶ This definition is not widely accepted, as some expert commentators claim it “goes too far” because it does not require the objective to have a “proximate nexus to military action.”³⁷

TARY ON THE HPCR MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE rule 12(a) cmts. 3 and 4 (2010) [hereinafter AMW MANUAL COMMENTARY].

33. AMW MANUAL, *supra* note 23, rule 1(y). This definition is based on Additional Protocol I, *supra* note 20, art. 52(2).

34. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(y) cmt. 4.

35. *Id.*, rule 1(y) cmt. 7. *See also* ICRC COMMENTARY, *supra* note 29, ¶ 2024.

36. ANNOTATED SUPPLEMENT TO THE COMMANDER’S HANDBOOK ON THE LAW OF NAVAL OPERATIONS 402–3 (A. R. Thomas & James C. Duncan eds., 1999) (Vol. 73, U.S. Naval War College International Law Studies) (describing this as a “statement of customary international law”).

37. Yoram Dinstein, *Legitimate Military Objectives Under the Current Jus In Bello*, LEGAL AND ETHICAL LESSONS OF NATO’S KOSOVO CAMPAIGN 139, 145–46 (Andru E. Wall ed.,

There are four different ways in which an object may fulfill the two express criteria (i.e., “effective contribution” and “definite military advantage”)—through its “nature, location, purpose or use.” “Nature” denotes “an inherent characteristic or attribute which contributes to military action.”³⁸ This would include all military equipment and facilities. “Location” relates to “selected areas that have special importance to military operations,”³⁹ regardless of how those areas are currently being used. A commonly cited example is a mountain pass that, if blocked, would halt an enemy’s advance.

“Use” refers to the present function of an object. Those objects that do not qualify as military objectives by “nature” become military objectives by “use” when employed for military purposes, but only for so long as they are so employed. For example, a civilian vehicle may be attacked if enemy forces commandeered it to transport troops, but not once it is returned to its civilian owner.⁴⁰ Lastly, “purpose” focuses on the future use of an object. It recognizes that “an attacker need not wait until an object is actually used for military ends before being allowed to attack it as a military objective.”⁴¹ Since “purpose” depends on the attacker’s perception of the enemy’s intent, and since the enemy’s intent is not always clear, the attacker must act reasonably.⁴² The ability to observe a potential target to determine whether it qualifies as a military objective on one of these four bases is a critical el-

2002) (Vol. 78, U.S. Naval War College International Law Studies). On the other hand, some commentators have argued that the term “military objective” should be interpreted even more broadly. *See, e.g.*, Charles J. Dunlap Jr., *The End of Innocence: Rethinking Noncombatancy in the Post-Kosovo Era*, STRATEGIC REVIEW, Summer 2000, at 9, 14); Jeanne M. Meyer, *Tearing Down the Façade: A Critical Look at the Current Law on Targeting the Will of the Enemy and Air Force Doctrine*, 51 AIR FORCE LAW REVIEW 143 (2001).

38. AMW MANUAL COMMENTARY, *supra* note 32, rule 22(a) cmt. 1; *see also* ICRC COMMENTARY, *supra* note 29, ¶ 2020.

39. AMW MANUAL COMMENTARY, *supra* note 32, rule 22(b) cmt; *see also* ICRC COMMENTARY, *supra* note 29, ¶ 2021.

40. AMW MANUAL COMMENTARY, *supra* note 32, rule 22(d) cmt. 1; *see also* ICRC COMMENTARY, *supra* note 29, ¶ 2022.

41. AMW MANUAL COMMENTARY, *supra* note 32, rule 22(c) cmt. 1; ICRC COMMENTARY, *supra* note 29, ¶ 2022.

42. AMW MANUAL COMMENTARY, *supra* note 32, rule 22(c) cmt. 3 (“The attacker must always act reasonably, i.e. as would be proper under a similar set of circumstances for any other Belligerent Party. In other words, the attacker must ask itself whether it would be reasonable to conclude that the intelligence was reliable enough to conduct the attack in light of the circumstances ruling at the time.”).

ement of target identification that is often made possible by advanced precision capabilities, most notably ISR.

Like military objectives, combatants are lawful targets and, as with the former, precision capabilities are often a key to their proper identification. Combatants are “[m]embers of the armed forces of a Party to the conflict as well as members of militias or volunteer corps forming part of such armed forces,”⁴³ excluding “medical or religious personnel.”⁴⁴ Members of other militias or volunteer corps are also combatants when they fulfill the following cumulative conditions:

- (a) Are commanded by a person responsible for his subordinates;
- (b) Have a fixed distinctive sign recognizable at a distance;
- (c) Carry their arms openly; and
- (d) Conduct their operations in accordance with the laws and customs of war.⁴⁵

Note that the term “combatant” is used to describe only participants in an international armed conflict (i.e., a conflict between States). However, “like members of the regular armed forces of the State concerned, members of a non-State organized armed group in a non-international armed conflict are lawful targets.”⁴⁶

Civilians directly participating in hostilities may also be targeted.⁴⁷ This norm was the subject of a five-year International Committee of the Red Cross project that led to the 2009 publication of the *Interpretive Guidance on the Notion of Direct Participation in Hostilities under International Humanitarian Law*.⁴⁸ Of particular importance is the *Guidance*’s delineation of the consti-

43. Convention Relative to the Treatment of Prisoners of War art. 4, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135 [hereinafter Geneva Convention III]; see also AMW MANUAL COMMENTARY, *supra* note 32, rule 10(b)(i) cmt. 1.

44. AMW MANUAL COMMENTARY, *supra* note 32, rule 10(b)(i) cmt. 2.

45. Geneva Convention III, *supra* note 43, art. 4(A)(2). See also AMW MANUAL COMMENTARY, *supra* note 32, rule 10(b)(i) cmt. 2.

46. AMW MANUAL COMMENTARY, *supra* note 32, rule 10(b); see also NILS MELZER, INTERNATIONAL COMMITTEE OF THE RED CROSS, INTERPRETIVE GUIDANCE ON THE NOTION OF DIRECT PARTICIPATION IN HOSTILITIES UNDER INTERNATIONAL HUMANITARIAN LAW 36 (2009) [hereinafter ICRC INTERPRETIVE GUIDANCE].

47. Additional Protocol I, *supra* note 20, art. 51(3); see also Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts art. 13(1), June 8, 1977, 1125 U.N.T.S. 609; AMW MANUAL, *supra* note 23, rule 28.

48. ICRC INTERPRETIVE GUIDANCE, *supra* note 46.

tutive elements of direct participation. By that standard, an act qualifying an individual as a direct participant “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.”⁴⁹ There must also be a causal connection between the act and the harm and the act must exhibit belligerent nexus.⁵⁰ Controversy remains over both the precise criteria for determining that a civilian is directly participating in hostilities⁵¹ and as to when the direct participant may be lawfully attacked.⁵² Despite these debates, the premise that civilians directly participating in hostilities may be targeted is widely accepted, and precision technology is invaluable in determining whether a civilian is participating as such.

C. Prohibition against Indiscriminate Attack

The law of armed conflict prohibits indiscriminate attacks, which are “those that cannot be or are not directed against lawful targets . . . or the effects of which cannot be limited as required by the law of international armed conflict, and which therefore are of a nature to strike lawful targets and civilians or civilian objects without distinction.”⁵³ In other words, the

49. *Id.* at 47.

50. *Id.* at 46–64.

51. AMW MANUAL COMMENTARY, *supra* note 32, rule 29 cmt. 5.

52. *Id.*, rule 28 cmt. 3. For a more robust examination of the various points of contention, see, e.g., Kenneth Watkin, *Opportunity Lost: Organized Armed Groups and the ICRC “Direct Participation in Hostilities” Interpretive Guidance*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS 641 (2010); Michael N. Schmitt, *Deconstructing Direct Participation in Hostilities: The Constitutive Elements*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS 697 (2010); Bill Boothby, “*And for Such Time As*”: *The Time Dimension to Direct Participation in Hostilities*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS 741 (2010); W. Hays Parks, *Part IX of the ICRC “Direct Participation in Hostilities” Study: No Mandate, No Expertise, and Legally Incorrect*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS 769 (2010); Nils Melzer, *Keeping the Balance between Military Necessity and Humanity: A Response to Four Critiques of the ICRC’s Interpretive Guidance on the Notion of Direct Participation in Hostilities*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS (2010).

53. AMW MANUAL, *supra* note 23, rule 13 (b); *See also* Additional Protocol I, *supra* note 20, art. 54. For the prohibition on indiscriminate attack as part of customary international law, see, e.g., Prosecutor v. Martić, Case No. IT-95-11-T, Judgment, ¶ 463 (Int’l Crim. Trib. for the former Yugoslavia June 12, 2007) (holding that firing high-dispersion non-guided rockets at a densely populated civilian area constituted an indiscriminate attack).

notion of indiscriminate attack encompasses both the use of weapons incapable of discriminating between lawful and unlawful targets and the use of weapons that, albeit capable of being directed at a lawful target, are used indiscriminately. Indiscriminate attacks are the antithesis of precision warfare.

A violation of the prohibition against indiscriminate use of a lawful weapon typically involves reckless disregard for the safety of civilian persons or objects.⁵⁴ At its most basic level, an indiscriminate attack is one where the weapon system could be aimed, but the attacker fails to do so, as in the case of blindly dropping bombs over enemy territory. Other examples include an attack based on patently unreliable information and one in which the weapon is employed in an environment that causes it to be highly inaccurate (e.g., at a very high altitude or in weather that disrupts guidance system functionality). As these examples demonstrate, every aspect of a precision airstrike (accuracy, C4ISR and outside factors) can prove determinative as to whether a strike is indiscriminate as a matter of law.

The prohibition also extends to certain types of “target area” bombing since “[a]ttacks must not treat as a single lawful target a number of clearly separated and distinct lawful targets located in a city, town, village or area containing a similar concentration of civilians or civilian objects.”⁵⁵ Compliance with this norm is directly related to the precision capabilities of the weapon systems involved. If those capabilities afford an attacker the option of individually attacking lawful targets in the area, it must do so. On the other hand, if the systems used are insufficiently precise to mount separate attacks, the area itself may be attacked (so long as the attack comports with the rule of proportionality and the requirement to take precautions in attack).

Use of indiscriminate weapons is likewise prohibited.⁵⁶ As noted above, certain weapons are prohibited per se from use, often because of their indiscriminate character.⁵⁷ All other weapons are analyzed on a case-by-case basis.⁵⁸ They may be proscribed as indiscriminate on two grounds.

54. YORAM DINSTEIN, *THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT* 126–28 (2010).

55. AMW MANUAL, *supra* note 23, rule 13(c); *see also* Additional Protocol I, *supra* note 20, art. 51(5).

56. The International Court of Justice has labeled the prohibition on indiscriminate weapons “cardinal.” Nuclear Weapons Advisory Opinion, *supra* note 28, ¶ 105E.

57. *See* AMW MANUAL COMMENTARY, *supra* note 32, rule 6.

58. *See id.*, rule 13(a) cmt. 2.

First, weapons cannot be used if they are incapable of being reliably aimed at a military objective. The paradigmatic example is the German V-2 rocket employed during World War II. Its guidance system was such that any attempt to use it to attack a particular military objective within its range, including large objectives such as military installations, would likely fail; a successful attack would effectively be the product of luck. The precision capabilities of most contemporary weapon systems would preclude them from running afoul of this prohibition. For instance, even in the case of unguided (gravity or “dumb”) bombs, delivery methodologies have been developed which provide the weapon system (aircraft and bomb) a degree of accuracy.

Second, the use of weapons that have uncontrollable effects is unlawful. The most commonly cited examples are biological contagions or persistent airborne chemicals that, even if accurately aimed at enemy forces, could easily spread to the civilian population. Both are by nature indiscriminate, a fact that explains their long-standing prohibition.⁵⁹

International law’s application and understanding of the rules prohibiting indiscriminate attacks will evolve with advances in precision weaponry. For example, while bombs dropped from a B-17 during World War II had a circular error probable exceeding three thousand feet, today such accuracy (or lack thereof) would be considered indiscriminate. In the future, it is plausible that unguided air-delivered weapons as such may begin to be characterized as violating the prohibition.

D. Proportionality

The rule of proportionality prohibits an “attack that may be expected to cause collateral damage which would be excessive in relation to the concrete and direct military advantage anticipated.”⁶⁰ It applies when an attack is properly directed at a lawful target but “collateral damage” is neverthe-

59. See AMW MANUAL, *supra* note 23, rule 6; Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, June 17, 1925, 26 U.S.T. 571; Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Jan. 13, 1993, 1974 U.N.T.S. 45; Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Apr. 10, 1972, 1015 U.N.T.S. 163.

60. AMW MANUAL, *supra* note 23, rule 14; see also Additional Protocol I, *supra* note 20, arts. 51(5)(b) and 57(2)(b). For proportionality as part of customary law of armed conflict, see Nuclear Weapons Advisory Opinion, *supra* note 28, ¶ 105E (Higgins, J., dissenting).

less unavoidable. Collateral damage consists of “incidental loss of civilian life, injury to civilians and damage to civilian objects or other protected objects or a combination thereof, caused by an attack on a lawful target.”⁶¹ Recognized injuries do not include mere inconvenience or fear among the civilian population.⁶² While there is some dispute regarding the extent to which “indirect effects” of an airstrike must be taken into account when assessing proportionality, general agreement exists that consequences should not be included in the proportionality analysis if they are “too remote or cannot be reasonably foreseen.”⁶³

Military advantage, the factor in the context of which collateral damage is considered, consists of “those benefits of a military nature that result from attack.”⁶⁴ Although certain commentators argue that the term includes only “ground gained” and “annihilating or weakening the enemy armed forces,”⁶⁵ the *AMW Manual* suggests the “better approach” is to include “any consequence of an attack which directly enhances friendly military operations or hinders those of the enemy.”⁶⁶ Consider a precision airstrike that does not destroy an enemy armored column, but instead reduces its mobility by, for example, destroying a bridge across which it would pass. The *AMW Manual* would properly characterize the diminished mobility of the column as a military advantage.

Key to correct application of the proportionality analysis is an emphasis on what is “expected” and “anticipated.” When performing a proportionality analysis, an attacker has to anticipate the likely consequences of a strike; the focus is on expectations, not results. These expectations must be “reasonable” in the sense that a “good faith assessment by the commander planning or approving the attack” would conclude that the outcome is “probable, i.e. more likely than not.”⁶⁷ The reasonableness requirement attaches at every stage of an attack. Accordingly, an individual with the authority or ability to suspend an attack must do so if, at any point, he or she concludes that an operation would cause excessive collateral damage in re-

61. AMW MANUAL, *supra* note 23, rule 1 (l); *see also* Additional Protocol I, *supra* note 20, art. 51(5).

62. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(l) cmt 5.

63. *Id.*, rule 14 cmt. 4.

64. AMW MANUAL, *supra* note 23, rule 1(w).

65. ICRC COMMENTARY, *supra* note 29, ¶ 2218.

66. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(w) cmt. 3.

67. *Id.*, rule 14 cmt. 6. Similarly, proportionality requires that the military advantage be “concrete and direct,” meaning it must be “clearly identifiable” instead of “based merely on hope or speculation.” *Id.*, rule 14 cmt. 9.

lation to the anticipated military advantage.⁶⁸ Both the commander who approves a mission and the aircrew that flies it would, for example, be included.

Precision is highly determinative of both the collateral damage and the military advantage that are likely to result from a strike. Attackers must consider such factors as the timeliness, reliability and comprehensiveness of target intelligence, the accuracy of the weapon system, and the effect of environmental factors when forming their expectations or anticipations.

Once the collateral damage and military advantage are estimated, the attacker has to determine whether the former is “excessive” relative to the latter. While the *AMW Manual* defines “excessive” as a “significant imbalance,”⁶⁹ it must be remembered that proportionality does not involve a strict mathematic balancing test. Such a test would be conceptually and practically impossible in that it would require commanders and others performing a proportionality analysis to value and compare dissimilar entities. For example, how is an attacker supposed to estimate how much a tank is “worth” in terms of civilian deaths or civilian property damage? The excessiveness standard avoids the legal fiction that the value of these dissimilar entities can be quantified along a single axis. Instead, it bans attacks in which proportionality between the ends sought and the expected harm to civilians and civilian objects is absent altogether. Restated, the test is simply one of reasonableness in the prevailing circumstances.

Since excessiveness is determined only in relation to the military advantage an attacker reasonably anticipates gaining, as the potential military advantage estimate grows so does the acceptable extent of likely collateral damage. While some have asserted that any attack resulting in “extensive” collateral damage is forbidden,⁷⁰ this is wrong as a matter of law; there is no absolute threshold of collateral damage above which the rule of proportionality ceases to apply and an attack is prohibited.⁷¹ Instead, proportionality assessments must be made for every attack and they are always contextual.⁷² Depending on the military advantage anticipated to result, some

68. *Id.*, rule 14 cmt. 15; see also Additional Protocol I, *supra* note 20, art. 57(2)(b).

69. AMW MANUAL COMMENTARY, *supra* note 32, rule 14 cmt. 7.

70. ICRC COMMENTARY, *supra* note 29, ¶ 1980.

71. AMW MANUAL COMMENTARY, *supra* note 32, rule 14 cmt. 8.

72. See, e.g., Nuclear Weapons Advisory Opinion, *supra* note 28, ¶ 105E (holding that the Court could not “conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake”).

highly precise strikes may cause collateral damage that qualifies as excessive, while attacks employing no precision systems may sometimes result in collateral damage that is not excessive in light of the military gain sought.

Improvements in precision airstrike capabilities will unquestionably exercise a direct influence on how proportionality will be understood in future combat operations. As noted in the context of indiscriminate attacks, standards generally become more restrictive with advances in precision technology. Therefore, as the capacity to conduct precision airstrikes grows, attitudes toward the acceptability of collateral damage under the law of armed conflict (i.e., what is considered “excessive”) will likely become more demanding.

E. Precautions in Attack

The law of armed conflict requires that “[c]onstant care must be taken to spare the civilian population, civilians and civilian objects.”⁷³ “Constant care” entails taking certain “feasible precautions” both before and during a strike.⁷⁴ The precautions are designed to ensure, to the extent possible, that only lawful targets are attacked and collateral damage is minimized. The availability of precision capabilities affects compliance with most of the obligatory precautionary measures.

Article 57 of Additional Protocol I generally codifies the specific precautions, each of which is reflected in the *AMW Manual*. These precautions need only be taken when doing so is “feasible.” “Feasible” denotes a measure of precaution that “is practicable or practically possible, taking into account all circumstances prevailing at the time, including humanitarian and military considerations.”⁷⁵ What is considered practicable or practically possible has been described as “a matter of common sense and good faith.”⁷⁶

At its core, feasibility is a reasonableness standard—those who plan, approve or execute an attack have to undertake any measures to limit harm

73. AMW MANUAL, *supra* note 23, rule 30. *See also* Additional Protocol I, *supra* note 20, art. 57(1).

74. *See* Additional Protocol I, *supra* note 20, art. 57; AMW MANUAL, *supra* note 23, rules 30–33.

75. AMW MANUAL, *supra* note 23, rule 1(q); *see also* Amended Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices art. 3(10), May 3, 1996, 2048 U.N.T.S. 93.

76. ICRC COMMENTARY, *supra* note 29, ¶ 2198.

to civilians and civilian objects that a reasonable warfighter in the same or similar circumstances would take. Of course, attackers are only required to take into account information that is “reasonably available”⁷⁷ to them “at the relevant time and place.”⁷⁸ Furthermore, in deciding whether a measure is feasible, they may factor in military considerations, such as the availability of precision weapons, competing demands for surveillance capabilities and risk to friendly forces.

As to specific measures, attackers must first do everything feasible to verify that the target is a lawful one and does not benefit from specific protection.⁷⁹ Determining which objectives qualify as lawful targets requires an attacker to utilize reasonably available ISR assets to gain information about the target. In particular, the “quality and timeliness of the intelligence has to be considered,” including the potential that the “enemy may attempt to provide disinformation.”⁸⁰ An attacker should also assess the availability of other sources of intelligence, such as “on the spot” visual observations.⁸¹

The requisite level of certainty as to target identification is not entirely clear. Some commentators appear to require near certainty.⁸² However, such a standard would ignore the realities of combat, in which attackers operate in the fog of war. A more manageable standard that comports with the notion of feasibility asks whether a reasonable warfighter, having exhausted all reasonably available means of verification in light of the prevailing circumstances, would launch the attack. This standard allows attackers to balance the potential military advantage against both the likely collateral damage and any degree of doubt as to the objective’s status as a lawful target, just as the law of armed conflict allows military advantage to offset collateral damage more generally. Obviously, precision capabilities play a key role in this process, especially ISR assets that allow targets to be located, monitored and identified. While these capabilities have immense military utility, they can also be constraining. If a “reasonable warfighter in the same or similar circumstances” would consider their use both helpful in

77. AMW MANUAL, *supra* note 23, rule 32(a).

78. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(q) cmt. 3.

79. AMW MANUAL, *supra* note 23, rule 32(a); *see also* Additional Protocol I, *supra* note 20, art. 57(2)(a)(i).

80. *See* AMW MANUAL COMMENTARY, *supra* note 32, rule 32(a). cmt. 2.

81. *Id.*

82. *See, e.g.*, ICRC COMMENTARY, *supra* note 29, ¶ 2195 (“[I]n case of doubt, even if there is only slight doubt, [those who plan or decide upon attack] must call for additional information.”).

identifying an objective and feasible, an attack not employing such capabilities would be unlawful.

Similarly, the requirement to take precautions in attack also mandates that an attacker choose from among feasible means (weapons) and methods (tactics) of warfare in order to minimize collateral damage.⁸³ As with target identification, precision capabilities can act as a double-edged sword when complying with this required precaution. While helpful both militarily and in conforming to the law of armed conflict, precision capabilities can also force an attacker's hand when their use is mandatory under this rule. After all, since precision capabilities usually allow for greater accuracy and lesser explosive force, their use (when available) may be required as a matter of law when the result would be less harm to civilians and civilian property.

This rule has two important caveats. First, States are not required to acquire or field precision capabilities.⁸⁴ The battlefield is "come as you are" in the law of armed conflict. Second, even when an attacker has precision capabilities available and their use would limit civilian harm, employment is compulsory only when feasible.⁸⁵ For example, precision capabilities may be in short supply at the time of attack. In such a situation, a commander may preserve some or all of his or her precision weapons for later operations, taking into account both military and humanitarian concerns. The paradigmatic example is retention for use in impending urban operations, where precision weapons will prove highly useful in avoiding collateral damage.

A third key precaution in attack applies when an attacker has a choice between several military objectives the destruction of which would result in

83. AMW MANUAL, *supra* note 23, rule 32 (b); *see also* Additional Protocol I, *supra* note 20, art. 57(2)(a)(ii).

84. AMW MANUAL, *supra* note 23, rule 8. *See also* DINSTEIN, *supra* note 54, at 142 ("No [law of international armed conflict] LOIAC obligation is incumbent on Belligerent Parties to use expensive 'smart bombs' where cheaper 'dumb bombs' will do.").

85. AMW MANUAL, *supra* note 23, rules 31–32. However, some claim there is a duty to use precision munitions whenever available or at least in certain environments (e.g., urban areas). *See, e.g.*, Stuart W. Belt, *Missiles over Kosovo: Emergence, Lex Lata, of a Customary Norm Requiring Use of Precision Munitions in Urban Areas*, 47 NAVAL LAW REVIEW 115, 174 (2000); Danielle L. Infeld, *Precision-Guided Munitions Demonstrated Their Pinpoint Accuracy in Desert Storm; But Is a Country Obligated to Use Precision Technology to Minimize Collateral Civilian Injury and Damage?*, 26 GEORGE WASHINGTON UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND ECONOMICS 109, 110–11 (1992). Both assertions are wrong as the decision is always fully contextual.

a similar military advantage. In that situation, an attacker must select the objective which, when attacked, would involve the least danger to civilian lives and civilian objects or to other protected persons and objects.⁸⁶ Here again, precision capabilities may have a restrictive effect on an attacker to the extent that they increase the number of potential targets that can be feasibly attacked. As with the other precautions though, the only objectives that need be considered are those on which an attack is militarily reasonable. For example, imagine there are two potential targets the destruction of which would yield the same military advantage. One is heavily defended, but remote from civilians, while the other has few defenses, but is located in the vicinity of civilians and civilian structures. In this situation, the targeting of the heavily defended objective would not be required, even though its destruction would offer a “similar military advantage” and cause less collateral damage.⁸⁷

IV. LOOKING FORWARD: A NEW GENERATION OF PRECISION WEAPON SYSTEMS

Three relatively new weapon systems—unmanned combat aerial vehicles (UCAV), autonomous weapon systems, and cyber-attack systems—have captured the attention of the law of armed conflict community. Each raises issues of precision that merit careful reflection.

A. Unmanned Combat Aerial Vehicles

An unmanned combat aerial vehicle, commonly referred to as a “drone,” is an “unmanned military aircraft of any size which carries and launches a weapon, or which can use on-board technology to direct such a weapon to a target.”⁸⁸ The use of UCAVs has dramatically grown over the past dec-

86. AMW MANUAL, *supra* note 23, rule 33; *see also* Additional Protocol I, *supra* note 20, art. 57(3).

87. However, the risk to military personnel must still be balanced against the risk of collateral damage. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(q) cmt. 5 (“[W]hereas a particular course of action may be considered non-feasible due to military considerations (such as excessive risks to aircraft and their crews), some risks have to be accepted in light of humanitarian considerations.”).

88. AMW MANUAL, *supra* note 23, rule 1(ee). Within the U.S. Air Force unmanned aerial vehicles are commonly referred to as “remotely piloted aircraft” (RPA). U.S. Air Force, AFDD 1-02, Air Force Supplement to the Department of Defense Dictionary of

ade, a trend which is certain to continue.⁸⁹ This is understandable in light of their ability to employ precision weapons using enhanced ISR capabilities in an operation that poses no risk to the aircrew conducting the mission.

While the law of armed conflict principles and rules discussed in Part III apply with equal force to UCAV operations,⁹⁰ the unique precision capabilities UCAVs offer commanders influence their application, especially with regard to the requirement to take precautions in attack. The fact that a UCAV sortie poses no risk to the aircrew enhances the feasibility of their use in high-threat environments, thereby increasing the precision of the strike itself and making possible attacks on alternative targets that might not otherwise be viable. Onboard ISR capabilities, such as sensors and cameras, and the ability of UCAVs to loiter over a target for extended periods, bolster their ability to identify a target. UCAV ISR capabilities also minimize the likelihood, or degree, of collateral damage by making possible execution of the attack when civilians and civilian objects are least likely to be harmed. Additionally, UCAVs are armed only with precision weaponry, thereby providing commanders an effective option when selecting methods and means of warfare with the goal of minimizing civilian harm in mind.

B. Automated Weapon Systems

Developments in automated weapons technology have led some States to “envision a world in which humans need not be in the decision loop.”⁹¹

Military and Associated Terms (Jan. 11, 2007, incorporating Change 1, Jan 6. 2012), available at <https://www.fas.org/irp/doddir/usaf/afdd1-2.pdf>.

89. For example, the Department of Defense is dramatically increasing reliance on UCAVs and other drones. Adam Entous et al., *More Drones, Fewer Troops*, WALL STREET JOURNAL, Jan. 27, 2012, at 10.

90. See, e.g., Michael N. Schmitt, *Unmanned Combat Aircraft Systems (Armed Drones) and International Humanitarian Law: Simplifying the Oft Benighted Debate*, 30 BOSTON UNIVERSITY INTERNATIONAL LAW JOURNAL 595, 609 (2012); Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, *Study on Targeted Killings* ¶ 79, Human Rights Council, U.N. Doc. A/HRC/14/24/Add.6 (May 28, 2010) (by Philip Alston), available at <http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf> (“[A] missile fired from a drone is no different from any other commonly used weapon, including a gun fired by a soldier or a helicopter or gunship that fires missiles. The critical legal question is the same for each weapon: whether its specific use complies with [international humanitarian law].”).

91. U.S. JOINT FORCES COMMAND, UNMANNED EFFECTS (UFX): TAKING THE HUMAN OUT OF THE LOOP 4 (2003). See also U.S. AIR FORCE, UNMANNED AIRCRAFT SYSTEMS FLIGHT PLAN 2009-2047, at 41 (2009).

Such “fully autonomous weapon systems” would be capable of identifying potential targets, selecting them for attack and striking them without human interface.⁹² Armed forces around the world are extremely interested in these systems since the operation of manned weapon systems can be personnel intensive and dangerous, while systems that are operated remotely, such as UCAVs, are vulnerable to communications jamming or cyber attack.

Fully autonomous weapon systems must be distinguished from other systems. For example, “human-supervised” autonomous systems—such as Israel’s Iron Dome—have been in operation for years.⁹³ These systems have a “human in the loop” that closely monitors an engagement and can override the system if needed. Certain other weapon systems such as the “close-in weapon system”⁹⁴ can be programmed to operate autonomously, but are presently used solely for point defense in accordance with very narrow fixed parameters.

The fact that autonomous weapon systems have become both militarily desirable and technologically feasible is spawning interest in the legal issues surrounding their use.⁹⁵ Indeed, Human Rights Watch has asserted the weapon systems would be “unable to meet legal standards” and therefore

92. An autonomous weapons system is defined as:

a weapon system that, once activated, can select and engage targets without further intervention by a human operator. This includes human-supervised autonomous weapon systems that are designed to allow human operators to override operation of the weapon system, but can select and engage targets without further human input after activation.

Deputy Secretary of Defense, DoDD 3000.09, *Autonomy in Weapon Systems* 13–14 (Nov. 21, 2012).

93. Iron Dome can operate automatically using programmed parameters, but the system also allows for human operator intervention. Inbal Orpaz, *How Does Iron Dome Operate?*, HAARETZ (Nov. 19, 2012), <http://www.haaretz.com/news/features/how-does-the-iron-dome-work.premium-1.478988>.

94. See generally U.S. Navy, *MK 15—Phalanx Close-In Weapons System (CIWS)*, http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=487&ct=2.

95. See generally Michael N. Schmitt & Jeffrey S. Thurnher, “Out of the Loop”: *Autonomous Weapon Systems and the Law of Armed Conflict*, 4 HARVARD NATIONAL SECURITY JOURNAL 231 (2013); Kenneth Anderson & Matthew Waxman, *Law and Ethics for Robot Soldiers*, 176 POLICY REVIEW (Dec. 1, 2012), <http://www.hoover.org/publications/policy-review/article/135336>; Markus Wagner, *Taking Humans Out of the Loop: Implications for International Humanitarian Law*, 21 JOURNAL OF INFORMATION AND SCIENCE 155 (2011).

“should be banned.”⁹⁶ Pronouncements of illegality are premature at best and more likely simply wrong. As with most weapon systems, the principal normative issues involve use of the systems, not their possible status as unlawful weapons per se. Unsurprisingly, most of the challenging legal questions bear on the degree of precision the systems might be able to achieve.

For example, Human Rights Watch contends that autonomous weapons violate the prohibition on indiscriminate attacks because “[f]ully autonomous weapon systems would not have the ability to sense or interpret the difference between soldiers and civilians, especially in contemporary combat environments.”⁹⁷ There are two problems with this statement. First, it ignores the fact that some battlespaces contain no civilian persons or objects. In such environments, fully autonomous systems that are unable to identify civilian persons or objects could still be used without violating the prohibition on indiscriminate attacks because there is no chance of harming civilian persons or objects. Second, and perhaps more importantly, the statement assumes that no technological developments will afford fully autonomous systems an ability to distinguish between military and civilian personnel and objects.⁹⁸ This is a curious stance since the ability of weapon systems to discriminate on the battlefield has been growing exponentially due to technological advances, often in ways that seemed unimaginable only a few years earlier.

The ability of autonomous weapon systems to comply with the principle of proportionality has likewise been questioned.⁹⁹ If there is no “human in the loop,” the weapon system would have to both estimate the likely collateral damage and determine whether that damage is excessive relative to

96. HUMAN RIGHTS WATCH, *LOSING HUMANITY: THE CASE AGAINST KILLER ROBOTS* 1–2 (2012), available at <http://www.hrw.org/reports/2012/11/19/losing-humanity-0>.

97. *Id.* at 30.

98. The current state of technology already allows computers to recognize many things:

Modern sensors can, *inter alia*, assess the shape and size of objects, determine their speed, identify the type of propulsion being used, determine the material of which they are made, listen to the object and its environs, and intercept associated communications or other electronic emissions. They can also collect additional data on other objects or individuals in the area and, depending on the platform with which they are affiliated, monitor a potential target for extended periods in order to gather information that will enhance the reliability of identification and facilitate target engagement when the risk of collateral damage is low.

Schmitt & Thurnher, *supra* note 95, at 297.

99. HUMAN RIGHTS WATCH, *supra* note 96, at 32.

the military advantage anticipated to result from the attack. While critics rightly suggest that current technology is incapable of performing this task, future autonomous weapon systems will likely be programmable to perform analysis similar to the collateral damage estimate methodology (CDEM)¹⁰⁰ currently used to determine the likelihood of harm to civilians or civilian objects in a target area. After all, CDEM relies on objective data and scientific algorithms. The resulting collateral damage estimate could then be used as the basis for “proportionality red lines” which, given the type of target being engaged, would preclude attack based on pre-programmed criteria.

The potential use of these weapons raises difficult legal questions. However, until the degree of precision they can achieve becomes clearer, any ban on their use would be rash. Indeed, it is conceivable that future fully autonomous systems might be more precise and better able to distinguish lawful targets from civilians and civilian objects than their manned or remotely operated counterparts.

C. Cyber Attacks

Cyber attacks launched from or through airborne platforms are by their very nature accurate. As with more traditional precision airstrikes, cyber attacks will almost always involve extensive C4ISR capabilities. Not only are advanced computer and communications capabilities required to mount these attacks, but increased cyber security has made cyber intelligence, surveillance and reconnaissance essential because the potential vulnerabilities of any target system must be identified and understood before effective exploitation is possible. Furthermore, attacking those vulnerabilities may require computer code specifically designed to exploit a particular vulnerability.

The law of armed conflict principles and rules discussed in Part III apply only to those cyber operations that qualify as an “attack.”¹⁰¹ As a term of art in the law of armed conflict, an attack is defined as “an act of vio-

100. For a discussion of the methodology, see Defense Intelligence Agency General Counsel, Briefing: Joint Targeting Cycle and Collateral Damage Estimate Methodology (CDM), Nov. 10, 2009, http://www.aclu.org/files/dronefoia/dod/drone_dod_ACLU_DRONES_JOINT_STAFF_SLIDES_1-47.pdf.

101. TALLINN MANUAL ON THE INTERNATIONAL LAW APPLICABLE TO CYBER WARFARE, ch. 4, § 2, cmts. 1–3 (Michael N. Schmitt ed., 2013) [hereinafter TALLINN MANUAL].

lence, whether in offence or in defence.”¹⁰² This includes non-kinetic operations, such as computer operations that “result in death, injury, damage or destruction of persons or objects.”¹⁰³

In the absence of State practice, all predictions as to how the law of armed conflict will eventually shape the use of cyber attacks remain highly speculative. That said, it is probable that the extant law will, as it has with other new weapon systems, generally suffice to govern cyber-weapon systems, albeit with some interpretive accommodation for the unique characteristics of cyberspace. In particular, the interconnectivity of military and civilian cyber systems may result in a greater demand for precision than is the case with kinetic weaponry. For instance, the prohibition on indiscriminate attacks could in the future be interpreted to restrict the use of certain malware against military objectives that rely on dual-use (civilian/military) networks. Similarly, the precautions in attack rules may be interpreted to require a certain degree of target network mapping due to the risk of bleed-over into civilian systems.

Due to the immense non-physical damage that cyber operations are capable of causing, it is also possible that, over time, the law of armed conflict will evolve in response. For example, it is conceivable that the current understanding of what constitutes an attack may expand to include certain cyber operations that do not cause physical injury or damage, thereby prohibiting the directing of such operations at protected persons and objects. This sort of shift in understanding may similarly end up expanding what qualifies as collateral damage. Beyond any evolution in the application of current law of armed conflict principles, new prohibitions may also be adopted that provide special protection for certain civilian objects, such as critical infrastructure. Any of these potential changes—lowering the threshold for what constitutes an attack, expanding the definition of collateral damage or adopting a new group of protected objects—would require heightened precision capabilities.

102. AMW MANUAL, *supra* note 23, rule 1(e). Additional Protocol I, *supra* note 20, art. 49.

103. AMW MANUAL COMMENTARY, *supra* note 32, rule 1(e) cmt. 7. *See also* TALLINN MANUAL, *supra* note 101, rule 30 (“[A] cyber attack is a cyber operation, whether offensive or defensive, that is reasonably expected to cause injury or death to persons or damage or destruction to objects.”).

V. CONCLUSION

Precision lies at the heart of both contemporary air warfare and the law of armed conflict rules that govern it. Precision capabilities increase an attacker's ability to distinguish between military and civilian objectives, thereby fostering compliance with the principle of distinction. Furthermore, the accuracy and C4ISR capabilities that are integral to precision weaponry mean that such weapons cannot be deemed indiscriminate. On the contrary, the increased ability to gather information about a target, distinguish lawful from unlawful targets and strike lawful targets with great accuracy help to ensure that attacks are neither indiscriminate nor violative of the principle of proportionality. Additionally, precision capabilities expand the means, methods and target options that are available to an attacker. This increases an attacker's feasible options in planning and executing airstrikes, thereby increasing the influence of the precautions in attack rules on air operations.

This does not mean that precision capabilities are a panacea. Of course, precision capabilities may be used in an unlawful manner. Perhaps most nefariously, precision can facilitate surgical strikes against protected persons or places such as religious or political leaders, gatherings of particular ethnic groups or cultural property. But in general, precision capabilities contribute positively to humanitarian ends.

While precision capabilities make possible attacks that the law of armed conflict would otherwise prohibit by limiting the risk of harm to civilians and civilian objects, such capabilities also act as a restraint on air operations in some situations. In particular, the requirements of precautions in attack may either mandate the use of precision capabilities before an attack is launched or prohibit an attack on an otherwise lawful target when another option is available that poses less risk to civilians or civilian objects. This is so even when the enemy may not be restricted in this manner, because it lacks precision systems. In other words, the law is relative; one side's precision capabilities may prohibit it from conducting operations open to its enemy.

In the future, demands for precision will unquestionably intensify. The expectations of the global community as to precision capabilities have grown steadily since the Vietnam conflict and show no sign of abating. On the contrary, the counterinsurgency campaigns in Iraq and Afghanistan heightened expectations because they were so restrictive in terms of collateral damage. The fact that operational and policy concerns, not legal con-

straints, drove the restrictions has gone unnoticed by many. Additionally, the advent of unmanned and cyber systems, both of which offer precision capabilities not otherwise available on the battlefield, will further amplify expectations as the international law community begins to grasp their potential to avoid civilian harm. Once this occurs, the interpretation and application of law of armed conflict norms regarding targeting will inexorably evolve, as they always have, with advances in precision technology.