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Blinded by the Light: International Law and the Legality of Anti-Optic Laser Weapons

Jack H. McCall, Jr.*

The modern Western state accepts the responsibility not merely to protect the individual's life and property, traditionally the legal minima, but to educate and heal him, support him in old age and when unemployed, and increasingly to guarantee his prosperity. Might the modern conscript not well think, at first acquaintance with the weapons the state foists on him, that its humanitarian code is evidence either of a nauseating hypocrisy or of a psychotic inability to connect actions with their results?¹

Does it matter—losing your sight? . . .
There's such splendid work for the blind;
And people will always be kind,
As you sit on the terrace remembering,
And turning your face to the light.²

Introduction

In autumn 1995, the United Nations convened an international conference to address the legality of certain weapons tending to cause "excessive or indiscriminate suffering."³ The conference focused on the continued legal-

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This article is respectfully dedicated to Jack H. McCall, Sr. and Albert G. McCall, Jr.

1. JOHN KEEGAN, *THE FACE OF BATTLE* 330 (1983).

2. Siegfried Sassoon, *Does It Matter?*, in *THE PENGUIN BOOK OF FIRST WORLD WAR POETRY* 132 (Jon Silkin ed., 2d ed. 1981) [hereinafter *FIRST WORLD WAR POETRY*].

3. Report of the Review Conference of the States Parties to 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, Sept. 25-Oct. 13, 1995, U.N. Report CCW/Conf. I/4 (Oct. 12, 1995) (on file with author) [hereinafter Report of the Review Conference].

ity of land mine warfare, which recently has been particularly virulent and indiscriminate in nature, killing and maiming civilians and soldiers.⁴ Although failing to approve heightened restrictions on land mine usage,⁵ the conference achieved one notable goal. It approved a new international protocol regarding an entirely new type of weapon, one whose existence until recently was a closely guarded secret, the tactical anti-optic laser.⁶

While just ten to fifteen years ago, such devices were widely regarded as creations of science fiction,⁷ the existence and capabilities of laser weap-

4. See Jack H. McCall, Jr., *Infernal Machines and Hidden Death: International Law and Limits on the Indiscriminate Use of Land Mine Warfare*, 24 GA. J. INT'L & COMP. L. 229 (1994).

5. See, e.g., Christopher Bellamy, *US Cancels Laser Weapon that Can Cause Blindness*, THE INDEPENDENT, Oct. 14, 1995, at 17; David Fairhall, *Ban on Landmines Eludes UN Forum*, MANCHESTER GUARDIAN WKLY., Oct. 22, 1995, at 3, available in LEXIS, News library, Curnws file.

Since the 1995 conference, U.N. representatives, European Parliament and several non-governmental organizations have pressed for an international ban on land mine warfare. A subsequent U.N. review conference in Geneva in May 1996 again failed to reach a consensus on the issue. Also in May 1996, the Clinton administration imposed a unilateral (but limited) ban on certain types of anti-personnel land mines. See, e.g., *Clinton Orders Limits on Land Mines; Critics Want Stronger Action*, BALT. SUN, May 17, 1996, at 2A; Stacey Evers, *USA Takes First Step in Banning Anti-Personnel Mines*, JANE'S DEF. WKLY., May 22, 1996, at 3; *MEPs Regret Failure of UN Review Conference to Ban Land Mines*, Reuters E.C. Rep., May 28, 1996, available in LEXIS, News Library, Allnws File.

6. "Laser" is an acronym for "Light Amplified by Stimulated Emission of Radiation." See generally HUMAN RIGHTS WATCH, UNITED STATES: U.S. BLINDING LASER WEAPONS 3 (1995) [hereinafter U.S. LASERS]. Besides their numerous civilian applications, e.g., industrial cutting and medical uses, military lasers are used for missile guidance, target designation and rangefinding. See *infra* notes 16-19 and accompanying text.

Lasers, for instance, are useful for eye surgery. One such system, involving laser photocoagulation for retinal damage and glaucoma treatment, is closely (and, in a sense, perversely) analogous to the types of injury resulting from military anti-optic lasers. Telephone Interview with Dr. Myron L. Wolbarsht, Professor of Ophthalmology and Biomedical Engineering, Duke University (June 20, 1996) [hereinafter Wolbarsht Interview].

Four general classes of lasers exist. The most low-powered, Class I lasers, are "intrinsically safe" and include such uses as bar code scanners and lasers in CD players. Class II lasers include lecture pointers and demonstration devices, which are only harmful to eyesight if a person "stares directly at them for longer than one-quarter second." Class III lasers are used for such purposes as alignment of building foundations and "can damage the eye in less time that it takes to blink," although their diffused reflections may be viewed with impunity. Class IV lasers include surgical and cutting lasers and ones with many military applications (e.g., rangefinders, laser designators and anti-optic lasers). The most high-powered category, Class IV lasers "can damage eyes and burn skin, cloth and other materials," and even their reflections may be dangerous. HUMAN RIGHTS WATCH, BLINDING LASER WEAPONS: THE NEED TO BAN A CRUEL AND INHUMANE WEAPON 16-17, 45-47 (1995) [hereinafter BLINDING LASER WEAPONS].

Military lasers intended to blind or dazzle enemy equipment and the eyesight of enemy soldiers are often referred to as blinding lasers, tactical anti-optic lasers and laser dazzlers, to distinguish them from other types of tactical lasers (e.g., rangefinders and laser designators) and from strategic lasers (e.g., the anti-missile lasers evaluated for the U.S. Strategic Defense Initiative ("Star Wars") program). Throughout this article, the author will use the term "anti-optic lasers" to describe such weapons.

7. See generally *Let There Be Light*, THE ECONOMIST, Jan. 6, 1995, at 100; *Soon, 'Phasers on Stun'*, NEWSWEEK, Feb. 7, 1994, at 24 (noting images of "death rays" and "ray

ons—including their capability to inflict extremely painful and permanently incapacitating wounds—are now very real indeed. Although billed in some quarters as being an ideal, “non-lethal” weapon⁸ whose use might actually save lives on both sides in future conflicts, the likely consequences of battlefield laser blinding make such claims arguable at best and, at worst, may establish the anti-optic laser as an inhumane weapon.⁹

This article explores the legal implications of the development and use of the tactical anti-optic laser, which is ostensibly intended to blind enemy surveillance systems but which has the capability—indeed, may have as one of its main purposes—of blinding persons, in many cases permanently.¹⁰ As such, the potential use of this high-technology method of warfare raises questions as to its legality as a weapon of war.¹¹ The article reviews the origins and development of the anti-optic laser and considers their likely combat deployment, the nature of the injuries that such weapons may inflict and the likelihood and consequences of laser proliferation. Part III examines the end product of the 1995 conference, and Part IV explores whether the use of such a weapon can be reconciled with the international law of armed conflicts. The Article concludes with an examination of the legal outlook regarding the anti-optic laser.

I. The Tactical Anti-Optic Laser: Origins, Development and the Consequences of Its Use

A. The Origins and Development of the Anti-Optic Laser

Military laser technology may be generally divided into two categories: passive and active. Passive military laser technology encompasses the use of equipment not directly designed to engage enemy forces in and of itself, but instead to enable other pieces of equipment to do so. The first item of passive military laser technology—which, incidentally, may have led to the precursors of tactical anti-optic lasers¹²—was the laser rangefinder, which

guns” as being a popular element of science fiction since the publication of H.G. Wells’ *The War of the Worlds* around the turn of this century).

8. The use of the term “non-lethal” to describe blinding lasers and other weapons is rather imprecise. As noted by one writer, “Clearly, a pilot flying into the sea or ground at high speed as a result of being dazzled by a laser has a low probability of survival,” and innocent bystanders have on occasion been killed by supposedly “non-lethal” rubber bullets. Rupert Pengelley, *Wanted: A Watch on Non-Lethal Weapons*, INT’L DEF. REV., Apr. 1, 1994, at 1. See *infra* notes 83-90 and accompanying text (discussing the potential for military personnel and civilians to be killed, whether intentionally or accidentally, after being blinded by lasers). But cf. Barbara Starr, *Pentagon Maps Non-Lethal Options*, INT’L DEF. REV., July 1, 1994, at 30 (noting that non-lethal weapons present certain advantages to achieve military objectives while “limit[ing] loss of life and collateral damage,” as well as joint Defense Department and law enforcement efforts to formalize cooperation on joint use of less-than-lethal technologies). Because of this relative imprecision, I will use the term “sub-lethal,” instead of “non-lethal,” to describe such weapons.

9. See *infra* notes 44-87 and accompanying text.

10. See *infra* notes 36-43, 55-60 and accompanying text.

11. See *infra* notes 61-87 and accompanying text.

12. See generally U.S. LASERS, *supra* note 6, at 4 (noting that “[f]rom the beginning, the U.S. military recognized that the proliferation of lasers would have adverse effects on

has been in military service since the early 1970s. Designed to determine ranges to targets more rapidly and accurately than optical methods such as binoculars or tank-mounted telescopes, laser rangefinders emit an intense beam of light. The distance between the beam's source and the target is electronically measured, providing more speedy and precise results than can be obtained by human observation. Laser rangefinders are now standard equipment on tanks, other combat vehicles, and artillery pieces.¹³ Similar versions of such lasers have also formed the basis of training systems intended to improve weapons marksmanship.¹⁴

Because of the intense strength of their laser emissions, many laser rangefinders are capable of creating permanent damage to the human eye. A number of non-combat injuries have resulted from peacetime training and maintenance accidents where soldiers and at least one civilian bystander have been accidentally blinded by laser rangefinders.¹⁵ Other passive laser technologies include the use of laser warning devices (which warn a vehicle's crew that it is being scanned by an enemy's laser rangefinder or a laser-guided missile in time for the crew to take evasive

'friendly' forces, even in the absence of laser weapons" and speculating that laser blinding accidents "may have led research and development establishments" to investigate lasers for potential weapons applications).

13. See generally *BLINDING LASER WEAPONS*, *supra* note 6, at 21; INTERNATIONAL COMMITTEE OF THE RED CROSS, *BLINDING WEAPONS: REPORTS OF THE MEETINGS OF EXPERTS CONVENED BY THE INTERNATIONAL COMMITTEE OF THE RED CROSS ON BATTLEFIELD LASER WEAPONS 102-04 (1993)* [hereinafter *ICRC BLINDING WEAPONS*].

14. These low-power laser training systems, including the U.S. Army's MILES system, may have provided the origins of civilian "laser tag" games, which use the same general principles. See generally *ICRC BLINDING WEAPONS*, *supra* note 13, at 105, 332 (describing Army MILES system); J.W. Rawles, *Laser Weapons on the Battlefield*, *DEF. ELECTRONICS*, Aug. 1989, at 83-84.

15. See, e.g., U.S. LASERS, *supra* note 6, at 4 (citing U.S. medical reports concerning laser accidents and the proliferation of such accidents among friendly troops, and noting that the U.S. military had at least 23 major laser exposure accidents as of 1984); *BLINDING LASER WEAPONS*, *supra* note 6, at 17-18, 22 (discussing at least two reported American laser blinding casualties during the Gulf War and the partial blinding of a German civilian casualty during NATO maneuvers); *ICRC BLINDING WEAPONS*, *supra* note 13, at 103 (noting that "[m]ost laser range finders are not eye-safe and a number of accidents and military eye damage have [sic] been reported"); *Thou Shalt Not Blind*, *THE ECONOMIST*, Oct. 15, 1994, at 54 (noting accidental blinding of friendly forces during the 1991 Gulf War from laser rangefinder usage).

The U.S. military, at least, has been aware for some years of the harmful effects of laser rangefinders on eyesight. In the operating manual for the M-1 Abrams, the Army's main tank, which is equipped with a laser rangefinder, the instructions note that (a) "[a]ll personnel who work down range of the laser must wear laser safety goggles;" (b) the laser rangefinder must never be aimed at personnel and must be treated "as a direct-fire weapon, with hazardous range of 8000 meters;" and (c) any accidental use of the rangefinder at any persons within 8000 meters of the tank must be reported to the appropriate commanders. U.S. DEP'T OF THE ARMY, *TM 9-2350-255-10, OPERATOR'S MANUAL FOR TANK, COMBAT, FULL-TRACKED, 105MM GUN, M1 (1981)*.

The frequency of laser rangefinder accidents has led to the development of "eye-safe" rangefinders by various nations, including Canada, the United States, and Norway, which will ultimately replace current models of rangefinders and which should also lessen the occurrence of accidental casualties resulting from laser rangefinder usage. Mark Hewish, *Battlefield Lasers-The Race Between Action & Countermeasure*, *INT'L DEF. REV.*, Feb. 1, 1995, at 39.

action) and laser designators (which illuminate targets for laser-guided bombs, missiles and shells that home in upon a laser beam "path" to the target).¹⁶

The active use of military lasers extends to their usage as weapons per se as opposed to being mere accessories to other weapons.¹⁷ Contrasted to passive, non-laser methods of warfare intended to confuse, obscure, or blur soldiers' vision (e.g., smoke screens or camouflage), anti-optic lasers are directly intended to overwhelm or burn out electronic and thermal sensors, control panels, night vision devices, video equipment, and rangefinders and other target acquisition devices. They also can cause—whether incidentally or intentionally—permanent retinal damage to the unprotected human eye.¹⁸ Indeed, the development of tactical anti-optic lasers as an active means of combat may have originated after observation of the unintended side effects of laser rangefinders to incapacitate electro-optical systems and to blind unwary observers.¹⁹

The first clear use of blinding lasers in wartime involved Britain's ship-mounted "Laser Dazzle Sight" during the 1982 Falklands (Malvinas) War, which, by dazzling enemy pilots, may have produced several Argentine cas-

16. Hewish, *supra* note 15 (noting that laser designators are used by Canada, France, Malaysia, the Netherlands, Spain, the United Kingdom, and the United States, including deployment in the former Yugoslavia, and that laser designators can help to minimize "collateral damage" by improving the accuracy of conventional weapons).

17. See, e.g., *BLINDING LASER WEAPONS*, *supra* note 6, at 21. In addition to anti-optic lasers, "directed energy" laser weapons intended to destroy targets with a high-energy beam are also under development. These include airborne anti-missile lasers derived from the "Star Wars" program originated under the administration of U.S. President Ronald Reagan and plasma lasers intended to rupture vehicle or aircraft hulls by creating powerful shock waves. As such, these weapons would clearly tend to move military lasers from the "non-lethal" into the lethal weapon category. See *Disabling Technologies—A Critical Assessment*, INT'L DEF. REV., July 1, 1994, at 33 [hereinafter *Disabling Technologies*]; *Airborne Laser Tracks and Blasts Enemy Missiles*, MACHINE DESIGN, Oct. 10, 1994, at 41.

18. U.S. LASERS, *supra* note 6 at 5-6; *Disabling Technologies*, *supra* note 17, at 33. For more on the ability of anti-optic lasers to damage eyesight permanently, see *infra* notes 48-56 and accompanying text. See *infra* note 31 for a definition of "dazzling" compared with blinding.

19. While few published reports are available, several studies suggest that the Soviets may have been the first to recognize the anti-personnel capabilities of their tank-mounted laser rangefinders, adapting some 50,000 vehicle and gun-mounted systems to blind enemy troops. Several late Cold War incidents involving use by the former Soviet Union of such modified rangefinders against United States pilots were reported. Mike DeMayo, U.S., *Others Work On Lasers That Can Blind*, BALT. SUN, May 7, 1995, at 7F. See also Nick Cook, *Chinese Laser "Blinder" Weapon For Export*, JANE'S DEF. WKLY., May 27, 1995, at 3 (reviewing U.S. intelligence reports of Soviet ground-based air defense lasers intended to blind NATO pilots).

Similar usages by the Soviets of laser rangefinders against Chinese troops on the Mongolian and Manchurian borders in the 1970s may have constituted the first hostile use of blinding laser weapons. Cf. U.S. LASERS, *supra* note 6, at 4 (discussing briefly U.S. intelligence reports regarding Soviet experiments on tactical laser weapons); Steven J. Zaloga, *Soviets Close to Deploying Battlefield Beam Weapons*, ARMED FORCES J. INT'L, May 1990, at 28-29 (discussing the eye hazards posed by older Soviet tanks' early-model laser rangefinders, and citing mid-1980s reports of Iraqi usage of Soviet-made laser rangefinders as anti-optic weapons against Iranians).

ualties.²⁰ Britain has since developed a tank-mounted anti-optic laser specifically designed to permanently blind enemy soldiers using vehicle-mounted gunsights and periscopes.²¹ At least six other nations presently have ongoing laser weapon development programs.²² Of these, two nations' efforts—the United States and China—have given rise to particular concerns.

1. U.S. Anti-Optic Laser Research and Development Programs

The United States is not the only nation to be researching or developing anti-optic lasers.²³ However, its research and development programs are the most well-documented and, therefore, may provide the best insights into the development and likely usage of such arms. Although the United States' tactical laser weapons program began in the 1970s, the full story of these weapons still remains largely secret, partly because of their highly unconventional nature and because of the political sensitivity surrounding their development and possible use.²⁴

Some sixteen different types of tactical lasers (some intended solely as anti-optic weapons, others being more similar to flamethrowers or conventional explosives in their functions) have been under development by all branches of the U.S. military. While the principal function of most of these is ostensibly to "counter battlefield surveillance by disrupting optical and electro-optical devices," many of these lasers have secondary effects tend-

20. Fermin Gallego & Mark Daly, *Laser Weapon in RN Service*, JANE'S DEF. WKLY., Jan. 13, 1990, at 48 (reporting first installation of Laser Dazzle Sights (LDS) on British ships in 1981 and attributing the destruction of three Argentine aircraft under "mysterious circumstances" to use of such weapons, but also noting British Ministry of Defense spokesman's statement that there is no evidence the LDS was used during the Falklands War). See also *BLINDING LASER WEAPONS*, *supra* note 6, at 20; Pengelley, *supra* note 8, at 1; DeMayo, *supra* note 19, at 7F (discussing British navy's use of the LDS during the Falklands War). Cf. David Fairhall, *Britain Halts Work on Laser Weapons*, THE GUARDIAN, May 23, 1995, at 5 (citing a letter by Britain's minister for defense procurement to the acting Secretary of Defense, admitting to the use of laser dazzlers during the Falklands War but also stating that British forces "do not possess, and currently have no plans to develop or procure" any blinding laser weapons); Cook, *supra* note 19, at 3.

21. ICRC *BLINDING WEAPONS*, *supra* note 13, at 173 (citing Simon O'Dwyer-Russell, *Army Building Laser Gun to Knock Out Tanks*, SUN. TELEGRAPH, Jan. 14, 1990).

22. See *U.S. Government Considering Laser Weapons Report*, Reuters, May 21, 1995, available in LEXIS, News Library, Curnws File; U.S. *LASERS*, *supra* note 6, at 3, 14 (identifying the six nations developing or having already developed anti-optic lasers as being China, France, Germany, Israel, Russia (ostensibly the Commonwealth of Independent States, as several of the other ex-Soviet states must certainly have inherited the capabilities to field anti-optic laser weapons), and the United States).

The French reportedly deployed a French-made battlefield laser as an anti-sniper weapon in Bosnia during part of 1995. See *BLINDING LASER WEAPONS*, *supra* note 6, at 2 & n.6 (reporting on deployment and potential usage of blinding lasers in Bosnia); U.S. *LASERS*, *supra* note 6, at 14; Michael Dynes, *Red Cross Calls For a World Ban on Blinding Laser Guns*, THE TIMES (London), Sept. 8, 1995.

23. See *supra* notes 20-22 and accompanying text and see *infra* notes 36-43 and accompanying text (discussing six other nations' efforts in developing anti-optic laser weapons).

24. U.S. *LASERS*, *supra* note 6, at 4, 8.

ing to cause some degree of blindness.²⁵ Several systems have progressed to the pre-fielding stage, with prototypes having been deployed but apparently not used by U.S. Marine and Army special operations units in Iraq in 1991 and Somalia in 1995.²⁶ Three of these systems may be viewed as representative of current efforts in anti-optic lasers.

Perhaps the most publicized of the U.S. Army's anti-optic laser devices, the Laser Countermeasure System (LCMS) was to have been the first mass-produced laser weapon.²⁷ The LCMS is sufficiently compact for its barrel to be mounted on the standard M-16 infantry rifle; complete with power unit, the entire device weighs 42 pounds and has an effective range of over two kilometers (approximately 1.25 miles).²⁸ The LCMS' primary stated role is to detect, jam, and suppress enemy fire control, optical and electro-optical systems; however, it also can impair vision and at 1,000 meters or less "may cause permanent eye injury to the [observer], including blindness."²⁹ The Defense Department, however, recently has withdrawn funding for series production of the LCMS, partly due to its cost and to diplomatic, political and humanitarian concerns.³⁰ Another anti-optic

25. *Id.* at 2-3 (surveying ten models of U.S. anti-optic laser having undergone experimentation or more advanced pre-fielding development). See also *BLINDING LASER WEAPONS*, *supra* note 6, at 9-11.

26. See *U.S. LASERS*, *supra* note 6, at 3 and Pengelley, *supra* note 8, at 1 (noting U.S. deployment of the Army's experimental, vehicle-mounted "Stingray" laser and its "Dazer" laser during Operation Desert Storm); DeMayo, *supra* note 19, at 7F (reporting the acknowledgment of an Assistant Defense Secretary that a special operations laser, intended to dazzle or temporarily blind, was deployed by U.S. forces in Somalia but "it was decided not to use it for that purpose during the operation"). The two Stingray vehicles deployed to Iraq in 1991 were used solely for passive roles (i.e., scanning the battlefield for potential targets for other weapons) but reportedly "no longer exist;" *Battlefield Laser Weapons Continue to Get DOD Attention*, *DEF. ELECTRONICS*, May 1995, at 12.

27. *U.S. LASERS*, *supra* note 6, at 2; Hewish, *supra* note 15, at 39.

28. *U.S. LASERS*, *supra* note 6, at 8 (noting weight of 42 pounds); Hewish, *supra* note 15, at 39 (noting range in excess of two kilometers).

29. *U.S. LASERS*, *supra* note 6, at 8-9. Several reports, however, indicate the threshold danger area for permanent blindness from an LCMS laser burst to be 3,000 meters or less. See, e.g., Bradley Graham, *Army Laser Weapon Becomes First Casualty of New Policy*, *WASH. POST*, Oct. 13, 1995, at A-4; *Laser Weapon Nixed*, *CHI. SUN-TIMES*, Oct. 13, 1995, at 31.

30. Only one day before announcement of the Defense Department policy, the Army had awarded a contract for 20 rifle-mounted LCMS systems at a cost of \$12 million, with 30 more units and 25 training versions to follow. The Defense Department subsequently ordered a halt to this Army-funded program in October 1995, on which \$23 million has already been spent. See Peter Almond, *Blinding Laser Weapons Are Banned by UN*, *DAILY TELEGRAPH*, Oct. 14, 1995, at International section 14; William M. Arkin, *Pentagon Sees the Light*, *BULL. ATOMIC SCIENTISTS*, Nov. 1995, at 76; Graham, *supra* note 29, at A-4; *Pentagon Cancels Controversial Laser*, *L.A. TIMES*, Oct. 13, 1995, at A-16. For more on the diplomatic concerns, see *infra* Part III.

U.S. troops deployed to Bosnia as part of NATO's peacekeeping efforts have taken several types of non-lethal weapons including a non-laser "flash-bang" explosive "intended to stun and confuse" by creating a loud noise and by causing temporary dazzling of the eyes upon detonation. Tactical lasers such as LCMS are apparently not part of the peacekeeping arsenal, in accordance with the new Defense Department policy. See generally *US Troops Try Nonlethal Arms*, AP Online, Dec. 7, 1995, available in LEXIS, News Library, Curnws File.

laser, the Air Force's Saber 203 laser grenade, is a diode laser bomb fired from a grenade launcher, with a range of 50 to 250 meters. The Saber 203 laser produces two effects: a glare (i.e., "dazzling", which is similar to looking at bright headlights at night), and flash blinding (i.e., temporary blindness of up to 15 minutes),³¹ which is similar to looking directly at a flashbulb.³² Both effects may generally be described as dazzling, as opposed to outright blinding.³³

The most dangerous U.S. tactical laser (potentially to its user as well as to its target) may be the Army's "Dazer," prototypes of which have been fielded since 1989. This system, a high-capacity alexandrite laser, is described as being "rifle-like," weighing only 20 pounds, with the capability to fire over 1,000 laser bursts at up to 50 bursts per minute, and costing approximately \$50,000 per device.³⁴ The Dazer is also described as being "highly dangerous" to its user because it uses a high-voltage power supply, and its beam is hazardous to skin as well as eyes.³⁵

For more on the United States policy regarding blinding lasers, see *infra* notes 194-220 and accompanying text.

31. See *BLINDING LASER WEAPONS*, *supra* note 6, at 35 (defining "dazzling" as a "state where an intense beam of light enters the eye and degrades vision by overloading retinal circuits at the site of the retinal image and by flooding the retina with scattered light, thus severely decreasing contrast sensitivity and visual acuity" for a period of time); *ICRC BLINDING WEAPONS*, *supra* note 13, at 98, 122 (defining "flash blindness" as being the exposing of photoreceptors to a bright flash of light and the "bleaching" of the photopigments used to absorb light and intensify photon energy into neural signs).

32. *U.S. LASERS*, *supra* note 6, at 10.

33. Wolbarsht Interview, *supra* note 6. Dr. Wolbarsht, a leading expert on ophthalmology and the etiology of laser-inflicted eye injuries, has analogized dazzling to looking at a "super-flashbulb:" visual sensitivity is temporarily lowered so that a large amount of light is necessary to allow the dazzled person to resume normal eyesight. At night, because of lowered light levels, the dazzling effect lasts longer, whereas a person dazzled in the full sunlight of daytime would recover more rapidly.

Because of this daytime-nighttime dichotomy, dazzling lasers like the Dazer and LDS are usually equipped with a range of settings, from low to full power. In order to ensure maximum effectiveness during daytime hours, operators would almost inevitably place their weapons on the maximum setting. Unfortunately, because of the amount of laser energy expended, the "full power" setting also is likely to create retinal hemorrhaging and some level of blindness. *Id.* Restated, this means that:

In reality, dazzle is almost impossible by a laser beam in daylight without also causing permanent visual damage, and at night, although dazzling is possible, it is not an extremely long-lasting type of incapacitation . . . Even at night, there is still a great risk of permanent damage, so that a laser dazzle weapon is as serious a hazard as those weapons whose primary purpose is permanent visual incapacitation from a retinal burn or hemorrhage.

Bengt Anderberg & Myron L. Wolbarsht, *Hand-Held Laser Weapons Are Waiting in the Wings*, *ARMED FORCES J. INT'L*, May 1992, at 60 (emphasis added) [hereinafter *Hand-Held Lasers*].

34. *U.S. LASERS*, *supra* note 6, at 10-11; DeMayo, *supra* note 19, at 7F.

35. *U.S. LASERS*, *supra* note 6, at 10-11. See also Robert Burns, *Pentagon Draws Fire on Proposed Blinding Laser Weapons*, *AP WORLDSTREAM*, May 22, 1995, available in LEXIS, News Library, Curnws File (citing a U.S. Special Operations Command spokesman as stating, "[Dazers] are a very dangerous weapon, not only for whoever [sic] they might be aimed at but also for the operator," and adding that Dazers could not be deployed without first obtaining special authorization).

2. Chinese Efforts To Market Anti-Optic Lasers

Possibly the single greatest impetus to international efforts to ban anti-optic lasers (as well as contributing to a reversal in long-standing U.S. military policy on such weapons)³⁶ was the announcement in mid-1995 that China had developed and was actively attempting to export an anti-optic laser. The ZM-87 "Portable Laser Disturber" weighs approximately 75 pounds and can transmit a beam at several different wavelengths, thus potentially thwarting attempts by soldiers to protect themselves with laser-proof goggles.³⁷ In its sales literature, the ZM-87's manufacturer explicitly stated its dual purpose:

One of the [ZM-87's] major applications is . . . to injure or [make] dizzy the eyes of an enemy combatant by means of high-power laser pulses . . . especially anybody who is sighting and firing at us [by means of] an optical instrument, so as to cause him to lose combat ability or result in suppression of his observation and sighting operation.³⁸

The Dazer may be the flamethrower-like weapon described in one report as a "man-portable laser supposedly used against oil-storage tanks at a range of 1,000 [meters]" and as being more similar to an anti-tank weapon than a rifle. Andrew C. Tillman, *Weapons For the 21st Century Soldier*, INT'L DEF. REV., Jan. 1, 1994, at 34. If this is the case, the Dazer may represent a hybrid of sub-lethal tactical lasers and purely lethal ones such as the GARDIAN anti-missile laser. An apparent spin-off of the SDI (Star Wars) program, GARDIAN is a directed energy weapon that generates a laser beam to burn a hole through its target. See, e.g., *Airborne Laser Tracks and Blasts Enemy Missiles*, *supra* note 17, at 41 (discussing U.S. Air Force and Navy developments of similar anti-missile lasers); *Battlefield Laser Weapons Continue to Get DOD Attention*, *supra* note 26, at 12 (discussing GARDIAN and other lasers and noting that the development of GARDIAN and similar concepts "seem to confirm the technical feasibility of moving lasers from the 'non-lethal' to the 'lethal' arena.").

While beyond the scope of this article, any usage of burning lasers against individuals raises additional international legal issues. Such usage may be analogized to the use of napalm, flamethrowers, incendiary bombs, and other flame or burning weapons against persons, particularly civilians, which is generally prohibited by the Protocol on Prohibitions or Restrictions On The Use of Incendiary Weapons (Protocol III), *annexed to 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*, Oct. 10, 1980, *opened for signature*, Apr. 10, 1981, U.N. Doc. A/CONF. 95/15, 19 I.L.M. 1523, 1534 [hereinafter the Conventional Weapons Convention]. It may also be worth noting that the U.S. policy has at time been at odds with international efforts to prohibit usage of incendiary weapons. See, e.g., DONALD A. WELLS, *THE LAWS OF LAND WARFARE: A GUIDE TO THE U.S. ARMY MANUALS 61-64*, 181 (1992), and Paul A. Robblee, Jr., *The Legitimacy of Modern Conventional Weaponry*, 71 MIL. L. REV. 95, 128-33 (1976).

36. See Arkin, *supra* note 30, at 76 (noting that China's active marketing of its portable blinding laser "was certainly one of the reasons" that U.S. Secretary of Defense William Perry issued the Defense Department's September 1995 policy statement against blinding lasers).

For more on U.S. policy positions regarding anti-optic lasers, see *infra* notes 194-212 and accompanying text.

37. BLINDING LASER WEAPONS, *supra* note 6, at 11. See *infra* notes 50, 70-72 and accompanying text (discussing inability of anti-laser goggles to defeat laser beams emitted at multiple wavelengths).

38. *Chinese Offer Laser Eye-Damage Weapon*, INT'L DEF. REV., May 1, 1995, at 19 (emphasis added). See also Cook, *supra* note 19, at 3.

Intentional injury to eyesight is in addition to the ZM-87's other stated purpose of damaging photoelectric sensors, laser rangefinders, night vision devices, video cameras, or laser-guided missiles.³⁹ The ZM-87 can cause permanent optical damage at two to three kilometers, which can be increased to over five kilometers when a magnifying optic is added; "flaring" blindness (i.e., dazzling) can be caused at up to ten kilometers.⁴⁰

China's efforts to market the ZM-87 establish several highly disturbing firsts. The ZM-87 is the first weapon of its type to be openly publicized by its manufacturer, as well as being the first anti-optic laser to be marketed for sale abroad.⁴¹ China's touting of this weapon at several arms shows has heightened concerns about acquisitions of these weapons by Third World and "pariah" nations, as well as terrorist groups.⁴² The ZM-87 is also the first tactical laser to be openly advertised as being built to blind enemy personnel, with its manufacturer also offering extra accessories to enhance this ability.⁴³

B. The Potential Medical and Social Consequences of the Use of Anti-Optic Lasers in Warfare

Anti-optic lasers are generally intended to overload battlefield electronic sensors and optical equipment by creating a brief (15 to 30 second) but very intense pulse of light that overwhelms the target equipment's ability to transmit information (e.g., night-vision goggles or video camera images of soldiers crossing a battlefield). With such equipment disabled, enemy forces using them would theoretically either attempt to repair the disabled equipment, thereby wasting valuable time during the course of combat, or abandon the damaged equipment and switch to non-electronic optics (e.g., binoculars, gunscoopes or tank-mounted periscopes), the users of which could then themselves be blinded by follow-on laser attacks.⁴⁴

As medical experts have noted, any anti-optic laser that creates temporary blindness by dazzling near the end of its range—for many anti-optic

39. *Chinese Offer Laser Eye-Damage Weapon*, *supra* note 38, at 19; Cook, *supra* note 19, at 3. See also *China Markets Blinding Laser*, JANE'S INTELLIGENCE REV., June 1, 1995, at 1.

40. *Chinese Offer Laser Eye-Damage Weapon*, *supra* note 38, at 19.

41. BLINDING LASER WEAPONS, *supra* note 6, at 11 (noting Chinese marketing of the ZM-87 at arms shows in Abu Dhabi and the Philippines); *China Markets Blinding Laser*, *supra* note 39, at 1 (stating that China's "overt marketing of such a system—and the open admission in sales literature [as to the ZM-87's major application of blinding] targeted individuals—takes China over a line that no other country has yet crossed").

42. Cook, *supra* note 19, at 3; Nick Cook, *Frightening Future For China's New Portable Blinding Laser*, STAR TRIB., June 25, 1995, at 17A [hereinafter *Frightening Future*]. The greater likelihood is that the ZM-87 would be purchased by rogue regimes instead of terrorist groups; however, "given the fine distinction between perceptions of 'rogue state' and 'terrorist,' this does little to allay the fears of such horrific technology." *Id.*

43. See *supra* text accompanying note 40 (discussing the marketing of an optional optics package for extending the ZM-87's range).

44. See, e.g., U.S. LASERS, *supra* note 6, at 5; William Arkin, *Ban Tactical Laser Weapons*, DEF. NEWS, July 17/23, 1995, at 20.

lasers, this range is at least one kilometer⁴⁵—would inevitably be able to create permanent blindness nearer its source.⁴⁶ Very high-powered lasers such as the Dazer can also cause deep skin burns as well. This effect may arguably place them in the category of burning weapons, which previously have been the subject of international regulatory action.⁴⁷

Laser blinding is caused by severe damage to the retina or the optic nerve, generally in the same manner that retinal damage can be caused by directly looking at the sun. For a person looking through optical equipment like binoculars, however, the anti-optic laser's beam would be greatly magnified by the beam's passage through the equipment's lenses.⁴⁸ The potential and severity of ocular injury is a function of (a) the distance between the human eye and the laser; (b) the color, intensity, and wavelength of the beam; (c) weather conditions (fog, mists and smoke tend to lessen the effectiveness of lasers by dissipating and refracting the beam); and (d) the presence or absence of suitable eye protection.⁴⁹

An observer need not look directly at the laser to be blinded because peripheral blindness can also result from a laser entering the eye at an angle, although a higher degree of blindness may result from gazing

45. BLINDING LASER WEAPONS, *supra* note 6, at 17 n.101 (citing one expert's report of animal experiments in which animals were blinded by laser rangefinders at distances of 850 meters); ICRC BLINDING WEAPONS, *supra* note 13, at 98. As noted above, for the Chinese ZM-87, this range is at least two to three kilometers (approximately 1.2 to 1.8 miles) and can be extended up to ten kilometers (6.2 miles). *Chinese Offer Laser Eye-Damage Weapon*, *supra* note 38, at 19.

46. John Marshall, *A Horrifying New Laser Weapon that the World Should Ban Now*, INT'L HERALD TRIB., Apr. 12, 1995, available in LEXIS, News Library, Curnws File; U.S. LASERS, *supra* note 6, at 6. See also David Fairhall, *Britain Halts Work on Laser Weapons*, THE GUARDIAN, May 23, 1995, at 5 (noting that it was unclear whether the Royal Navy's LDS dazzler device "could be effective in bright sunlight without causing some permanent eye damage"); Mark Abley, *Blinding Light: Laser Weapons Moving from Sci-Fi to Battlefield*; UN Conference to Debate Ban, MONTREAL GAZETTE, Sept. 2, 1995, at B3, available in LEXIS, News Library, Curnws File (citing an ICRC researcher as stating:

The scientists we have spoken with . . . are absolutely adamant: it is totally impossible to have a laser weapon that can dazzle the eyes without also having the capacity to blind. To have any dazzle effect, you need a certain energy level. The laser goes through the lens to the retina. And so you end up with damage to the eye.

and quoting a U.S. psychologist's observation that "[it is] the eye's ability to process light that puts it at jeopardy").

47. See *supra* note 35 and accompanying text. See also ICRC BLINDING WEAPONS, *supra* note 13, at 47. "Depending on the intensity of the laser, laser weapons could also cause simultaneous other injuries, such as burns." *Id.* In past wars, blinding injuries were often the result of facial burns. *Id.* Paul Szasz, *The Conference on Excessively Injurious or Indiscriminate Weapons*, 74 AM. J. INT'L L. 212, 213-24 (1980) (noting areas of disagreement as to what constitutes "incendiary weapons" and "flame weapons" under the Conventional Weapons Convention).

48. Arkin, *supra* note 44, at 20.

49. See generally U.S. LASERS, *supra* note 6, at 5; ICRC BLINDING WEAPONS, *supra* note 13, at 339-40; Abley, *supra* note 46. See also *Thou Shalt Not Blind*, *supra* note 15, at 54 (noting that the laser beam widens with distance; at a range of one kilometer, "[the beam] will have grown to a width of at least 50 [centimeters]").

directly into the laser beam.⁵⁰ Because the human eye amplifies light by approximately 100,000 times, the laser beam's energy is absorbed by the eye and is rapidly transformed into heat, which can either tear tissues apart or cause coagulation in retinal blood vessels.⁵¹ The result is vitreous hemorrhaging of retinal blood vessels, leading to destruction of the retina or the underlying optic nerve.⁵² The most severe injuries to either of these areas cause permanent blindness, which can be neither cured, ameliorated, or delayed.⁵³

It is important to note that permanent blindness, as caused by lasers, is not blindness in the sense of total darkness or to such a degree that the victim would require a guide or a seeing-eye dog. Laser blindness generally is limited to the victim's central field of vision, but the resulting injuries may be regarded as being severe enough to make the victim legally blind. Such a victim could not perform many daily functions requiring average or better-than-average eyesight. For instance, driving, reading, using precision tools or computers, or aiming a rifle would all be rendered highly difficult, if not impossible. Therefore, the victim would be functionally incapacitated in the sense that he or she could not perform many of the tasks required in either military or daily life.⁵⁴

Permanent blindness is quite unlike any other type of wound inflicted in warfare. Most battle casualties—approximately sixty percent—recover

50. See generally *Frightening Future*, *supra* note 42 (noting that one need not look directly into a laser beam to be blinded and that eye-protective goggles are presently only effective against a single wavelength). "To guard against multiple wavelengths, goggles would need to be dense to the point of opacity." *Id.*

Because an increased potential for blindness may result from looking directly into the anti-optic laser's beam, some anti-optic lasers may incorporate a flashbulb-type device to take a perverse advantage of a psychological "attention reflex" to look in the direction of a sudden flash of bright light. See, e.g., Peter Herby, *Outlaw Blinding*, BULL. ATOMIC SCIENTISTS, Mar./Apr. 1995, at 4; Tim Radford, *Weaponry: A New Meaning to Light Infantry*, THE GUARDIAN, May 25, 1995, at 8 (noting that "laser marksmen won't use this trick very often" because use of such a device would also pinpoint the laser operator's location for retaliatory fire).

51. See, e.g., BLINDING LASER WEAPONS, *supra* note 6, at 17; ICRC BLINDING WEAPONS, *supra* note 13, at 29, 115-20, 158-63.

52. See, e.g., Dynes, *supra* note 22.

The experience of being blinded, even if only temporarily, by a laser is extremely painful and graphic:

When the beam struck my eye, I heard a distinct popping sound caused by a laser-induced explosion at the back of my eyeball. My vision was obscured almost immediately by streams of blood . . . I have seen several terrible scenes of human carnage, but none affected me more than viewing the world through my blood-filled eyeball.

Arkin, *supra* note 44, at 20 (quoting a researcher's experience with being injured by a laboratory laser during an experiment).

53. ICRC BLINDING WEAPONS, *supra* note 13, at 33, 134.

54. Wolbarsht Interview, *supra* note 6. See also Jiemin Xu & M.L. Wolbarsht, *Laser Injury in China*, 6 LASERS IN THE LIFE SCIENCES 181, 181-84 (1994) [hereinafter *Laser Injury in China*]; Bengt Anderberg et al., *Blinding Laser Weapons and International Humanitarian Law*, 29 J. PEACE RES. 287, 291 (1992); Myron L. Wolbarsht, *Permanent Blindness From Laser Exposures in Laboratory and Industrial Accidents*, 2674 PROC. SOC'Y PHOTOGRAPHIC & INSTRUMENTATION ENGINEERS 21, 21-24 (1996).

fully from their wounds. Between twenty-five to thirty percent of casualties subsequently die of their injuries, and about ten to fifteen percent survive with some level of disability.⁵⁵ Unlike most combat wounds, however, laser blinding would likely create a large category of permanently disabled survivors, potentially taxing the resources of any nation's medical and socio-economic systems.⁵⁶

Laser wounds are different from those caused by any other class of weaponry currently under international legal scrutiny in at least one critical respect. While many land mine victims die outright, one of the most pernicious types of injury resulting from mine explosions is that of lower limb amputations.⁵⁷ Gruesome, painful, costly, and highly crippling though such wounds undoubtedly are, at least there is the hope offered to many land mine victims that they may regain *some* mobility and opportunity to resume their past lives through artificial limbs.⁵⁸ No prosthetic device, however, can yet replace the human eye, and while (ironically) laser surgery presently can help correct certain types of ocular damage, no medical technologies exist to repair, replace, or correct severely damaged or destroyed retinas or optic nerves.⁵⁹ Such injuries would be the likely by-product of laser blinding.

Some argue that it should be preferable to be blinded permanently by a laser than to be shot with a bullet or maimed by a mine, grenade or shell.⁶⁰ This relativistic view presupposes the availability of western-style socio-economic and medical systems to provide reasonably adequate care

55. *Gentler Warfare on the Way: Non-Lethal Weapons Are Not Necessarily Humane*, *Critics Say*, ROCKY MOUNTAIN NEWS, June 4, 1994, at 33A; Colman McCarthy, *Battlefield Instruments of Blindness*, WASH. POST, May 16, 1995, at E24; ICRC BLINDING WEAPONS, *supra* note 13, at 183 (noting that some 60% of U.S. soldiers wounded in Korea were returned to battle).

56. See *infra* notes 61-79 and accompanying text.

57. See generally McCall, *supra* note 4, at 247-50 (discussing generally amputations required by extensive land mine usage in Cambodia and Angola and costs of artificial limbs).

58. But see *id.* at 250, n.119 (discussing the permanent trauma inflicted upon land mine victims and the need for extensive funding from non-governmental organizations and international aid agencies for provision of basic medical care for land mine casualties). See also Boutros Boutros-Ghali, *The Land Mine Crisis: A Humanitarian Disaster*, FOREIGN AFF., Sept./Oct. 1994, at 8, 9-10.

59. See, e.g., BLINDING LASER WEAPONS, *supra* note 6, at 17; ICRC BLINDING WEAPONS, *supra* note 13, at 211; Dynes, *supra* note 22; Abley, *supra* note 46; *Laser Injury in China*, *supra* note 54, at 183-84 (discussing the limited and "problematical" abilities of certain types of medical treatments for laser injuries). But see Robert Bunker, *U.S. Must Seize the Future with Tactical Laser Development*, DEF. NEWS, Aug. 28/Sept. 3, 1995, at 15 (arguing that "organ harvesting" from dead soldiers may provide a source in future wars for replacement eyes for blinded soldiers).

60. Compare Bunker, *supra* note 59, at 15 (criticizing arguments against anti-optic lasers), with Arkin, *supra* note 44, at 20 (reasoning that the argument that "it is better to blind than to kill" is "an odd argument to make if blinding isn't the goal—which is the claim—and it ignores the reality that lethal fire would follow temporary disabling by [anti-optic lasers]") and ICRC BLINDING WEAPONS, *supra* note 13, at 80 (reasoning that "[d]eath is not invariably regarded as the worst form of injury or suffering which may be inflicted upon a victim," and noting international human rights agreements and domestic laws prohibiting torture while permitting the death penalty).

for the blinded survivors of laser attacks. Leaving aside the possibility that many casualties of anti-optic lasers may be citizens of less-developed nations without such capabilities, such an argument disregards at least three factors: (a) the likely inability of medical facilities and socio-economic structures to cope with the massive number of ocular casualties to be generated by anti-optic lasers; (b) the lifelong trauma to the blinded casualty and the wider effects of such trauma on society; and (c) the increased likelihood that blinded soldiers or non-combatants would suffer further injuries or death on the modern battlefield as a direct and proximate consequence of laser blinding.

1. *The Medical and Socio-Economic Concerns Generated by Laser Blinding*

Assuming that the victims of laser blinding can survive other threats on the battlefield after they are injured,⁶¹ they will need medical treatment of a type which will tax the abilities of most, if not all, modern medical systems. According to International Committee of the Red Cross (ICRC) estimates, in the event that anti-optic lasers proliferate, twenty-five to fifty percent of all future combat casualties could result from use of such weapons.⁶²

Like land mines, anti-optic lasers provide forces using them with a way of maximizing "anti-personnel potential," overloading an enemy's ability to cope with its casualties because of the time, cost, specialized medical attention, and evacuation and other logistics systems required to remove casualties from the battlefield.⁶³ Anti-optic lasers may also have high anti-personnel potential as a "terror" weapon that may create some degree of psychological trauma even in the uninjured survivors of a laser attack,⁶⁴ much as some degree of mental trauma persisted in many otherwise injured survivors of bombardments or poison gas attacks during the First World War. For blinded soldiers, the medical demands become greater than for many other casualties, beginning with the efforts necessary to remove a now sightless soldier from harm's way, coupled with a type of injury that medical systems are ill-prepared to face in large quantities.⁶⁵

In order to treat successfully the most serious retinal injuries, highly specialized medical treatment must be performed within forty-eight

61. See *infra* notes 83-87 and accompanying text.

62. Radford, *supra* note 50, at 8. See also ICRC BLINDING WEAPONS, *supra* note 13, at 306, 313-16; INTERNATIONAL COMMITTEE OF THE RED CROSS, BLINDING WEAPONS: GAS 1918 . . . LASERS 1990s? 6 (Sept. 1994) (Campaign Brochure) [hereinafter ICRC Brochure] (noting, by comparison, that the number of eye injuries increased from 0.5% during the 19th century to between five and nine percent during the Vietnam War, principally as a result of the use of fragmentation weapons).

63. See generally McCall, *supra* note 4, at 234 n.26.

64. ICRC BLINDING WEAPONS, *supra* note 13, at 26 (noting that anti-optic lasers could instill a high degree of fear "in soldiers who witness their comrades being blinded"); Bengt Anderberg & Myron L. Wolbarsht, *Blinding Lasers: The Nastiest Weapon?*, MIL. TECH., Mar. 1990, at 58-62 ("The psychological impact on soldiers will be significant once they [realize] that observing the terrain as well as looking towards the enemy may entail a significant risk of being blinded.").

65. See, e.g., McCarthy, *supra* note 55, at E24.

hours.⁶⁶ Such specialized care is not usually available near battlefields, and transportation of blinded casualties to special treatment facilities would likely present major logistical difficulties. For example, the U.S. Veterans Administration's facilities can only accommodate approximately 1,000 blinded veterans at a time, with another approximately 1,500 patients waiting for admission.⁶⁷ As one expert concluded, the introduction of anti-optic lasers into combat would:

[translate] into numbers in the hundreds of visually impaired troops who would quite overwhelm any medical field station [and larger hospital facilities, as well] conceived today or likely in terms of resources that could be deployed*The introduction of battlefield anti-eye laser weapons will mean that the number of soldiers with . . . eye injuries will increase to a level that is impossible to handle with the medical resources available.*⁶⁸

Despite the tactical advantages that may be gained by using them against a non-laser-armed opponent,⁶⁹ one might well expect any nation's military forces to be hostile to introduction of anti-laser weapons purely as a matter of self-preservation. "[N]o known foolproof countermeasures" exist to defeat blinding laser weapons,⁷⁰ and those that do exist are still relatively primitive. Several models of anti-optic lasers fluctuate their beams among multiple wavelengths to defeat anti-laser goggles, which are made to filter out laser beams emitted at certain (but not all) wavelengths.⁷¹ Therefore, such goggles cannot provide a total defense, and several experts have suggested that the only means of preserving some degree of eyesight is to keep one eye covered at all times under an eyepatch⁷²—hardly a recipe for an effective countermeasure or for battle-

66. ICRC BLINDING WEAPONS, *supra* note 13, at 137; *Thou Shalt Not Blind*, *supra* note 15, at 54. See also Wolbarsh Interview, *supra* note 6 (describing such medical care as requiring "the most highly technical and highly advanced" type of modern surgery).

67. Lane Evans, *Laser Warfare's Blinding Effect*, CHRISTIAN SCI. MONITOR, Aug. 15, 1995, at 20.

68. ICRC BLINDING WEAPONS, *supra* note 13, at 137-39 (emphasis added). "If only half the casualties required vitrectomy . . . , there would be over a month's work for one vitrectomy surgeon." *Id.* at 138. The potential medical situation could be "that conjectured for the detonation of a Hiroshima-sized atomic bomb in London, where the whole of the burn beds in the UK would be overwhelmed with serious burn casualties." *Id.* See also ICRC BLINDING WEAPONS, *supra* note 13, at 173 (citing O'Dwyer-Russell, quoting experts as stating that "enemy [vehicle] crews, if wounded in large numbers by [Britain's anti-optic] laser, would flood the enemy's casualty evacuation system").

69. But see *infra* notes 80-96 and accompanying text (noting that the spread and simplification of laser technology, in general, may lead to lower costs of acquisition and, in turn, proliferation and use by other nations).

70. Evans, *supra* note 67, at 20.

71. See *supra* note 50 and accompanying text. See also U.S. LASERS, *supra* note 6, at 6 n.17; BLINDING LASER WEAPONS, *supra* note 6, at 16; ICRC BLINDING WEAPONS, *supra* note 13 at 31, 45, 99, 140-41, 163-64; *Hand-Held Lasers*, *supra* note 33, at 71.

72. BLINDING LASER WEAPONS, *supra* note 6, at 18-19 (noting that because laser weapons allow no time for evasive action and because "tunable" lasers emit beams at several wavelengths, "no 100 percent effective protective measures" are presently feasible); ICRC BLINDING WEAPONS, *supra* note 13, at 27 (noting the reaction of several ICRC experts to this proposal as being "one of amusement"). See also ICRC Brochure, *supra* note 62, at 4.

field survival.

Because sight provides eighty to ninety percent of human sensory stimulation,⁷³ the loss of sight would have an immense impact on every aspect of the daily lives of anti-optic laser victims. Psychologically, blindness often creates an initial and profound sense of shock or grief, which may continue in the form of long-term depression or emotional upheaval and may worsen pre-existing psychological pathologies.⁷⁴ Such psychological effects would tend to make rehabilitation and vocational training more difficult.⁷⁵ Further, just as large numbers of blinded casualties would be extremely difficult for medical treatment facilities to treat adequately,⁷⁶ a large influx of blind adults would likely place enormous strains on rehabilitative and vocational resources in those nations where such programs were generally available.⁷⁷ For nations lacking the most minimal of these resources, the results of massive blindings would be even worse⁷⁸ and may be likened to the dire socio-economic straits of certain developing nations, such as Angola and Cambodia, where the numbers of land mine casualties and the related medical, political and socio-economic costs are so high as to effectively strangle national development.⁷⁹

2. "Collateral Damage": Other Threats Potentially Faced by Laser-Blinded Casualties

The primary stated role for most anti-optic lasers (excepting those for which blinding of enemy soldiers is a specifically stated purpose)⁸⁰ is to disrupt or incapacitate enemy electro-optical and optical equipment.⁸¹ Merely doing this would not necessarily result in death to laser-blinded persons, thus giving some support to those who argue that anti-optic lasers

73. Herby, *supra* note 50, at 4. See also ICRC BLINDING WEAPONS, *supra* note 13, at 205 (noting studies of blinded person in Afghanistan and Pakistan to the effect that blindness carries with it drastic impairments in basic motor skills and ease in certain forms of communications).

74. See, e.g., ICRC BLINDING WEAPONS, *supra* note 13, at 47-48.

75. *Id.* at 49, 190-98.

76. See *supra* notes 66-68 and accompanying text.

77. See generally ICRC BLINDING WEAPONS, *supra* note 13, at 50, 210 (noting that even in the United States, "only 25% [of handicapped persons] have access to rehabilitation resources and, of these, only a third get rehabilitated").

78. *Id.* at 50 (also noting that "it may be these very countries [i.e., the ones with fewer vocational and rehabilitative resources] that experience the influx of laser-blinded young men and women"); *Id.* at 200-02, 304-05, 307-08 (discussing the negative impact massive blinding would have on the viability of less-developed nations, such as the West African nations and Afghanistan, and noting that in several West African nations, premature mortality rates are three to four times higher for blind persons aged 30 years and older, compared with sighted persons of the same age groups).

79. See, e.g., McCall, *supra* note 4, at 247-49, 250-51; ICRC BLINDING WEAPONS, *supra* note 13, at 293-302 (analyzing overall direct and indirect costs to a society of massive increase in blindness of young adults in that society). See also NOVA: *Terror in the Mine Fields* (WGBH/PBS television broadcast, Jan. 15, 1996, Show No. 2301) (discussing the deleterious effects of unrestricted land mine usage by various nations and warring factions upon Cambodia).

80. See *supra* notes 38, 39 and accompanying text.

81. See also *supra* text accompanying note 44.

are "non-lethal" weapons that are also more humane.⁸² The role of the anti-optic laser, however, is not necessarily so straightforward.

Most, if not all, anti-optic lasers would likely be deployed in tandem with conventional weapons on the modern battlefield, with the latter following up the former's attack by attempting to destroy the now-blinded enemy. Despite statements that anti-optic lasers are "soft-kill" weapons that will "dazzle" enemy forces and allow friendly forces to "engage" the enemy,⁸³ the reality is that enemy troops and vehicle crews, after they have been blinded, are much easier to kill and destroy. If it is easier to destroy a tank after its sighting systems have been impaired, it would be at least as easy to kill an infantryman who has been blinded by an anti-optic laser while peering through binoculars. Also, for any high-performance aircraft pilot blinded in flight, death would likely be the consequence of loss of control over the aircraft, short of the pilot's bailing out or somehow regaining control.⁸⁴

82. See, e.g., Bunker, *supra* note 59, at 15.

83. See generally U.S. LASERS, *supra* note 6, at 6 (arguing that claims that "it is better to be blind than to be dead" are inconsistent with the tactical scenarios discussed for anti-optic lasers in combat; discussing role of anti-optic lasers as being essentially anti-personnel, not anti-equipment; and noting that anti-optic lasers "are meant to make it easier [for troops using them] to kill" and that such weapons would only augment other, lethal weapons which would finish the attack); CNN interview with Daniel Goure and Stephen Goose (CNN television broadcast, May 23, 1995, transcript no. 944-3), available in LEXIS, News Library, Curnws File (quoting arms control expert, Stephen Goose:

Laser weapons are not being developed as a humane alternative to lethal weapons [T]hey're designed to make it easier for U.S. forces to kill the opponent.

So the issue is not whether it's better to blind than to kill. We're not going to abandon killing [simply by using sub-lethal weapons like anti-optic lasers]).

ICRC BLINDING WEAPONS, *supra* note 13, at 25-26 (noting that it would be unrealistic to assume that an anti-optic laser would successfully blind an entire platoon of enemy soldiers, implying that conventional weapons may still be necessary to continue the attack); Arkin, *supra* note 44 (reasoning that, in application, "lethal fire would follow temporary disabling" by anti-optic lasers, as forces using anti-optic lasers would attempt to destroy the now-blinded enemy); and Radford, *supra* note 50, at 8 ("[Anti-optic laser] weapons are more likely to blind so that the killing can be [made] easier. The whole point of laser systems is to overwhelm enemy technology and render the other side more vulnerable.").

84. ICRC BLINDING WEAPONS, *supra* note 13, at 333 (noting U.S. simulations involving anti-optic lasers, one in which a squadron of untrained pilots attempting to reach a laser-defended target were lost, and another involving tank crew blindings). See also BLINDING LASER WEAPONS, *supra* note 6, at 12-13 (noting that enemy forces would be "sitting ducks" after being disabled with sub-lethal weapons; also citing one U.S. Defense Department consultant as stating that after sub-lethal weapons have been used to incapacitate enemy forces, troops would "go in with conventional weapons and destroy them") (emphasis added) and at 27 (reasoning that after being blinded, an enemy soldier would be easy prey and be helpless to avoid danger, so that anti-optic lasers may "have the effect of increasing mortality rates").

As a noteworthy aside, the blinding hazards posed by lasers has had an effect on the world of civil aviation. Complaints voiced by numerous airline pilots over temporary dazzling by laser shows for entertainment, particularly in the Las Vegas area, have recently led to FAA bans on use of such lasers near aircraft flight paths. See generally Alan Staats, *Las Vegas Lasers Shut Down*, FLIGHT INT'L, Jan. 3, 1996, at 11; William B. Scott, *Southwest Pilot Injured by Laser*, AVIATION WK. & SPACE TECH., Nov. 20, 1995, at

Further, life on a modern battlefield, even before the advent of the anti-optic laser, is desperate, nasty, brutish, and short. The life expectancy of the modern infantryman in extended periods of combat can be measured in terms of days, if not merely hours or minutes.⁸⁵ Suppose that a soldier has been blinded in combat. That soldier's ability to escape the battlefield without further injury, to signal intentions to surrender, or to get medical help has now been effectively eliminated. After one has been blinded, where can one turn to seek aid or to avoid the menaces posed by mines, tanks, snipers, or the myriad other threats of the battlefield? The psychological effects of blinded soldiers on their comrades may also be extremely profound.⁸⁶ Such concerns would also apply to civilians, medics, clergy, or other non-combatants who may be blinded by anti-optic lasers and left to survive with their own meager resources in the midst of a battle. While many wounded soldiers do not escape the battlefield, the likelihood that blinded casualties of anti-optic lasers may be wounded again or may be killed may be greater than many of those wounded by conventional arms.⁸⁷

92; John Hiscock, *Travel: Las Vegas Lasers "Blind" Pilots*, DAILY TELEGRAPH, Oct. 15, 1994, at 31.

85. See generally SHELDON M. COHEN, *ARMS AND JUDGMENT* 30-33 (1989) (citing casualty figures for several U.S. infantry divisions during the heaviest fighting of the Second World War in Europe, with one 15,000-soldier infantry division having all of its subordinate units "wiped out" and replaced three times in six weeks and estimating that an infantryman in that particular division "could expect to last fourteen days before becoming a casualty"); KEEGAN, *supra* note 1, at 328-29 (discussing generally the risks faced by troops on the modern battlefield).

86. *Hand-Held Lasers*, *supra* note 33, at 71:

When a soldier suddenly becomes more or less blinded, it will be difficult to convince others to observe the enemy if they know that there is a substantial risk of being blinded. While it may be fairly easy to ignore a dead body, it is not easy to ignore a soldier who can still communicate and get around but is unable to function further . . . or only at a very low level of efficiency.

The psychological effects of blinding casualties on the uninjured can unnerve even battle-hardened veterans, like the First World War poet and British officer Wilfred Owen, writing here of a shell-blinded sentry:

We dredged [the wounded sentry's body] up, for killed, until he whined
 "O sir—my eyes,—I'm blind—I'm blind—I'm blind."
 Coaxing, I held a flame against his lids
 And said if he could see the least blurred light
 He was not blind; in time he'd get all right.
 "I can't," he sobbed. Eyeballs, huge-bulged like squids',
 Watch my dreams still . . .

Wilfred Owen, *The Sentry*, in *FIRST WORLD WAR POETRY*, *supra* note 2, at 198-99.

87. One may also conclude that the ability of anti-optic lasers to create permanent blindness may provide another extremely sinister threat to international law. For those troops, guerrilla forces or rogue regimes that are prone to the commission of atrocities or that adopt a "take-no-prisoners" approach to treatment of captured foes, anti-optic lasers provide an unfortunate mechanism to enable such forces to dispose of potential witnesses to violations of the laws of warfare and human rights. Considering the virulence of so many recent conflicts, particularly those with ethnic or religious overtones—Chechnya and Bosnia, for instance, or Iraq's campaigns against its Kurdish minority—in which international law regarding war crimes has been abused, this may be a distinct possibility. See *infra* notes 93-96 and accompanying text (discussing the potential for pariah nations to acquire and use anti-optic lasers).

C. The Implications of the Potential Spread of Anti-Optic Lasers as “Non-Lethal” Weapons

While some may claim that the possible spread of anti-optic lasers may deter future conflicts, this does not seem to be a reasonable assumption. In the hierarchy of deterrence, the anti-optic laser would provide little or no deterrent effect.

The credibility of traditional weapons of deterrence—whether battleships in pre-1914 naval strategy, or modern weapons of mass destruction⁸⁸—rests in large part on the assumption that no enemy would willingly use such armaments for fear of inviting retaliation and unacceptable levels of destruction. The anti-optic laser, however, is not such a weapon. It is presently more like a rifle or machine gun in that it can more effectively target *individuals*, rather than having the widely destructive effects of nuclear weapons. The technology necessary to produce anti-optic lasers is also more readily available than that necessary to produce missiles and other weapons of mass destruction.⁸⁹ It can therefore be expected that the anti-optic laser’s deterrent value would be slim to nil (at least against western-style forces who could just as easily have and use such weapons).

Further, categorizing anti-optic lasers as “non-lethal” weapons may, perversely, make the use of lethal weapons more likely. The assumption may be made that because a weapon is “non-lethal,” it is harmless, so that customary social, moral and legal boundaries restricting the use of lethal weapons can be more readily crossed. However, it may be disingenuous to describe the anti-optic laser as a “non-lethal” weapon just because such weapons do not immediately inflict death or obvious wounds on its targets.⁹⁰ Sub-lethal weapons are still weapons. Because their use may actually lower the threshold of violence, their use may lead, perversely, to

88. See generally JOHN KEEGAN, *THE PRICE OF ADMIRALTY* 103-06 (1989); ROBERT L. O’CONNELL, *SACRED VESSELS: THE CULT OF THE BATTLESHIP AND THE RISE OF THE U.S. NAVY* 7 (1991) (discussing battleships and fleets as early models of deterrence); MICHAEL WALZER, *JUST AND UNJUST WARS* 269-74 (1977) (discussing generally nuclear deterrence).

89. See generally Jack H. McCall, Jr., *The “Inexorable Advance of Technology?”: American and International Efforts to Curb Missile Proliferation*, 32 *JURIMETRICS J.* 387 (1992) (discussing effects of international controls and export regimes in curbing or halting ballistic missile development programs in various nations); W. SETH CARUS, *BALLISTIC MISSILES IN THE THIRD WORLD* 64 (1991) (discussing high costs of ballistic missile research, development, and production programs, with one specific missile program’s costs averaging \$8 million per missile, and concluding that “[m]ost Third World countries will have difficulty devoting such large amounts of money to projects of this sort.”).

Many reports indicate that anti-optic lasers may be more cheaply procured than both weapons of mass destruction and also fairly basic conventional arms: “[o]nce these small laser weapons are produced on a large scale, they will probably cost less than an ordinary rifle.” Cook, *supra* note 42, at 17A (citing the head of the University of London’s Department of Ophthalmology).

90. See *supra* notes 83, 84 and accompanying text. See *supra* note 8 (describing “non-lethal” weapons as being more appropriately called “sub-lethal” armaments because death may still occur under certain circumstances by use of such devices).

acts of greater violence.⁹¹ Moreover, in the case of anti-optic lasers, most discussions of their tactical role on the battlefield assume that they will be used alongside traditional, lethal arms.⁹²

Finally, it is foolish to assume that anti-optic lasers will be restricted to use by traditional governments and armies, among whom concepts of deterrence and international laws governing warfare might exert some moderating influence. The spread of such weapons (partly due to the growth of laser technology and its decreasing cost) will likely result in their acquisition by rogue regimes, terrorists or criminal groups; in fact, such efforts have already occurred.⁹³ This spread has historically been the case for weapons ranging from firearms (e.g., semi-automatic and automatic guns)⁹⁴ to the recent attempts by a Japanese religious sect to acquire and use weapons of mass destruction.⁹⁵ There is absolutely no reason to believe that anti-optic lasers would not be acquired by terrorist or criminal groups and that they would not be used solely against soldiers, but also against civilians, within the next twenty to thirty years.⁹⁶

Instead of being merely a non-lethal panacea for defense planners, the potential spread of the anti-optic laser opens a Pandora's box that makes the modern battlefield a vastly more deadly place than it already was. The

91. See, e.g., *Gentler Warfare on the Way*, *supra* note 55, at 33A (citing one expert as stating: "Making it easier to contemplate action might tempt countries to jump in too quickly. It might lower the threshold for conflict, which would then invite conventional retaliation from the other side. This might not have happened without the temptation of high-tech non-lethal [weapons].").

92. See *supra* notes 83, 84 and accompanying text.

93. See U.S. LASERS, *supra* note 6, at 3 (noting the dangers of potential spread of tactical lasers to extremists, terrorists, or guerilla groups); ICRC BLINDING WEAPONS, *supra* note 13, at 347 (summarizing discussions among ICRC conference participants as to the threats posed to civilian populations if such weapons fell into the hands of terrorists and criminals); Evans, *supra* note 67, at 20 (stating that "it would be difficult to prevent [anti-optic lasers] from falling into the hands of terrorists and criminals" as such devices proliferate; *Ban on Anti-Eye Lasers the Right Move*, AVIATION WK. & SPACE TECH., Oct. 2, 1995, at 70 (noting that "[c]heap, small anti-eye lasers could become a weapon of choice for less-developed countries and terrorists").

94. For instance, one can consider popularity of the submachine gun—originally a purely military weapon—among gangsters in the 1920s. In a more current vein, the proliferation of cheap and readily available Chinese-made SKS and AK-47 semiautomatic assault rifles, originally manufactured for the military as fully automatic weapons, during the 1990s, and reports linking their usage in violent crimes, led in part to the placing of an import ban on such weapons by the Clinton administration in 1994. See generally Radford, *supra* note 50; Paul F. Horvitz, *U.S. Ends Link to Rights, China Keeps Trade Status*, INT'L HERALD TRIB., May 27, 1994, available in LEXIS, Nexis Library, Curnws File; Carolyn Skorneck, *Clinton Ban on Chinese Firearms Locks Out Popular Semi-automatic Rifle*, A.P., May 26, 1994, available in LEXIS, Nexis Library, Curnws File.

95. The Aum Shinrikyo cult's efforts to produce the nerve gas sarin, as well as to acquire other armaments, were well on their way to success, according to recent reports from the trials of several of its leaders. The testimony of several Aum Shinrikyo leaders cited the sect's attempts to break into defense industry facilities to obtain documents relating to laser weapons. See, e.g., BLINDING LASER WEAPONS, *supra* note 6, at 2, 19; *Tokyo Court Gives Ex-Cultist 8 Months For Aiding Fugitive*, MAINICHI DAILY NEWS, Nov. 30, 1995, at 18, available in LEXIS, News Library, Curnws File.

96. See generally U.S. LASERS, *supra* note 6, at 3; BLINDING LASER WEAPONS, *supra* note 6, at 32; ICRC BLINDING WEAPONS, *supra* note 13, at 346, 347.

following section will explore potential legal responses to the development and use of the anti-optic laser, and will consider the arguments surrounding the legality of such weapons.

II. International Law and the Possible Legal Parameters on the Use of Tactical Anti-Optic Lasers

A fundamental purpose of the law of war is to mitigate the suffering and damage caused by armed conflict to the greatest extent possible without unduly restricting the legitimate application of force to achieve the purpose of war.⁹⁷

A. The General Principles of International Law of Armed Conflict Relevant to the Legality of Anti-Optic Lasers

As a weapon that is potentially subject to international regulation, the legality of anti-optic lasers must be considered under existing international law relating to the usage of weapons that tend to be indiscriminate or that tend to cause unnecessary suffering. Certain weapons may be considered to be indiscriminate or "blind" weapons because they are inherently incapable of distinguishing between combatants (legitimate targets) and non-combatants.⁹⁸ Present models of anti-optic lasers, with their fairly narrow beams, would likely be used more like rifles or other "direct-fire" weapons that must be aimed at individual targets.⁹⁹ The development of an anti-optic laser that could generally scan large portions of a battlefield and blind large numbers of persons may tend to establish such a type of laser as an indiscriminate weapon. Instead, legal critiques of anti-optic lasers have focused on whether such weapons are militarily necessary¹⁰⁰ or inflict unnecessary suffering or superfluous injury¹⁰¹ under international agreements or under the dictates of custom, humanity, and the public conscience.¹⁰² We shall now explore each of these key legal theories governing legality of lasers and other weapons.

97. Robblee, *supra* note 35, at 109 (citing Department of State Report).

98. See, e.g., MORRIS GREENSPAN, *THE MODERN LAW OF LAND WARFARE* 362-63 (1959); Burris M. Carnahan, *The Law of Land Mine Warfare: Protocol II to the U.N. Convention on Certain Conventional Weapons*, 105 *MIL. L. REV.* 73, 75-76 (1984) (discussing land mines in context of international law governing indiscriminate weapons); McCall, *supra* note 4, at 258.

99. See *supra* text accompanying note 89 (comparing anti-optic lasers to rifles or machine guns in their anti-personnel roles). See also ICRC *BLINDING WEAPONS*, *supra* note 13, at 72 (reasoning that international law prohibitions against indiscriminate weapons would generally not apply to lasers "since most battlefield laser weapons are likely to be capable of very precise targeting," and concluding prohibitions on perfidy or treacherous methods of war would likewise tend not to apply). For more on the laws of war applicable to treachery or perfidy, see Robblee, *supra* note 35, at 123-24.

100. See *infra* notes 114-20 and accompanying text.

101. See *infra* notes 122-31 and accompanying text.

102. *BLINDING LASER WEAPONS*, *supra* note 6, at 23.

1. The Principles of Proportionality, Military Necessity and Unnecessary Suffering

(a) A General Overview

As a matter of established international law, military necessity¹⁰³ “must yield to humanitarian considerations when weapons or methods of waging war cause unnecessary suffering or superfluous injury.”¹⁰⁴ Related to this rule, which was most recently codified in the 1977 Additional Protocol I to the Geneva Conventions of 1949¹⁰⁵ and which is regarded as a standing principle of customary international law,¹⁰⁶ is the principle of proportionality, which is itself akin to the military principle of economy of force.¹⁰⁷ Such fundamental principles of the law of armed conflicts apply equally to the treatment of combatants and non-combatants.

The principle of proportionality dictates a “least harmful alternative” approach:¹⁰⁸ the “loss of life and damage to property must not be out of proportion to the military advantage to be gained.”¹⁰⁹ Under the economy-of-force principle, a military commander must use the minimum amount of force necessary to achieve the intended mission; thus, “no greater force should be employed than is necessary to achieve the objectives toward which it is directed.”¹¹⁰ The proportionality rule limits the level of acceptable violence in armed conflict for humanitarian and legal purposes, while economy of force achieves the same end for purely practical, military reasons.¹¹¹ For both rules, a balancing test between military necessity for the

103. See *infra* text accompanying note 114 (defining military necessity).

104. BLINDING LASER WEAPONS, *supra* note 6, at 22. See *infra* notes 123-31 and accompanying text (defining unnecessary suffering or superfluous injury).

105. *Id.* at 22 & n.137 (citing Protocol I to Diplomatic Conference on Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflict, adopted June 9, 1977, opened for signature, Dec. 12, 1977, U.N. Doc. A/32/144, 16 I.L.M. 1391, 1409, at art. 35(2) [hereinafter Geneva Convention Protocol I]. “It is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering.” *Id.* art. 35(2).

106. BLINDING LASER WEAPONS, *supra* note 6, at 23. See generally INTERNATIONAL COMMITTEE OF THE RED CROSS, COMMENTARY ON THE ADDITIONAL PROTOCOLS OF 8 JUNE 1977 TO THE GENEVA CONVENTIONS OF 1 AUGUST 1949, at 390-91 (1987) [hereinafter ICRC COMMENTARY].

107. See *infra* text accompanying note 110 (defining economy of force).

108. BLINDING LASER WEAPONS, *supra* note 6, at 23.

109. DEPARTMENT OF THE ARMY, FM 27-10: THE LAW OF LAND WARFARE para. 41, at 19 (1956) [hereinafter FM 27-10]; Robblee, *supra* note 35, at 106 (noting that proportionality requires that a specific type of weapon’s foreseeable effects “must not be out of proportion to the foreseeable advantages expected to be gained pursuant to its use”); COHEN, *supra* note 85, at 39-41. The proportionality rule, while historically applicable solely to combatants, has more recently been held to apply to non-combatants as well. THE ARMS PROJECT OF HUMAN RIGHTS WATCH AND PHYSICIANS FOR HUMAN RIGHTS, LANDMINES: A DEADLY LEGACY 268 & n.19 (1993).

110. Robblee, *supra* note 35, at 113. See generally WALZER, *supra* note 88, at 130.

111. Robblee, *supra* note 35, at 113. Note, however, that the principles of economy-of-force and proportionality may also directly contradict another military principle, that of mass. Mass is the precept that a commander must “mass” all forces available to crush an enemy decisively, with the least amount of casualties resulting to the commander’s forces. See generally DEPARTMENT OF THE ARMY, FM 100-1: OPERATIONS 174 (1986) (discussing mass as the concentration of superior combat power at “the decisive place and

weapon or method of warfare, on the one hand, and for the humanitarian toll (under proportionality)¹¹² or the logistical cost (under economy of force), on the other, is applied to evaluate the permissibility or utility of the particular weapon or means of warfare.

Under international law, military necessity is a utilitarian concept that restricts violence in combat to the minimum level necessary to achieve the success of a particular military operation. Excessive violence or destruction in seizing an objective cannot be justified by military necessity.¹¹³ Military necessity is similarly determined by reference to a two-pronged test: (a) whether the military action in question is one that is deemed essential to achieve the goal of defeating the enemy, and (b) whether the action in question is also one in accordance with the laws and customs of warfare.¹¹⁴ While military necessity may authorize the wounding and kill-

time"). The doctrine of mass was crucial to the U.S. and coalition defeat of the Iraqi army in 1992 and lies at the heart of the so-called "Powell doctrine." I am indebted to my colleague John Lucas for making this point to me.

While beyond the limited scope of this article, I am also aware that some may argue that it is "more" proportional to use massive (even potentially excessive) military power to intimidate and rapidly destroy an enemy, instead of using smaller military forces closely tailored to achieve specific, proportional ends. While this argument must be addressed in another forum, I note in passing that it is a position which is—if taken to extremes—inherently capable of exceeding the bounds of international law. One need not think too long to find many historical examples of military action premised on this view, which have been subject to widespread condemnation (e.g., saturation bombing of industrial cities), not only in retrospect but also at the time such actions were taken. See, e.g., MAX HASTINGS, *BOMBER COMMAND* 170-78 (1987) (noting various examples of dissent among the British press, clergy, and political leadership as to almost-unrestricted bombing of German cities).

112. See, e.g., Judith Gail Gardam, *Proportionality and Force in International Law*, 87 AM. J. INT'L. L. 375, 391, 397-98, 402-03 (1993) (noting that the balance is to be struck between accomplishment of a military objective and the cost in terms of lives taken to achieve that objective). But see Bernard L. Brown, Note, *The Proportionality Principle in the Humanitarian Law of Warfare: Recent Efforts at Codification*, 10 CORNELL INT'L L.J. 134, 147-51 (noting enforcement and definitional problems involved in proportionality and suggesting that a standard, unified definition be adopted by international agreement).

113. See, e.g., *BLINDING LASER WEAPONS*, *supra* note 6, at 24 & nn.146-49 (citing William Gerald Downey, *The Law of War and Military Necessity*, 47 AM. J. INT'L L. 251, 254 (1953), as defining military necessity as "an urgent need, admitting of no delay, for the taking by a commander of measures, which are indispensable for forcing as quickly as possible the complete surrender of the enemy by means of regulated violence, and which are not forbidden by the laws and customs of war"); Robblee, *supra* note 35, at 114 (citing General Order No. 100, the first modern codification of the law of warfare, as defining military necessity as "the necessity of those measures which are indispensable for securing the ends of war, and which are lawful according to the modern law and usages of war"). See also WALZER, *supra* note 88, at 129 (citing Henry Sidgwick that "[i]n the conduct of hostilities, it is not permissible to do 'any mischief which does not tend materially to the end [of victory], nor any mischief of which the conduciveness to the end is slight in comparison with the amount of the mischief,'" but noting that under this purely utilitarian view, "[a]ny act of force that contributes in a significant way to winning the war is likely to be called permissible."); William J. Fenrick, *The Role of Proportionality and Protocol I in Conventional Warfare*, 98 MIL. L. REV. 91, 93 (1982).

114. See, e.g., *BLINDING LASER WEAPONS*, *supra* note 6, at 24 (reasoning that "the legal definition of military necessity is restrictive. In terms of the necessity of a particular weapon, a decisive military advantage must be identified, and the degree of injury and

ing of enemy soldiers and the destruction of property, it “does not admit of cruelty . . . [or] any act of hostility which makes the return to peace unnecessarily difficult.”¹¹⁵ This principle of military necessity was also explicitly adopted by the 1868 Declaration of St. Petersburg,¹¹⁶ which, in the first successful international agreement prohibiting certain weapons tending to cause unnecessary suffering,¹¹⁷ provided that:

[T]he only legitimate object which states should endeavor 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.*¹¹⁸

Military necessity is no defense if the military actions taken otherwise violate existing international law and custom.¹¹⁹

Further, under Additional Protocol I to the Geneva Conventions of 1949, the determination of whether a new weapon or means of warfare qualifies as a military necessity is not to be left merely to a *post hoc, ergo propter hoc* determination: parties to the convention are obligated to determine to what degree its use would violate Additional Protocol I or any other rule or custom of international law.¹²⁰ While it has ratified neither Additional Protocols I nor II to the Geneva Conventions of 1949, the

suffering to people, including combatants, must be considered”); Robblee, *supra* note 35, at 131 (noting that the “military advantage determination . . . entails more than a determination that mere benefit will accrue to the user of the weapon”); ICRC COMMENTARY, *supra* note 106, at 684 (reasoning that the military advantage to be achieved must be “substantial and relatively close” to be acceptable under the military necessity principle, and that “hardly perceptible” advantages should be disregarded). *But see* COHEN, *supra* note 85, at 40 (reasoning that the utilitarian calculus at work in the military necessity principle merely requires a modest degree of military benefit to be obtained by the harm to be inflicted, and that the principle “allows inflicting a great deal of harm to obtain a modest benefit”); Letter from Brig. (Ret’d) Patrick M. Blagden, Dep’t of Peacekeeping Operations, U.N., to the author (July 1, 1994) (on file with author) (noting that—at least in the context of the practicalities involved in limiting land mine warfare under Protocol II to the Conventional Weapons Convention—the principle of military necessity is “almost meaningless because the worth of the [persons affected, particularly civilians] is not considered by most military/quasi-military commanders”).

115. Robblee, *supra* note 35, at 114 n.116. *See also* FM 27-10, *supra* note 109, para. 41, at 19-20 (requiring that “loss of life and damage property must not be out of proportion to the military advantage to be gained”) and WELLS, *supra* note 35, at 96 (citing FM 27-10’s provisions).

116. Declaration of St. Petersburg 1868, 1 AM. J. INT’L L. 95-96 (Supp. 1907) [hereinafter St. Petersburg Declaration].

117. In the case of the Declaration of St. Petersburg, the proscribed weapon was explosive projectiles weighing less than 400 grams (approximately 14 ounces). *See id.*; Robblee, *supra* note 35, at 103.

118. St. Petersburg Declaration, *supra* note 116, at 96-97 (emphasis added). *See also* Robblee, *supra* note 35, at 114-15. BLINDING LASER WEAPONS, *supra* note 6, at 28.

119. FM 27-10, *supra* note 109, para. 3(a), at 5.

120. In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party.

United States is required by its domestic law to perform such a review for its new weapon acquisitions before their deployment in combat.¹²¹

Following the Declaration of St. Petersburg, numerous other international treaties and agreements have sought to limit the use of weapons which tend to cause “unnecessary suffering or superfluous injury,”¹²² as reflected in Article 35(2) to 1977’s Additional Protocol I forbidding the use of such weapons or methods of combat.¹²³ The expression “unnecessary suffering or superfluous injury”—two subtly different English translations of the French expression *maux superflus* (the phrase used in the original text of Article XXIII(e) of the 1899 Hague Regulations)—conveys the essence of this principle. That is, it is illegal to use weapons that inflict suffering, injury, or damage to property which is unnecessary and disproportionate to the military task at hand.¹²⁴ This principle similarly applies

Geneva Convention Protocol I, *supra* note 105, 16 I.L.M. at 1409, art. 36.

121. Such a review is required by Department of Defense (DoD) Instruction 5000.2, under which each branch of service’s Judge Advocate General is required to conduct a legal review and issue an opinion regarding the legality under international law of any new weapon meeting a military requirement of the Department of Defense to be introduced under the proponentcy of the particular branch of service. *See generally* U.S. LASERS, *supra* note 6, at 7 & n.23; BLINDING LASER WEAPONS, *supra* note 6, at 21 & n.127; Robblee, *supra* note 35, at 108 and WELLS, *supra* note 35, at 73 (citing DoD Instruction 5000.15, the predecessor to DoD Instruction 5000.2); *New DOD Instruction on Legality of Weaponry Under International Law*, THE ARMY LAWYER, Nov. 1974, at 25-26.

For a summary and critique of the U.S. Army Judge Advocate General’s opinion regarding tactical anti-optic lasers under this requirement of international law, see *infra* notes 195-205 and accompanying text.

122. *See, e.g.*, Convention With Respect to the Laws and Customs of War on Land, July 29, 1899, arts. XXIII(a), (e), 32 Stat. 1803, 1817, T.S. No. 403 [hereinafter 1899 Hague Convention]; Declaration Concerning Asphyxiating Gasses, 1 AM. J. INT’L L. 157 (Supp. 1907); Declaration Concerning Expanding Bullets 1899, 1 AM. J. INT’L L. 155 (Supp. 1907) [hereinafter 1907 Hague Declaration]; Geneva Convention Protocol I, *supra* note 105, art. 35(2), 16 I.L.M. at 1524; Conventional Weapons Convention, *supra* note 35, pmb.; *Respect for Human Rights in Armed Conflict*, G.A. Res. 2444, U.N. GAOR, 23d Sess., Supp. No. 18, U.N. Doc. A/7433 (1968).

123. Geneva Convention Protocol I, *supra* note 105, art. 35(2), 16 I.L.M. at 1408-09. For a critical review of the ICRC conferences leading up to the adoption of Additional Protocol I and a discussion of the U.S. position that the unnecessary suffering criterion of Article 35(2) was not met “until the suffering clearly outweighed the military advantage” to be gained, see Robblee, *supra* note 35, at 107-08, 118-121 (criticizing various nations’ recommendations of criteria to assess unnecessary suffering as too subjective for consistent application; discussing a six-factor approach focusing more on military necessity than on the nature of the injuries, which was advocated by the U.S. delegation to the ICRC-sponsored Lucerne Weapons Conference of 1974; and concluding that, under the U.S. position, “the best test of which weapons contravene the criterion of unnecessary suffering is the practice of states,” i.e., reliance on customary international law).

124. *See* R.R. Baxter, *Modernizing the Law of War*, 78 MIL. L. REV. 165, 180 (1978) (noting that the expressions *maux superflus* is best translated as “excessive harm,” not “superfluous injury” or “unnecessary harm”); Robblee, *supra* note 35, at 117-19 (discussing the interrelationship between the unnecessary suffering principle and the military necessity principle as requiring a comparison between the damage or suffering created by the weapon and its anticipated military advantage: “if the former is excessive when compared to the latter, then the weapon’s use is unlawful”).

Note, however, that at least one military commentator has argued that the unnecessary suffering/superfluous injury analysis should include the addition of the word

to methods and means of warfare. Not only may it categorically prohibit a particular weapon (e.g., expanding or “dum-dum” bullets¹²⁵), but it may also prohibit a weapon with a generally legitimate use that is capable of being used to inflict unnecessary suffering. For battlefield lasers in general, this aspect may have added importance “since it is not clear to what extent a battlefield laser may be put to different uses.”¹²⁶

The fact that a weapon inflicts extreme pain or severe injuries is not the determinative factor under this rationale. What is relevant is whether the injury or pain inflicted serves no vital military purpose (i.e., the injury or pain inflicted is not militarily necessary).¹²⁷ The length of time that a weapon places a soldier *hors de combat* (“out of combat”) is also relevant. Humanitarian law extending back to the Declaration of St. Petersburg “permits only that a soldier be put *hors de combat* for the duration of the conflict, and not for life-long incapacitation short of death;” the extent to which a weapon generally causes injuries other than permanently crippling ones is likewise relevant.¹²⁸

The analysis whether a weapon inflicts unnecessary suffering or superfluous injury essentially involves a “totality of the injury” approach. This includes the following for humanitarian criteria, coupled with a military necessity analysis: (1) the degree of physical pain inflicted; (2) the severity of the injury (physical and psychological) inflicted; (3) the incidence and likelihood of death, permanent damage, incapacitation and disfigurement (i.e., the *hors de combat* criterion); (4) the strain placed on medical systems; and (5) an analysis whether the weapon provides a “significant military advantage [i.e., the military necessity principle] [that] cannot be provided by another weapon” causing less suffering or injury.¹²⁹ The concept that

“clearly,” arguing that because the level of permissible violence in combat (and thus military necessity) depends on “the ebb and flow of the tactical situation . . . [the inclusion of the word ‘clearly’ is necessary to insure that a shared consensus may be more attainable in applying the legal standard.” Robblee, *supra* note 35, at 147.

125. See, e.g., WELLS, *supra* note 35, at 48-50.

126. ICRC BLINDING WEAPONS, *supra* note 13, at 73, 331 (noting that “[a] weapon may either inherently cause unnecessary suffering, and thus all use is prohibited, or it may cause such suffering in certain cases only and therefore these uses are prohibited;” also noting that the principle is violated if weapons or methods of warfare “needlessly aggravate the suffering of wounded men or render their death inevitable”).

127. *Id.*

128. BLINDING LASER WEAPONS, *supra* note 6, at 27. See also ICRC BLINDING WEAPONS, *supra* note 13, at 335, 338-39.

129. BLINDING LASER WEAPONS, *supra* note 6, at 24, 30; ICRC BLINDING WEAPONS, *supra* note 13, at 74-77, 79; Robblee, *supra* note 35, at 96, 118-19 (discussing U.S. recommended criteria, “less susceptible of quantification” focusing more on the military necessity of the weapon under review, namely the weapon’s effectiveness in performing various missions, its cost, its “effectiveness in providing security for friendly troops,” and the availability of alternative weapons, concluding that the “best test of which weapons contravene the criterion of unnecessary suffering is the practices of states,” i.e., customary international law, and discussing British recommendations similarly focusing on military necessity and the military requirements for the weapon).

The United States’ long-standing position on many weapons considered to cause unnecessary suffering has been to focus on the customary international law aspects. Since 1956, the only weapons specifically identified by the Judge Advocate General of

the very brutality of a weapon may itself be the proof of its military effectiveness has been generally rejected under international law since the Declaration of St. Petersburg.¹³⁰ This raises the question of whether anti-optic lasers are legally defensible under these principles.

(b) As Applied to Anti-Optic Lasers

Under the first half of the balancing test associated with both the proportionality and economy-of-force principles, it is an open issue whether the anti-optic laser is legally defensible as a military necessity that is essential for achieving military objectives. Closer scrutiny, however, suggests that the anti-optic laser is by no means a military necessity.

As noted by various observers, the anti-optic laser apparently did not arise, unlike many new weapons advances, to meet any specific need. While generally characterized as a “defensive” weapon, its precise mission has not yet been clearly defined, nor has its funding been a high priority item in defense budgeting.¹³¹ Its only clearly stated mission appears to be the potential role of an anti-sniper device, in which case its use would clearly not be limited to destruction or jamming of electronics. It would be functioning solely as an anti-personnel weapon¹³² with dazzling or blinding of snipers the logical consequence, likely to be followed by the sniper’s death from engagement by conventional weapons.¹³³

In fairness, it may be argued that—even assuming anti-optic laser use is anti-personnel and not anti-equipment—highly selective use against snipers or terrorists may be, in a sense, *more* proportional than other options available to a commander. One can envision a situation in which terrorists or snipers barricade themselves in a tower or urban area. Rather than destroy a city block with conventional artillery or endanger the lives of large numbers of civilians or soldiers, might it not be preferable to use an anti-optic laser to dazzle the terrorists or snipers, with a relative degree of precision, and allow them to be overwhelmed with (relative) impunity? This is, of course, about the best argument in favor of anti-optic lasers, as well as other forms of non-lethal weapons, and admittedly, there is much appeal to such an argument.¹³⁴

the U.S. Army as causing unnecessary suffering under customary international law are all fairly archaic weapons—i.e., barbed lances, irregularly shaped bullets, glass-filled projectiles and bullets with scored or filed-off tips—some of which are not likely to be encountered in modern combat. See FM 27-10, *supra* note 109, para. 34, at 18. See also WELLS, *supra* note 35, at 69, 95.

130. ICRC BLINDING WEAPONS, *supra* note 13, at 75.

131. See generally BLINDING LASER WEAPONS, *supra* note 6, at 13, 30; ICRC BLINDING WEAPONS, *supra* note 13, at 332.

132. U.S. LASERS, *supra* note 6, at 8; BLINDING LASER WEAPONS, *supra* note 6, at 13 &

14. See also *supra* text accompanying note 22 (discussing French deployments of anti-optic lasers as anti-sniper weapons in Bosnia in 1995).

133. See *supra* text accompanying note 83 (discussing the use of conventional arms as follow-ups to anti-optic laser attacks).

134. It must be noted, however, that U.S. military thought has not yet fully evolved on the use of anti-optic lasers to the point that any established doctrine has been set. Nevertheless, with the greater likelihood that U.S. forces will be engaged in fewer “set-piece”

Nevertheless, such an anti-personnel role would belie claims that anti-optic lasers would be used purely for electro-optical jamming, with harmful consequences to the observer merely an unintended consequence of use. Again, this reveals the anti-optic weapon's limited role as a stand-alone "non-lethal" weapon. Furthermore, from a pragmatic military standpoint, the apparent need to use conventional weapons to "finish the job" against the blinded enemy calls into question whether the anti-optic laser is the most economical use of military force, if other weapons are deemed necessary to complete the mission. Either way, the tendency exists for such use of lasers to cause unnecessary suffering and superfluous injury.¹³⁵

Other, less harmful alternatives of proven effectiveness already exist that may not be fully supplanted by anti-optic lasers. Lasers are ineffective in poor weather because heavy precipitation and fog tend to dissipate the beam's effectiveness, and laser beams cannot be lobbed around a building corner or shot over a hill.¹³⁶ Various weapons already exist, however, which provide temporary dazzling and stunning effects without causing long-term blinding. Such weapons, including "flash-bang" explosives and stun grenades, have been used effectively worldwide by police, anti-terrorist and special forces units for many years. These devices may not have the range and accuracy that anti-optic lasers offer, yet the consequences of their use provide relatively less harmful alternatives to persons. Also, unlike lasers, such devices still retain some effectiveness in inclement weather. In sum, under the first half of the proportionality test, the anti-optic laser does not appear to be a military necessity.

Similar concerns arise in applying the second half of the balancing test (i.e., the consideration of various humanitarian and social concerns). Undoubtedly, permanent injury can result from the use of anti-optic lasers, but would infliction of such injuries amount to the "useless aggravation of suffering" or "superfluous injury" under international law? The answer appears to be yes, as demonstrated by the following:

- (1) Permanent blinding by lasers generates a relatively intense degree of physical pain, as the retina and its accompanying blood vessels are burned (although many other existing conventional weapons can, of course, cause similarly highly painful injuries, including blindness);¹³⁷
- (2) Blindness involves a high degree of both physical and psychological long-term trauma to the individual;¹³⁸

wars and battles (e.g., the World Wars, Korea, and Operations Desert Shield/Desert Storm), and will likely be involved in more anti-insurgency/counter-terrorist and peace-keeping operations (e.g., Panama, Bosnia, Rwanda, Haiti, and Somalia), the need for non-lethal weapons may become much greater as the risks to urban areas and civilians grow exponentially. I am indebted to Colonel Donnie George, U.S. Army, for discussing this point and its ramifications with me.

135. Cf. BLINDING LASER WEAPONS, *supra* note 6, at 27.

136. See generally ICRC BLINDING WEAPONS, *supra* note 13, at 332.

137. Cf. ICRC BLINDING WEAPONS, *supra* note 13, at 335-36 (comparing discussions and disagreements among various experts and participants in an ICRC committee as to the results of laser-versus-conventional arms' wounding).

138. *Id.* at 26.

(3) The potential for permanent damage and incapacitation resulting from anti-optic laser usage is great (particularly if such weapons are equipped with additional intensifying lenses like those marketed for the ZM-87¹³⁹), and the high degree of inevitability of such permanent injuries is an outright violation of the *hors de combat* principle.¹⁴⁰

(4) While difficult to establish to a precise degree, the risk of death following infliction of injuries by such lasers certainly appears to be heightened significantly, even if death is not made inevitable;¹⁴¹ and

(5) The results of permanent laser blinding in large numbers would place massive, long-term strains on the medical and social structures of any nation, and might possibly handicap peace negotiations or the implementation of normalized relations between combatants after the end of hostilities.¹⁴²

When the humanitarian toll addressed above is combined with the failure of anti-optic lasers to create any significant military advantage, the inescapable conclusion is that the anti-optic laser is a weapon whose use will likely result in unnecessary suffering and superfluous injury. If such weapons are fielded and used in large numbers, this suffering may occur on a massive scale. While the injuries caused by anti-optic lasers may not be of a totally gratuitous nature,¹⁴³ the overall conclusion can only be that such suffering would be unnecessary in light of the alternative weapons available. Hence, under the proportionality principle, the legality of the anti-optic laser appears questionable at best, and, as such, the weapon should be regarded as one whose use would be contrary to international law.

2. *The Role of the Martens Clause*

The Martens clause provides an additional legal consideration. As embodied in the 1899 and 1907 Hague Conventions, Additional Protocol I, and the 1980 Conventional Weapons Convention,¹⁴⁴ this clause requires application of humanitarian customs and principles and “the dictates of public conscience” to address the rights of combatants and non-combatants alike in cases not expressly addressed by international agreement, in situations where such agreements may be unclear and, to the extent no such agreement provides guidance, to require any new technologies or methods of warfare to be analyzed under principles of custom, humanity and public conscience.¹⁴⁵

139. See *supra* text accompanying note 40.

140. ICRC BLINDING WEAPONS, *supra* note 13, at 335, 338; COHEN, *supra* note 85, at 40.

141. See *supra* text accompanying notes 88-90. See also ICRC BLINDING WEAPONS, *supra* note 13, at 79.

142. BLINDING LASER WEAPONS, *supra* note 6, at 32. See *supra* text accompanying notes 66-68.

143. See generally ICRC BLINDING WEAPONS, *supra* note 13, at 79.

144. 1899 Hague Convention, *supra* note 122, pmbl., 32 Stat. 1803, T.S. No. 403; 1907 Hague Declaration, *supra* note 122, pmbl., 36 Stat. 2277, T.S. No. 539; Geneva Convention Protocol I, *supra* note 105, 16 I.L.M. at 1397-98; Conventional Weapons Convention, *supra* note 35, 19 I.L.M. at 1524, app. A, pmbl.

145. BLINDING LASER WEAPONS, *supra* note 6, at 30-31.

(a) An Overview of the Martens Clause

As incorporated in various international agreements,¹⁴⁶ the Martens clause provides:

In cases not covered by [a particular agreement or protocol] or by other international agreements, civilians and combatants remain under the protection and authority of the principles of international law derived from established custom, from the principles of humanity and from dictates of public conscience.¹⁴⁷

Under the Martens clause, a weapon is illegal “if its effects are so contrary to considerations of humanity and the public conscience that it arouses widespread revulsion,” even if the weapon does not violate the unnecessary suffering or proportionality principles.¹⁴⁸

In addition to the customary international law component,¹⁴⁹ the “dictates of public conscience” are an additional consideration under the Martens clause. The extent to which the clause provides an independent legal basis for determining the illegality of a weapon (despite prior determinations of a valid military necessity for the weapon and that no unnecessary suffering results from its use) is open to dispute.¹⁵⁰ The Martens clause may be challenged as being vague and—because of its “public conscience”

146. See *supra* text accompanying note 144.

147. See, e.g., Geneva Convention Protocol I, *supra* note 105, 16 I.L.M. at 1396-97; Conventional Weapons Convention, *supra* note 35, 19 I.L.M. at 1524, app. A, pmbl.

148. ICRC BLINDING WEAPONS, *supra* note 13, at 77.

149. See generally Robblee, *supra* note 35, at 105 & n.70 (noting that, despite the failure of certain leading nations to ratify the 1899 and 1907 Hague Declarations—i.e., the United States and Britain—customary international law has essentially prohibited poison and expanding bullets “as a result of the practices of states in World War I in refraining from their use”).

150. Compare *id.* (noting that while the Martens clause “should not be viewed as laying down a separate general principle for judging the legality of weapons under existing law,” it nevertheless may provide a useful inspiration for certain situations, especially where the unnecessary suffering principle would not require complete prohibition of a weapon) with ICRC BLINDING WEAPONS, *supra* note 13, at 340-41 (noting differing views between various experts at the ICRC’s Second Roundtable of Experts on Battlefield Laser Weapons in April 1991 as to the application of the Martens clause), and BLINDING LASER WEAPONS, *supra* note 6, at 31 (arguing that, even if a weapon was not found illegal on grounds of unnecessary suffering, it should still be subject to illegality under the Martens clause because the clause itself is “generally considered customary law” and because it is a rule of *jus cogens*, i.e., a peremptory and fundamental norm of standing international law; and reasoning that “lawyers do not necessarily make the best policy decisions, so the values of humanity and the public conscience also have to be taken into account”)(citing ICRC COMMENTARY, *supra* note 106, at 345); and Robblee, *supra* note 35, at 124-25 (noting “a wide divergence of opinion” among experts at the 1974 Lucerne Weapons Conference, a prelude conference to the Conventional Weapons Convention, as to the feasibility of using the Martens clause as a criterion for judging the legality of weapons; in arguing against the validity of the Martens clause as a separate legal principle, observing that, “[t]he fundamental difficulty with accepting the public opinion criterion is that it is more appropriate as a political consideration than as an independent legal criterion regulating weaponry” in that if a nation has chosen to go to war it will be “unlikely to refrain from using its most effective weapons” simply because world public opinion is against it; and concluding that the public conscience portion of the Martens clause violates the principle of military necessity).

component—overly subject to fluctuations in public opinion. It is clear, however, that international custom and public opinion played a significant role in the proscription of certain weapons, despite what the detractors of the Martens clause may say about its separate validity or effectiveness as a legal principle.¹⁵¹

(b) The Martens Clause Applied to Anti-Optic Lasers

Prior to the advent of Protocol IV,¹⁵² and assuming for the moment that Protocol IV fails to gain a level of international acceptance necessary to establish its place as enforceable international treaty law, the Martens clause would provide an additional tool by which to judge the legality of anti-optic lasers. As an entirely new class of weapon, no existing international agreement clearly addresses the legality of anti-optic lasers or blinding methods of warfare, much as was the case with the 1925 Geneva Gas Protocol. In the case of the latter protocol, the Martens clause provided one basis by which the “horrific and barbarous nature” of poison gas and chemical warfare was judged under international custom and “the dictates of humanity” to be worthy of international action.¹⁵³

Various commentators have noted that the informed members of the international community who have studied anti-optic lasers tend to view them as “horrific” weapons, comparing such lasers to phosgene and mustard gas, two poison gases extensively used by Germany and the Allies during the First World War and subsequently proscribed under the 1925 Geneva Gas Protocol.¹⁵⁴ Further, because no army has yet relied on anti-optic lasers as a critical addition to its arsenal, the Martens clause would tend to prohibit such “horrific” weapons, “since such a ban does not require armies to give up weapons on which they have come to rely.”¹⁵⁵

151. See generally *BLINDING LASER WEAPONS*, *supra* note 6, at 31 (discussing the role of the Martens clause in post-First World War analyses of the illegality of poison gas, leading to the 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gasses, of Bacteriological Methods of Warfare, which analyses focused on gas’ “horrific and barbarous nature . . . rather than a careful appreciation of [poison gas] legality under the existing rules”); Robblee, *supra* note 35, at 105 & n.70 (discussing role of customary law in proscribing the use of poison and dum-dum bullets).

152. See *infra* Part III.B (discussing Protocol IV).

153. See *BLINDING LASER WEAPONS*, *supra* note 6, at 30-31.

154. See, e.g., *id.* at 31-32 (noting that “[e]xperts . . . were largely in agreement that laser weapons and methods of warfare that cause blindness would run counter to the requirements of established custom, humanity and public conscience,” while others noted that their nations’ individual civilians “would find the use of blinding as a method of warfare horrific”); ICRC *BLINDING WEAPONS*, *supra* note 13, at 336-37. See also VALERIE ADAMS, *CHEMICAL WARFARE, CHEMICAL DISARMAMENT* 49 (1990) (noting generally that “the mainstream of [post-World War I] contemporary public opinion” was in favor of the prohibition of gas warfare).

One may also compare anti-optic lasers with two other forms of now-proscribed chemical weapons, white phosphorous grenades and napalm, which can also leave hideous, long-term injuries and which are often used to inflict injuries on groups of persons rather than mere individuals.

155. *BLINDING LASER WEAPONS*, *supra* note 6, at 31.

Because the Martens clause would tend not to abolish or restrict nations' use of "weapons on which they have come to rely" and because of its emphasis on good faith actions, the Martens clause would not prohibit or restrict use of other long-established laser weapons, such as rangefinders or target designators, to the extent those weapons are used for their intended purposes. Indeed, because such lasers can greatly improve the accuracy of conventional explosives and missiles, laser rangefinders and designators have a high military utility and may benefit humanitarian and international law by lessening the odds of "collateral damage," i.e., unintended harm to civilian or non-combatants.¹⁵⁶ To the extent such devices can be used as anti-personnel devices and because of their innate capability to blind, however, the Martens clause's considerations would similarly act to prohibit such usage by providing an additional humanitarian check and balance.¹⁵⁷

B. Protocol IV: The First International Response to Anti-Optic Laser Warfare

At the behest of the ICRC, two roundtables of experts on battlefield lasers were conducted in June 1989 and April 1991, and two working groups of experts met from May through June and in November 1990.¹⁵⁸ From these meetings the groundwork for international consideration of the legality of anti-optic lasers was laid. At the conclusion of the April 1991 conference, the various options for future international regulation were identified as: (1) a total prohibition on the use of all or some types of anti-optic or anti-personnel lasers; (2) prohibition of only certain uses of such weapons (e.g., banning their use against persons or against infantry); (3) prohibition of the use of weapons which have certain effects, without identifying the classes of weapons by name, the method used in Protocol I of the Conventional Weapons Convention (e.g., "[t]he use of weapons the primary effect of which is to damage eyesight is prohibited,"¹⁵⁹ which language would

156. See, e.g., Abley, *supra* note 46 (citing Stephen Goose of the Human Rights Watch Arms Project: "Lasers can do good on a battlefield. They can enhance the accuracy of weapons; they can decrease collateral damage to civilians.").

157. See BLINDING LASER WEAPONS, *supra* note 6, at 21, 32 (noting that the U.S. Army's Judge Advocate General has never issued a separate legal opinion under DoD Instruction 5000.2 on the legality of laser designators and rangefinders; this may suggest that such devices were not, and are not, viewed as being primarily "weapons" by U.S. forces). See *supra* note 121 (concerning DoD Instruction 5000.2 and its requirements).

But see Robblee, *supra* note 35, at 125 (arguing against application of the Martens clause on the grounds that its consideration of "public opinion" is merely a "political consideration" rather than a pre-existing, independent legal criterion and as such, where a nation has already decided to go to war and use all weapons at its disposal, the Martens clause's reliance on public opinion is "immaterial"). In my view, this position is erroneous. For instance, to the extent that the Martens clause was clearly invoked by the drafters of the 1925 Geneva Gas Protocol as grounds for providing for international action against gas warfare arising from the First World War's use of such weaponry, public opinion was most certainly "material."

158. See ICRC BLINDING WEAPONS, *supra* note 13, at 19-20, 83-88, 321, 353-60.

159. *Id.* at 353.

tend to cover a wide range of weapons besides lasers but which would also create interpretive difficulties in resolving whether the "primary" effect of any given system is to blind); and (4) a prohibition on certain actions without referring to a given weapon's characteristics (e.g., "[b]linding as a method of warfare is prohibited;" "[b]linding as a method of rendering a combatant *hors de combat* is prohibited").¹⁶⁰ Participants considered the available options for such regulation as including the structuring of an independent treaty on the issue, the addition of a new protocol to the 1980 Conventional Weapons Convention, the adoption of a "soft-law" declaration as a precursor to a future treaty or encouragement of the growth of customary international law, and encouragement of arms control methods.¹⁶¹

Despite objections to creating a new protocol to the Conventional Weapons Convention raised by several participants in the April 1991 ICRC conference,¹⁶² various calls to the United Nations to reopen the Conventional Weapons Convention to address the crisis posed by land mines under Protocol II of that agreement presented an opportunity to consider the issue of anti-optic weapons.¹⁶³ Hence, in connection with the U.N.-convened Review Conference for the 1980 Convention on Conventional Weapons scheduled for September and October 1995 (the "Review Conference"),¹⁶⁴ experts and governmental representatives would consider not merely land mines under Protocol II, but would also be requested to consider the creation of a new Protocol IV to address blinding weapons and

160. *Id.* at 353-54. See also *Report of the International Committee of the Red Cross for the Review Conference of the 1980 United Nations 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*, 299 INT'L REV. OF THE RED CROSS, Mar.-Apr. 1994, at 153-54 (noting similar assessments at a February 1994 ICRC-sponsored conference attended by 37 governmental officials from 22 countries).

161. ICRC BLINDING WEAPONS, *supra* note 13, at 354-55.

162. *Id.* at 358-59 (noting criticisms as being (a) that the addition of a new protocol to the Conventional Weapons Convention might tend to delay ratification by additional nations of that convention, and (b) that, because the Conventional Weapons Convention was applicable by its terms only to international armed conflicts, any new protocol might not cover internal armed conflicts such as civil wars and insurrections). See Conventional Weapons Convention, *supra* note 35, art. 1, 19 I.L.M. at 1525 (providing for the scope of application of the Conventional Weapons Convention and its ancillary protocols to be governed by Article 2 of the 1949 Geneva Conventions for the Protection of War Victims and 1977's Additional Protocol I to those conventions, which cover international armed conflicts and some forms of "wars of self-determination," i.e., wars against colonial domination, alien occupation, and racist regimes); GERHARD VON GLAHN, *LAW AMONG NATIONS* 741 (6th ed. 1992).

Fifty-three nations signed the Conventional Weapons Convention in 1980, but until recently, only 41 nations have ratified it. DIETRICH SCHINDLER & JIRI TOMAN, *THE LAW OF ARMED CONFLICTS* 191-92 (1988); Boutros-Ghali, *supra* note 61, at 12.

163. See generally McCall, *supra* note 4, at 270 & nn.213-15 (summarizing several governments' and non-governmental organizations' requests to reopen the convention and the convening of U.N.-sponsored preliminary review meetings for that purpose in 1994).

164. See generally BLINDING LASER WEAPONS, *supra* note 6, at 3.

methods of warfare.¹⁶⁵

1. Protocol IV as Initially Proposed

The leading initial draft protocol for Protocol IV was proposed by Sweden. This draft consisted of three articles providing as follows (with alternative language in brackets):

Article 1

It is prohibited to employ laser beams of a nature to cause permanent blindness [serious damage] against the eyesight of persons as a method of warfare.

Article 2

It is prohibited to [produce and] employ laser weapons primarily designed to blind [permanently].

Article 3

Blinding as an incidental or collateral effect of the legitimate employment of laser beams on the battlefield is not covered by this prohibition.¹⁶⁶

As noted by commentators, Article 1 as proposed would categorically prohibit blinding as a method of warfare, thereby “establish[ing] as an international norm that common and systematic use of lasers to blind is unacceptable and unlawful”¹⁶⁷ and, consistent with the preamble to the Conventional Weapons Convention, would tend to “emphasize the importance of ending the production and proliferation of weapons whose use is restricted or prohibited.”¹⁶⁸

Article 2, as proposed, would prohibit both the use and manufacture of all tactical anti-optic lasers, provided, however, that such weapons’ primary purpose was to blind. Certain alternative wording proposed by the European Parliament addressed laser weapons with a secondary effect that “can cause” blindness,¹⁶⁹ which could extend to prohibit laser rangefinders and target designators as well, while one leading non-governmental organization, Human Rights Watch, recommended the use of the phrase “have blinding as a primary effect.”¹⁷⁰ This is because the choice of “primary purpose” or “primarily designed to blind” would tend to exclude anti-optic devices like the LCMS, Dazer and the ZM-87 whose “primary purpose” is arguably only an anti-equipment role but which clearly can cause permanent blindness.¹⁷¹

165. See, e.g., *Experts Make “Remarkable Progress” on Mines Ban*, AGENCE FRANCE PRESSE, Jan. 20, 1995, available in LEXIS, News Library, Curnws File (noting also a split between Western powers, such as France and Germany, calling for precise verification measures to be included in an anti-laser ban, with other nations such as China and Cuba calling only for non-binding “transparency” measures).

166. BLINDING LASER WEAPONS, *supra* note 6, at 33.

167. *Id.*

168. *Id.* See also Conventional Weapons Convention, *supra* note 35, pmb., 19 I.L.M. at 1524.

169. *Id.* at 33, 37 (citing resolution of the European Parliament, adopted June 29, 1995).

170. BLINDING LASER WEAPONS, *supra* note 6, at 34.

171. *Id.* at 33-34.

Article 3 would further protect devices like laser rangefinders and target designators inasmuch as they would cause blinding only as an unintended effect of use, without specifically carving out an exception for such devices by name. One suggested alternative was to adopt the wording “[i]t is prohibited to use lasers whose original purpose is either targeting or rangefinding as laser weapons deliberately against the eyesight of persons,” in order to specifically exempt such devices by name, but only to the point that they were not intentionally used as anti-optic weapons.¹⁷²

As initially proposed, Protocol IV dealt specifically and exclusively with lasers as blinding weapons. To the extent other weapons or devices could be used as blinding weapons (e.g., blinding explosives; mirrors; certain kinds of welding equipment which can create “arc flashes” and cause retinal injury), Protocol IV as originally drafted would have been simply inapplicable.¹⁷³ As will be seen, however, the same can be said for Protocol IV as approved by the Review Committee.

2. *The Product of Compromise: Protocol IV as Approved*

While the Review Conference failed to achieve a consensus as to further international regulation or prohibition of land mines,¹⁷⁴ with at least twenty-five nations (but, notably, not the United States) supporting a prohibition on anti-optic lasers prior to the conference,¹⁷⁵ a new Protocol IV to the Conventional Weapons Convention ultimately emerged, albeit in a considerably different form from Sweden’s original draft. Ten different draft proposals and documents were submitted for the consideration of the Review Committee’s Main Committee III, the group tasked with consideration of a new Protocol IV, including working papers compiled by the United States, the Netherlands, Austria, and Bulgaria.¹⁷⁶ On October 6, 1995, Main Committee III adopted the draft text of Protocol IV,¹⁷⁷ which was approved by the Review Committee on October 13, 1995.

As adopted, Article 2, the heart and soul of Protocol IV, provides as follows:

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

172. *Id.* at 34 (noting that “[t]he fear that combatants will be unable to distinguish between legitimate and unacceptable use of laser target designators and rangefinders and so put themselves at risk of criminal liability ignores the fact that soldiers always are obligated to make such distinctions”).

173. *See generally id.* (advocating a definition of “laser weapons” as: any weapon “that uses a laser beam as the primary mechanism of injury to the eyesight” or “that uses a laser beam as the primary kill mechanism,” and defining what are not “laser weapons” as: any systems “that use laser beams to aid the use or targeting of another weapon” or “that use a laser beam to aid other weapons in their tasks”).

174. *See generally* Bellamy, *supra* note 5, at 17; Fairhall, *supra* note 5, at 3; Johan Molander, *Getting Together to Ban the Use of Blinding Laser Weapons*, *Int’l Herald Trib.*, Dec. 18, 1995, available in LEXIS, News Library, Curnws File.

175. *See* Arkin, *supra* note 44; Abley, *supra* note 46; Herby, *supra* note 50.

176. Report of the Review Conference, *supra* note 3, at 177-78.

177. *Id.* at 178.

corrective eyesight devices. The High Contracting parties shall not transfer such weapons to any State or non-State entity.¹⁷⁸

The focus of this document is thus on (1) laser weapons, which are not specifically defined in Protocol IV, that are (2) "specifically designed" as a sole combat function or as one of their combat functions (3) to cause "permanent blindness" to "unenhanced vision." Temporary dazzling, or flash blindness, is excluded from the scope of Protocol IV. Permanent blindness, for purposes of Protocol IV, means "irreversible and uncorrectable loss of vision which is seriously disabling [i.e., a disability equal to a visual acuity of less than 20/200 Snellen, using both eyes] with no prospect of recovery," which is a more restrictive definition of blindness than that advocated by several commentators.¹⁷⁹ The addition of the concluding sentence may have been an arms control effort directed, in part, at developments such as China's blatant marketing of the ZM-87 as an instrument of blinding.

Article 3 contains a hortatory instruction that the parties to Protocol IV "shall take all feasible precautions to avoid the incidence of permanent blindness to unenhanced vision," to include training of armed forces and "other practical measures," in their utilization of laser systems.¹⁸⁰ The question as to what constitutes "other practical measures" may include steps such as the procurement of eye-safe laser rangefinders, which are already under development by several nations' military forces,¹⁸¹ but which may also involve an analysis of military necessity and the availability of less harmful alternatives.

In response to the United States' and several other nations' concerns that otherwise legitimate military laser technology such as laser rangefinders, laser weapons training systems, and target designators might be proscribed under the new Protocol IV, Article 4 of the protocol states that "[b]linding as an incidental or collateral effect of the legitimate military employment of laser systems, including laser systems used against optical equipment, is not covered by the prohibition of this Protocol."¹⁸² Ostensibly, "legitimate" military employment would be anything not proscribed by Protocol IV, i.e., any military lasers not "specifically designed" with permanent blindness of unenhanced vision as a combat function.

3. *A Critique of Protocol IV: A Useful Beginning or a Paper Tiger?*

As adopted by the Review Conference in October 1995, Protocol IV is a useful step towards regulation of a new type of weaponry, but it has some

178. *Id.* at 179 (Protocol IV, art. 2).

179. *Id.* (Protocol IV, art. 5). *Cf.* BLINDING LASER WEAPONS, *supra* note 6, at 34 (recommending that the World Health Organization's definition of blindness be used for purposes of Protocol IV, i.e., if a person has less than 5 percent of normal vision remaining, and also "low vision," i.e., if a person has less than 30 percent of normal vision remaining).

180. Report of the Review Conference, *supra* note 3, at 179.

181. *See, e.g., supra* note 15 and accompanying text. *See also* Rupert Pengelley, *OEC's Eye-Safe Laser Option*, INT'L DEF. REV., Feb. 1990, at 176.

182. Report of the Review Conference, *supra* note 3, at 179 (Protocol IV, art. 4).

very significant flaws. Despite its advocates' urging that Protocol IV has outlawed an entire class of "particularly cruel weapons" and has abolished deliberate blinding as a method of combat,¹⁸³ in reality, such pronouncements somewhat overstate the case for Protocol IV. As adopted, Protocol IV is more sound than fury.

Although continued development of both devices has been canceled in the United States by a reversal of long-standing Defense Department policy, at roughly the same time that the Protocol was being finalized in Vienna,¹⁸⁴ the Protocol's wording tends to allow certain laser weapons such as the LCMS and Dazer to escape international regulation. The adoption of the terminology "weapons specifically designed . . . to cause permanent blindness" generally place such weapons outside Protocol IV's scope because such weapons arguably were not "specifically designed" (with the possible exception of the ZM-87¹⁸⁵) for such functions and, under Article 4, to the extent a nation can reasonably argue that blinding is merely an "incidental or collateral effect" of the use of its model of anti-optic laser against electronic or optical equipment, any resulting blinding would not be illegal under Protocol IV. Hence, if read broadly, an entire class of laser weaponry with "secondary" design characteristics causing permanent blinding may escape the reach of Protocol IV, regardless of whether those weapons may tend to cause unnecessary suffering.¹⁸⁶ By not abolishing *intentional* blinding as a prohibited method of warfare, by *whatever* means it is inflicted, Protocol IV does not go far enough to curb a method of warfare with definite tendencies to cause superfluous injury or unnecessary suffering.¹⁸⁷

Additionally, the wording of Article 2 applies to the blinding only of persons with "unenhanced vision" or wearing eyeglasses or contact lenses. The intentional, purposeful blinding of any soldier (or civilian, for that matter) using binoculars, night vision goggles, or a telescopic gunsight by an anti-optic laser is not covered.¹⁸⁸ For that matter, Protocol IV does not address any other class or type of weapon or tactic, apart from lasers, that may cause blindness.

Furthermore, and perhaps most seriously, no specified verification or enforcement provisions have yet been crafted for Protocol IV. Thus, even assuming a given type of laser is specifically designed to blind permanently a person with unenhanced vision, the ability of signatory parties and the

183. See, e.g., Molander, *supra* note 174 (citing Johan Molander, a Swedish statesman and the president of the Review Conference).

184. See *infra* notes 207-12 and accompanying text.

185. See *supra* notes 37-39 and accompanying text.

186. See, e.g., Bellamy, *supra* note 5, at 17.

187. See generally Joost Hilterman & William Arkin, *No Blinding Lasers*, DEF. NEWS, Oct. 23/29, 1995, at 29 (presenting a similar critique in the context of the U.S. Defense Department's September 1995 policy statement regarding anti-optic lasers).

188. *Negotiators Near Agreement on "Blinding Laser" Ban*, A.P., Oct. 6, 1995, available in LEXIS, News Library, Curnws File (also noting that the U.S. delegation to the Review Conference had reversed its earlier position against any restrictions on lasers and expressed its willingness to consider language "prohibit[ing] the use of lasers specifically designed to cause permanent blindness in (normal) vision").

international community to take concrete actions to enforce Protocol IV are less than clear, and no compliance procedures whatsoever are set forth in Protocol IV. This is a long-standing criticism offered against Protocol II and other aspects of the Conventional Weapons Convention,¹⁸⁹ which the Review Conference failed to address satisfactorily.¹⁹⁰

To take effect, twenty states must consent to be bound by Protocol IV through ratification of its terms before it can achieve the force of international law.¹⁹¹ In December 1995, the 135 nations represented at an ICRC and International Committee of the Red Crescent international conference unanimously agreed to adhere to Protocol IV¹⁹² despite its shortcomings. Due to the limits to Protocol IV's effectiveness, perhaps the best that can be said is that it provides a starting point for future international efforts to restrict blinding weapons. The existence of the Martens clause and its humanitarian and customary international law bases¹⁹³ may, at least, provide some measure of additional protection for those situations not covered by the language and scope of Protocol IV.

C. Shifting Positions: The United States' and Other Nations' Policies Regarding Anti-Optic Lasers

For seventeen years prior to the 1995 Review Conference, the United States' position as a leading experimenter in military laser technologies had consistently been one of opposition to any international restrictions on anti-optic lasers.¹⁹⁴ Under DOD Instruction 5000.15,¹⁹⁵ the Judge Advocate General of the Army (the TJAG) conducted a general review of the use of lasers as antipersonnel weapons in September 1988. After analyzing the few precedents (including a prior TJAG opinion from December 1984 concluding that injury to combatants arising from the use of range finder or target acquisition lasers was lawful), TJAG noted that "[b]linding is no stranger to the battlefield." Recognizing that various weapons (e.g., bomb and shell fragments, land mines, poison gas and bullets) can create eye

189. See generally McCall, *supra* note 4, at 266 & n.195 (noting such criticisms in the specific context of Protocol II).

190. Also, because the Conventional Weapons Convention currently applies solely to international conflicts and a narrowly limited group of "internal" conflicts, Protocol IV's application to prohibit use of specifically designed blinding lasers in an internal conflict (e.g., possible Iraqi use of anti-optic lasers or modified laser rangefinders against Kurdish and Shi'ia minorities) is doubtful. See *supra* note 162 and accompanying text. Customary international law, however, prohibiting harm to civilians, and the humanitarian concerns of the Martens clause, may at least tend to provide a modicum of protection against anti-optic laser blinding to the extent such usage clearly falls outside the scope of Protocol IV.

191. See Ann Peters, *Blind Spot in Arms Protocol*, THE INDEPENDENT, Oct. 25, 1995, at 18.

192. See Molander, *supra* note 174.

193. See *supra* notes 146-51 and accompanying text.

194. See generally BLINDING LASER WEAPONS, *supra* note 6, at 3 (noting U.S. resistance to any ban on laser weapons in the context of research and development of various tactical laser programs, with estimates of research and development expenses for such programs at over \$400 million).

195. See *supra* note 121.

injuries, the TJAG reasoned that, unlike lasers, "injury from each of these mechanisms frequently results in death," so that antipersonnel laser blinding would be "more humane" than such "comparable" weapons.¹⁹⁶ The TJAG opined that "such use would not cause unnecessary suffering when compared to other wounding mechanisms to which a soldier might be exposed on the modern battlefield, and hence would not violate any international law obligations. . . . Accordingly, the use of antipersonnel laser weapons is lawful."¹⁹⁷

One major premise to this memorandum, which remained a major although often unstated buttress behind the United States' subsequent position on anti-optic lasers, was the assumption that a proposal to denounce anti-optic, blinding lasers as causing unnecessary suffering "would lead to a contradiction in the law that soldiers legally could be blinded ancillary to the lawful use of a laser rangefinder . . . but could not be attacked individually."¹⁹⁸ The unspoken concern in the TJAG's September 1988 memorandum was the fear that, if other types of laser weapons were proscribed, laser rangefinders and target designators—devices in which the United States had a technological advantage over other nations' forces—might be denounced subsequently as illegal if blinding resulted from their use, a position taken until recently by the current administration.¹⁹⁹ Further, the "contradiction" noted by the TJAG was no more contradictory than long-standing rules of proportionality, inasmuch as a soldier inside a tank can be legitimately killed by a large-caliber artillery piece directed at the tank, while the use of the same weapon against an individual soldier would be considered excessive. Subsequent Army TJAG reviews were performed under DoD Instruction 5000.2 (the successor to DoD Instruction 5500.15) specifically for the Army's Stingray and LCMS laser systems, concluding in both cases that the antipersonnel use of such weapons "would not cause superfluous injury or unnecessary suffering even if it resulted in permanent blindness."²⁰⁰

Despite the limited utility of such systems,²⁰¹ the failure to allocate funding for various laser programs in the Army's 1996 budget²⁰² and the

196. ICRC BLINDING WEAPONS, *supra* note 13, at 368-70 (citing Memorandum of Law, *Use of Lasers as Antipersonnel Weapons*, U.S. Army Judge Advocate General's Office, Sept. 29, 1988). *But see supra* note 60 and accompanying text (challenging arguments that lasers and laser blinding are necessarily more humane than other battlefield injuries).

197. ICRC BLINDING WEAPONS, *supra* note 13, at 367.

198. *Id.* at 371.

199. *See* U.S. LASERS, *supra* note 6, at 7-8 & n.22 (citing Letter from President Bill Clinton to U.S. Reps. Ron Dellums, Lane Evans, & U.S. Sen. Patrick Leahy 2/1/95).

200. BLINDING LASER WEAPONS, *supra* note 6, at 3 & n.13. *See also* U.S. LASERS, *supra* note 6, at 7 & n.23.

201. *See, e.g.*, BLINDING LASER WEAPONS, *supra* note 6, at 4-5.

202. Robert Burns, *Pentagon Draws Fire on Proposed Blinding Laser Weapons*, A.P., May 22, 1995, available in LEXIS, News Library, Curnws File. *See also* Arkin, *supra* note 44 (noting that a 1994 U.S. Defense Science Board study of non-lethal weapons, including a ranking by various military commands of their top requirements, failed to list anti-sniper lasers and placed anti-optic laser dazzlers as 41st in a list of 51 priority technologies).

failure to establish doctrine for the tactical use of anti-optic lasers, while, for several years, also denying the existence of such systems,²⁰³ the TJAG's legal opinion represented the United States' official position until September 1995. Besides the argument that any movement towards admitting certain types of anti-optic lasers caused unnecessary suffering would provide a basis to find other systems such as laser rangefinders and designators illegal²⁰⁴ and potentially "lead to the prosecution" of American troops using such weapons, the Clinton administration argued that support for an anti-optic laser ban would distract attention from "the more immediate humanitarian problem" of land mines.²⁰⁵

Following calls by various non-governmental agencies and members of the Congress and Senate in support of Protocol IV or similar proscriptions on blinding lasers,²⁰⁶ the Defense Department announced on September 1, 1995 a new policy that "prohibits the use of lasers specifically designed to cause permanent blindness of unenhanced vision and supports negotiations prohibiting the use of such weapons."²⁰⁷

While in many respects a major policy shift,²⁰⁸ as well as a sensible move from a standpoint of military self-preservation, inasmuch as defenses to anti-optic laser blinding still remain woefully inadequate,²⁰⁹ the wording of the Defense Department's September 1995 policy statement was very similar to that of Article 2 of Protocol IV. Protocol IV tends to exempt laser systems that are arguably not "specifically designed" to create blindness but that do so as a direct cause of their intended use, like the Dazer and

203. See, e.g., Arkin, *supra* note 44.

204. See *supra* note 198 and accompanying text.

205. See William Arkin, *Weapons of Destruction*, BALT. SUN, May 19, 1995, at 19A, and Burns, *supra* note 202 (both citing a letter from President Bill Clinton, to Sen. Patrick Leahy and several U.S. Congressmen).

On a related note, despite State Department efforts in support of an anti-mine ban, until recently the DoD has steadfastly refused to consider reduction of U.S. military mine stocks and to consider the phasing-out of mines. This may be another indication of the somewhat disjointed nature of institutional politics and the vested interests involved in the domestic resolution of such issues.

206. See, e.g., BLINDING LASER WEAPONS, *supra* note 6, at 41-44 (reprinting letters from Senator Leahy, Representative Evans and other legislators to Secretary of State Warren Christopher and Secretary of Defense William Perry); DeMayo, *supra* note 19 (discussing a meeting in early 1995 between Senator Leahy and Assistant Defense Secretary H. Allen Holmes); Evans, *supra* note 67.

207. BLINDING LASER WEAPONS, *supra* note 6, at 3-4; USA Bans "Blinding" Lasers, JANE'S DEF. WKLY., Oct. 7, 1995, at 5; News Release No. 482-95, Off. of Assistant Secretary of Defense (Sept. 1, 1995) (noting, also, the "critical technological edge [provided] to US forces" by laser rangefinders and designators and reaffirming such laser systems as "legitimate" uses).

208. See Arkin, *supra* note 30 (noting that the new policy represented "a phenomenal departure, the reversal of 17 years of argument by the U.S. government that blinding is perfectly legal" and reasoning that the DoD may have been spurred to act, in part, by China's efforts to market the ZM-87 internationally; but also noting that, on August 31, 1995, one day before announcement of the new Defense Department policy, the U.S. Army entered into a \$17 million contract to buy a number of LCMS prototypes, "the very systems that the new policy is intended to prohibit").

209. See generally Editorial, *Ban on Anti-Eye Lasers The Right Move*, AVIATION WK. & SPACE TECH., Oct. 2, 1995, at 70.

LCMS.²¹⁰ Hence, many of the concerns that bedevil Protocol IV may be similarly applicable to the new U.S. policy. Nevertheless, at roughly the same time that the Review Conference was completing its deliberations on Protocol IV, the Department of the Army was ordered to terminate its procurement plans for the LCMS.²¹¹ Although it was explained that continued development of the LCMS was indefensible on “conceptual or policy grounds” and the LCMS was too costly, the Army’s Vice Chief of Staff insisted that the canceled laser program was “fully consistent” with current Army doctrine and did not violate the new policy. This position stood in stark contrast to the views of other officials, who tacitly suggested the potential illegality of the LCMS under the new Defense Department policy and Protocol IV.²¹²

Steps by other nations indicate a gradual shift in favor of a no-use policy for anti-optic lasers. Following its early lead in the development and fielding of anti-optic laser technology, the British Ministry of Defense publicly announced in May 1995 that the United Kingdom “has no plans to develop, test or procure a laser weapon designed permanently to blind human targets. The feasibility of making use of temporary dazzle effects was investigated in 1983 and tests on one system were conducted which were subsequently discontinued.”²¹³ While not categorically denying that Britain may be still working on anti-optic lasers not “specifically designed to cause blindness,” the reference to the discontinuance of research on temporarily dazzling lasers (a probable allusion to the Royal Navy’s Laser Dazzle System²¹⁴) suggests a likely cessation to “development, testing and procurement.”²¹⁵

Before the revised Defense Department policy of 1995, the United States and the former Soviet Union had already entered into a memorandum of understanding, effective on January 1, 1990, “under which the sig-

210. BLINDING LASER WEAPONS, *supra* note 6, at 4. See also notes 184-86 and accompanying text.

211. See, e.g., *Pentagon Cancels Controversial Laser*, L.A. TIMES, Oct. 13, 1995, at A16; Peter Almond, *Blinding Laser Weapons Are Banned by UN*, DAILY TELEGRAPH, Oct. 14, 1995, at 14 (noting that the decision to terminate the LCMS occurred about 24 hours before the passage of Protocol IV by the U.N.’s Review Committee).

212. See *Army Drops Laser Weapon Plan*, Armed Forces Newswire Service, Oct. 13, 1995, available in LEXIS, News Library, Curnws File; Graham, *supra* note 29 (but quoting one governmental official:

The Army claimed this was an anti-optical system But what’s the purpose of temporarily messing up a sensor on, say, an enemy tank when you still have the tank coming at you and you have other ways of eliminating it? For the laser to be effective, it would have to be used to blind the opposition. But trying to blind temporarily is very hard, and trying to blind permanently is not our policy.

(emphasis added)).

213. *China Markets Blinding Laser*, *supra* note 39, at 1 (emphasis added). See also *supra* note 20.

214. See *supra* note 20 and accompanying text. See also Fairhall, *supra* note 20, at 5 (quoting acting British Defense Secretary David Clark: “These laser weapons ought to be treated in the same way as chemical and biological weapons. It is a matter of priority to have them banned . . .”).

215. See generally Fairhall, *supra* note 20, at 5.

natories agreed not to use laser dazzlers against each other.”²¹⁶ Further, in June 1995, the European Parliament adopted a resolution in support of the Review Committee’s efforts and calling for periodic reviews every five years of the Conventional Weapons Convention.²¹⁷

In the absence of international approval and effective verification and enforcement measures, Protocol IV and various nations’ unilateral efforts may delay and hamper, but not necessarily prevent, those pariah nations and groups who desire anti-optic weapons from using them.²¹⁸ In one sense, due to the spread of civilian laser technology and increasingly lower unit costs for such technology (some of which is well capable of a dual military use as anti-optic devices²¹⁹), the genie of anti-optic laser warfare may have been released, and the risk of such weapons being introduced in future combat is here to stay. Nevertheless, despite its shortcomings,²²⁰ Protocol IV represents a historic accomplishment inasmuch as, for the first time since 1868, the international community has taken positive steps to consider the legality of a new class of weaponry *before* it is fielded and used in large numbers.

Conclusion

No longer merely an image from the pages of science fiction, the battlefield laser is now reality. While not necessarily the “death ray” foreseen by H.G. Wells and others, lasers’ ability to inflict permanently incapacitating injuries and death is now clearly established. While blinding may arguably be preferable to maiming or other combat wounds, nothing precludes the victim of an anti-optic laser attack from being further wounded or killed. In fact, deprived of vision and left to fend for himself on the chaos of the battlefield, the odds of the laser victim’s survival are poor. Furthermore, the issue of survival is not merely one left on the field of combat. Given the difficulties of even developed nations’ medical systems to cope with large numbers of blind patients in peacetime, the same diminished odds may well haunt anti-optic laser casualties long after the guns have ceased to roar. In the absence of concerted international action, however, we cannot

216. *China Markets Blinding Laser*, *supra* note 39, at 1. See also Pengelley, *supra* note 8. Notably, however, this memorandum was not primarily directed to address only laser blindings. Instead, the confidential memorandum addressed a variety of confidence-building measures intended to prevent the likelihood of a variety of peacetime accidents and incidents that might occur in joint U.S.-Soviet areas of occupation (e.g., Berlin) from flaring into hostilities, only one of which referred to laser-related injuries. See Wolbarsht Interview, *supra* note 6.

217. BLINDING LASER WEAPONS, *supra* note 6, at 37 (noting that the resolution was adopted on June 29, 1995, by a vote of 247-3, with eight abstentions).

218. See, e.g., Abley, *supra* note 46 (citing Dr. Myron L. Wolbarsht, Professor of Ophthalmology at Duke University: “People who are going to use them . . . are unlikely to find an international ban of any consequence.”).

219. See generally note 84 (discussing the dazzling effects of entertainment lasers on U.S. airline pilots and the subsequent promulgation of federal regulations to reduce the likelihood of civil aircraft accidents resulting therefrom).

220. See *supra* notes 182-93 and accompanying text.

long expect the anti-optic laser to remain under wraps in arsenals and research facilities.

During the First World War, images of blinded, shuffling columns of soldiers, robbed of sight by the use of chemical agents such as mustard gas, left a lingering impression of the horrors of gas warfare.²²¹ Contrary to the reports of those who depicted gas warfare as being a more "civilized" method of combat,²²² the injuries inflicted by such weapons frequently led to permanent debilitation, long-term psychological injury, and shortened life expectancies for many gas casualties.²²³ These injuries potentially mirror those that may be suffered by laser victims. The public outcry and revulsion resulting from the use of poison gases in the First World War led, in part, to international protocols against gas and biological warfare and to gas not being used—at least, not against developed, Western nations whose governments could retaliate massively—following that war.²²⁴

The world now has been presented with a unique opportunity. For the first time since 1868, the international community has been given the opportunity to consider the consequences of continued development and possible use of a new and hitherto secret method of warfare *before* it is extensively used in action. The nations of the world must take advantage of this opportunity to consider whether the benefits of national security are outweighed by the possible use of such weapons against a nation's own troops or its civilian populations in the not-too-distant future, along with the inhumane consequences of anti-optic laser warfare.

221. See generally *BLINDING LASER WEAPONS*, *supra* note 6, at 32; ICRC Brochure, *supra* note 65, at 1, 8 (depicting on its cover a photograph of gas-blinded soldiers during the First World War).

222. ADAMS, *supra* note 154, at 44, 47-48; ROBERT HARRIS & JEREMY PAXMAN, *A HIGHER FORM OF KILLING* 37 (1982).

223. HARRIS & PAXMAN, *supra* note 222, at 38.

224. See, e.g., 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, of Bacteriological Methods of Warfare, June 17, 1925; R.R. Baxter & Thomas Buergenthal, *Legal Aspects of the Geneva Protocol of 1925*, 64 AM. J. INT'L L. 853, 854-55 (1970) (discussing the signatories to, and overall scope of, the Geneva Protocol of 1925); ADAMS, *supra* note 154, at 66-69 (discussing the fear of retaliation, particularly against civilian populations, as being the major deterrent to gas warfare during the Second World War).

Such concerns, however, have evidently not deterred various "have" nations from using chemical weapons against "have-not" peoples, frequently including civilians (e.g., Italian use of poison gas in Abyssinia and Japanese use against China in the 1930s and, more recently, allegations of Soviet use of poison gas against the Afghans and confirmed Iraqi use of gas against both Iran and its own Kurdish minority, all in the 1980s. See, e.g., ADAMS, *supra* note 154, at 50-51, 85-90, and 95-98.

