HUMAN RIGHTS WATCH ARMS PROJECT

May 1995 Vol. 7, No. 5

UNITED STATES

U.S. BLINDING LASER WEAPONS

Contents

Human Rights Watch
485 Fifth Avenue
New York, NY 10017-6104
Tel: (212) 972-8400
Fax: (212) 972-0905
E-mail: hrwnyc@hrw.org

Human Rights Watch
1522 K Street, NW, Suite 910
Washington, DC 20005-1202
Tel: (202) 371-6592
Fax: (202) 371-0124
E-mail: hrwdc@hrw.org

I. INTRODUCTION

The United States has pursued the development of at least ten different tactical laser weapons that have the potential of blinding individuals. The existence of most of these programs is not known to the American public or to most of the U.S. Congress. In fact, the programs are little known even within the U.S. military, and services responsible for laser weapons seem largely unaware of the programs in research and development in other services. Further, the Office of the Secretary of Defense does not appear to have an overview of the program.[1] Secrecy and lack of oversight and coordination are thus the hallmarks of the "family" of U.S. tactical laser weapons.

Blinding lasers have been the subject of international legal discussions for more than a decade, with the International Committee of the Red Cross long advocating a ban on such weapons. Human Rights Watch believes that blinding laser weapons are unnecessarily cruel and injurious, and that the use of blinding laser weapons is repugnant to the public conscience. The Swedish government has proposed adding a protocol banning use of blinding laser weapons to the 1980 U.N. Conventional Weapons Convention[2] at the Review Conference to be held this September in Vienna. While it appears that the protocol will have widespread support (more than twenty European nations are currently in favor), the U.S. government has thus far expressed opposition to the proposal.

The Human Rights Watch Arms Project is the first to identify publicly and provide details on all ten U.S. tactical laser weapon programs. They are code-named: Laser Countermeasure System, Saber 203, Stingray, Outrider, Dazer, Cobra, Perseus, Coronet Prince, Compass Hammer and Cameo Bluejay. The function of all these weapons, as described by the military, is to counter battlefield surveillance by disrupting optical and electro-optical devices - from binoculars to gunner's sights to infrared sensors. But it appears that all can also function as blinding antipersonnel weapons.

The U.S. Army is hoping for a government decision next month (June 1995) to approve start of a full scale production contract for the portable Laser Countermeasure System (LCMS), which is mounted on an M-16 rifle.[3] It would be the first laser weapon ever to begin full-scale production in the United States, or, it

[1] Letter, Assistant Secretary of Defense (Special Operations/Low-Intensity Conflict) H. Allen Holmes to Representative Lane Evans and Senator Patrick Leahy, March 27, 1995. This letter states that there are only two systems within the Department of Defense.

[2] Officially 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* (1980), it is also sometimes known as the Inhumane Weapons Convention.

[3] This would be the initial production contract in a planned $80 million procurement program and would fund the purchase of

is believed, anywhere in the world. This decision seems particularly rushed given the possibility of an international ban, or at least internationally agreed restrictions, on laser weapons this fall. There is certainly no particular new "threat" creating an urgency to go to full-scale production of the LCMS. Moreover, the Army has admitted that "specific tactics and doctrine have yet to be developed" for LCMS use.[4]

fifty LCMS weapons, out of about 2,500 desired by the Army.

[4] U.S. Army, Questions and Answers for Chris Hanson, *Hearst Newspapers*, April 14, 1995.

Another secret laser weapon - Saber 203 - was actually taken to Somalia by the U.S. Marine Corps in early 1995. Senior U.S. Department of Defense officials reportedly halted its experimental use in Somalia at the eleventh hour for "humane reasons." Skeptics in the military apparently questioned whether there was either a policy or doctrine governing use of such a weapon.[5]

The other eight U.S. tactical laser weapon systems are in various stages of research and development. Dazer, which was a prototype that lost out to LCMS in development, is perhaps the most dangerous, and is deployed with the U.S. Special Operations Command (USSOCOM), a "joint" unified command of the Department of Defense. Stingray and Outrider are under active development in the Army and Marine Corps with prototypes already in existence. They await funding for full-scale production. Two Stingray prototypes were deployed, but not used, in the Gulf War. Perseus appears to be an Army system similar to Saber 203, though currently unfunded. Cobra and Coronet Prince were supposedly cancelled, but are still being actively "marketed" by their developers and contractors. The fate of two others - Compass Hammer and Cameo Bluejay - is unknown.

This aggressive state of development of tactical laser weapons within the U.S. military, which heretofore has been mostly shrouded in secrecy, makes a ban on tactical laser weapons and on blinding as a method of warfare more urgent now than ever before. Tactical laser weapon development in other countries has been difficult to determine because it is often hidden beneath even more levels of secrecy than in the United States. According to confidential U.S. government sources, other countries alleged to have blinding laser weapons programs include Russia, China, France, Britain and Israel. Germany has also been mentioned in the military literature. The spread of tactical laser weapons - to extremists, terrorists or guerrilla groups, as well as many nations in conflict - is a very real likelihood, especially if the systems perfected are small and portable.

The secrecy surrounding tactical laser weapons and the apparent lack of oversight raises the question of whether national and international negotiations about these weapons have proceeded only on a partially- and ill-informed basis, particularly with respect to the nature and scale of actual developments. Nevertheless, the Review Conference of the 1980 Conventional Weapons Convention presents a unique opportunity to effect an international prohibition on an inhumane and unnecessary weapon system before it has the chance to proliferate. The Human Rights Watch Arms Project calls on all countries to ban tactical laser weapons and to stop the development and deployment of these weapons systems now.

II. BACKGROUND ON TACTICAL LASER WEAPONS

The term *laser* is an acronym for light amplification by the stimulated emission of radiation. Lasers, of course, have many important non-military functions. They also have useful and legitimate military purposes, for example in applications such as guidance, target designation or range-finding. There is, nonetheless, a clear distinction between these non-weapon laser systems and the ten tactical laser weapons systems identified by the Human Rights Watch Arms Project. Although this distinction is evident from U.S. military documents, in many cases the U.S. and other governments claim otherwise.

[5] Eric Schmitt, "Now, to the Shores of Somalia with Beanbag Guns and Goo," *New York Times*, February 15, 1995. The senior Defense Department official quoted further said," I know that (the rationale) sounds weird, but we had some qualms given the lack of experience we've had with them."

The Human Rights Watch Arms Project has chosen to use the term "tactical" laser weapons to distinguish them from the high energy and directed energy laser weapon applications most often associated with ballistic missile defenses.[6] This report does not address these high energy laser weapons, which do not have antipersonnel effects.

Interest in tactical laser weapons began in the early 1970s, when technological advances held out the prospect that small and powerful lasers with offensive applications could be developed at relatively low cost. U.S. intelligence reports in the late 1970s also indicated Soviet interest in tactical laser weapons. Several U.S. Army studies in the early 1980s reached the conclusion that laser weapons would be "highly effective force multipliers."[7]

The introduction of lasers in non-weapons applications, as well as advances in electro-optics such as night vision devices and forward-looking infrared sensors, provoked the military to evaluate both self-protection and countermeasures. From the beginning, the U.S. military recognized that the proliferation of lasers would have adverse effects on "friendly" forces, even in the absence of laser weapons. There were a number of accidents from inadvertent laser exposure, numbering some twenty-three major cases as of 1984.[8]

---

[6] With President Reagan's articulation of the "Star Wars" concept in March 1983, new enthusiasm was found for directed energy and laser weapons to attack satellites and ballistic missiles. Most of the high energy laser work in the Navy and the Air Force was taken over by the Strategic Defense Initiative Organization in 1984, and continues to be pursued as part of the ballistic missile defense program. See Vincent P. Grimes, "Lasers as Naval Weapons," *Wings of Gold*, Summer 1993, p. 52.

[7] U.S. Army Concepts Analysis Agency (Hock, Lyons, et al.), "Military Implications of Laser Employment by the Soviets (MILES)," Study Report CAA-SR-80-8, 1981; U.S. Army, TRADOC Systems Analysis Agency, "Forward Area Directed Energy Weapons (FADEW) Study," TRASANA TR-33-83, 1983. Both studies have been requested under the Freedom of Information Act.

[8] See Dr. John A. Wolfe, Captain, U.S. Public Health Service, "Laser Retinal Injury," Letterman Army Institute of Research, Institute Report No. 177, June 1984 (ADA144 187); and John A. Wolfe, "Laser retinal injury," *Military Medicine*, Vol. 150 (1985), No. 4, pp. 177-185.

At least one report speculated that "incidents of temporary blindness and vision damage ... may have led research and development establishments to investigate further."[9]

Work on specific tactical laser weapons began between 1975 and 1976 when Martin Marietta and Lockheed Sanders (then Sanders Associates) contracted with the Army to develop laser weapons systems for attack helicopters. The Lockheed prototype, the ALQ-169 Optical Warning Location/Detection (OWL/D) device, was flight-tested starting in 1980, but was cancelled in 1986.[10] The tank- and helicopter-mounted C-CLAW (Close Combat Laser Assault Weapon) was developed in the early 1980s and was cancelled in 1983 because of its excessive weight.[11] Focus then shifted exclusively to ground-based weapons.

[9] Forecast International/DMS Market Intelligence Report, *Electronic Warfare*, Airborne Electro-Optical Countermeasures (February 1993), updated April 1995.

[10] Ibid.

[11] Jeff Hecht, "Lasers Designed to Blind," *New Scientist*, August 8, 1992, p. 28.

The Army continued to fund work by Martin Marietta to develop the Stingray laser weapons system, and advanced development research began in 1982.[12] Three companies also competed to develop a portable laser weapon: Allied-Signal developed Dazer; McDonnell-Douglas developed Cobra; and Lockheed Sanders developed the Laser Countermeasure System (LCMS). Stingray (and its outgrowth Outrider) were eventually supported as vehicle mounted systems pursued by the Army and Marine Corps, while the Lockheed LCMS was chosen as the portable system. (See below for additional details on these and other laser weapon systems).

III. WEAPONS TO BLIND OR TO DESTROY SENSORS?

The United States is quick to state that it "does not possess, nor is it developing, laser weapons designed or intended primarily to permanently blind enemy combatants,"[13] and that its weapons are "not designed to cause ocular injury to opposing soldiers."[14] However, the actual workings of the various tactical laser weapons, and the most likely scenarios for their operation, reveal a great potential for their use against individuals and their capability to blind.

Even though tactical laser weapons are described as "protective systems" and intended for "defensive purposes," they counter optical and electro-optical devices (OEDs) primarily by attacking the opponent's eyes, not through physical destruction of the OEDs. The U.S. soldier searches for a battlefield surveillance device then points the laser beam at it. In the case of a simple optical device, such as a gunner's sight, the laser would be intensified by the optic in front of the human eye and would shoot back to the human retina in less than one second, causing eye damage. Depending on the distance between the human eye and the laser, and the wavelength and intensity of the beam, a pulse might or might not cause permanent blindness. The U.S. Laser Countermeasure System fires a beam powerful enough to burn out human retinas from up to 3,000 feet away.[15]

---

[12] U.S. Army, "Weapon Systems - United States Army 1992," p. 19.

[13] Letter, Asst. Sec. Def. Holmes to Rep. Evans and Sen. Leahy, March 27, 1995. See also, Pat Cooper, "Congressmen Urge Ban on Using Lasers to Blind," *Defense News*, January 16-22, 1995.

[14] U.S. Army, Response to press query by Chris Hanson, Washington correspondent, *Hearst News Service*, Subject: Stingray System, March 21, 1995. Describing the LCMS, the Army further states that it "does not have sufficient energy to blind enemy troops **at tactically significant ranges**." (emphasis added); U.S. Army, Questions and Answers submitted by Chris Hanson, *Hearst News Service*, April 14, 1995.

[15] Department of the Army, Office of the Judge Advocate General, Memorandum, Subject: AN/PLQ-5 Laser Countermeasure System; Law of War Review, September 16, 1994, released under the Freedom of Information Act.

In the case of an electro-optical device, the laser would work in the same way a driver's night vision is overwhelmed by bright headlights.[16] The sensor is overloaded, but the laser beam does not have enough power to destroy the sensor. Temporarily "jammed," enemy soldiers would be forced, the theory goes, to either repair the electronic device or to switch to observation with non-electronic optics, where their unprotected eyes would be prey.

It is only in the cases of electro-optical devices such as forward-looking infrared sensors (FLIRs) or closed circuit camera sensors - where there is a separation between the sensor and the human eye such as a television screen that delivers the image from a sensor - that the tactical laser weapon would not "attack" the person involved.

[16] Hecht, "Lasers Designed to Blind," p. 31.

An examination of military thinking behind use of tactical laser weapons reveals them to be essentially antipersonnel in nature. The military envisions that the presence of tactical laser weapons will either deter soldiers from using OEDs, force soldiers to employ protection devices that will degrade their performance,[17] or overwhelm OEDs and provide advantages for the U.S. to follow-on with lethal attacks.

The claim of some laser weapon proponents that "it is better to blind than to kill" is inconsistent with the fact that there is no credible non-lethal scenario for use of tactical laser weapons in conventional warfare. Tactical laser weapons are merely augmentations of other, lethal weapons; they are electronic warfare devices that could open up opponents to easier, more successful lethal attack.[18] During conventional military operations, engagements to disrupt electro-optical systems with laser weapons for long enough periods of time to afford employment of other conventional weapons would be fundamentally antipersonnel, not anti-sensor, battles. The target ultimately would be the human, not the electronic system. Given this, it should be asked whether the only real usefulness for tactical laser weapons is in their unique ability, under the right conditions, to blind.

IV. BLINDING AS A METHOD OF WARFARE

The eye is the organ most vulnerable to laser radiation. As noted above, how much damage occurs depends on several factors, but many medical and military experts believe it is not possible to design a laser that can only temporarily blind or dazzle. According to one medical specialist, "A laser that could dazzle toward the end of its range would inevitably cause permanent blindness nearer the source. Aiming for

[17] At present, no 100 percent effective protective measures against laser weapons have been developed. There are goggles that protect against a laser emitting a single wavelength, but it is possible to design a laser system that can fire a variety of wavelengths.

[18] In a legal memorandum, the Pentagon acknowledges this by stating that tactical laser weapons would never be used at ranges where the opponent was not also subject to "permanent loss of vision or considerably greater injury, including death, from lawful weapons other than lasers." See Department of the Army, Office of the Judge Advocate General, Memorandum, Subject: AN/PLQ-5 Laser Countermeasure System; Law of War Review, September 16, 1994, released under the Freedom of Information Act.

temporary blindness under battlefield conditions appears impossible."[19] To date, no research by the military has been found to disprove this conclusion.[20]

[19] John Marshall, "A Horrifying New Laser Weapon That the World Should Ban Now," *International Herald Tribune*, April 12, 1995.

[20] See, for example, U.S. Air Force Office of Scientific Research, Abstract, Laser Photonics Technology, Inc., "Chemical Processing of Novel Multifunctional Materials for Sensor Protection Against Laser Threats," Final Report, September 15, 1990-May 15, 1991, TR-91-05870; U.S. Army Natick Research, Development and Engineering Center, Abstract, "Proceedings of the International Symposium on Nonlinear Optical Polymers for Soldier Survivability," June 13-14, 1989, Final Report, September 1990, Natick/TR-90/028; U.S. Air Force School of Aerospace Medicine, Abstract, "Laser Eye Protection," Interim Report, January 1990, USAFSAM-PROC-89-27 (ADA219659).

The International Committee of the Red Cross has built up an impressive dossier of evidence that blinding is more severe and debilitating than most other wounds inflicted in war.[21] Sixty percent of military casualties in war survive and fully recover over time. Prosthetic devices may be used to regain the functions of arms or legs. No prosthetic device can replace sight. Sight provides individuals with 80 to 90 percent of their sensory stimulation. Blinding may lead to a loss of self-esteem and severe psychological depression, at least in the initial stages. The impact of blinding could be exaggerated when the injury occurs in war because the injury is instantaneous and may be accompanied by post-traumatic stress. The use of laser weapons or their suspected presence during a military engagement also could increase the general occurrence of combat stress disorder because laser weapons are a silent and invisible threat.

The U.S. government argues that a prohibition on blinding as a method of warfare would open up its soldiers to laws of war charges in cases where legitimate lasers (e.g., rangefinders or target designators) caused incidental eye injury, or in cases of "collateral" damage.[22] Yet, as this report attests, and as the government even indirectly acknowledges, there are a specific set of tactical laser weapons distinct from other lasers on the battlefield.[23] It is their use that should, and can be, the focus of discussion.

V. STATUS OF U.S. TACTICAL LASER WEAPON PROGRAMS

[21] ICRC, *Blinding Weapons: Reports of the Meetings of Experts Convened by the ICRC on Battlefield Laser Weapons 1989-1991* (Geneva: ICRC, 1993).

[22] See Letter, President Bill Clinton, to Representatives Ron Dellums and Lane Evans, and Senator Patrick Leahy, February 1, 1995, released under the Freedom of Information Act.

[23] Legal reviews, as required by DOD directive, were done by the Army on at least Stingray and LCMS "to ensure compliance with the international legal obligations of the United States, including the law of war." Department of the Army, AN/PLQ-5 Laser Countermeasure System; Law of War Review, September 16, 1994. See also, Department of the Army, Legal Review of the Combat Protection System AN/VLQ-7 (STINGRAY), June 10, 1991.

Department of Defense Instruction (DODI) 5000.2, "Defense Acquisitions Management Policies and Procedures," February 1991 (with Change 1, February 26, 1993), p. 2-10, states, "All actions of the Department of Defense with respect to the acquisition and procurement of **weapons**, and their intended use in armed conflict, will be consistent with the obligations by the U.S. government under all applicable treaties, with customary international law, and in particular, with the laws of war." (emphasis added).

DODI 5000.2 replaces DODI 5500.15, "Review of Legality of Weapons Under International Law," which was cancelled. Legal reviews are required for weapons, not systems.

There appear to be five active and five dormant U.S. tactical laser weapons programs. Five tactical laser weapons are virtually fielded in prototype form. The military is currently seeking approval of a production contract for its Laser Countermeasure System (LCMS) in June 1995 and is awaiting funding for full-scale production for its Stingray and Outrider weapons. In addition, the USSOCOM possesses prototypes of the Dazer and Saber 203 laser weapons for "special" missions.

The surprisingly large number of U.S. tactical laser weapon programs should not be interpreted as meaning that "the cat is out of the bag" and there is no hope to prohibit the system. There continues to be significant skepticism and opposition within the U.S. military to tactical laser weapons. Many do not perceive a clear and necessary military function for these weapons, particularly given the expanding range and greater precision of lethal conventional weapons. The cost of militarily significant lasers, their size and weight, and their reliability under battlefield conditions have all raised questions in the past. Indeed, there is reason to doubt the usefulness of tactical laser weapons on a modern battlefield given the limited opportunities for their employment.

Deployment of tactical laser weapons has also been stymied because they are (correctly) considered politically sensitive within the U.S. government. The result, however, has not been to abandon tactical laser weapon programs, but rather to drive them further into the "black" - making them mostly secret. The development of tactical laser weapons appears to have mostly moved into the realm of "special operations" and "nonlethal" weapons, instead of their previous, more publicly visible, "conventional" military status.

Special Missions for Blinding Lasers

It appears that tactical laser weapons have primarily found post-Cold War support in the U.S. military for "special missions," described as peacekeeping, counterinsurgency and counterterrorism, rather than large-scale conventional military actions. This means that laser weapons are likely to be used far differently than originally conceived and often described by supporters. The conventional missions envisioned for tactical laser weapons - disabling sophisticated electro-optical and fire control systems, particularly those associated with radar-guided surface-to-air missiles, armored vehicles with precision main guns, and advanced attack helicopters - are mostly absent in these special operations scenarios. Before proceeding with any of its tactical laser weapon programs, the U.S. government should reexamine whether the justifications it has contemplated as to the military necessity and legality of these weapons are accurate given the apparent transformation to use in special operations. Human Rights Watch is particularly concerned that the likely uses of tactical laser weapons in special operations - such as in counter-sniper missions - may be inherently antipersonnel in nature, with blinding the exact intended effect.

Laser Countermeasure System (LCMS) (AN/PLQ-4 and AN/PLQ-5)

LCMS is a one-person portable, manually operated, shoulder-fired, battery-powered, system mounted onto an M-16A3 rifle. It weighs forty-two pounds. Its developer is Lockheed Sanders (Lockheed-Martin) of Nashua, New Hampshire, and it is managed by the Night Vision & Electronic Sensors Directorate of the U.S. Army Communications-Electronic Command, Ft. Belvoir, Virginia, with participation by the Air Force and Marine Corps.

According to Lockheed, LCMS has the "primary objective to detect, jam, and suppress threat fire control, optical and electro-optical subsystems."[24] These subsystems can be moving or stationary, on the ground or in the air. The U.S. Army states that LCMS "meets the requirement to acquire a system which can

[24] Lockheed Sanders Fact Sheet, Laser Countermeasure System (LCMS) AN/PLQ-5, 1994.

be employed by the individual soldier to find and disrupt threat optical and electro-optical (OEO) surveillance devices."[25]

[25] U.S. Army Night Vision & Electronic Sensors Directorate Fact Sheet, "Laser Countermeasure System," (no date, obtained April 1995), released under the Freedom of Information Act.

According to the Army, LCMS functions include "acquisition...to identify threat OED for engagement with either the LCM or by direct/indirect fire weapons;" and "disruption...to negate the capabilities of threat OED or **impair the vision of an OED operator.**" (emphasis added) For soldiers using direct view optics, such as binoculars, the Army concludes, "At maximum ranges, the LCM may dazzle the threat operator. At small arms range (1,000 meters or less), the disruption laser may cause permanent eye injury to the operator, including blindness."[26]

Lockheed states that the effective range of LCMS is greater than two kilometers. The LCMS employs a Class IV laser. Current plans are that LCMS would be issued to light infantry, armor, cavalry and special operations troops. They would be distributed on the basis of three systems for each infantry platoon and one for each scout vehicle. Lockheed states that LCMS also can be mounted on a Bradley armored fighting vehicle, High Mobility Multi-purpose Wheeled Vehicle (HMMWV, and pronounced "Humvee"), helicopters or small boats. "Typical scenarios" for use include anti-narcotics operations and hostage rescue, as well as in decoy and deception operations or for psychological impact.[27]

Two versions of the LCMS exist, the PLQ-4 "basic" LCMS used in development testing, and the Phase II PLQ-5 "objective" LCMS. The initial contract for PLQ-5 research was awarded in February 1992.[28] Field testing of the PLQ-5 in the summer of 1994 resulted in negative comments about the system's overall weight of forty-two pounds,[29] and the PLQ-5 is slated to alleviate these initial testing concerns.

According to the Army, $22 million has been spent on the LCMS program thus far. The Army hopes for a development and production decision in June 1995 to continue with the PLQ-5. The initial production

---

[26] Department of the Army, Office of the Judge Advocate General, Memorandum, Subject: AN/PLQ-5 Laser Countermeasure System; Law of War Review, September 16, 1994, released under the Freedom of Information Act.

[27] Lockheed Sanders Fact Sheet, Laser Countermeasure System (LCMS) AN/PLQ-5, 1994.

[28] U.S. Army Night Vision & Electronic Sensors Directorate Fact Sheet, "Laser Countermeasure System," no date (1995), released under the Freedom of Information Act.

[29] Mark Hewish, "Battlefield Lasers: The Race Between Action & Countermeasure," *International Defense Review*, February 1995 (Vol. 28, No. 2), p. 39.

contract in a planned $80 million procurement program would support the purchase of fifty PLQ-5s, out of about 2,500 desired by the Army.[30]

Saber 203 Grenade Shell Laser Intruder Countermeasure System

The Air Force's Phillips Laboratory in Albuquerque, New Mexico developed Saber 203, "a laser system that can temporarily blind or impair the vision of enemy soldiers, reducing their ability to fight."[31] It is suspected as having been developed for use by special operations forces as well as by Air Force security police. The Human Rights Watch Arms Project has identified the Saber 203 as the system deployed to Somalia with the Marine Corps in early 1995, although it appears that the Saber 203 is now controlled by the USSOCOM.

[30] U.S. Army, Answers to Questions submitted by Chris Hanson, *Hearst Newspapers*, March 14, 1995; Mark Hewish, "Battlefield Lasers: The Race Between Action & Countermeasure," *International Defense Review*, February 1995 (Vol. 28, No. 2), p. 39; "U.S. Army to Award Laser Contract in '94," *Defense News*, May 24-30, 1993, p. 2.

[31] Fact Sheet from the United States Air Force, Air Force Materiel Command, Office of Public Affairs, Phillips Laboratory, "Saber 203 Grenade Shell Laser Intruder Countermeasure System," (no date, obtained May 1995).

The Air Force describes the Saber 203 laser weapons system as "lightweight, compact, and extremely simple to operate." The Saber 203 uses a standard 40mm M-203 grenade launcher attached to an M-16 rifle. It consists of two parts; the laser itself, which is the actual grenade; and a small control box snapped underneath the grenade launcher. A button on the box's side acts as an external trigger that fires the high-brightness diode laser grenade. The Air Force maintains that the laser operates "well below the Maximum Permissible Exposure (ME) at the attend range, 50 to 250 meters."[32]

According to the Air Force, the laser light causes glare, similar to the effect of looking at bright headlights at night, and flash blinding, similar to looking into a camera's flashbulb. The glare and flash blinding "can impair an adversary's ability to aim or reload a weapon, open a door or gate, plant or arm explosives, drive a vehicle, or leave the area." The Air Force also notes that the system "can also be useful to law enforcement agencies for helping subdue or control criminals."[33]

Though much more information is not known, Saber 203 is similar to the Army's Perseus system described below (Saber 203 was developed by the Air Force Phillips Laboratory while Perseus was developed by the Los Alamos National Laboratory). Though a Saber 203 prototype was offered to the Marines in Somalia and appears to be under the control of the USSOCOM, the Defense Department states that the system is "unfunded."[34]

Dazer

Dazer was a competitor for the Army's portable laser weapon contract awarded to Lockheed Sanders for the LCMS. The program was subsequently taken over by USSOCOM, which now possesses the prototype Dazers and may be secretly sponsoring further procurement. Dazer is a portable rifle-like, shoulder-fired, non-scanning, manually operated tactical laser weapon.[35] According to USSOCOM, the Dazer prototype "is not routinely issued for training and will only be issued as a result of USSOCOM SOJ3 [Director of Operations] direction. The Dazer is normally reserved for operational missions."[36]

---

[32] Ibid.

[33] Ibid.

[34] The Defense Department has acknowledged in a letter to Congressman Lane Evans and Senator Patrick Leahy that "One presently unfunded program investigated the potential use of lasers to temporarily impair vision" and that this "temporarily vision-impairing system...was deployed during the Somalia operation, but it was decided not to use it for that purpose during the operation;" Letter, Asst. Sec. Def. Holmes, to Rep. Evans and Sen. Leahy, March 27, 1995.

[35] U.S. Special Operations Command (USSOCOM) Fact Sheet, "Dazer System NSN 6660-00-X01-6666," (no date, obtained May 1995).

[36] Ibid.

The system, which is battery powered and self-contained, was developed under contract for the Army by Allied-Signal Electro-Optical Products Division, Westlake, California.[37] It consists of a ten pound laser rifle, a twenty-three pound electronics package, a battery pack, and an optical sight (Simrad KN-200 or KN-250).[38] Dazer employs a short-range (about one kilometer) near infrared spectrum alexandrite laser beam, and was tested around 1989.[39] Dazer's battery life is in excess of 1,000 individual shots, and the system may be fired single-shot or in a burst of up to fifty shots per minute.[40]

According to USSOCOM, there are no approved safety procedures for Dazer. It warns in its internal Fact Sheet that:

- The system can be highly dangerous to users.
- The Dazer is a high powered Class IV laser - the laser beam is hazardous to the eyes and skin.
- The Dazer operates at peak power of 1600 amps at 1450 volts. This voltage is lethal.[41]

Dazer is the unnamed system the Office of the Secretary of Defense referred to in its March 27, 1995 letter to Senator Patrick Leahy and Representative Lane Evans when it stated, "Another laser system, intended for special missions (not battlefield use), can blind and is operational in very limited quantities."[42] No additional details are known about current Dazer funding.

Stingray Combat Protection System (AN/VLQ-7)

The Stingray is the least secret of the tactical laser weapon systems. Two prototypes of Stingray were deployed in Saudi Arabia during the Gulf War, though they were never used. The U.S. Army states that Stingray is:

> a tactical laser system integrated on the Bradley Fighting Vehicle and designed to acquire and defeat threat direct fire control systems. Stingray increases the effectiveness and survivability of the Bradley crew and other friendly forces in the area by employing in-band laser energy to acquire and disable threat fire control systems..."[43]

Stingray detects, tracks, and counters optical and electro-optical devices on tanks, combat vehicles, and other ground and airborne systems "beyond the threat's effective [conventional weapons] ranges."[44] The weapon works by scanning for a sensor with a low-power near infrared spectrum beam (a novel solid-state

[37] Bengt Anderberg and Myron L. Wolbarsht, "Blinding Lasers: the Nastiest Weapon?," *Military Technology (MILTECH)*, March 1990.

[38] USSOCOM Dazer Fact Sheet.

[39] Hecht, "Lasers Designed to Blind," p. 28; Neil Munro, "Army Tests Hand-Held Laser Rifles: But Existing Lasers Already Threaten Troops, Experts Say," *Defense News*, March 5, 1990.

[40] USSOCOM Dazer Fact Sheet.

[41] Ibid.

[42] Letter, Asst. Sec. Def. Holmes to Rep. Evans and Sen. Leahy, March 27, 1995.

[43] U.S. Army, Response to press query by Chris Hanson, *Hearst News Service*, Subject: Stingray System, March 21, 1995.

[44] U.S. Army, "Weapon Systems - United States Army 1992," p. 19.

neodymium laser), reflecting a small fraction of the light back upon entering an optical system, and then instantaneously increasing the level of laser energy to overload or jam the sensor.

Stingray was developed by Martin Marietta Electronics and Missiles Group of Orlando, Florida, for the U.S. Army Communications-Electronics Command, Ft. Monmouth, New Jersey. General Electric (GE) was the subcontractor for the actual laser. The 350-pound system consists of four components:

> (1) sensor assembly with optics, stabilization, and high resolution detector; (2) laser transmitter; (3) commander's controls and display; and (4) system electronics which contain signal processing, built-in test, host vehicle interface and target handoff. The system operates in three modes - automatic, semi-automatic (man-in-the-loop), and manual...[45]

The Stingray program entered advanced development in 1982. A prototype of the first Stingray was delivered to the Army in 1986[46] and tested for more than thirty-six months. A second prototype was assembled for the Gulf War and both were deployed. They were not tested during the ground war, according to the Army, because of the short duration of the conflict.[47]

As of 1995, Martin Marietta is completing work on the three-year $68.4 million "Advanced Technology Demonstration" (ATD) contract for the Stingray. Using the two field-ready prototypes, Martin Marietta evaluated the tactical utility and operational effectiveness of the laser, as well as its safe operation.[48]

The Stingray program is unfunded in the FY 1996 Army budget request, but the program can move into full scale production if funding were made available. According to the Army, "The systems are planned for integration into the Experimental Forces (EXFOR) as part of Task Force XXI. Future plans will depend on the outcome of this exercise."[49]

Outrider Combat Protection System

Outrider is a multi-faceted reconnaissance and surveillance system incorporating the Martin Marietta-GE Stingray laser, and under development for the Marine Corps. The program is managed by the U.S. Army Communications-Electronics Command's Stingray program office, Ft. Monmouth, New Jersey. Outrider is integrated on a HMMWV ("Humvee") wheeled vehicle for use in scout and reconnaissance missions. The system consists of a passive surveillance suite (forward-looking infrared sensor and low-light level TV), navigational and communications equipment, and the Stingray laser.

According to Martin Marietta, Outrider is intended as a "nonlethal technology option for low intensity conflicts and special operations."[50] According to the U.S. Army, "it is capable of both active and passive target acquisition and has an active target countermeasure."[51]

---

[45] U.S. Army, "Weapon Systems - United States Army 1992," p. 19; see also Hecht, "Lasers Designed to Blind," p. 28.

[46] Forecast International/DMS Market Intelligence Report, *Electronic Warfare*, Airborne Electro-Optical Countermeasures (February 1993), April 1995.

[47] U.S. Army, "Weapon Systems - United States Army 1992," p. 19.

[48] Martin Marietta Fact Sheet, "Stingray," January 1995.

[49] Letter, U.S. Army Communications-Electronic Command, to William M. Arkin, April 27, 1995, in response to Freedom of Information Act request.

[50] Martin Marietta Fact Sheet, "Outrider Combat Protection System," 1994.

[51] U.S. Army, Response to press query by Chris Hanson, *Hearst News Service*, Subject: Stingray System, March 21, 1995.

Outrider is an "Advanced Technology Demonstration" (ATD) that will be completed in 1995. The Marine Corps is funding the demonstration of the prototype. According to the Army, it is "refining the Stingray requirement to include a heavy and light variant that will include the Outrider concept." Still, future plans for Outrider in the Army are not decided.[52]

Perseus Optical Munition

The Perseus "optical flash" 40mm rifle grenade projectile is similar to the Saber 203 developed by the Air Force. Perseus was developed by the Los Alamos National Laboratory (LANL) as part of its "disabling technologies" program. It is managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, New Jersey. Perseus works when the "Light from an explosion-induced shock-wave is used to pump an inexpensive plastic compact laser (CL) 'bullet' or 'optical flash' device..."[53] The grenade's pulsed chemical laser would put out a flash of intense white and laser light brilliant enough to temporarily blind people and sensors.[54]

The Army officially states that the Perseus program was cancelled in 1992,[55] but LANL was reported to be testing a more compact prototype in May 1993,[56] and sources state that LANL is still actively pursuing sponsorship and funding.

---

[52] Letter, U.S. Army Communications-Electronic Command, to William M. Arkin, April 27, 1995, in response to Freedom of Information Act request.

[53] Richard Kokoski, "Non-lethal Weapons: A Case Study of New Technology Developments," in *SIPRI Yearbook 1994* (Oxford University Press, 1994), p. 375.

[54] The concept of an optical flash round was described (though not by name) in "Nonlethal Weapons Give Peacekeepers Flexibility," *Aviation Week & Space Technology*, December 7, 1992, p. 50), and (under the name "Battlefield Optical Munition") in Joseph A. Dowden, "Non-Lethal Defense Options," *Armed Forces Journal International*, October 1993, p. 42.

[55] Letter, U.S. Army Tank-Automotive and Armaments Command, Armament Research, Development and Engineering Center, Picatinny Arsenal, New Jersey, to William M. Arkin, March 17, 1995, in response to Freedom of Information Act request.

[56] Andrew C. Tillman, "Weapons for the 21st Century Soldier," *International Defense Review*, January 1994 (Vol. 27, No. 1), p. 34.

Cobra

McDonnell-Douglas Electronic Systems Co. of McLean, Virginia, developed the Cobra for the Army. It is a portable, rifle-like, shoulder-fired, manually operated, non-scanning tactical laser weapon. Cobra was tested in 1989[57] and competed for the LCMS contract that was awarded to Lockheed Sanders. Cobra likely employs a diode-pumped neodymium laser (in the near infrared spectrum).[58] U.S. military sources have indicated to the Human Rights Watch Arms Project that McDonnell-Douglas is still actively pursuing sponsorship to continue development and production of Cobra.

Coronet Prince (ALQ-179)

This airborne advanced Electro-optical Countermeasures Pod was developed by Westinghouse Electric Corp., in Baltimore, Maryland, for the Air Force. Development began in 1979, in competition with the Martin-Marietta ALQ-180, and the prototype was completed in 1985. According to one report, the prototype used a

> scanning laser to illuminate the ground and a close-circuit TV camera to detect energy or the 'glint' reflected from optics... Actual details regarding how the Westinghouse system suppresses optics has not been released, but is believed to involve a high-power, blue-green laser that is aimed at the target, degrading optical equipment.

[57] Munro, "Army Tests Hand-Held Laser Rifles."

[58] Hecht, "Lasers Designed to Blind," p. 28.

This report noted that the program was terminated in 1991: "Due to other budgetary priorities, USAF has put off full-scale development, though basic research and engineering efforts continue."[59]

Compass Hammer

This optical countermeasure system associated with Coronet Prince was developed for the Air Force under a secret program. No other details are available.[60]

A 1993 report stated that a classified Air Force program was under way to fit a tactical laser weapon onto the F-15E Strike Eagle "for precisely locating and blinding enemy electro-optical systems."[61] The Human Rights Watch Arms Project suspects that this system is either Compass Hammer or the Coronet Prince system mentioned above.

Cameo Bluejay

The Cameo Bluejay is a helicopter-mounted tactical laser weapon developed by Sanders Associates (Lockheed Sanders), and a spin-off of the Army's ALQ-169 Optical Warning Location/Detection (OWL/D) device. Technical problems led to cancellation of Cameo Bluejay in 1989.[62] It is not known whether Cameo Bluejay or other derivatives have been revived for helicopter use.

VI. FOREIGN TACTICAL LASER WEAPON PROGRAMS

According to confidential U.S. government sources, Russia, China, Britain, France and Israel are known to have, or alleged to have, tactical laser weapon programs. Germany has also been mentioned in the military literature.[63] A Pentagon source told one reporter that "several European countries are perfecting laser technologies 'suitable for application to weapons systems for blinding human eyes.'"[64] A source told

[59] Forecast International/DMS Market Intelligence Report, *Electronic Warfare*, Airborne Electro-Optical Countermeasures (February 1993), updated April 1995.

[60] Ibid.

[61] David A. Fulghum, "Wild Weasels May Get Optics-Blinding Laser," *Aviation Week & Space Technology*, March 8, 1993, p. 25.

[62] Ibid.

[63] Paul Beaver, "Technology Comes of Age," *Jane's Defence Weekly*, January 13, 1990.

[64] Christopher Hanson, "Debate Over Use of Laser Weapons," *Seattle Post-Intelligencer*, April 17, 1995, p. 3.

the Human Rights Watch Arms Project that France had purchased a former Soviet battlefield laser and proposed using it as a counter-sniper weapon in Bosnia, but that its use was rejected.

Britain has deployed a ship-based laser, known as the Laser Dazzle Sight (LDS) or Outfit DEC since the early 1980s. The British laser system is intended to produce a dazzling effect on the cockpit screen of targeted aircraft or helicopters. Outfit DEC also has been configured for ground use, and reportedly has been fielded in tanks and armored vehicles.[65]

According to a 1992 U.S. Army report, the Soviet Union is thought to have developed (and so passed on at least to the Russian Federation) "significant numbers of similar type systems" to the U.S. Stingray in the form of an armored vehicle-mounted laser weapon.[66] The same report notes that China has a research and development program for this type of weapon. A 1987 Pentagon report stated,

> The USSR has established a very large and well-funded multi-ministerial program to develop strategic and tactical laser weapons... The tactical laser program has progressed to where battlefield laser weapons could soon be deployed with Soviet forces. The Soviets have the technological capability to deploy low-power laser weapons - at least for antipersonnel use and against soft targets...[67]

The Soviet naval-based Squeezebox laser (NATO designation) was reported in this time frame to have anti-sensor and antipersonnel functions.

VII. RECOMMENDATIONS

- The U.S. government should not approve full-scale production of the Laser Countermeasure System (LCMS) when the decision is before it in June 1995.

- The United States should cancel all ongoing research and development of tactical laser weapons because of their potential use as blinding antipersonnel weapons. Existing prototypes of tactical laser weapon systems should be destroyed.

- All other nations, including Russia, China, France, the United Kingdom, Germany, and Israel, should abandon any existing research and development programs for tactical laser weapons and should destroy existing prototypes.

---

[65] Vincent P. Grimes, "Lasers as Naval Weapons," *Wings of Gold*, Summer 1993, pp. 52-53; FI/DMS, *Electronic Warfare*. The LDS was developed by Irwin Desman Ltd., Letchworth, Hertfordshire.

[66] U.S. Army, "Weapons Systems - United States Army 1992," March 1992, p. 19.

[67] U.S. Department of Defense, *Soviet Military Power 1987*, p. 112.

- The United States should review its policies, rules of engagement, and doctrine with respect to laser weapons, and should adopt a firm prohibition on the use of lasers for the purpose of blinding.

- Nations which are parties to the 1980 Conventional Weapons Convention should adopt a new protocol at the September 1995 Review Conference which would prohibit blinding as a method of warfare and ban blinding tactical laser weapons.

ACKNOWLEDGMENTS

William M. Arkin, a weapons consultant to the Human Rights Watch Arms Project, was the primary researcher and writer for this report. Additional research and writing was provided by Ann Peters, a London-based researcher for the Arms Project on blinding lasers. The report was edited by Stephen Goose, the program director of the Arms Project. Kathleen Bleakley, Arms Project research assistant, and Selamawit Demeke, Arms Project associate, assisted with research and prepared the report for publication.

The Arms Project gratefully acknowledges funding for its work on blinding lasers from the S.H. Cowell Foundation, Ruth Mott Fund, and Ploughshares Fund, as well as general support funds from the Rockefeller Foundation.

Human Rights Watch Arms Project

Human Rights Watch is a nongovernmental organization established in 1978 to monitor and promote the observance of internationally recognized human rights in Africa, the Americas, Asia, the Middle East and among the signatories of the Helsinki accords. It is supported by contributions from private individuals and foundations worldwide. It accepts no government funds, directly or indirectly. Kenneth Roth is the executive director; Cynthia Brown is the program director; Holly J. Burkhalter is the advocacy director; Ann S. Johnson is the development director; Gara LaMarche is the associate director: Juan E. Méndez is general counsel; Susan Osnos is the communications director; and Derrick Wong is the finance and administration director. Robert L. Bernstein is the chair of the board and Adrian W. DeWind is vice chair. Its Arms Project was established in 1992 to monitor and prevent arms transfers to governments or organizations that commit gross violations of internationally recognized human rights and the rules of war and promote freedom of information regarding arms transfers worldwide. Joost R. Hiltermann is the director; Stephen D. Goose is the program director; Ann Peters is research associate; Kathleen A. Bleakley and Ernst Jan Hogendoorn are research assistants; William M. Arkin is a consultant; and Selamawit Demeke is associate.