**Centre for Conflict Resolution**
**Department of Peace Studies**

# Bradford Non-Lethal Weapons Research Project (BNLWRP)

## Research Report No. 8

**Neil Davison**
**Nick Lewer**

**March 2006**

UNIVERSITY OF BRADFORD
MAKING KNOWLEDGE WORK

# The Bradford Non-Lethal Weapons Research Project (BNLWRP)

The BNLWRP was established at the Centre for Conflict Resolution, Department of Peace Studies in 1995. The project's key objectives are to:

- Review and describe non-lethal weapons (NLWs), which are being developed and deployed.
- Identify and track defence and related research institutes involved in the development and manufacture of NLWs.
- Follow doctrine and policy debates related to the use of NLWs.
- Monitor the operational use of NLWs;
- Examine the impact of NLWs on international laws, arms treaties and conventions.
    - Highlight the ethical and societal issues that surround the research, development, deployment and use of such weapons.

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**Previous BNLWRP reports:**

Past BNLWRP reports are available to download from:
http://www.bradford.ac.uk/acad/nlw/research_reports/

Research Report 7 - May 2005
Research Report 6 - October 2004
Research Report 5 - May 2004
Research Report 4 - December 2003
Research Report 3 - August 2001
Research Report 2 - June 1998
Research Report 1 - November 1997

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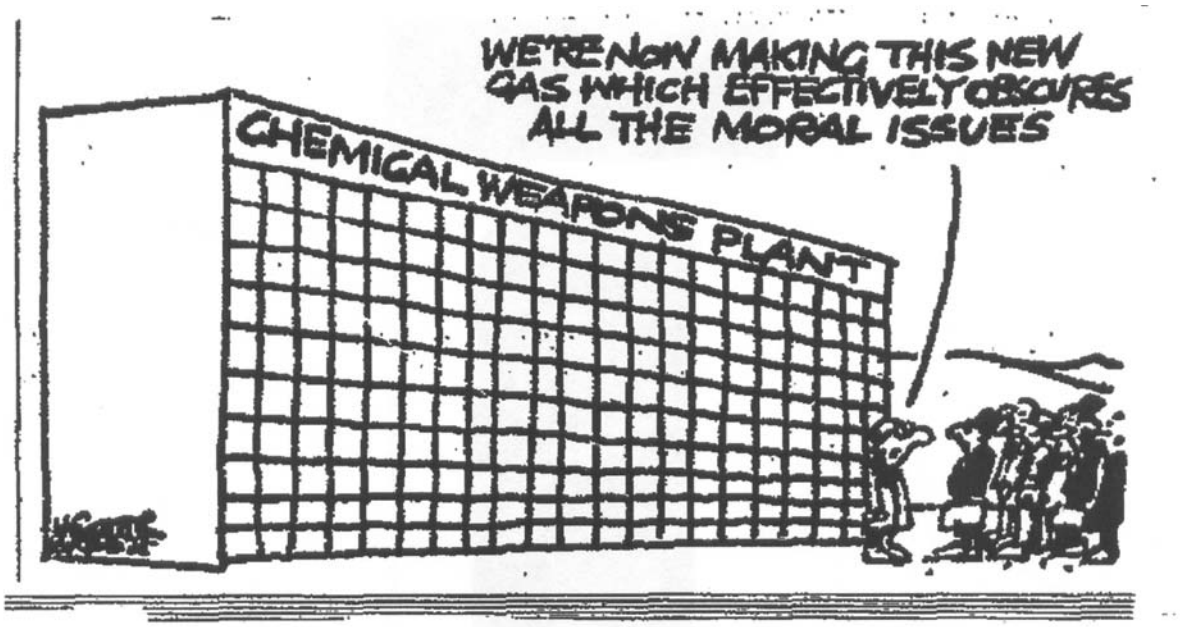


*Source: The Independent, Thursday 12 January 1989*

**See section 2.7 of this report on 'Biochemical Incapacitating Agents'. pp. 50-56**

## Selected Publications by BNLWRP Staff


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# Acronyms

| | |
|---|---|
| ACLU | American Civil Liberties Union |
| ACPO | Association of Chief Police Officers (England and Wales) |
| ADS | Active Denial System |
| AEP | Attenuating Energy Projectile |
| AFOSR | Air Force Office of Scientific Research (U.S. Air Force) |
| AFRL | Air Force Research Laboratory (U.S. Air Force) |
| AI | Amnesty International |
| ANLM | Airburst Non-Lethal Munition |
| ARDEC | Army Research and Development Engineering Command (U.S. Army) |
| ATL | Advanced Tactical Laser |
| ATM | Anti-traction materials |
| BNLWRP | Bradford Non-Lethal Weapons Research Project |
| BSF | Border Security Force (India) |
| BTWC | Biological and Toxin Weapons Convention |
| BW | Biological Weapons |
| CCW | Convention on Certain Conventional Weapons |
| CED | Conducted Energy Device |
| CS | Ortho-chlorobenzalmalononitrile / tear gas |
| CW | Chemical Weapons |
| CWC | Chemical Weapons Convention |
| DARPA | Defense Advanced Research Projects Agency (U.S. Military) |
| DE | Directed Energy |
| DEPSCoR | Department of Defense Experimental Program to Stimulate Competitive Research |
| DOD | Department of Defense (U.S.) |
| DOJ | Department of Justice (U.S.) |
| DOMILL | DSAC Sub-Committee on the Medical Implications of Less-lethal Weapons. |
| DSAC | Defence Scientific Advisory Council (DSAC) (U.K.) |
| DSTL | Defence Science and Technology Laboratory (U.K.) |
| DSTO | Defence Science and Technology Organisation (DSTO) |
| ECBC | Edgewood Chemical and Biological Center (U.S. Army) |
| FOIA | Freedom of Information Act |
| GAO | Government Accountability Office (U.S.) |
| HEAP | Human Effects Advisory Panel |
| HECOE | Human Effects Center of Excellence (U.S. Military) |
| HERB | Human Effects Review Board (U.S. Military) |
| HERC | Human Effects Risk Characterization |
| HOSDB | Home Office Scientific Development Branch (U.K.) (formerly PSDB) |
| HPM | High Power Microwave |
| HSARPA | Homeland Security Advanced Research Projects Agency (U.S.) |
| ICRC | International Committee of the Red Cross |
| ILEF | International Law Enforcement Forum |
| IPCC | Independent Police Complaints Commission |
| JAG | Judge Advocate General |
| JNLWD | Joint Non-Lethal Weapons Directorate (U.S. Military) |
| KE | Kinetic Energy |
| LIPC | Laser Induced Plasma Channel Technology |
| LLW | Less-Lethal Weapon |
| LRAD | Long Range Acoustic Device |
| MAD | Magnetic Acoustic Device |
| MPA | Metropolitan Police Authority |
| MPS | Metropolitan Police Service |
| MRAD | Medium Range Acoustic Device (or LRAD 500) |

| | |
|---|---|
| NATO | North Atlantic Treaty Organisation |
| NCIS | National Criminal Intelligence Service (U.K.) |
| NIJ | National Institute of Justice (U.S.) |
| NIO | Northern Ireland Office (U.K.) |
| NLCS | Non-Lethal Capability Sets (U.S. Military) |
| NLW | Non-Lethal Weapon |
| NSWD | Naval Surface Warfare Division (U.S. Navy) |
| OC | Oleoresin Capsicum |
| OFT | Office of Force Transformation (U.S. Military) |
| ONR | Office of Naval Research (U.S. Navy) |
| OOTW | Operations Other Than War |
| PADS | Portable Active Denial System |
| PAVA | Synthetic Oleoresin Capsicum (OC) |
| PELT | Portable Efficient Laser Testbed |
| PEP | Pulsed Energy Projectile |
| PSDB | Police Scientific Development Branch (U.K.) (now HOSDB) |
| PSNI | Police Service of Northern Ireland |
| RAP | Ring Airfoil Projectile |
| RCA | Riot Control Agent |
| TAPM | Taser Anti-Personnel Munition |
| TSU | Tear Smoke Unit (Border Security Force, India) |
| TUGV | Tactical Unmanned Ground Vehicle |
| UAV | Unmanned Aerial Vehicle |
| VLAD | Vehicle Lightweight Arresting Device |
| XREP | Extended Range Electronic Projectile |

# 1. OPINION AND COMMENTARY

### Electrical Shock Weapons (Tasers) in the UK

In the UK at present Taser electrical stun weapons can only be used by trained firearms officers in situations where the use of firearms is also authorised. But the Association of Chief Police Officers (ACPO) is asking for these 'non-lethal' weapons to be made more widely available to other police officers. If this is agreed there will be significant implications for the use of force by police in the UK. In July 2005 the Home Office Minister, Hazel Blears, had stated that the Taser was a dangerous weapon and not appropriate for wider use.

The rationale behind the deployment of 'non-lethal' or 'less-lethal' weapons, such as the Taser, is to provide police officers with an alternative to lethal force for dangerous and life-threatening situations they face. Wider availability of such weapons should, it is argued, further limit the need to resort to lethal firearms and thereby reduce incidence of serious injury and death. Over the past few months senior police officers have issued public statements that the Taser weapon should be made available to all officers on the beat. They argue that because police are facing dangerous individuals on an everyday basis, the Taser is required to protect their officers and deal with violent offenders without having to call in a firearms unit in certain situations. A crucial point about this proposal is that it would represent a scaling up in the 'visible' arming of police officers in the UK. It is claimed by opponents that such an extended use of Taser would actually result in an increase in the level of force used by police in the UK, a concern also echoed by the Independent Police Complaints Committee (IPCC) in the minute of their 27 April 2005 'Casework and Investigations Committee' meeting.

The lessons of wider deployment from the United States are not encouraging. A report from Amnesty International in 2004 found evidence that "…far from being used to avoid lethal force, many US police agencies are deploying Tasers as a routine force option to subdue non-compliant or disturbed individuals who do not pose a serious danger to themselves or others." In other words, the Taser has suffered from mission creep. It is not merely employed against dangerous individuals where the alternative is lethal force, but also against school children, mentally ill individuals, people in handcuffs or other restraints, and people passively resisting or simply arguing with the police. In an increasing number of cases it has become a compliance tool for police officers rather than a weapon used to prevent injury or death caused by use of other means. A 2004 study by the *Denver Post* of Taser use in Colorado found that in one county a third of the 112 people shot with a Taser had been handcuffed at the time. The 1990 UN *Basic Principles on the Use of Force and Firearms by Law Enforcement Officials* state that "Law enforcement officials, in carrying out their duty, shall, as far as possible, apply non-violent means before resorting to the use of force and firearms." Unfortunately the US experience indicates that non-violent techniques, such as simple negotiation, are being bypassed in many instances by early use of the Taser to gain compliance.

What is it like to be incapacitated by a Taser weapon? When fired the Taser propels two barbed darts with trailing wires that attach to the skin or clothing. Upon impact a 50,000-volt electric shock is discharged into the victim for a period of five seconds. Whilst the barbs remain attached this discharge can be repeated multiple times by pulling the trigger again (and again). The immediate effects are debilitating. The current causes involuntary muscle

contraction and extreme pain. The victim completely loses control over their body and falls to the floor until the current stops. The whole experience is both painful and degrading. So much so that in 1997 Robin Cook, the then Foreign Secretary, considered electro-shock weapons, including Tasers, amongst equipment "designed primarily for torture", saying that the UK Government would "press for a global ban." In the intervening years the marketing of electro-shock weapons has changed significantly but their profound effects remain.

Receiving a shock from a Taser is not without its health risks. Whilst initial research carried out by the MoD's Defence Science and Technology Laboratory (Dstl) prior to the Home Office's introduction of the Taser concluded that the electrical discharge is unlikely to have an adverse effect on the heart in healthy individuals, there are concerns about the increased susceptibility of those with existing heart problems (at least 2.5 million people in the UK) and those under the influence of recreational drugs, including alcohol. Subsequent research at Dstl found that increased risk of heart failure amongst such individuals following Taser use could not be excluded. This is significant given that, during the year-long trial in the UK, over 50% of Taser victims were under the influence of drugs or alcohol. Interim results of a US study of over 21,000 uses of various 'less-lethal' weapons, including the Taser, have showed that 23% of victims were under the influence of drugs and/or alcohol. Canadian Police highlighted two other safety concerns in a recent report. The muscle spasms caused by the Taser can impair breathing, particularly if a person receives multiple shocks, and this may also contribute to a lowering of pH in the body, a potentially life-threatening chemical imbalance. Also the electric shock does not affect everyone equally. Those with smaller body size and lower weight are more susceptible to potential adverse effects.

Secondary injuries to the head and other parts of the body have occurred since the victim falls to the ground once shocked. Often this fall will be on a hard surface such as a road or pavement, a far cry from the controlled conditions under which some police officers have volunteered to experience a Taser shock (with two officers supporting them under each arm and a safety mat on the floor). The barbs can leave small cuts and burn marks on the skin but worse injuries can result if they hit sensitive areas of the body such as the eye, mouth, neck and groin.

Amnesty International has documented 103 deaths in the United States and Canada between June 2001 and March 2005 following the use of the Taser by the police. In 17 of these cases medical examiners cited the Taser either as a contributing factor or could not rule it out. In many cases the victim received multiple shocks from the Taser. Other factors such as drug intoxication, existing heart problems and a condition called 'excited delirium' have commonly been cited as the primary cause of death. The manufacturer and other observers argue that these factors would have caused death independent of Taser use, whilst others claim that the interaction of the Taser's electric shock with these factors is not sufficiently well understood to justify this assertion.

The Home Office and UK police forces have engaged in an in depth review of Taser weapons and participated in some public debate with respect to their deployment plans. Their conclusions are that potential adverse health effects and possibilities of abuse are outweighed by their operational utility. But we would argue that the painful and degrading effects of the Taser, its susceptibility to misuse, and the associated health risks militate against a wider deployment on our streets and could, as the US experience has shown, result in the weapon becoming a compliance tool. Of course we must support the police so that they can carry out, on our behalf, often difficult and dangerous duties, but we are concerned that such a wider

deployment of the Taser will further undermine the ethos of 'policing by consent' and increase a perception of armed officers 'policing by compliance'.

*Postscript*

Despite the number of deployments of the Taser by the Metropolitan Police, figures provided by them and quoted in *House of Commons Hansard* show few cases where they were actually fired:[1]

| **Metropolitan police—Deployment of Taser**<br><br>**Number** | | |
|---|---|---|
| | **Deployed** | **Fired** |
| October 2004 | 213 | 2 |
| November 2004 | 168 | 1 |
| December 2004 | 174 | 2 |
| January 2005 | 148 | 1 |
| February 2005 | 157 | 2 |
| March 2005 | 176 | 2 |
| April 2005 | 241 | 4 |
| May 2005 | 262 | 5 |
| June 2005 | 264 | 2 |
| July 2005 | 301 | 3 |
| August 2005 | 268 | 2 |
| September 2005 | 273 | 2 |
| (Up to 07/10/05)<br>October 2005 | 45 | 0 |

However, even at this low level of actual usage, as Dr. Brian Rappert has noted in his paper presented to Jane's 8th Annual Less-Lethal Weapons Conference, "…Tasers are being used in ways far more diverse than as a substitute for firearms."[2] In January 2006 statistics on for overall police use of firearms were published by the Home Office for the period 1 April 2004 to 31 March 2005: "The Police discharged a conventional firearm 18 times covering 5 incidents. In addition, the Police discharged baton rounds in 23 incidents and fired Taser in 35 incidents."[3]

Another House of Commons written answer refers to medical issues:

> A Taser Deployment Form is completed on each occasion that a Taser is deployed. These forms are passed to DOMILL, together with any post-incident medical assessments undertaken by the Force Medical Examiner. From examination of these reports DOMILL are content that the medical issues attributable directly or indirectly Taser use were not unexpected and addressed by their extant statements.[4]

*Also see:*

Rappert, B. (2005) Determinants of the Acceptability of LLWs: The View of a Skeptical Outsider. Paper presented to the *Jane's 8th Annual Less-Lethal Weapons Conference*, October 2005.

Marks, P. (2005) The shocking use of police stun guns. *New Scientist*, No. 2525, p. 30-31, 12 November 2005.

*Official Documentation:*

ACPO. *Independent Evaluation of the Operational Trial of Taser*. *Final Repor*t, PricewaterhouseCoopers LLP (PwC), May 2004.

ACPO. *Operational Use of Taser. Policy*.

Cooper, G. *UK Government's assessment of the medical risks of M26 and X26 Tasers*. Dstl. Presentation at Janes LLW Conference, 27th October 2005.

DSAC Sub-Committee on the Medical Implications of Less-Lethal Weapons (DOMILL). *Statement on the comparative medical implications of the use of the M26 Advanced Taser*. DSTL/CBS/BTP/PAT-ACPO/MAN/REP/4/ dated 9th December 2002.

DSAC Sub-Committee on the Medical Implications of Less-Lethal Weapons (DOMILL). Second s*tatement on the medical implications of the use of the M26 Advanced Taser*.(July 2004). DSTL/CBS/BTP/PAT-ACPO/MAN/REP/4/ dated 27th December 2004.

DSAC Sub-Committee on the Medical Implications of Less-Lethal Weapons (DOMILL). *Statement on the comparative medical implications of the use of the X26 Taser and the M26 Advanced Taser*. Dstl/BSC/BTP/DOC/803 dated 7th March 2005.

Police Federation of England and Wales. *Taser*. 16th November 2005

Wilkinson, D. *Police Scientific Development Branch Further Evaluation of Taser Devices*. PSDB Publication No 19/05, St Albans, Hertfordshire, UK, 2005.

## Torture

Whilst we have continually highlighted our general concern about the misuse of non-lethal weapons technologies for torture and the causing of unnecessary suffering in previous reports, we think it is important to keep this issue high on the agenda. There have been attempts to 'redefine' torture and justify its use in obtaining information from terrorists and terrorist suspects. One such example was highlighted by Amnesty International where Fritz Allhoff, of the University of California, argued that:

> ..... torture is, under some circumstances, morally permissible. In doing so, I have not presupposed utilitarianism to be correct, but have argued that even other normative approaches would be able to accommodate this conclusion. The conditions that I have suggested to be met in order to allow torture are: pursuit of information, reasonable expectation that captive has the information, reasonable expectation that the information corresponds to an imminent and significant threat, and reasonable expectation that the information can be used to disarm the threat. There are, of course, substantive

> issues as to what constitutes reasonable expectation, but I think that we could settle these ostensively, or else be confident that we have made progress on the formal account. I have also stressed that, though I would support torture if these conditions were met, we should still be prudent to administer the minimum amount of torture necessary (measured both in terms of intensity and quality) that is necessary to achieve the desired goal. Hopefully this moderate position has both intuitive appeal and is theoretically attractive.[5]

Alan Dershowitz, a Professor at Harvard Law School, has advocated the issuing of "torture warrants" in the so called "war on terror".[6] We would strongly oppose these, and other similar attempts, to diminish international conventions banning the use of torture. Human rights lawyer Clive Stafford-Smith made a robust defence of decency in a 2005 article for *Open Democracy*:

> Decency is genuinely a good idea. When we treat others with decency, they become far less likely to wish us harm, and far more likely to tell us what they know about the extreme plans of others. Torture is indeed uncivilised; it is also unwise.[7]

In November 2005 *ABC News* reported new accounts of torture of prisoners in Iraq by US soldiers with Tasers and 'rubber bullets':

> According to Sabbar, U.S. soldiers used Taser guns and rubber bullets to control detainees.
>
> "They had another kind of torture using electrical shocks, pointing a hand gun towards you that shocks you and causes you to lose consciousness for a while," he said. "That was one of the methods at the airport [jail]. Or use rubber bullets that end up hurting or burning the area where it hits you, and very painful ones."[8]

These weapons have been used in prison camps in Iraq, as we reported in our previous report *(BNLWRP Research Report No.7*, May 2005). A 2004 questionnaire about 'detainee operations' in Iraq, filled in by a US Army Officer, describes disciplinary measures used: (documents were released to the American Civil Liberties Union (ACLU) under the Freedom of Information Act in September 2005).

> [Q] What control measures do you use to maintain detainee discipline and security in the collection point?
>
> [A] Isolation rooms, withhold treats, non-lethal rounds, batons … & Tazers [sic][9]

Peter Gorman, in an article[10] providing cases where people had received multiple shocks from a Taser fired by the police, describes one incident where a suspect was Tasered seven times whilst handcuffed and lying face down on the ground. Defence Attorney David Henderson stated "That's not police work, that's torture". Incidents such as this, and confusion over where the Taser lies on the 'use of force continuum' for some law enforcement agencies, indicate that Taser is being used far too early in many situations. For example, when suspects refuse immediately to obey a police order, or when there are still opportunities for resolution using negotiation and communication skills. As Gorman points out there is a danger that the Taser will be seen not as a tool for use in life threatening situations, "but as a bully's tool of compliance, something to get people into line". In an incident in Nashville, U.S, a man who had been taking drugs was reportedly Tasered up to 19 times by police officers.[11] The article also highlighted a warning that had been issued by Taser on 28th June 2005, which warned police officers about the dangers of shooting someone multiple times with the company's stun guns:

> Repeated, prolonged and/or continuous exposure(s) to the Taser electrical discharge may cause strong muscle contractions that may impair breathing and respiration, particularly when the probes are placed across the chest or diaphragm. Users should avoid prolonged, extended, uninterrupted discharges or extensive multiple discharges whenever practicable in order to minimize the potential for over-exertion of the subject or potential impairment of full ability to breathe over a protracted time period.[12]

The issue of non-lethal weapons which are banned for export in the UK came into the public domain again because of an arms fair held in London's Docklands, September 2005. An Israeli company, TAR Ideal, advertised leg irons, stun guns and stun batons.[13] As reported in Hansard (19th December 2005), Malcolm Wicks (on behalf of the Secretary of State for Defence) restated the UK Governments 1997 ban on the 'export and transhipment through the UK of torture goods related to portable devices designed or modified for riot control purposes or self-protection to administer an electric shock, including electric-shock batons, electric-shock shields, stun guns, and tasers'. This explicit acknowledgement that electro-shock weapons can be used for torture reinforces demands for a constant vigilance and monitoring of their use in the UK. This is also in line with calls from the Independent Police Complaints Commission (IPCC) for regular reviews of the use of both the Taser and chemical irritants.

*European Regulation on Torture*

A new EC regulation, *Council Regulation (EC) No 1236/2005 concerning trade in certain goods which could be used for capital punishment, torture or other cruel, inhuman or degrading treatment or punishment*, was passed in June 2005.[14] Under Article's 3 and 4 of the legislation all equipment with no practical use apart from capital punishment, torture, and cruel, inhuman or degrading treatment or punishment will be banned for export or import from the European Community. Equipment covered, which is listed in Annex II of the legislation, includes electric-shock restraint belts. This European consensus on these devices is not shared in the United States, where they are used in some States, to escort prisoners. These shock belts are also considered part of "the family of electro-stun devices" for use by the US military.[15]

Annex III items, which include portable electric-shock devices and chemical irritant sprays, will require a licence for export from the EC under Article 5. Article 7 of the regulation allows member States to "…adopt or maintain a prohibition on the export or import of leg irons, gang chains and portable *electric shock devices*."[16] [emphasis added] The UK already has a ban to all destinations on these items[17] and, as we mentioned in our previous report (*BNLWRP Research Report No. 7*, May 2005, p. 42) had been pushing for all Member States to accept stricter controls. Pressure should now be brought on other EU Member States to follow suit.

**Civil Society Views**

It seems that both police and civilians are aware of the dangers associated with non-lethal weapons. However the demand of operational needs and the 'heat of the moment' can, at times, appear to the civilian to over-ride ethical and civil rights considerations. The demand by civil rights groups, independent researchers and analysts for long term evaluations of the health and social implications of non-lethal or less-lethal weapons can be frustrating for front-line police officers who express a need for such technologies within a shorter time frame to help them with their often difficult job. Some police officers have expressed an

opinion that because police officers are getting smaller, they need more technological help to do their job! For 'community acceptance' of current technologies there must be a transparent and accountable process for evaluation of their effects, and also of their use. In this respect ethical codes of conduct/practice related to such weapons must be a priority for civil society and the police forces.

For police and security sector services this ethical and social problem is not going to go away. It will, in essence, become a bigger issue, as the new technologies start to mature, and offer a wider range of technological opportunities (with associated socio-political implications) to those responsible for law and order. It will test potential linkages between the temptation of using such technologies for the 'political control' of populations, and the police-state relationship.

**Neuroscience and the military**

In early 2006 the think tank Demos and the Welcome Trust published a collection of essays entitled *Better Humans? The politics of human enhancement and life extension*. In his contribution, Professor Steven Rose, a leading neuroscientist based at the Open University, warns of increasing military interest in emerging technologies that may enable the manipulation of the brain:

> …in the panicky environment of the so-called 'war on terror' there is increasing military interest in the development of techniques that can survey and possibly control and manipulate the mental processes of potential enemies.[18]

He points to the use of electromagnetic energy to manipulate the brain:

> …there is a long history of attempts by DARPA [US Defense Advanced Research Projects Agency] to develop techniques for focusing microwave beams to disorient or confuse opponents. Whether microwave technology is capable of achieving this goal is uncertain. More promising, however, is a much newer technique – transcranial magnetic stimulation (TMS). This focuses an intense magnetic field on specific brain regions, and has been shown specifically to affect thoughts, perceptions and behaviours that are dependent on those regions. Currently usable only when a subject's head is placed inside the relevant machine, TMS at a distance is now under active investigation. So is chip technology, which might provide implanted prostheses to overcome sensory deficits or control behaviour.[19]

Ostensibly DARPA's interest in TMS is in enhancing the performance of US soldiers, as described on the web site of its Defense Sciences Office:

> The goal of the Preventing Sleep Deprivation Program is to define and implement approaches to prevent the harmful effects of sleep deprivation, and to provide methods for recovery of function with particular emphasis on cognitive and psychomotor impairments. Among the approaches currently under investigation include novel pharmaceuticals that enhance neural transmission, nutraceuticals that promote neurogenesis, cognitive training, and devices such as transcranial magnetic stimulation.[20]

However, given the current interest in directed energy and suppressive/incapacitating weaponry, it is hard to imagine that this technique is not under consideration for use as a weapon. Other means of manipulating the nervous system using electromagnetic beams certainly are. In the 'Directed Energy' section of this report we describe research sponsored by the US Air Force that seeks to use electromagnetic energy to manipulate the nervous system by altering neurotransmitter release.

Russia is also conducting research into the use of electromagnetic radiation to manipulate the nervous system.[21]

## Non-Lethal Weapons and International Law

David Fidler's paper in the September 2005 issue of the *International Review of the Red Cross*, entitled 'The meaning of Moscow: "Non-lethal" weapons and international law in the early 21st century', provides an interesting historical overview of the debate between advocates and critics over the development of non-lethal weapons. It then moves on to a detailed legal analysis of the issues surrounding incapacitating chemicals and the Chemical Weapons Convention (CWC). He draws a broad conclusion about the future implications of non-lethal weapons development for international law:

> In short, the meaning of Moscow teaches that rapid technological change will continue to stress international law on the development and use of weaponry, but in ways more politically charged, legally complicated and ethically challenging than the application of international humanitarian law in the past to technologies specifically designed to kill and destroy.[22]

## US Department of Defense

The US Department of Defense's June 2005 *Strategy for Homeland Defense and Civil Support* sees the potential role for non-lethal weapons in 'homeland defense':

> The Department will expand basic research into the physiological effects of non-lethal weapons. The Department will also identify opportunities to share appropriate non-lethal capabilities with domestic law enforcement agencies, consistent with applicable law.[23]

The DoD's February 2006 *Quadrennial Defense Review* also highlights a perceived need for non-lethal weapons in "defeating terrorist networks".

## US National Institute of Justice R&D

In October 2005 the US National Institute of Justice (NIJ) issued another solicitation, *Less Lethal Technologies*, announcing their desire to fund further development of non-lethal weapons:

> NIJ seeks concept papers that describe the development of new, innovative devices that incapacitate individuals without risk of death or serious or permanent injury. NIJ is seeking devices that:
> • Discretely incapacitate an individual (who may be in a crowd) at a distance.
> • Compel near-instantaneous compliance at arms length.
> • Compel one or more individuals to rapidly exit or not enter an area.
> Proposed technologies should be safe and have predictable and reversible effects. Ideally, they will be lightweight, preferably handheld, require minimal training, and be rapidly deployable. Devices should be designed for use by the average criminal justice practitioner. Technologies proposed should also be easily maintained and should impose a minimal logistics burden. Technologies must be affordable by State and local law enforcement and corrections agencies.
>
> Possible Technical Approaches
> Solutions to meet the needs described in this solicitation might include but are not limited to:
> • Chemically based devices.
> • Directed energy based devices.
> • Conductive energy devices.[24]

The National Institute of Justice's FY 2005 funding in the area of *Less-Lethal Incapacitation*, details of which are now available on their website, focus on studies of the Taser:

> Less-Lethal Incapacitation
>
> *Analysis of Human Injuries and Taser Deployment: Effect of Less-Lethal Weapons in the De-escalation of Force*
> Florida Gulf Coast University
> $99,856
> 2005–IJ–CX–K050
>
> *Analysis of Less-Lethal Technologies: Taser Versus Stinger*
> Florida Gulf Coast University
> $36,103
> 2005–IJ–CX–K049
>
> *Collection and Dissemination of Applicable Databases to the Law Enforcement Community: Phases II and III*
> Pennsylvania State University
> $250,000
> 2004–IJ–CX–K039
>
> *Effect of Taser on Cardiac, Respiratory, and Metabolic Physiology in Human Subjects*
> University of California–San Diego
> $231,754
> 2005–IJ–CX–K051
>
> *Evaluation of Standard Development for Kinetic Energy Impact Munitions*
> Wayne State University
> $149,493
> 2002–MU–CX–K006
>
> *Human Electromuscular Incapacitation Devices in Trainees*
> New Jersey Medical School–Medicine and Dentistry
> $375,000
> 2005–IJ–CX–K065
>
> *Interdisciplinary Working Group for Review of Kinetic Energy Impact Injuries*
> Wayne State University
> $190,246
> 2005–MU–MU–K001
>
> *Less-Lethal Weapon Technology Review and Operational Needs*
> Pennsylvania State University
> $300,000
> 2004–IJ–CX–K040 [25]

Another October 2005 NIJ solicitation sought ideas for vehicle stopping technologies such as "Analysis, development, evaluation, or demonstration of a working model or prototype electromagnetic pulse (EMP) vehicle immobilization system."[26]

A third solicitation in 2005, 'School Safety Technologies', actually sought research ideas for weapons that could be used in schools against children:

> Low-Level Force Technologies: Better, more effective, and more acceptable low-level force devices than are currently available are needed. These devices should be inherently safe, causing no long-term

> or permanent injury to minors, the elderly, the infirm, or to the general population. Use of these devices on minors should also not engender objection from the public, the media, or government.[27]

**Russia**

Russia's weapons export agency, Rosoboronexport, has been advertising a number of incapacitating weapons systems. Russian news agency *Novosti* described an arms exhibition in July 2005:

> Rosoboronexport also displayed non-lethal weapons, such as pistols and grenade-launchers that temporarily disable terrorists' ability to breathe, see, or hear. Others instantly immobilize terrorists, literally tying them up hand and foot with special nylon nets and glutinous substances.[28]

Other non-lethal weapons were also shown at an international arms fair held in Moscow in October 2005:

> Non-lethal weapons will also be presented by demonstrating at the stand: special grenades of combined action used for temporary incapacitation of the criminals, such as the SV-1351 grenade, which produces combined psycho-physiological and mechanical effect on the perpetrators, with its intense flash, sound impulse and rubber shrapnel impact; the SV-1334 sound-and-flash hand grenade with automatic primer, that distracts and stuns criminals; and the SV-1357 smoke grenade that is used to limit visibility indoors and in the open. The inventory of the Russian special operations forces units also includes the Plamya-M sound-and-flash stationary grenades, Zarya-2, Fakel and Fakel-S sound-and-flash hand grenades, as well as Dreif and Gvozd tear-and-gas hand grenades.[29]

Rosoboronexport also took part in a NATO arms exhibition of non-lethal weapons, held in late October 2005 at NATO headquarters in Brussels.[30]

A number of papers were presented at the 3rd European Symposium on Non-Lethal Weapons in May 2005 that give further insight into Russian weapons development in this area, in particular: *Prerequisites and Capabilities for Development and Deployment of Special Means of Combined Non-Lethal Effect* by V. N. Baranov, V. V. Lazarev, and V. V. Selivanov[31]; and *Current and Emerging Non-Lethal Technologies* by V. Selivanov, J. Alexander, D. Cole, V. Klochikhin, and O. Rams.[32] There were also a number of papers on electromagnetic weapons (see 'Directed Energy' section of this report).

**Non-Lethal Capability Sets (NLCS)**

In October 2005 the US *Army News Service* reported that 68 Non-Lethal Capability Sets (NLCS) were being sent to troops in Iraq and that the US Army was planning to purchase a total of 438 of theses sets.[33] Also in October 2005 the US Marines awarded a contract to Aardvark Tactical[34] to provide them with Non-Lethal Capability Sets.[35]

**UK Home Office Database**

Under the aegis of the International Law Enforcement Forum (ILEF) the UK Home Office Scientific Development Branch (HOSDB) has developed an online 'Less Lethal Weapons Database', a beta version of which is available at: http://www.ilef.org/ It is currently only available to organisations providing information for the database but, according to the web site, it will be made publicly available once fully developed. Most of the contributors to the database are police or military organisations or research agencies involved in the development and/or use of these weapons. The database provides information on use,

evaluation, deployments, and research on these weapons. Since the database provides information about research projects in this field, after careful consideration we have added the details of our project to the database as we hope to highlight those issues which we have brought to attention in our series of research reports. Our entry in the database reads as follows:

> *Research Information:*
>
> Bradford University's Non-Lethal Weapons Research Project (BNLWRP) Research objectives:
>
> * Review and describe non-lethal weapons (NLWs), which are being developed and deployed.
> * Identify defence and related research institutes involved in the development and manufacture of NLWs.
> * Follow doctrine and policy debates related to the use of NLWs.
> * Monitor the operational use of NLWs.
> * Examine the impact of NLWs on international law, arms treaties and conventions.
> * Highlight the ethical and societal issues that surround the research, development, deployment and use of such weapons.
>
> Reports can be downloaded at http://www.bradford.ac.uk/acad/nlw/

HOSDB gave presentations on the development of the database at the 3rd European Symposium on Non-Lethal Weapons, and the Jane's 8th Annual Less-Lethal Weapons Conference.[36]

**Pennsylvania State University Online NLW Courses**

In June 2005, with funding from the Joint Non-Lethal Weapons Directorate (JNLWD), Pennsylvania State University started two online training courses in non-lethal weapons, one for the military and one for the police.[37] These are in addition to existing courses taught by Pennsylvania State as various US military war colleges.[38]

**BNLWRP News**

We would like to congratulate Tobias Feakin, a research associate for the BNLWRP, on obtaining his PhD. His thesis is entitled *"Non-lethal weapons: technology for lowering casualties?"*

The BNLWRP gave presentations to the 3rd European Symposium on Non-Lethal Weapons in May 2005, *Non-Lethal Weapons: Areas of Concern*, and the Jane's 8th Annual Less-Lethal Weapons Conference, *Non-Lethal Weapons: Saving Lives? – But Still Serious Areas of Concern*. Both presentations are available on our web site.[39]

# 2. TECHNOLOGIES,[40] POLICY AND ASSOCIATED ISSUSES

This section (a) highlights non-lethal technology developments, weapons usage, and policy related issues since Report No. 7 was published in May 2005, and; (b) identifies less recent sources we have not previously referred to which we think contribute to these elements. Readers are directed to previous reports and publications for a more thorough description of the variety of NLWs.[41]

## 2.1 KINETIC ENERGY

### Impact Munitions

*British Irish Rights Watch Report.*

This report, *Plastic Bullets: A Human Rights Perspective* (January 2006),[42] takes a strong stand against the use of plastic bullets in any circumstances for crowd control. The report voices a concern that the firing of the bullets by the British Army is still not subject to proper independent scrutiny. The conclusion to the report states:

> In our opinion, once plastic bullets are available to a police force, their use becomes inevitable, and once they are used, experience shows that abuse also becomes inevitable. Although physically different from live ammunition, both in form and effect, the firing of plastic bullets from a weapon has the same psychological effect on police officers as the use of an actual firearm. They give the police officer concerned such a disproportionate advantage over an unarmed civilian, however riotous his or her behaviour, that the officer is very likely to resort to it as a means of self-protection that can be operated at a relatively safe distance from any opponent. This may also mean that police officers will fail to make full use of any opportunity that may exist or arise for defusing violent situations by less draconian means that might be attempted by unarmed officers. We recognise that, however well-trained police officers may be, and however tight the guidelines under which they operate, in the heat of the moment and especially when in fear for their own safety or that of their colleagues they are likely to over-react. Furthermore, the use of plastic bullets, especially if it appears to be indiscriminate, may provoke an already riotous crowd to become even more violent. A weapon that has caused so many fatal and serious injuries during the history of its deployment is, we argue, unsuitable for use in crowd control in any civilised democracy.[43]

Also see: British Irish Rights Watch. *Plastic Bullets: A Human Rights Perspective,* September 2005.

The Police service of Northern Ireland (PSNI) fired 22 plastic baton rounds to control rioting in Belfast in July 2005. Chief Constable Hugh Orde asked for a review of regulations relating to use of plastic bullets after police officers claimed that there was too much of a delay (40 minutes) from their first request before they were authorised to fire them. 105 officers and a large number of rioters were injured during the disturbances.

*Riots in Northern Ireland*

Serious riots occurred following the Ardoyne and Whiterock parades in July and September 2005 respectively, where the. The Northern Ireland Policing Board subsequently published a report on the riots, which detailed extensive use of the Attenuating Energy Projectile (AEP) and the water cannon:[44]

> Stones, bricks and other missiles were thrown by those opposed to the [Ardoyne] parades. In addition, petrol bombs and at least nine blast bombs were thrown, six of which exploded. 105 police officers and (at least) eight members of the public were injured. Most of the injuries were minor, but two were serious and one of the blast bombs broke the leg of a journalist who was present. The police used water cannon extensively and discharged 21 Attenuating Energy Projectiles (AEP impact rounds), at least nine of which struck individuals. Although no resulting injuries have been formally notified, it is highly likely that injuries were sustained. AEP impact rounds were introduced in June 2005 to replace plastic baton rounds. Neither had been used by the Police Service of Northern Ireland (PSNI) for nearly three years.
>
> As is also now well-known, serious disorder broke out during and after the [Whiterock] parade that day. That disorder spread across Belfast during the night of 10th - 11th September and continued for several days thereafter. It is estimated that 150 live rounds were fired at the police and military. In addition, hundreds of blast bombs and petrol bombs were thrown at the police, along with many other missiles including paving stones, bricks and bottles. 93 police officers were injured, along with at least two serious injuries in the military and an unknown number of civilian injuries. 167 vehicles were hijacked and set on fire and there was extensive damage to property. During the weekend of 10th – 11th September, the PSNI discharged six live rounds, 238 AEP impact rounds and used water cannon extensively. The military discharged five live rounds and 140 AEP impact rounds over the same period. That no one was killed and that there were so few serious injuries to police officers, the military or members of the public is remarkable.

*The Death of Victoria Snelgrove*

Victoria Snelgrove was killed after being struck by an FN303[45] less-lethal impact munition, manufactured by FN Herstal, in October 2004. After publicly apologising on behalf of the police department, Boston Police Commissioner Kathleen O'Toole appointed an outside Commission, chaired by Donald K Stern, to investigate her death. A Report was issued on 25th May 2005.[46] Three other separate investigations were also initiated by O'Toole. The Commission found that "inadequate planning and training, combined with a breakdown of command discipline, set up a situation ripe to produce an unintended result". The Commissions recommendations included: a review of use-of-force policies; developing specific use-of-force policies for each less-lethal weapon; restrict use of less-lethal weapons to certified officers; improve training of police officers on less-lethal weapons to include instruction on the role and use of each weapon; create national standards for certification of less-lethal weapons. The Commission also commented on inadequacies related to operational planning and the need to establish a police-civilian injury board to review officers and civilians resulting from uses of force.

*US Army*

The US Army is currently evaluating both the FN303 and Beretta's Less-Lethal Launcher system as its 'Individual Serviceman Non-Lethal System'. The FN303 is already in limited use by the Army.[47] Beretta's system is in ongoing development funded by the Italian Ministry of Defence.[48]

According to a conference presentation in May 2005 the US Army is ultimately seeking the following capability from such a weapon:

– Greater stand-off range, 100m-300m
– Greater Non-Lethal and Effective Engagement ranges, 10m to 150m+
– Consistent Target Effect at wide engagement ranges.
– Variability/Scalability of Effect
– Greater Integration with lethal systems for flexible use of force[49]

*Israel*

Israeli forces were reported to be using new non-lethal ammunition at Bilin village located west of Ramullah on the wall of separation. Peace protestors claimed that they had been hit by various rounds including 'some covered with plastic or sponge pieces – but they all caused a strong chemical smell'.[50] Some were claiming that the Israeli Army were using Bilin as a test site for weapons to be used when evicting protestors opposed to the settlement pull outs. A stun cartridge has been developed for use by the guns on Israeli tanks. The range of the ammunition, which produces a flash/bang, smoke and plastic pellets is reported to be up to 30 metres.[51]

Another Israeli development is the 'compressed sand bullet'[52], which is thought to be a replacement for rubber bullets in use with the IDF.

*Metal Storm*

The Australian company that is developing technology for rapidly firing bullets and projectiles has recently been awarded a $730,000 contract by the US Army's Army Research and Development Engineering Command (ARDEC) to design the "Metal Storm Crowd Control System" that will reportedly fire less-lethal munitions to "provide a scalable effect for crowd control".[53]

**Water cannon**

In November 2005 *The Observer* obtained a photograph of a British Tactica water cannon being used against civilians in West Papua area of Indonesia.[54] This raised serious concerns given the history of human rights abuses in the country.[55]

## 2.2 BARRIERS AND ENTANGLEMENTS

QinetiQ was awarded two contracts by the US Army for their X-Net or Vehicle Lightweight Arresting Device (VLAD). In September 2005 paid $413,924[56] to purchase VLAD systems and in December 2005 it awarded $596,553[57] for development of a 'remote deployment device' for the VLAD.

## 2.3 ELECTRICAL

### Taser

Analysis and commentary related to the Taser has again been extensive since the last BNLWRP Report in May 2005. The following section presents an overview of the key issues appearing in the media, and from research and policy documents during this period.

*US Doctors Recommend Oversight of Taser Use*

In the US, the Metropolitan Municipalities EMS Medical Directors Consortium issued a statement in February 2006 saying that the Taser presented a low risk compared to guns, batons and police dogs provided it was used appropriately. The doctors, who oversee emergency medical services in 30 major US cities, advised that the Taser should only be used when there is a risk of injury and as few shocks as possible should be used. They also recommended that every city track the use of the Taser to prevent misuse noting that "some cities are more liberal with their use, and the devices are considered more of a behaviour-modification tool" used against anyone not complying with police.[58]

*Taser change the language describing the electro-shock weapon*

In October 2005, Taser International announced that it would stop referring to the Taser as 'non-lethal' and that it would no longer claim that the weapons 'left no lasting after effects'. The company submitted a voluntary 18 point product warning to the Attorney-General's office to indicate more accurately to consumers the effects of the weapon.[59]

*Suicide Bombers*

After a Taser was used against suspected suicide bomber, Yasin Hassan Omar, by police in Birmingham, U.K., questions were asked about the potential risk of the electrical currents actually detonating a bomb carried by a terrorist. Jeff Slotnik, who is a US distributor of Taser devices and training,[60] said that the risks were minimal for most commercial explosives, but that because the Taser causes muscles to contract there was a risk that a bomber with a 'button-fire' detonator would depress it, but he also stated that such detonators could also be thrown clear when the Taser was fired.[61] Other analysts take the view that explosives used by terrorists tend to be unstable and therefore more likely to be detonated if a Taser is used. These included the Scotland Yard Commissioner, Sir Ian Blair who commented strongly against the use of Tasers in such situations [62] and explained that it was a key reason why Metropolitan police officers used lethal force on the suspect Brazilian Jean Charles de Menezes earlier in the month. Menezes was later proved to be innocent of any terrorist activities. An internal enquiry was launched by the West Midlands Police and the Independent Police Complaints Commission into the Birmingham arrest of Omar. In July 2005, in Leeds, U.K., another suspected bomber was Tasered by police whilst travelling on a bus. It was subsequently reported that the man did not respond to police warnings because he was a diabetic and had lapsed into a hypoglycaemic coma. The incident was referred to the IPCC for an inquiry. [63]

*Health Studies*

Argument continues to rage over whether Tasers have caused the death of people shocked with the weapon. For the first time (June 2005) in the U.S, a county medical examiner's office ruled that a violent man, with a significant amount of methamphetamine in his bloodstream, and who was shocked for 57 seconds, died as a result of being electro-shocked by the weapon. Taser International contested the finding.[64] Taser also filed a suit against *USA Today* claiming that it had overstated the level of electrical output from a stun gun in an article, which implied that the weapon is more dangerous than it is.

The U.S. Department of Justice commissioned an independent study on the health effects of the Taser using researchers from the University of Wisconsin and Wake Forest University.[65] One of the appointed researchers, Dr Robert Stratbucker, was subsequently removed from the research programme when it was revealed that he was Taser's medical consultant. The ethics of the research was also questioned by Dr Jonathan Balcombe who argued that the proposed methodology, which involved shocking pigs, was an unnecessary use of animals for this purpose. He cited several prior research publications involving the use of anaesthetised pigs (including those carried out by Stratbucker) and data bases containing information on shocked human subjects said:

> This scenario not only illustrates wasteful repetition in dubious animal research, it corroborates the conclusions of a 2004 report from the *British Medical Journal*: animal studies are often conducted despite the availability of more reliable human clinical data.[66]

Another study carried out by the U.S. Air Force for the Department of Defence attracted criticism because information discovered by *The Arizona Republic*[67] revealed that Taser personnel, (including the CEO, Director of Technical Services, the Medical Director, and an electrical engineer) were intimately linked to the research panels, and in the provision of selected material for the study.

The research cited in the March 2005 DSAC Sub-Committee on the Medical Implications of Less-Lethal Weapons (DOMILL)[68] statement on the interaction of recreational drugs with the Taser's electrical discharge is published in the *European Journal of Pharmacology*: 'Effects of seven drugs of abuse on action potential repolarisation in sheep cardiac Purkinje fibres'.[69]

After claims linking Taser use to deaths in Canada, a report was commissioned by the Victoria Police Department on behalf of the British Columbia's Office of the Police Complaint Commissioner. In the report *Taser Technology Review Final Report*, 14th June 2005, the terms 'lower lethality' and 'conducted energy devices (CEDs)' were preferred to 'non-lethality' and 'Taser' to reflect the report members view that (a) deaths may be associated with such weapons, and (b) that the use of CEDs was more inclusive than the trademark term Taser since there are now other companies marketing electric-shock weapons. The report reviews other studies related to the health effects and also operational and training issues. It notes:

> The variety and complexity of the circumstances that may confront an officer make it impossible for any policy to encompass every possible scenario. We can, however, suggest general guidelines, recognizing that they are not iron-clad; rather they are general principles which will be diverse in their application.
> 1. With respect to CED's, including the TASER, we are recommending, subject to situational factors, that they not be used against subjects who are demonstrating only passive resistance.

2. For subjects who are displaying active resistance, those who are resisting an officer's efforts to take them into custody without attacking the officer, where an officer believes the use of a CED is appropriate we are recommending that CED's be used in a push stun mode only.
3. In situations where officers are confronted by active resistance, assaultive resistance, or the threat of grievous bodily harm or death, where an officer believes that the use of a CED is appropriate we are recommending that CED's be used in either a push stun or probe deployment mode.
These recommendations should be read in context with the previous discussion of medical contra indicators. [70]

Also see (reviewed in *BNLWRRP Report No.7*): British Columbia: Office of The Police Complaint Commissioner. *Taser Technology Review and Interim Recommendations*. OPCC File No.2474. September 2004.[71]

The Canadian Police Research Centre also published a report in August 2005 entitled *Review of Conducted Energy Devices. Technical Report: TR-01-2006*.[72] The following sections were extracted from this report:

> Because of the concerns linking the use of Tasers with the death of victims, in August 2004 the Canadian Association of Chiefs of Police (CACP) asked the Canadian Police Research Centre (CPRC) to undertake a review of the existing scientific research and data and provide a national perspective on the safety and use of Conducted Energy Devices (CEDs). CPRC closely collaborated with representatives from the Victoria Police Department who were concurrently studying CEDs on behalf of the BC Office of the Police Complaints Commissioner (BCOPCC). This report complements the existing BCOPCC reports, which were published respectively in December 2004 and June 2005. At the same time, CPRC and BCPOCC consulted with their UK and US counterparts who were also reviewing the use of CEDs. In Canada, the use of CEDs are limited to police officers and guided by policies established by the responsible agencies be they at the federal, provincial or municipal level. In turn, the agencies are guided by the National Use of Force Framework (NUFF), which was established in 2000, by the CACP. This report is intended to provide guidance and assistance to the Canadian police community in reviewing the operational use of CEDs and the development of future training programs, governing policies and procedures.
>
> The CPRC's review of CEDs focused on three areas: the medical safety of CEDs, the policy considerations for Police CED operations and the analysis of the medical condition excited delirium. In its conclusions the report provided guidance for establishing best practices for the safe use of CEDs. These were:
> • Definitive research or evidence does not exist that implicates a causal relationship between the use of CEDs and death;
> • Existing studies indicate that the risk of cardiac harm to subjects from a CED is very low;
> • Police officers need to be aware of the adverse effects of multiple, consecutive CED cycles;
> • The issue related to multiple CED applications and its impact on respiration, pH levels, and other associated physical effects, offers a plausible theory on the possible connection between deaths, CED use, and people exhibiting the symptoms of excited delirium (ED).
> • It would be unwise and counter-productive for any police service or government body to develop policies and procedures that explicitly specify in what kinds of circumstances a CED may or may not be used.
> • The application of best practices relating to the safe use of CEDs should lead to an increase in public confidence in CEDs as appropriate law enforcement tools

Also see: Laur, D. *Excited Delirium and its Correlation to Sudden and Unexpected Death Proximal To Restraint. A Review of the Current and Relevant Medical Literature.* TR-02-2005, Canadian Police Research Centre, Victoria, December 2004.

In a study entitled *Stun Gun Fallacy: How The Lack of Taser Regulations Endanger Lives*[73] involving 79 law enforcement agencies in northern and central Carolina, ACLU of Northern Carolina noted that 56 have officers using the Taser. 54 gave ACLU access to their training

and policy documents which revealed that only 4 regulated the number of times that an officer could shock the same individual; the majority relied on Taser training material rather than developing their own; and, that, in ACLU's opinion, the Taser material downplayed the medical risks. ACLU recommended that the California legislature should pass a law defining more carefully that Tasers should only be used as an alternative to deadly force; that stricter policies relating to the multiple shocking of individuals should be adopted; and that more appropriate training materials and methods should be developed. It was also recommended that a more rigorous collection, collation, and analysis of use of force data for each type of force should be a requirement for local government and local law enforcement agencies.

Taser have produced a detailed reply to ACLU-NC in a paper titled: *DEADLY RHETORIC: How the ACLU of Northern California's Fight Against Law Enforcement Control Tools Endangers Communities*.[74] In the introduction to the executive summary Taser state:

> The ACLU of Northern California (ACLU-NC), with author Mark Schlosberg, released a 25-page "study" in September 2005 that is highly critical of the TASER® electronic control device and its manufacturer, as well as law enforcement departments, their training, and policies surrounding TASER device use. Contemporaneous with the release of this report, the author launched a media campaign supporting a multimillion dollar lawsuit filed by a related chapter of the ACLU against TASER International and a law enforcement department using TASER equipment. The report is an emotional, onesided collection of newspaper clippings along with a survey of law enforcement training practices. The ACLU-NC report has only two citations from the medical literature, but a whopping 49 from news clippings. Hence, the "study's" contents are based upon sources that are 96 percent emotion and innuendo (popular media), and only 4 percent science. This response will scientifically debunk the questionable reasoning of the ACLU-NC and will deliver a 10-point challenge to the ACLU-NC and Mr. Schlosberg.

Also see: ACLU Nebraska. *Taser Use by Nebraska Law Enforcement Agencies: The Case for Policy Reform*. November 2005[75]; and ACLU Massachusetts. *Less Lethal Force. Proposed Standards for Massachusetts Law Enforcement Agencies.* October 2005.[76]

*United States Government Accountability Office (GAO) Report*

The United States Government Accountability Office published a report in May 2005 entitled *Taser Weapons: Use of Tasers By Selected Law Enforcement Agencies*.[77] The GAO was asked to provide information on (1) the policies and procedures related to the issues of 'use of force', training, operations, and safety for selected law enforcement agencies that have purchased and used Tasers, and; (2) federal, state, and local laws that specifically address Tasers, including the Transportation Security Administration's (TSA) authority to regulate Tasers on aircraft. The GAO reviewed the policies and procedures of seven state and local law enforcement agencies and their personnel. The GAO used Taser International's customer database to identify U.S. law enforcement agencies that had purchased Tasers.

In brief, all the seven agencies contacted by the GAO had:

(1) "included the use of Tasers into their existing use-of-force policies so that police officers would have guidance on the circumstances in which the use of Tasers may be appropriate".
(2) "ensured that Taser training is required for officers who use the weapons and that training—especially for non-law enforcement individuals who may be authorized to use Tasers—is of critical importance to help ensure the safe use of these weapons. For the seven agencies, operational protocols, which provide guidance on police officers' daily law enforcement activities, require that Tasers be visually inspected on a daily basis, be

appropriately safeguarded, and, in some cases, be tested on a weekly basis or at the beginning of an officer's shift".
(3) "designed safety procedures which required that the Taser not be used on children, pregnant suspects, or near bystanders or flammable liquids and that individuals hit in specific body areas with Taser barbs, such as the neck or face, be examined by an emergency room physician".

There were variations amongst the agencies studied regarding (a) the classification/non-classification of the Taser as a firearm (b) the availability of Tasers to non-law enforcement persons, and (c) the locations at which Tasers could be carried. The report stated that:

> We observe that as the Taser becomes more widely available for use, especially by non-law enforcement persons, training is critical to help ensure its safe, effective, and appropriate use.[78]

*Australia*

Tasers are to be trialled in the New South Wales region of Australia with the riot police.[79] In other areas of the country police forces are already trialling the weapon. In the Australian Capital Territory a trial began in December 2004.[80]

*New Zealand*

In February 2006 New Zealand police announced a trial of the X26 Taser that they say will be based on the British model. The weapon will be trialled in "North Shore/Waitakere Rodney, Auckland City, Counties Manukau and Wellington (including Wairarapa) districts."[81] The New Zealand police press release states that it will be used against:

> • unarmed (or lightly armed) but highly aggressive people,
> • persons under the influence of mind altering substances, solvents or alcohol.[82]

It is a worrying that they consider the Taser specifically for use against those under the influence of drugs or alcohol since these people may be at greater risk of adverse effects. Also, the use of the Taser should represent a proportional response to a dangerous situation rather than something to be used against people who are drunk and disorderly.

*UK Taser Distributor Conflict of Interest*

In October 2005 *The Sunday Times* reported that one of the main advocates of the introduction of the Taser to British Police, Peter Boatman, had held a stake in the company with the exclusive UK distribution rights, Pro-Tect Systems[83], whilst still a serving police officer:

> Inspector Peter Boatman had a 50% share in a company that sold Tasers at the same time as devising Britain's first police training programme for the use of weapons.
>
> Boatman was in charge of assessing the merits of Taser as head of operational training for Northamptonshire police and was regarded as an impartial expert on the weapon.
>
> Since he left the force a little more than three years ago, his firm has provided 1,500 Tasers worth about £1m to 20 British police forces. It is the exclusive UK distributor for the US company, Taser International. …

> Companies House records show that Boatman took a 50% stake in a start-up company, Pro-Tect Systems, in December 2000. He became a director of the firm on December 5 and resigned three weeks later, on December 27, but held on to his stake in the company.
>
> In February 2001, Pro-Tect received the Taser contract for the UK. Within two months Boatman was acting as an adviser to the Home Office on whether to issue Tasers to British officers. …
>
> He retired from the police on April 16, 2002. Two days later he was installed as chairman of Pro-Tect Systems.[84]

*UK Deployment*

Police in North Wales (UK) in September 2005 reported that the use of Tasers over a two year period had made the region a safer place. During this period they had only been discharged four times, but had considerable deterrence effect. Reassuring the public Sgt Dave Jones, chief firearms instructor, said:

> I can understand public concerns but the Tasers are not given out willy-nilly to officers.[85]

The three other police forces in Wales (Gwent, Dyfed-Powys and South Wales) also planned to deploy the Taser. [86] As well as the 5 forces who trialled the Taser (see previous BNLWRP reports) other UK police forces acquiring the stun gun include Strathclyde Police, Grampian Police, Dumfries and Galloway, Kent, Humberside, South Yorkshire and North Yorkshire Police.

Also see: Amnesty International. *UK: Briefing as Kent police introduce new electro-shock weapons*. 29th September 2005.[87]

*Sales*

Taser received an order worth $1.4 million for the X26 Stun Gun from the U.S military in June 2005.[88] The Taser X26C (retailing at about US$1,000) is now available for purchase by the public in over 40 states in the US. Taser also announced that it received an order for TASER X26 devices and accessories totalling more than $390,000 for police forces in the United Kingdom.

*Taser Foundation*

The Taser Foundation has been making gifts to the families of police officers killed whilst on duty. This has prompted two responses. Firstly that the action of the company was simply a gesture of kindness, and secondly a more cynical interpretation which argues that this is another avenue for Taser to improve its image with police forces, thus promoting sales – especially at a time when the Taser weapon was being widely reviewed with respect to its health and safety implications.[89]

*Other Taser News*

Taser have developed a Taser Cam (audio and video recorder), which can be fitted to the weapon and is switched on when the Taser is in use.[90] If used properly this should give more accountability and recording of evidence every time a Taser is fired.

At the Jane's Less-Lethal Weapons Conference in October 2005 Noah Shachtman from *DefenseTech.org* gave a presentation on *Media and Public Perceptions of LLW*, which focussed on the Taser. The presentation can be viewed online.[91]

**Wireless – Projectile**

Harrington Group Limited are continuing to test and develop their Shockrounds[92]. According to the Harrington Group website there are several initial proposed variants of the ShockRounds bullet which have been selected for initial development and commercialisation:

> (a) 37mm rubber bullet, compatible with police 37mm launchers, that does not penetrate the skin and delivers a painful behaviour modifying electric charge. The bullet is considered to be highly marketable to those looking for less-lethal solutions and deterrents for situations such as violent crowd control.
> (b) 12 gauge police-calibre rubber bullet that will deliver an incapacitating electric charge. This bullet would produce decreased wound characteristics and decrease the number of shots required to incapacitate a threat. It is considered to be highly marketable to those looking for less-lethal solutions.
> (c) 9mm or 10mm standard police-calibre bullet that delivers an incapacitating electric charge. The bullet would produce normal wound characteristics, but could be less-lethal because of its ability to potentially decrease the number of shots required to incapacitate the threat. In effect, an electric charge is added to bullets currently employed by police and military forces. This bullet has straightforward marketability, since its wound characteristics are already accepted and the benefit of the added electric charge should reduce the incidence of return fire and substantially contribute to user safety in the field as well as that of bystanders or innocent civilians.[93]

A video demonstration of the piezoelectric technology can be viewed at:
http://www.comcourse.com/piezo_web_15fps.mov

The Homeland Security Advanced Research Projects Agency (HSARPA) is also funding the development 'electric bullets' through contracts with several companies. As reported in *New Scientist,*[94] Lynntech, Texas is researching into ammunition that can be fired from shotguns or 40mm grenade launchers - the bullets would stick to the target and deliver an 80,000 volt shock. Midé Technology is working on what appears to be similar to the Harrington groups Shockrounds. Physical Optics Corporation is developing the Inertial Capacitive Incapacitator (ICI), a ring-foil projectile incorporating an electrical discharge.[95] Further details of the contracts can be found on the HSARPA web site.[96]

A Kentucky based M2 Technology associate has talked of a 'non-lethal air burst munition' that 'involves the use of nanoparticulate materials that could conduct an electrical charge'. According to John Blair this involves producing a fine mist of particles that can conduct an electrical discharge over a crowd.[97]

In February 2006 Taser demonstrated its' new XREP (eXtended Range Electro-Muscular Projectile), the development of which has been funded by the US Office of Naval Research (ONR). According to a company press release the XREP is fired from a 12 gauge shotgun and has a range of 30 metres. It has been tested on 35 human volunteers. The Marines want to use it in urban operations such as clearing buildings.[98] There is no further information available about the XREP, which the company says will be released in 2007, such as the size of the electrical charge released. It is also unclear whether the charge is released all at once or whether the projectile affixes to the victim and releases a charge over a period of time.

In our *BNLWRP Research Report No. 6* (October 2004), we raised some questions and concerns about electrical projectiles in general:

> The inherent problem with any projectile is that the effects of gravity will decrease accuracy at longer ranges. With non-lethal projectiles the dangers of reduced accuracy are that people are more likely to be struck in unintended and vulnerable places such as the head and neck. Although these proposed new projectiles, such as ShockRounds, might be fired with less kinetic energy they will still need considerable momentum to reach targets at up to 100 metres (as envisioned by the ShockRounds' developers), especially if they are to remain accurate. And so the potential for serious injury remains.
>
> It is also unclear how the projectiles will cause electrical incapacitation. The Taser, for example, can only remain effective whilst the trigger is held down and the electrical current flowing into the body is maintained. Some questions remain: what will be the duration of electrical incapacitation? If it is only momentary does it confer any advantage? If it lasts longer, will the need for increased electrical energy discharge incur increased health risks?[99]

### Wireless – Plasma

Ionatron has been awarded a $2.8 million contract by the US Navy for weaponization of its laser induced plasma channel (LIPC) weapon that would deliver electric shocks wirelessly through conductive plasma. The planned weapon would have variable effects and be capable of delivering lethal electric shocks.[100]

An August 2005 article in the *Washington Post*, 'Xtreme Defense', features an interview with the head of Xtreme Alternative Defense Systems[101], which is also developing wireless electrical weapons incorporating conductive plasma. The article gives an insight in to the relationships between such companies and the advocates of new weaponry within US Department of Defense, in particular the Marine Corps.[102]

### Wireless – Other

At the 3rd European Symposium on Non-Lethal Weapons, the German company Diehl BGT Defence showed video footage of their prototype 'Liquid Taser'. The weapon fires two streams of conductive liquid that send an electric shock in to a victim's body. When the reservoir of liquid is used up it can be used as a conventional stun gun.[103]

### Stinger Systems

Stinger announced that it was marketing its new Stinger projectile stun gun.[104] It hopes to capture a market at present dominated by Taser. The Stinger gun was being marketed at a lower price than the Taser X26, it fires more darts and has a longer range than the Taser, and the company say that they will not sell the weapon to civilians.[105] Wayne State University in the US have completed a study of the health effects of the weapon,[106] which was funded by Stinger Systems at a cost of $270,000.[107]

### Criminal Use

Stun guns continue to be used by criminals for robbery and assault [108]. In Canada authorities have noted an increase in the smuggling of the weapons – the Canadian Border Services Agencies seized 126 in 2003, 95 in 2004, but by mid-August they had already confiscated 173 such weapons. In the U.K. stun guns are available for purchase illegally – in Manchester reporters from the *Manchester Evening News* bought a 'Black Cobra' weapon. In the U.K. it is an offence to own or sell a weapon under section five of the 1968 firearms Act.[109]

New York State is one of the few states in the US that prohibits sale of the stun guns and Tasers to members of the public. However, many of theses weapons have been brought into the region through sales over the Internet. In October 2005 eBay announced that they would block the sale of stun guns to New Yorkers and the company helped authorities track down illegal sales:

> eBay helped authorities in an undercover investigation that netted 16 sellers believed responsible for the sale of more than 1,100 stun guns and Tasers to New Yorkers from September 2003 to August 2005.[110]

**Other recent articles related to electro-shock weapons**


Bruce, B. *Six Months Taser Study*. Defensive Tactics Unit; Columbus, Ohio Police Department, 5th July 2005.

Dearing, M & Lewis, T. 'Foreign body lodged in distal phalanx of left index finger-taser dart'. *Emergency Radiology*, 10th September 2005. This is published on-line. Access by subscription.

Heightman, A.J. 'Don't Be Shocked'. *Journal of Emergency Medical Services*, Vol.23, ssue 5, May 2005, pp.12&32.

Hongyu Sun et al. *Electromuscular incapacitating device safety*. Paper given at the 3rd European Medical and Biological Engineering Conference, November 20 – 25, 2005, Prague, Czech Republic. http://www.engr.wisc.edu/bme/faculty/webster_john/EMD-safety.pdf

International Law Enforcement Forum (ILEF). *Visits and meetings in Washington, August 2004*.

Levine, S et al. 'Cardiac monitoring of subjects exposed to the Taser'. *Academic Emergency Medicine*, Vol.12, No.5, Supplement 1 71, 2005

Schmiederer, B et al. 'Specific traces in stun gun deployment'. *International Journal of Legal Medicine*, Vol. 119, No.4, July 2005, pp.207-212

National School Safety and Security Services. *Tasers and Police in Schools*. http://www.schoolsecurity.org/trends/tasers.html. Accessed: 30/11/05.

Weng, N & Chehade, M. 'Taser penetrating ocular injury'. *American Journal of Opthalmology*, Vol.139, No.4, April 2005, pp.713-715.

Whitehead, S. 'A rational response to Taser strikes' *Journal of Emergency Medical Services*, Vol.23, Issue 5, May 2005, pp.56-66. [111]

Letter to *The New England Journal of Medicine* 'Ventricular fibrillation after stun-gun discharge'. Vol 353, 1st September 2005, pp.958-959.

## 2.4 ACOUSTIC

### Long Range Acoustic Device (LRAD)

*Deployment and Usage*

As of September 2005 around 350 LRAD systems had been deployed. Military users include the US Navy (to protect ships and for maritime interdiction), US Army (including use at checkpoints and for psychological operations), and the Military Police (use at prison camps). According to a July 2005 report in *National Defense*, the 3rd Infantry Division of the US Army has 150 LRADs.[112] It has also been deployed on two UK Navy ships in the Gulf, and has been used by the US Coast Guard, Arizona Border Patrol, New York Police Department, and cruise ship companies such as Princess and P&O.[113]

LRAD was also deployed and used by police in Santa Ana, California to clear 10 people out of a house for which they had a search warrant. The weapon was panned back and forth across the house.[114] American Technology (LRAD manufacturers) sent three MRAD and one LRAD to Marines operating in the disaster areas affected by Hurricane Katrina.[115]

In the UK the Medium Range Acoustic Device (or LRAD 500) is being marketed by Audio Nation Limited and has been demonstrated to Coastguard and BARB (hovercraft operators) in Somerset.[116] In November 2005 the LRAD was used to help repel a pirate attack on the cruise ship *Luxury Spirit* as it was at sea off the Somali coast.[117] Subsequently there was a discussion feature about the LRAD on Radio 4's Today Programme.[118]

*Health Effects*

A 2004 NATO technical report on non-lethal weapons made the following observation with regard to acoustic weapons:

> If well selected, the frequency and power of the [acoustic] weapon can rapidly overcome even highly-motivated individuals. If badly used, on the other hand, they can cause irreversible damage to the hearing apparatus.[119]

Although some reports dismiss it, permanent hearing damage is a real danger with these weapons. Juergen Altmann, who is conducting an independent scientific assessment of acoustic weapons, has warned that there is risk of hearing damage to people exposed to the beam at ranges of up to 100m.[120] In a 2005 paper presented at the 3rd European Symposium on Non-Lethal Weapons (and in a presentation at the October 2005 Jane's Less-Lethal Weapons Conference) he recommended that the power output of the device should be limited. In its current format there is no automatic cut-off or limit, and it is entirely dependent on the operator. A key has to be turned and a button pushed to select the higher output 'tone' mode but that, and the training of the operator are the only precautions.

> Avoiding permanent hearing damage to unprotected target subjects requires keeping appropriate limits for intensity and duration, depending on the distance. Thus, the rules for weapon operation are decisive. In order to prevent operator errors and overdoses, technical precautions – limiting the sound power and/or duration according to the target distance – are recommended.[121]

An added difficulty with ensuring no permanent damage is that some people are more susceptible to noise-induced hearing loss than others and hearing damage can occur at levels below the threshold for ear pain. A report from the US Army's 361st Psychological Operations Company gives an idea of the powerful effects of the LRAD: "During distance tests at 100 meters, the sound was painful to listeners, even with hands held over the ears and ear plugs in."[122]

A report assessing the health effects was produced by Joint Non-Lethal Weapons Directorate collaborator Pennsylvania State University and funded by M2 Technologies but it does not appear to be publicly available. The web site of one of the co-authors the report, Dr. Tom Frank at Pennsylvania State University, describes the purpose of the report:

> Human Effects Assessment of the Long Range Acoustic Device (LRAD) (Co Principal Investigator with Nicholas, PI, Senior Research Associate, Institute for Non-Lethal Defense Technologies). The purpose of this research was to: 1) establish safe operating guidelines for the LRAD, and 2) determine the effectiveness of presenting different types of sounds via the LRAD that interfere with communication, create an annoyance, and for crowd control and dispersal. This project was funded by M2 Technologies, Inc.[123]

*Oversight*

We are not aware of any reports of misuse of the LRAD in Iraq or elsewhere but given its deployment at prison camps and the historical record of loud noise being used as a torture technique we would urge strict oversight of the use of this weapon. A 2004 International Committee of the Red Cross Report on treatment by coalition forces of prisoners in Iraq stated that: "The methods of ill-treatment most frequently alleged during interrogation included the following: …Exposure while hooded to loud noise or music…"[124]

*Pre-Lethal Weapon*

Reports, also from the US Army's 361st Psychological Operations Company indicate the variety of ways the LRAD has been used in Iraq:

> The LRAD has proven useful for clearing streets and rooftops during cordon and search, for disseminating command information, and *for drawing out enemy snipers who are subsequently destroyed by our own snipers*. [emphasis added][125]

The latter example shows how it has been used in a pre-lethal way to incapacitate before killing. This is an issue that critics have warned of for many years in that a weapon may be promoted as "non-lethal" and aimed at "reducing casualties" but its actual use may prove to be quite the opposite in enhancing the killing power of lethal force.

*Legal Review*

Another concern is that the LRAD appears to have avoided the military legal review that is required for all new weapons systems. This seems to be because it is classified by the US military as an 'acoustic hailing device' rather than a weapon. A 2004 article in the military publication *Stars and Stripes* reported:

> The LRAD is not classified as a nonlethal weapon because it's not intended to be used as one, said Pentagon spokesman Lt. Col. Rivers Johnson. …

> In order for a system to been classified as a nonlethal weapon, it must undergo "very extensive legal review and the human-effects review," Corps spokesman Capt. Dan McSweeney said. The LRAD has not been put through any such reviews.[126]

Although the device can simply be used to deliver warning messages, it is also capable of causing pain and incapacitation, as it did when used aboard the cruise ship mentioned above or against snipers in Iraq. In these situations it would appear more akin to an acoustic weapon than a loudspeaker.

### Magnetic Acoustic Device (MAD)

HPV Technologies have also demonstrated their Magnetic Acoustic Device (MAD) - the Los Angeles Sheriff's Department may acquire the MAD to replace conventional public address systems and for use as a non-lethal "area denial option" to avoid the use of chemical agents and baton rounds in situations of civil disturbance.[127] The test of the MAD device at a one mile range is described by Sid Heal from the Los Angeles Sheriff's Department on *DefenseTech.org*.[128]

### US

In January 2006 the Joint Non-Lethal Weapons Directorate (JNLWD) announced that it was seeking to evaluate existing 'acoustic hailing devices' for use by the US Navy and Army.[129] According to a February 2006 article in *National Defense* the Joint Non-Lethal Weapons Directorate has tested a sonic weapon that cracked car windscreens.[130]

### Israel

Israeli forces are also reported to have used acoustic weapons to disperse protestors. Called 'The Scream' by the Israeli Army, the weapon causes dizziness and nausea and long exposure can cause damage to hearing. [131] On US National Public Radio Malcolm Davies from the British Joint Services Command Staff College discussed this weapon.[132]

Sonic booms created by Israel Defence Force warplanes have been used as a so called "non-lethal tactic" against civilians in the Palestinian territories.[133]

### 'The Mosquito'

In the UK, Compound Security Systems are marketing a device called 'The Mosquito' which emits 'high pitched soundwaves' rather like the buzzing from a mosquito. It has been used to deter groups of teenagers from loitering near a shop in Barry, Wales.[134] Two of these systems have also been acquired by Staffordshire police and are being piloted in the Leek area.[135]

### Other recent articles/papers related to acoustic weapons

Grimes, J. *Modelling Sound As A Non-lethal Weapon in the Combat$^{XXI}$ Simulation Model.* Thesis, Naval Postgraduate School, Monterey, California, June 2005.

Leventhall, G. 'Big Noise in Baghdad'. *Noise and Vibration Worldwide*, June 2004, pp.27-30.

Vinokur, R. ‘Acoustic noise as a non-lethal weapon’. *Sound and Vibration*, October 2004, pp.19-23.

## 2.5 DIRECTED ENERGY

### Bioelectromagnetic weapons

A final report on a three-year US Air Force funded project to study the effects of radiofrequency (RF) energy on nervous system function gives some insight into an area of weapons development where there has been much speculation but little available information over many years. Two researchers at the University of Nevada, Reno, Dr. Gale Graviso, an Associate Professor of Pharmacology in the School of Medicine, and Dr. Indira Chatterjee, a Professor in the Department of Electrical Engineering, have been investigating the use of RF energy to manipulate the release of neurotransmitters in the nervous system with a view to developing an incapacitating weapon. The research project, entitled *Sensitivity to Neurotransmitter Release to Radiofrequency Fields*, ran from 1 June 2002 until 31 May 2005 under contract number F49620-02-1-0306 with the Air Force Office of Scientific Research (AFOSR) for $357,652. The abstract of the final report[136] is very clear about the purpose of the research undertaken:

> Exploring the interactions between radiofrequency (RF) radiation and biological systems is essential for developing RF-based non-lethal stunning/immobilizing weaponry. To this end a research effort was initiated to identify RF parameters potentially capable of selectively altering exocytosis, the process underlying neurotransmitter release and hence nervous system function.[137]

Experiments were conducted on nerve cells from the adrenal medulla section of the adrenal gland. The adrenal medulla controls release of the catecholamine neurotransmitters adrenaline and noradrenaline into the bloodstream. The main observation given in the final report on the research is that they found an increase in release of catecholamines from these cells as a result of exposure to certain frequencies of RF energy.

A second concurrent three-year research effort ('Project 2') being conducted by the same researchers, which began on 1 June 2003, has been funded by the 'Department of Defense Experimental Program to Stimulate Competitive Research (DEPSCoR)' and the University of Nevada, Reno with a total of $750,000. This project is not only looking at influencing the nervous system with RF radiation but also affecting muscle contraction:

> The project addresses the long-term goals set in Project 1 funded by the AFOSR, i.e. investigating the feasibility of designing novel non-lethal stunning/immobilizing weapons based on non-thermal effects of RF/microwave radiation on neurotransmitter release from chromaffin cells. It extends the scope of Project 1 by proposing to conduct exposures at low levels of microwave radiation, as well as by using another type of excitable cell i.e. skeletal muscle cells, to investigate whether RF/microwave radiation will produce non-thermal effects on muscle contraction, thereby providing another strategy to design novel immobilizing weaponry. [138]

This research, funded under the DEPSCoR programme, which provided $500,000 out of the $750,000 funding, is entitled *Exploring Non-Thermal Radiofrequency Bioeffects for Novel Military Applications*.[139]

Having learnt about these projects we looked for any announcements about the research at the time of the initial funding award in 2003, and we found a University of Nevada press release from March 2003 that is deeply deceptive. Not only does it omit any reference to the sole purpose of the research, i.e. development of "novel immobilizing weaponry", but it also claims that the research is for beneficial therapeutic purposes:

> The Air Force Office of Scientific Research, which is sponsoring the researchers, wants to find out what exposure to radiofrequency fields does to neurotransmitters and skeletal muscle tissue, and to use the information toward the development of beneficial, non-invasive medical treatments for injuries and diseases of the nervous system and skeletal muscle, said Craviso.
>
> The team's research will benefit human health, said Chatterjee. [140]

More recently the researchers contributed an abstract to 'Bioelectromagnetics 2005', a joint meeting of the Bioelectromagnetics Society and the European Bioelectromagnetics Association, under the title *Use of Cultured Adrenal Chromaffin Cells as an In Vitro Model System to Study Non-Thermal Effects of RF Radiation on Exocytosis*.[141] The abstract concludes:

> The effects of RF exposure on catecholamine release that have been observed to date cannot be explained by an increase in temperature. We are currently investigating possible mechanisms to explain the non-thermal RF effects on catecholamine release. [142]

The search for biological effects of radiofrequency (RF) radiation that are not based on heating is also relevant to weapons technologies such as the millimetre wave Active Denial System (see section below), which exert their primary effects through heating. In 2001, when the ADS was first made public, some of the initial concerns expressed by scientists related to the potential for non-thermal effects on the body.[143] The ADS developers have dismissed such concerns saying that the millimetre wave beam only affects the skin, and the effects are solely heating. However, as yet uncharacterised non-thermal effects cannot be ruled out, especially given the Air Force's concurrent interest in the non-thermal effects of RF energy shown in research such as that described above.

As regards the broader issue of whether it is in any way acceptable to develop bioelectromagnetic weapons that could have an incapacitating and suppressing effect on people by manipulating their nervous system or their muscles, the University of Nevada's 2003 press release and its evident omission answers this question for us.

**Active Denial System (ADS)**

Since our last research report in May 2005 there have been regular news items about the Active Denial System (ADS) and some reports of its imminent deployment in Iraq. In early July 2005 an *Associated Press* report indicated that directed energy weapons would not be rushed into service and that the Joint Non-Lethal Weapons Directorate (JNLWD) was exercising a cautious approach.[144] In mid-July 2005 the Sunshine Project released documents obtained under the Freedom of Information Act detailing the experimental protocols (but not the results of the experiments) from 2002 and 2003 for human tests carried out with the ADS.[145] A 22 July 2005 *New Scientist* article reported some of the information in these documents, expressing several concerns.[146] A few days later the *USA Today* ran two 'publicity' type stories with comments from Joint Non-Lethal Weapons Directorate (JNLWD) officials extolling the virtues of directed energy weapons and indicating that there would be a public demonstration of the ADS 'over the summer' and it would be deployed in Iraq 'within months'.[147] Neither of these events materialised and in mid-August a company called Conceptual Mindworks received a $7 million contract to carry out further research on the human effects of directed energy weapons.[148] Also in August 2005, Kelly Hearn, a journalist who wrote an article in March 2001, shortly after the existence ADS was made

public, expressing the concerns of some scientists over the potential for long-term adverse health effects[149], wrote a follow up piece for *AlterNet* entitled *Rumsfeld's Ray Gun*.[150]

Towards the end of last year, on 21 December 2005, *Inside the Army* reported that the Head of the US Army's Rapid Equipping Force had requested that the ADS be deployed to Iraq, as had the Commander of the 18th Military Police Brigade who had apparently requested the ADS "…to help 'suppress' insurgent attacks and quell prison uprisings."[151] The article reported that further tests had been carried out with the ADS in August and September of 2005, with the weapon being fired 2,370 times during 'military utility assessments'. The article reported that the results of these tests had not been assessed but that the next step would be "extended user evaluations" by sections of the military interested in the weapon. However, it appears there is only one prototype ADS system in existence at the moment. The latest report on the weapon in the January 2006 issue of *National Defense* under the headline *Non-lethal Weapon Readied for Battlefield* reported comments by General Bruce Carlson, the Commander of the Air Force Material Command, at a recent conference saying that the ADS could be fielded within months if required and could be deployed before the end of 2006.[152] He apparently stated that the range of the weapon is 1km, something that had not been confirmed publicly until now. He also said that it can either be targeted at an individual or the beam can be widened to affect 3 or 4 people standing close together. This is a significant insight since few details about the way the weapon operates have been released thus far.

*Human testing experimental protocols*

The three experimental protocols for human testing of the Active Denial System (ADS), obtained by the Sunshine Project under the FOIA are as follows:

> "Protocol FWR-2003-0028-H: Perceptual and Thermal Effects of Frontal Exposure to Millimeter Wave Energy" – This set out plans for two experiments to determine people's tolerance of the heating effects of the ADS. The first experiment was designed to assess the power level that is 'effective in achieving pain intolerance' and the second to assess the length of exposure needed to 'repel' people. Emotional and cognitive impacts of being a victim of the weapon were to be assessed by questionnaire and interview pre and post exposure.
>
> "Protocol FWR-2002-0046-H: Perceptual and Thermal Effects of Millimeter waves." – This is another experimental design looking at pain thresholds amongst victims and whether they change according to variations such as the amount of skin exposed to the beam or the exposure of bare skin versus clothed skin.
>
> A third experimental protocol: "Protocol FWR-2003-03-31-H: Limited Military Utility Assessment of the Active Denial System (ADS)" planned two experiments using 50 people to a) further determine the power level necessary to repel people and b) test possible scenarios for use of the weapon.

The effects of the millimetre wave energy are dose dependent and so the power level and exposure time are the critical factors. A 2004 NATO report on non-lethal weapons warned that "excessive power levels can have serious consequences for human targets."[153] The power level used with the ADS weapon is not public knowledge and neither is the safety margin, i.e. the difference in exposure time between it being effective in 'repelling' people and it causing permanent damage to their skin or eyes, which are most sensitive to the energy

beam. However the safety margin is thought to be in the realm of seconds, and this means that exposure to the beam has to be short to avoid adverse effects. It is stated in one of experimental protocols that the level of exposure to the radiation emitted by the ADS may be as much as 20 times more than the limit set in the relevant US Air Force Occupational Safety and Health Standard.[154]

On reading the three experimental protocols the main issue that stands out is the central assumption upon which safety claims are based, which is that the painful effects will cause the person who is targeted to move out of the beam before their skin temperature reaches damaging levels and to close their eyes or avert their head before it causes permanent damage to the eyes. There are some problems with this assumption:

- The victims may not able to move out of the beam if constrained by other people or barriers especially if they are in pain and have had to close their eyes due to the effects of the weapon. (Note: the beam is invisible).
- It assumes that all individuals will be affected equally, disregarding differences in age, size, health and sensitivity to the millimetre wave energy.
- The victim of the weapon is entirely at the mercy of the operator's judgement since there does not appear to be an automatic cut-off mechanism. One danger would be if the operator chose to follow a person or group of people with the beam to punish them.[155]

There are a number of other concerns raised by the experimental protocol documents:

- In the experimental protocols the volunteers were to be given a 15 second 'cooling off period' in between exposures to the beam in order to allow the skin to cool down. Clearly if the skin is already hot then it will take an even shorter exposure than normal to heat it to damaging levels. The question is how this factor will be incorporated in real-life operations. Will someone exposed to the beam be given time to cool off before being re-targeted? If so, how will the operator keep track of who has been exposed previously and how long ago? It doesn't seem practical operationally, which leaves the same question of how to avoid over exposure.
- In addition, the local climate may also become an important factor. If it is a hot day in mid-summer in Iraq for example then people's skin may already be heated above normal levels by the sun's rays. Will this mean a shorter margin of safety if exposed to the heating effects of the ADS beam?
- Another issue mentioned in one of the protocols is that some areas of the skin were affected more than others during direct exposure of the face to the beam. "Hot spots" were observed in the medial canthus area of the eyelid, which is the corner of the eyelid nearest the nose. The protocol states that these hot spots disappear with changes in orientation of the head to the beam but offers no further comment. During the exposure tests volunteers were also asked to remove contact lenses and glasses. It appears that the impact of eyewear on the effects of the beam has yet to be understood.[156]

One of the experiments in "Protocol FWR-2003-0028-H: Perceptual and Thermal Effects of Frontal Exposure to Millimeter Wave Energy" aimed to

> …attempt to measure how this new directed energy non-lethal weapon might interact with a person's attitudinal and belief systems (e.g. religious or cultural), and emotional processes in terms of anxiety, fear, or panic reactions…[157]

using questionnaires and interviews pre- and post- exposure. The text of the protocol expands on the reasons gathering such data, saying it will help determine how to best use the weapon and more broadly to "help maintain favorable relations with populations military units encounter." It is also noted that such data is not only important for operational reasons "…but also for larger international and public relations concerns." However, the validity of the data collected through the experiments outlined in the document may be limited, in part due to the small size of the test group (30 people) but significantly due to the cultural and social bias of the test subjects who were all to be drawn from military personnel, DoD civilians and government contractor personnel. From other reports[158] it seems that some of the volunteers for exposure tests were either involved in the development of this weapon and/or had an active interest in the success of the programme. This is unlikely to give a representation of how the general population in the US or, more importantly, in Iraq will react to being on the receiving end of this weapon. It seems that considerations of the psychological and cultural reactions to being targeted by an invisible, intangible, and very painful beam of electromagnetic energy have been given little serious attention.

A component of all three of the experimental protocols is to determine the threshold in terms of pain inflicted that people are unable to tolerate, and that causes them to move away. Some experts in the study of pain are very concerned, not only about the development of devices specifically designed to cause pain, but also about the assumptions made about how victims will be affected by the pain inflicted.

Dr. Amanda C de C Williams, a Reader in clinical health psychology at University College London who had commented on such issues in a March 2005 *New Scientist* article on the Pulsed Energy Projectile (PEP),[159] expressed the following concern:

> I'm shocked by the assumption that a fixed stimulus can result in a fixed/controllable amount of pain, as this is not true in any clinical setting, and a minority of people, particularly those with pain already, can suffer major exacerbation of pain from a relatively minor stimulus.[160]

This issue does not only apply to the Active Denial System but a number of weapons under development that are being designed to cause pain. Experience of the pain induced by such weapons is likely to be highly variable amongst populations.

*Published Research on Human Effects*

Although the technology behind the Active Denial System is often presented as extensively researched and well understood, the reality is that there has been a relatively small amount of published research on the effects of this particular type of electromagnetic radiation on humans. A 2004 NATO report on non-lethal weapons noted:

> The long-term physiological effects of the microwaves received by an individual are still being studied (maximum acceptable dose, cumulative effect of successive exposures). The absence of definitive results is the main obstacle to the use of radio frequencies.[161]

All the published research on the specific frequency (94 GHz) of electromagnetic beam that the ADS produces appears to have been carried out by US Air Force scientists and associated contractors from academia and industry. The body of ADS-specific research, which has been published in the *Health Physics*, *Bioelectromagnetics*, and *Carcinogenesis* journals, is as follows:

Blick DW, Adair ER, Hurt WD, Sherry CJ, Walters TJ, Merritt JH. (1997) Thresholds of microwave-evoked warmth sensations in human skin. *Bioelectromagnetics*. 18(6):403-9.

Riu PJ, Foster KR, Blick DW, Adair ER. (1997) A thermal model for human thresholds of microwave-evoked warmth sensations. *Bioelectromagnetics*. 18(8):578-83.

Ryan, KL, D'Andrea JA, Jauchem, JR, Mason PA. (2000) Radio Frequency Radiation of Millimeter Wave Length: Potential Occupational Safety Issues Relating to Surface Heating. *Health Physics*. 78(2):170-181, February 2000.

Walters TJ, Blick DW, Johnson LR, Adair ER, Foster KR. (2000) Heating and Pain Sensation Produced in Human Skin by Millimeter Waves: Comparison to a Simple Thermal Model. *Health Physics*. 78(3):259-267, March 2000.

Nelson DA, Nelson MT, Walters TJ, Mason PA. (2000) Skin heating effects of millimeter-wave irradiation-thermal modeling results. *IEEE Transactions on Microwave Theory and Techniques*. 48(11): 2111-2120, November 2000.

Mason PA, Walters TJ, DiGiovanni J, Beason CW, Jauchem JR, Dick Jr EJ, Mahajan K, Dusch SJ, Shields BA, Merritt JH, Murphy MR, Ryan KL. (2001) Lack of effect of 94 GHz radio frequency radiation exposure in an animal model of skin carcinogenesis. *Carcinogenesis*. 22(10): 1701-1708, October 2001.

Chalfin S, D'Andrea JA, Comeau PD, Belt ME, Hatcher DJ (2002) Millimeter Wave Absorption In The Nonhuman Primate Eye at 35 GHz And 94 GHz. *Health Physics*. 83(1):83-90, July 2002.

Nelson DA, Walters TJ, Ryan KL, Emerton KB, Hurt WD, Ziriax JM, Johnson LR, Mason PA. (2003) Inter-Species Extrapolation of Skin Heating Resulting from Millimeter Wave Irradiation: Modeling and Experimental Results. *Health Physics*. 84(5):608-615, May 2003.

Foster KR, D'Andrea JA, Chalfin S, Hatcher DJ (2003) Thermal Modeling of Millimeter Wave Damage to the Primate Cornea at 35 GHz And 94 GHz. *Health Physics*. 84(6):764-769, June 2003.

Walters RJ, Ryan KL, Nelson DA, Blick DW, Mason PA (2004) Effects Of Blood Flow on Skin Heating Induced by Millimeter Wave Irradiation In Humans. *Health Physics*. 86(2):115-120, February 2004.

In addition to the lack of data about the health effects of the ADS referred to in the NATO report, and the practical concerns discussed above (and in our previous research reports) about whether it is really possible to control the 'dose' received by a victim of this weapon, there appear to be other major gaps in the scientific knowledge that should be tempering calls to rush it into service. Many of these gaps were discussed by the weapon developers themselves in their 2003 paper presented to the European Working Group on Non-Lethal Weapons.[162] These include: the potential variability of the effects of the ADS beam depending on human factors (differing sensitivities, the impact of drugs and alcohol on sensitivities and reactions, psychological reactions) and environmental factors (temperature, humidity); the potential for adverse effects on the eyes and damage to vision; the unknown

impact of contact lenses and eyewear; and the unknown effects on fertility particular with regard to the testes.

*Another approach*

Sometimes the military's assessment of the Active Denial System (ADS) can seem more like a PR campaign than an objective analysis of the costs and benefits of deploying a pain inducing weapon, the effects of which are not fully understood. William Arkin's 'Early Warning' column in the *Washington Post* for 6 October 2005 expands on these concerns:

> Highly controversial directed energy weapons have been pushed for almost two decades as the next silver bullet. It's been two decades because along the way, they have run into complications, some having to do with the technology itself -- aim and controllable effects, compact power sources, military ruggedness -- but mostly their problem has been moral principles. Military leaders have been concerned about legality. Commanders have been hesitant or sceptical about new technologies with uncertain effects
>
> Those concerns are being brushed aside as the weapons advance along the familiar development path of boosters and patrons feeding information to war gamers who feed study participants who feed researchers who feed manufactures. At the end of the day, it is hard to tell whether high powered microwaves and lasers came into being because someone conceived it out of need or because its existence in the laboratory created the need.
>
> …
>
> The introduction of a completely new weapon -- particularly one that could cause excruciating pain, blindness, and hearing loss -- requires the most deliberate process, and the unintended consequences -- humanitarian, public relations, the possibility of the same weapon ending up in the hands of our enemies -- needs to be carefully weighed.[163]

In an opinion piece in the *San Francisco Chronicle* in January 2006, Brett Wagner, a former US Naval War College professor and Director of the California Center for Strategic Studies, made an argument against deployment of the Active Denial System:

> Rather than deploying a pain ray, President Bush should instead begin developing a plan -- drawing inspiration from the post-World War I leaders who banned the use of chemical weapons -- to forever ban the use of millimeter waves (or similar technologies) in combat or any other form of "crowd control." Otherwise, it will only be a matter of time before such weapons are used against American troops or by repressive regimes against their own citizens -- or perhaps even by the U.S. government against dissidents or unruly crowds in our own country.[164]

*Active Denial System (ADS) 2*

In previous reports we have mentioned development work on different versions of the Active Denial System. There now appear to be at least three weapon systems under development by the Air Force Research Laboratory (AFRL) and the primary manufacturer, Raytheon, using this millimetre wave technology. The first is the original ADS weapon discussed above, which is a long range Humvee-mounted or fixed installation weapon. The second is a smaller version called the ADS2 or System 2, which Raytheon received a $7.5 million contract to develop in April 2005:

> Raytheon Missile Systems, Tucson, Ariz., is being awarded a $7,549,715 cost-plus award-fee contract. The purpose of this contract program is to design, fabricate, test rapidly, field and support a fixed Active Denial System (ADS) referred to as System 2 and ADS2. System 2 is an autonomous millimeter-wave directed energy unit capable of being transported via C-130 or truck and operated

> either from the ground or from military vehicle. The location of performance is Raytheon Co., Rancho Cucamonga, Calif., is the contracting activity (FA8728-05-C-0001).[165]

The continued development of the ADS2, which has also been called the "Portable Active Denial System (PADS), is being carried out through a partnership, established in May 2005, between the US Department of Energy's Office of Security and Safety Performance Assurance (SSA) and the Department of Defense's Office of Force Transformation (OFT). The DOE want to develop the smaller ADS2 for use to protect nuclear facilities in the US and the OFT want to incorporate it into their planned Stryker vehicle-mounted lethal and non-lethal weapons system called the Full Spectrum Effects Platform (FSEP) or 'Project Sheriff'.[166] Human effects tests with the Raytheon-built prototype were planned for the latter half of 2005.[167]

In May 2005, the Chief of Staff for Multi-National Corps-Iraq had asked for funding to be made available to produce 14 'Project Sheriff' vehicles, four each for the Army's 18th Military Police Brigade and 42nd Military Police Brigade, and six for the Marines.[168] The May 2005 National Defense Authorization Act for Fiscal Year 2006 recommended an increase of $10 million for 'Project Sheriff' arguing:

> Project Sheriff is an Office of Force Transformation initiative to rapidly field for operational experimentation transformational concepts such as target discrimination, speed of light weapons, fused sensors, and cognitive computing working in concert with active protection to produce weapons effects capabilities scalable from non-lethal to lethal. The committee believes Project Sheriff will significantly expand a tactical commander's options and should be rapidly developed for fielding.[169]

A prototype ADS 2 for the OFT's 'Project Sheriff' was completed in September 2005 and given to the Naval Surface Warfare Center (NSWC) in Virginia for integration onto a Stryker vehicle. The system was then to be passed on to the Army's Futures Center at Fort Benning in Georgia.[170] According to *Inside the Army* the first four 'deployable' vehicles are planned for mid to late 2006.[171]

Planned scenarios for the use of the Joint Non-Lethal Weapons Directorate's Humvee-mounted Active Denial System have included crowd control situations and protection of key installations[172] and comments by DoD officials in the media have repeatedly emphasized the 'life-saving' rationale behind its use in these scenarios. However, the smaller ADS system being integrated into 'Project Sheriff' is clearly planned for use during combat (such as urban fighting in Iraq) in an unrestricted role. We have mentioned this in previous reports but it is worth re-stating: In this 'Project Sheriff' configuration it is likely that the Active Denial weapon would be used in some situations as a pre-lethal weapon to incapacitate fighters who will then be more susceptible to lethal fire.

In an August 2005 *Boston Globe* article a US Marine Colonel described his thinking with regard to the Project Sheriff suite of non-lethal weapons:

> If anyone appears willing to withstand the discomfort, "I know your intent," Hall said. "I will kill you."[173]

The third planned ADS system is a portable hand-held version. Both the Department of Defense and the Department of Justice (DOJ) are interested in developing such a weapon. DOJ funded Raytheon to develop an initial prototype of this weapon with a $499,000 contract for the period September 1 2004 to August 31 2005.[174]

## High Power Microwaves (HPM)

A Canadian report on non-lethal weapons research and development gives some background information on HPM weapon development and an overview of international activity in this area:

> The U.S., France, U.K. and Russia are the main players in this technology. Russia advertises sources that can be bought off the shelf. From the U.S. also, it is easy to buy sources with peak power ranging into 100's of Megawatts. The information on whether any of these nations are deploying these sources as weapons for any of the scenarios mentioned above is classified and is not shared.[175]

An August 2005 article in *Aviation Week* confirms continued UK interest in the development of HPM weapons as well as lasers targeted at sensors.[176]

At the 3rd European Symposium on Non-Lethal Weapons in May 2005 there were several papers presented on HPM weapons, including proposed uses of these weapons to disable improvised explosive devices and studies of the effects of high power microwaves on humans.[177] Two German companies who gave presentations at the conference, Diehl Defence and Rheinmettall Waffe Munition, are collaborating on the development of HPM weapons.[178]

In June 2005 in the US Alliant Techsystems was awarded $1.5 million by the US Air Force to produce a prototype HPM weapon, called the Scorpion II, for use to disable improvised explosive devices.[179]

## Lasers

*'Dazzling' Lasers*

The US Air Force Research Laboratory (AFRL) has recently unveiled two new 'dazzling' laser weapon prototypes, developed by a research group at Kirtland Air Force base in New Mexico called ScorpWorks. The first, revealed in November 2005, is called the Personnel Halting and Stimulation Response (PHaSR).[180] Two prototypes of the hand-held PHaSR weapon are now being tested by the AFRL's Human Effectiveness Directorate and the Joint Non-Lethal Weapons Directorate (JNLWD). The information released about the weapon is very limited but it comprises a two-wavelength laser system, perhaps to avoid countermeasures such as goggles that filter out certain wavelengths. According to the military publication *Stars and Stripe*s it can only affect one person at a time and the beam has to hit the victims' eyes for it to have an effect but details of the system such as range are reportedly classified.[181] The second weapon to be announced is called the Aircraft Countermeasures (ACCM) system, which is a dazzling laser apparently designed to prevent attacks on helicopters from individuals on the ground. Again there is very little information available about the weapon but a prototype system is being tested by the Air Force.[182]

The issue of eye safety was raised in two *New Scientist* articles about these weapons.[183] Additional Protocol IV to the Convention on Certain Conventional Weapons (CCW) bans laser weapons intentionally designed to blind. This ban has meant that developers of dazzling weapons have sought to try and make such weapons eye-safe at aperture, thus limiting their effectiveness at longer ranges. It seems that the military are now trying a

different approach that is to include a range finder on the weapon that adjusts the power level according to the range. A major concern raised by the International Committee of the Red Cross (ICRC) in the *New Scientist* is that the safety of the weapons with respect to the eyes will be dependent on the soldiers' operation of the weapon in a given situation.[184]

Interest in these laser weapons in not limited to the military. The National Institute of Justice (NIJ), the research arm of the Department of Justice (DOJ) has long funded research in to these laser 'dazzling' weapons. NIJ awarded over $400,000 during 2004-5 to Scientific Applications and Research Associates for development of a 'Multiwave Dazzler'.[185] It has also provided $250,000 to the US Air Force for the development of an "eye-safe laser range finder" for the PHaSR weapon mentioned above.[186] The Homeland Security Advanced Research Projects Agency (HSARPA) awarded around $100,000 for the period January to December 2005 to a company called Intelligent Optical Systems for the further development of a "Less-Lethal Eye Safe Handheld LED-Based Incapacitator for Law Enforcement"[187] described as:

> …a prototype dazzler that utilizes an array of super-bright Light Emitting Diode (LED) clusters to produce disorientation and strong flashblindness with afterimages. In this project, IOS proposes to develop a significantly improved device that can operate at distances up to 50 feet at the maximum permissible eye-safe level. Two new innovations will be incorporated into the device: (1) a rangefinding technology that will permit rapid adjustment of the radiant power to the maximum eye-safe level, in real time, at any of the operational target distances; and (2) a novel scanner that will allow the device to cover an area much larger than the beam size, while still providing a flash frequency and exposure level as effective as the single beam over the entire area. Control electronics and a preprogrammed chip will be used to allow operation at randomly varying frequencies within the band of maximum effectiveness, and to utilize several colors of light to enhance disorientation.[188]

Researchers at QinetiQ in the UK are also working on laser 'dazzling' devices. At the 3rd European Symposium on Non-Lethal Weapons in May 2005 they presented a study on the effects of using a multi-wavelength (red and green) laser system.[189]

One laser dazzler system already in use by the US military in Iraq is the Photonic Disruptor Green (PD/G), which is produced by a company called Xtreme Alternative Defense Systems (XADS),[190] the same company that is developing a wireless electrical weapon as described in BNLWRP Research Report No. 5. XADS produces several versions: a Personal Defense Laser Pointer (PDLP) with a 5mW green laser that is sold to the general public, and two more powerful versions marketed to the military and police – the 105mW PD/G 105 and the PD/G 200.[191] According to a January 2005 conference presentation by the company, they are also working on a laser-dazzling rifle as well.[192] There is no safety information on the XADS website about these green laser devices. However, the conference presentation also mentions that the lasers can be used for 'minor burning applications' such as 'remotely igniting fuels' and 'cauterizing minor cuts and wounds',[193] which questions their safety for use on a persons eyes.

A February 2006 US Army press release announced that 2,000 green laser pointers were being shipped to soldiers in Iraq. According to the announcement they are being used as a "…non-lethal way of dissuading aggressive drivers" at vehicle checkpoints.[194] The US military have had serious problems at vehicle checkpoints in Iraq that have resulted soldiers killing a number of innocent people who didn't understand instructions to stop.[195] Following the killing by US troops of an Italian security agent who was escorting a journalist recently freed from her kidnappers[196], a US enquiry into the event reportedly recommended that more

non-lethal 'options' should be considered.[197] Laser dazzling devices are seen by the Joint Non-Lethal Weapons Directorate (JNLWD) as a solution to these problems at checkpoints. The February 2006 issue of *National Defense* reported that a number of dazzling devices are currently being evaluated by the JNLWD.[198]

*High Power Lasers*

The US Department of Justice has increased its interest in directed energy weapons in the past year. In addition to funding work on a portable version of the Active Denial System and a 'dazzling' laser (see earlier sections), during 2004-5 it provided Sterling Photonics with $358,259 for development of a portable pulsed laser weapon that would act by producing a plasma shock-wave.[199] This weapon development effort, which we mentioned in our previous research report (*BNLWRP Research Report No. 7*, p. 29), appears to be similar to the Pulsed Energy Projectile (PEP). The US Marines has also funded Sterling Photonics with over $350,000 for non-lethal weapons development (beginning in July 2004) but there is no information on the details of the research.[200]

The *New Scientist*, which reported on NIJ funded directed energy weapons in May 2005, also described NIJ funding of a US Air Force research effort to produce a hand-held laser weapon that uses a semiconductor laser to cause 'heat compliance' in the target person.[201] The development programme is called the Portable Efficient Laser Testbed (PELT).

A company called NP Photonics was awarded two contracts by the Joint Non-Lethal Weapons Directorate (JNLWD) in late 2005 under the JNLWD's drive to fund applied research and technology development, which they announced in November 2004.[202] There is very little information provided about the proposed research in the award announcements. The first contract is a two-year contract (No. N66001-05-C-6054) for just under $1.5 million that started on 30 September 2005 described as 'Research and Development of Non-Lethal Fiber Laser in support of Joint Non-Lethal Weapons Directorate'.[203] The second is another two-year contract (No. N66001-06-C-6003) for $1.3 million that started on 6 October 2005 described as 'Research and Development of Portable GHz Sources in support of Joint Non-Lethal Weapons Directorate'.[204] The homepage of NP Photonics describes its business area as follows:

> NP Photonics is using innovative glass and fiber technology to design, produce and deliver a new class of advanced optical light sources for a number of applications. The company is developing a family of products based on proprietary glass, fiber and intelligent controls. NP Photonics products are tunable, small, powerful and highly reliable.[205]

Although there is a white paper on their web site describing potential military applications, such as for sensors and radar, there is no mention of applying the technology to laser weapons development.[206]

## 2.6 RIOT CONTROL AGENTS & MALODORANTS

### Riot Control Agents (RCAs)

*US Policy*

A senate amendment to the 2006 US Defense Authorization Bill introduced by the Republican senator John Ensign in July 2005 sought to engineer a change in US policy governing the military use of riot control agents.[207] The proposed amendment was designed to allow use of riot control agents in combat, which some figures in the US administration have been pushing for, including the Secretary of Defense Donald Rumsfeld.[208] This would be illegal under the 1993 Chemical Weapons Convention (CWC), which prohibits the use of riot control agents as a 'method of warfare'. The amendment that was eventually passed by the senate in November 2005 was altered from the original proposal in that the reference to use of RCAs in combat had been removed and assurances were given that it did not represent any change in US policy.[209] Despite this, a press release from the office of John Ensign falsely claimed that the amendment meant that US troops would now be able to use RCAs in "certain combat situations".[210] Other senators, such as Democratic senator Joseph Biden, disagreed saying that the amendment "will in no way modify either U.S. policy or U.S. international obligations regarding the use of riot control agents".[211] The amendment again exposed the differences in opinion over interpretation of the Chemical Weapons Convention both between the US and other CWC States Parties and within the US on this issue. It highlighted, once again, the contradictions between the CWC's absolute prohibition of use of RCAs as a 'method of warfare' and the 1975 US Law, Executive Order 11850[212], which permits use of riot control agents under certain situations. Professor David Fidler, from Indiana University School of Law, has made the argument, most recently in the September 2005 *International Review of the Red Cross*[213], that two of the situations that the US claims to be legally permissible under EO 11850 are prohibited by the CWC and not covered by the Article II.9 (d) of the Convention, which only permits use of RCAs for 'law enforcement including domestic riot control purposes':

> The use of riot control agents against enemy combatants attempting to capture downed aircrew and passengers or escaping POWs, or against enemy combatants who are employing civilians as human shields or to mask attacks, is more akin to a method of warfare than to a law enforcement purpose.

For a detailed assessment of the CWC's provisions on the use of riot control agents see David Fidler's paper: 'The meaning of Moscow: "Non-lethal" weapons and international law in the early 21st century' in the September 2005 issue of the *International Review of the Red Cross.*[214]

*US Prisons*

Ten inmates are suing the Florida Deparment of Corrections alleging excessive use of chemical irritants amounting to punishment and torture.[215]

*Finland*

The Finnish Ministry of Defence recently announced that Finnish peacekeeping forces would now be allowed to use riot control agents in Kosovo and in all future peacekeeping missions in which they are involved.[216]

*India*

In October 2005 India's Border Security Force (BSF) held an annual meeting of its Tear Smoke Unit (TSU). The Unit was established in 1976 and is involved in development and manufacture of various riot control agent munitions, which are supplied to the all police forces in India as well as the Indian Air Force, Army and Navy. They are also exported to various countries including Nepal, Bhutan, the Maldives, Mauritius and Turkey. According to the BSF press release the Unit manufactures 36 different types of munitions and during 2005-05 they produced a total of 150,221.[217]

*UK - Adverse Health Effects*

The potential for serious adverse effects following exposure to CS spray were starkly illustrated in February 2005 when it emerged that a Dorset man sprayed in the face with CS by police suffered severe burns that will leave him scarred for life.[218]

Recent published research on the health effects of CS includes the following papers:

Viala, B., Blomet, J., Mathieu, L., and Hall, A. (2005) Prevention of CS "Tear Gas" Eye and Skin Effects and Active Decontamination with Diphoterine: Preliminary Studies in 5 French Gendarmes. *The Journal of Emergency Medicine,* Vol. 29, No. 1, pp. 5-8.

Watson, K. and Rycroft, R. (2005) Unintended cutaneous reactions to CS spray. *Contact Dermatitis*, Vol. 53, Issue 1.

Horton, D., Burgess, P., Rossiter, S., and Kaye, W. (2005) Secondary Contamination of Emergency Department Personnel from o-Chlorobenzylidene Malonitrile Exposure, 2002. *Annals of Emergency Medicine*, Vol. 45, No.6, pp. 655-8

**Malodorants**

At the 3rd European Symposium on Non-Lethal Weapons a Captain in the Italian Navy presented a paper on *Military use of Chemical Riot Control Agents*. In his opinion malodorants are not covered by the Chemical Weapons Convention (CWC) and he advocated continued research in this area.[219] As we discussed in our previous report (*BNLWRP Research Report No.7*, May 2005) this is a contentious issue. At a conference in March 2005 a US Navy legal representative also said he thought malodorants were not covered by the CWC. However, it has been argued convincingly that malodorants cause sensory irritatation and therefore may be classed as riot control agents, therefore covered by the CWC.[220]

## 2.7 BIOCHEMICAL INCAPACITATING AGENTS

*The Militarization of Biology*

In the September 2005 issue of the *International Review of the Red Cross* Mark Wheelis and Malcolm Dando (a BNLWRP co-director) warn of the imminent militarization of biology.[221] Using neurobiology as a case study they argue that urgent action is needed to prevent the misuse of expanding knowledge in this area for use as weapons. Importantly they note that current interest in so called "non-lethal" biochemical weapons is the major driving force in this militarisation and that there is a bleak future ahead "…unless there is active intervention of governments to prevent the development of pharmaceutical weapons."[222]

Countries involved in the development of these new pharmaceutical weapons must be aware of the deep contradictions between their ostensible desire to prevent the proliferation of chemical and biological weapons, and their continuing contribution to this very proliferation problem (**See the cartoon on page 5 of this report**). The US Air Force Academy solicits research into various arms control and security issues and in their research topics for both FY 2005 and FY 2006 there is an item which illustrates this contradiction perfectly.[223] Within the 'Counterproliferation and Force Protection' section of the research topics is a topic entitled 'What are potential new or emerging WMD technologies?' Under this heading a series of questions are posed for interested researchers including: 'What are the leading edge therapeutics that could be used as weapons?' Essentially they are considering whether pharmaceutical weapons could be an emerging weapon of mass destruction. Tellingly the 'key terms' given underneath the research questions include the phrase "non-lethal weapons". A "non-lethal weapon" as an emerging WMD technology? This should raise some concerns over the weapons development described below.

A paper that appeared in the US Army's *Military Review* confirms Wheelis and Dando's fears. Co-authored by two Chinese scientists, the paper, entitled *Ultramicro, Nonlethal, and Reversible: Looking Ahead to Military Biotechnology*[224] advocates the militarization of new knowledge in biology. They argue that "The times call for new weapons, and modern biotechnology can contribute such weapons…"[225]

*Czech Republic*

Last year it emerged that the Czech military are developing biochemical incapacitating weapons. At the 3rd European Symposium on Non-Lethal Weapons in Ettlingen, Germany in May 2005 a paper was presented entitled *Pharmacological non-lethal weapons*.[226] The authors are: Professor Ladislav Hess, from the Institute for Clinical and Experimental Medicine in Prague; Dr. Jitka Schreiberova, formerly of the Department of Anaesthesia at the University Hospital in Hradec Kralove and now Chief anaesthesiologist in the Department of Neurosurgery at Charles University Prague; and Dr. Josef Fusek, from the Czech Army's Purkyne Military Medical Academy in Hradec Kralove. The work, which began in 2000,[227] to develop sedative and anaesthetic agent combinations for use as weapons has been funded by the Czech Army under Project No: MO 03021100007 assigned to Dr. Fusek.[228] In the introduction to their paper the authors propose that "there is a possibility of pharmacological control of an individual behaving aggressively".[229] They propose that these new chemical weapons could "possibly find widespread use in police work". They also note with regard to military use that "at present, their use contradicts the conventions on the use of chemical

weapons". The latter acknowledgement begs the question: if that is the case, why is this work being funded by the Czech Army?

The types of drugs/agents they consider are not novel, in fact they are much the same as those considered recently in the US,[230] and include dissociative anaesthetics such as ketamine, benzodiazepines such as midazolam, alpha$_2$ agonists such as dexmedetomidine, and opioids such as fentanyl analogues. The Czech paper describes the results of experiments with rhesus monkeys over several years in which they injected the animals with different mixtures of drugs to work out combinations and doses of the drugs which would result in 'reversible immobilization'. They also carried out experiments with ten volunteer nurses who were injected with a mixture of midazolam, dexmedetomidine and ketamine and with patients before surgery, injecting them with a mixture of dexmedetomidine, midazolam and fentanyl. The key point about these experiments is that the doses of the drugs administered were strictly controlled having been precisely calculated according to the body weight of each subject person and given by injection, much as they would be during anaesthesia procedures in hospital. Following injection the volunteers were then monitored continually (heart rate, respiration, nausea etc.). This level of control is simply not possible in the proposed use of these drugs as incapacitating weapons. In the latter part of the paper the authors discuss other means of delivering the drug such as inhalation and transdermal techniques but they fail to acknowledge the fact that the dose cannot be controlled in any conceivable use of these drugs as weapons. They suggest using dimethyl sulphoxide (DMSO) to facilitate absorption through the skin:

> The transdermal technique of administration could possibly be used to induce long-term sedation with alpha$_2$ agonists, benzodiazepines, and a combination of them to pacify aggressive individuals. Using the pain-ball gun principle, anesthetic-containing balls could be used. Impact of the ball would be followed by their destruction and absorption of garment with the anesthetics which will be quickly absorbed via the skin.[231]

The idea of using a paint-ball type projectile filled with potent anaesthetic drugs mixed with DMSO is not a new one. In the mid 1990's Lawrence Livermore National Laboratory (LLNL) in the US were proposing the very same technique having discounted the idea of a dart gun:

> Scientists are now looking at other possibilities. One is to lace a paintball with DMSO, a chemical incapacitant. The paintball would splatter on the subject, and the DMSO, which is absorbed immediately through the skin, would carry the drug into the body.[232]

By 1997 LLNL were looking at a similar transdermal delivery system:

> The design of a novel, non-lethal system integrated highly potent fentanyl-based anesthetic compounds, skin penetrating solvents, and timed-released antidotes, all delivery with a small felt pad projectile.[233]

As we noted *in BNLWRP Research Report No. 4*, the US National Research Council report on non-lethal weapons in 2003 confirmed that such pharmaceutical weapons were being studied by the U.S. military's Edgewood Chemical and Biological Center (ECBC) after a "…lull in R&D for 10 years", including a project to develop a sponge projectile designed to deliver a 'dose' of a fentanyl analogue.[234]

As we have argued in previous reports the development of these 'pharmaceutical weapons', particularly by military organisations, is a grave threat to the international prohibitions against chemical and biological weapons. Moreover, the use of potent drugs in a 'safe' manner is simply not practical outside the confines of the hospital where anaesthetists can precisely calculate the dose according to body weight, age, and health, and provide continuous monitoring of vital signs.

It is of serious concern that the development of these weapons is continuing in several countries. We would expect that the majority of medical doctors would consider the final paragraph of the Czech researchers' paper both unethical and dangerous:

> …many agents used in everyday practice in anesthesiology can be employed as pharmacological non-lethal weapons. An anesthetist familiar with the pharmacokinetics and pharmacodynamics of these agents is thus familiar with this use. As a result, he or she can play a role in combating terrorism.

Unfortunately this ill-conceived suggestion, with its disrespect for the international prohibition of chemical weapons and its disregard of the Hippocratic Oath for medical doctors, appears to have the tacit support of a number of other countries. At the same conference in Germany the US Chair of the NATO group that has been investigating the human effects of non-lethal weapons (HFM-073 at NATO's Research and Technology Organisation) presented an overview of NATO studies in the area of non-lethal weapons.[235] During his presentation he discussed the conclusions of the HFM-073 group that have yet to be published. With regard to development of these new chemical weapons he reported the NATO panel's conclusions that the siege in Moscow in 2002, where Russian Special Forces used an anaesthetic drug as a weapon, had received 'bad press' and that the large number of deaths had mainly been due to poor medical aftercare. He went on to offer his support for the 'Czech approach' to chemical weapons development presented at the conference.

In fact the Czech representative to the NATO HFM-073 panel investigating the human effects of non-lethal weapons was, for some time, Dr. Joseph Fusek, co-author of the paper on *Pharmacological Non-Lethal Weapons*. Dr. Fusek works at the Czech Army's Military Medical Academy where he specialises in defensive measures against chemical agents.[236] In 2004 he co-authored a paper warning about the threat of chemical terrorism: *Chemical Agents and Chemical Terrorism*.[237] In this paper drugs acting on the central nervous system as "calmatives" are considered amongst potential weapons that could be used by terrorists. The paper neglects to mention, however, that one of the authors is concurrently contributing to the development of the very weapons he is issuing the warning about. The introduction to the paper warns that the "Prohibition of chemical weapons is not respected by terrorists and by non-conventional [sic] countries." With the ongoing development of these pharmaceutical weapons many observers fear that 'conventional' countries such as the Czech Republic, Russia, and the United States have also lost this respect.

In 2004 two articles were published by representatives from the Czech Military Medical Academy and the Department for Control of the Prohibition of Chemical Weapons at the Czech State Office for Nuclear Safety on the subject of "non-lethal" chemical weapons:

Streda, L. and Patocka, J. (2004) Neletální Chemické Zbraně a Úmluva o Zákazu Chemických Zbraní [Non-lethal Chemical Weapons and the Convention on Prohibition of Chemical Weapons], *Vojenske Zdra Votnicke Listy*, Vol. LXXIII, c. 5-6.[238]

Patocka, J., Bajgar, J., Cabal, J., Fusek, J. and Streda, L.(2004) Neletální chemické zbraně [Non-Lethal Chemical Weapons], *Kontakt*, Vol. 6, No. 2.[239]

Both papers are in Czech but have the title and a very brief summary in English. An unfortunate translation that appears in the English summary of the second article perhaps betrays the reality of Czech interest in these pharmaceutical weapons. It reads, "This paper is addicted to toxic chemicals that can be used for military or terrorist purposes only."[240]

Hess, Schreiberova, and Fusek had actually published some of their research into the use of anaesthetics as weapons in a Czech publication in 2003:

Hess, L., Schreiberova, J., and Fusek, J. (2003) Zbraně, které nezabíjejí. *Vesmír,* 82, pp. 156-158.[241] [Article in Czech]

Following the paper presented to the 3rd European Symposium on Non-Lethal Weapons in May 2005, Schreiberova and Hess also presented their research as an abstract to the Annual Meeting of the European Society of Anaesthesiology in Vienna in late May 2005.[242] In October 2005 Shreiberova gave a further presentation on their research into *Pharmacological Non-Lethal Weapons* at the Jane's 8th Annual Less-Lethal Weapons Conference, where she again advocated the further development of these weapons with assistance from anaesthetists.[243]

Other anaesthetists have a different view of their role in relation to chemical weapons, which is to provide treatment to those who have been exposed to them rather than to help encourage their development and use:

> Among civilian health care providers, anesthesiologists and intensivists are especially well trained to treat victims of chemical warfare because they 1) understand and routinely apply the physiology and pharmacology of cholinergic nicotinic and muscarinic receptors through their daily clinical use of neuromuscular blocking drugs and reversal agents, 2) understand the pharmacodynamics and pharmacokinetics of both toxins and antidotes, 3) are very knowledgeable regarding the pharmacology of benzodiazepines, and 4) are experts in airway management, oxygen-delivery dynamics, cardiopulmonary monitoring, and advanced life-support technology. Moreover, although anesthesiologists are especially and uniquely qualified to provide immediate life support to victims of chemical attacks, they are also very likely to be called on to provide surgical anesthesia to survivors of chemical exposure who have been otherwise injured.[244]

*Russia*

Following the use of a fentanyl analogue as a weapon by Russian Special Forces during the siege of a theatre in Moscow in 2002 there has been speculation about the status of Russian development of these incapacitating weapons. It now appears that the deployment of these weapons was not a 'one off' and that such weapons are stockpiled for rapid deployment when required. On 13 October 2005 militants carried out attacks in the Russian town of Nalchik. Russian Special Forces were deployed to the town, and during the second day of fighting Russian NTV reported that they used a "knockout gas" against militants who were holding hostages in a shop.[245] The use of this "gas" received relatively little media attention and there was no information in the UK press about the nature of the chemical used. However, it seems reasonable to assume it was a similar agent to that used in Moscow in 2002 especially since it was reported that victims of the attack were administered an antidote.[246] In late October 2005 one Russian news source reported that naloxone, an antidote to opioids such as

fentanyl, was made available to doctors during the school siege in Beslan in anticipation of Special Forces using narcotic agents again.[247]

Ongoing Russian research in this area was also presented to the 3rd European Symposium on Non-Lethal Weapons. A paper entitled *Principles of Modelling of the Scenario of Calmative Application in a Building with Deterred Hostages* describes computer modelling and simulation of pumping aerosolised pharmaceutical incapacitating agents into buildings to incapacitate hostages and hostage takers alike. The authors acknowledge that in reality the incapacitation of those inside the building cannot be carried out effectively without killing people because the agent does not disperse evenly within the building and those inside receive a cumulative does over time:

> If the level of 95% efficiency is absolutely required to neutralize terrorists and to prevent mass destruction, there is no chance to eliminate hard consequences and fatalities. Calculations show that the majority of hostages can get serious poisoning and part of them – fatality. This is the cost of releasing if no other solutions left.

These factors, amongst others, were highlighted by the Federation of American Scientists (FAS) in their 2003 position paper: *Chemical Incapacitating Weapons Are Not Non-Lethal*.[248]

*USA*

The Sunshine Project obtained a heavily redacted 2004 contract proposal between Scientific Applications and Research Associates Inc. (SARA) and the US National Institute of Justice (NIJ) for SARA to develop a computer simulation of non-lethal weapons usage scenarios. A worrying example of a scenario developed by SARA is given on page 2 of the document under an illustration:

> This picture was taken from a 3D "virtual reality" interactive combat simulation. Here, we see a gas-masked soldier in position near a building's air supply intake. With appropriate additions to the program, we can have the soldier's weapon-usage abilities alow for the application of *knockout-gas* or other less-than-lethal methods. [emphasis added][249]

*France*

In our previous research report we noted a Sunshine Project report on *Biological and Biochemical Weapons Related Research in France*, which described military interest in psychoactive and anaesthetic compounds although the project did not discover any indication of actual weapons development. [250] A 2004 paper, *Chemical Weapons: documented use and compounds on the horizon*[251], authored by several leading French scientists and a military anaesthesiologist, gives an indication of French interest in this area. One section of the paper describes the Moscow theatre siege in 2002 and warns that the dangers of using drugs in such a hostage situation "must not be underestimated" but is apparently supportive in the use of these weapons:

> However, there is certainly a future for "calmative" drugs in this scenario. Publication of these data demands caution as the terrorists themselves could use these new indications and methods. Other means of personnel control are under study, including use of microwaves and acoustic weapons. Secrecy in this research is essential for their future efficacy.

A 2003 opinion piece in the French publication *Le Monde Diplomatique* by two of the same authors, Prof. Chantal Bismuth and Col. Patrick Barriot, describe the likely militarization of

drugs, saying that the chemical weapons of tomorrow may be found within medical dictionaries of drugs.[252] In the article they appear to be more wary of their development, warning that, although presented as 'non-lethal' such agents can be pre-lethal, to incapacitate people before they are killed.

*Biochemical Weapons Symposium, Geneva, June 2005*

In June 2005, just prior to the 2005 Meeting of Experts for the Biological and Toxin Weapons Convention (BTWC) in Geneva, the Scientists Working Group on Biological and Chemical Weapons of the of the Center for Arms Control and Non-Proliferation[253] and the Geneva Forum[254] held a Symposium on Biochemical Weapons to raise the profile of the issue and encourage discussion. Details of the seminar can be found at the following web site: http://www.armscontrolcenter.org/cbw/symposium/. Two background papers can also be downloaded from the site:

*Chemical and Biochemical Weapons and Law Enforcement Under the Chemical Weapons Convention*, by David P. Fidler.[255]

*Military Interest in Low-lethality Biochemical Agents: The Historical Interaction of Advocates, Experts, Pragmatists and Politicians*, by Martin Furmanski.[256]

Fidler's paper provides a detailed analysis of the Chemical Weapons Conventions' (CWC) law enforcement provision [Article II.9(d)] and the implications of its' legal interpretation for the CWC and the BTWC. A similar analysis of this provision together with a broader analysis of the implications of the 2002 Moscow Siege for non-lethal weapons and International law can be found in Fidler's recent paper in the *International Review of the Red Cross*: 'The meaning of Moscow: "Non-lethal weapons and international law in the early 21st century'.[257]

Furmanski's paper traces the history of military interest in chemical, pharmaceutical, biological and toxin agents that are intended to incapacitate rather than kill using three case studies: Irritant chemical agents (i.e. riot control agents); Incapacitating psychochemical (or pharmacological) agents; and Incapacitating biological agents. In his conclusions he observes that "…the energy and commitment of advocacy has been overridingly important in the development or suppression of non-lethal agents when they are in the developmental stage." He also highlights the role of secrecy in relation to the development of these types of agents.

Marie Chevrier and Ambassador James Leonard presented an interesting paper on the relationship between mid-spectrum biochemical weapons and the Biological and Toxin Weapons Convention (BTWC). Through an analysis of the drafting, development and implementation of the BTWC they reach a clear conclusion that the BWC prohibits the development of these weapons:

> We conclude that the development of biochemicals for deliberate use to impair the physical or mental functions of humans without their consent would be a violation of the Convention. Any attempt to reconcile the prohibitions of the BTWC with an interpretation that would allow the development, production or use of such biochemical weapons would not be credible given the historical record.[258]

Peter Herby from the International Committee of the Red Cross warned of what is really at stake if the development of these weapons is permitted to advance:

> Yielding to the temptation to gain tactical advantage from technological advances, to bend or rewrite the rules and to ignore age old taboos in this field may bring short term gain for some. But this is also the most likely path back to chemical and biological warfare – the complete prohibition of which was one of the important achievements of the 20th century.[259]

*Historical Aspects*

In a recently published book, *Deadly Cultures: Biological Weapons Since 1945,* Malcolm Dando and Martin Furmanski author a chapter entitled 'Midspectrum Incapacitant Programs', which details the history of UK and US efforts during the Cold War to develop incapacitating agents acting on the nervous system.[260] The chapter is a timely reminder of the long history of military research and development in this area dating back to the 1950's as an integral part of offensive chemical weapons programmes. It is also a warning of the potential for military expansion in this area if countries are permitted to continue the development of such chemical weapons under the "non-lethal" banner. An expanded history of the UK incapacitant programme has also been published by the Bradford Disarmament Research Centre (BDRC): *The UK's Search for an Incapacitating ('Non-Lethal') Chemical Agent in the 1960s.*[261]

In February 2006 the Secret Intelligence Service (SIS), or MI6, made out of court financial settlements with three former UK servicemen who were administered LSD at the Ministry of Defence's Porton Down site during 1953 and 1954 after they had volunteered to assist research into the 'common cold'.[262] Wiltshire Police have investigating a number of such cases in a major enquiry called Operation Antler that was initiated in 1999:

> …its purpose is to examine the issues surrounding the Service Volunteer Programme at Porton Down in relation to experiments conducted into the use of chemical and biological agents during the period 1939-1989.[263]

## 2.8 COMBINED TECHNOLOGIES

*Multi-Sensory Grenade / Clear-a-Space Device*

The Sunshine Project obtained a heavily redacted 2004 contract proposal between Scientific Applications and Research Associates Inc. and the US National Institute of Justice (NIJ) for SARA to develop a computer simulation of non-lethal weapons usage scenarios (including SARA's Multi-Sensory Grenade) based on the popular computer games 'Quake' and 'Half-Life'. According to the proposal abstract:

> The project goal is to produce a computer-simulation-based educational tool that will help law enforcement to quickly familiarize themselves with the capabilities, effects, and applications of LTL technologies.[264]

The Sunshine Project drew attention to the mention of "knockout-gas" in the contract as one possible scenario. (See Biochemical Incapacitating Agents' section of this report).

*Cobra Stunlight*

According to reports Los Angeles Police will start carrying the Cobra Stunlight, a combination flashlight and pepper spray device, in a pilot programme with 500 of the devices.[265] According to press releases from the manufacturer, Universal Guardian Holdings, Cobra Stunlights have also been sold to distributors in Afghanistan and Mexico.[266]

## 2.9 DELIVERY SYSTEMS

### Non-Lethal Munitions

*US Army Edgewood Chemical and Biological Center (ECBC) Patents*

In our Research Report No. 4 (December, 2003) we reported on a US Army Patent brought to our attention by the Sunshine Project that appeared to violate the Biological and Toxin Weapons Convention and the Chemical Weapons Convention.[267] The February 2003 patent for a 'Rifle-launched non-lethal cargo dispenser'[268] to deliver aerosols (Patent No. 6,523,478) included amongst possible payloads both chemical and biological agents. According to a recent, January 2006, report the patent has now been changed with the reference to chemical and biological agents removed but the online version has yet to be altered.[269] A divisional patent[270] of the February 2003 patent has also been accepted: Patent No. 6,668,032 of February 2004for the 'Rifle-launched non-lethal cargo dispenser'[271] seems to be identical to patent No. 6,523,478 apart from small changes also relating to claimed payloads and their legality. In the claims section of the two patents the differences are as follows:

> The projectile of claim 4, wherein the aerosol composition is further selected from the group consisting of smoke, crowd control agents, biological agents, chemical agents, obscurants, marking agents, dyes and inks, chaffs and flakes. [Patent 6,523,418]
>
> The projectile of claim 1, wherein the aerosol composition is further selected from the group consisting of smoke, crowd control materials, obscurants, marking materials, dyes and inks, chaffs and flakes. [Patent 6,688,032]

Other references to "crowd control agents, biological agents, chemical agents" elsewhere in the Patent language have also been replaced with the rather unspecific phrase "crowd control materials". The other change is the addition of a sentence (that didn't appear in the first patent) in the 'detailed description of the invention' section, which reads: "Of course, all payloads will be in compliance with national and international laws, treaties, and agreements to which the United States is a party." [Patent 6,688,032]

A full list of patents held by the US Army's Edgewood Chemical and Biological Center (ECBC) can be viewed on their web site.[272] Another patent that raises some cause for concern is No. 6,802,172 for a 'Particle aerosol belt',[273] an aerosol delivery system apparently designed to deliver payloads

> …selected from the group consisting of metallic particles, *pharmaceutical compositions*, smokes producing particles, obscurants, riot control agents, insecticides, pesticides, fungicides, fertilizer feed, seed confetti, bio-remediation compositions, fire retardant and extinguishing agents" [emphasis added].[274]

The patent contends that:

> Aerosols are used in the military to defensively position and protect combat forces. In civilian use, aerosol dispersal used by police for riot control and by farmers for agricultural purposes.[275]

It goes on to say that:

> In civilian use, aerosols are dispersed by police as a non-lethal means for crowd control dispersal, riot control, personal protectants and/or *incapacitating agents*. Additionally, aerosols used for civilian

> commercial purposes include the dispersal of aerosols for agricultural uses, such as disseminating insecticides, pesticides, fertilizers or feed over a wide area. [emphasis added]. [276]

*Airburst Non-Lethal Munition (ANLM)*

Further insight into the Joint Non-Lethal Weapons Directorate's (JNLWD) effort to develop 20mm and 40mm airburst projectiles with chemical agent payloads can be gained from a 2002 report on the development of the ANLM (then called Objective Individual Combat Weapon (OICW)) authored by the Institute for Non-Lethal Defense Technologies (INLDT) at Pennsylvania State University, a long established partner with the JNLWD. (For background on the ANLM see our *BLWRP Research Report No. 7* [277]). The document, *Independent Technology Assessment: The Objective Individual Combat Weapon Non-Lethal Munition*, was obtained by the Sunshine Project under the US Freedom of Information Act (FOIA).[278] The report describes initial tests with the riot control agent CS (tear gas) but the authors contend that CS may not be sufficiently incapacitating and they recommend looking to more potent chemical agents: "There may be better and more concentrated agents. Moreover, new agents are continually emerging". This is a clear reference to the investigation of pharmaceutical-type anaesthetic and sedative agents, which is unsurprising since two of the authors were also authors of the 2000 Pennsylvania State report, *The Advantages and Limitations of Calmatives for Use as a Non-Lethal Technique*, advocating the development of new pharmaceutical weapons.[279]

*Ring Airfoil Projectile (RAP)*

Previously we reported the ongoing funding by the US National Institute of Justice (NIJ) of the RAP projectile, which would also be designed to carry chemical agents. Since our last report (*BNLWP Research Report No. 7*, May 2005) the Sunshine Project have made the details of this contract available on their web site.[280]

**Unmanned Systems**

*Unmanned Aerial Vehicles*

The US military's 'UAV Roadmap 2005-2030'[281] was published during 2005. As we have discussed in our previous research reports UAVs are seen as one platform from which non-lethal weapons can be delivered as shown in the US Department of Defense definition of a UAV:

> A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non-lethal payload.[282]

*Unmanned Ground Vehicles*

A prototype of the US Marine's Tactical Unmanned Ground Vehicle (TUGV), the Gladiator, was demonstrated in August 2005. As we have described previously, it is being designed to carry lethal and non-lethal weapons. They are not likely to be deployed until at least 2009 or 2010.[283]

In June 2005 there was another report of Florida police acquiring a robot called the Andros Wolverine 2000, built by Remotec. It can fire various weapons and, according to the article, there are now seven in use by Florida police agencies.[284]

Australia's Defence Science and Technology Organisation (DSTO) have developed a small unmanned vehicle specifically designed to carry weapons called the eXperimental Multirole Under-vehicle Tactical Scout (X-MUTS). According to *Jane's Defence Weekly* it may be used to carry non-lethal weapons such as "…tear gas canisters, flash-grenades or acoustic screamers to clear a room".[285]

*Other*

According to an August 2005 report by Market Analysis company Frost and Sullivan:

> Some manufacturers are also working on intelligent cameras with non-lethal weapons that have the ability to lock on their target, measure the distance and shoot if the target is within a range of 50 feet. These cameras are expected gain acceptance in extremely high security and high-risk areas such as prisons or covert government research facilities.[286]

## Non-Lethal Landmines

*New Scientist* reported on the US military's development of a new remotely triggered landmine system called Spider that will reportedly include non-lethal weapons.[287]

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# 4. CONFERENCES

**Recent Conference Proceedings and Presentations**

*Directed Energy Weapons 2006*
IQPC
23 - 24 January 2006
Thistle Marble Arch Hotel, London, UK

Programme available:
http://www.defenceiq.com/cgi-bin/templates/document.html?topic=228&event=8776&document=64137&slauID=2&

*Jane's 8th Annual Less-Lethal Weapons Conference*
Jane's Information Group
26 - 27 October 2005
Royal Armouries, Leeds, UK

Programme available:
http://www.janes.com/defence/conference/JLLW2005/overview.shtml

*International Infantry & Joint Services Small Arms Systems Annual Symposium, Exhibition and Firing Demonstration*
National Defense Industrial Association (NDIA)
16-19 May 2005
Atlantic City, NJ, USA

Including some presentations related to non-lethal weapons:
http://www.dtic.mil/ndia/2005smallarms/2005smallarms.html

*3rd European Symposium on Non-Lethal Weapons*
European Working Group on Non-Lethal Weapons
10-12 May 2005
Stadthalle Ettlingen, Germany

Programme available:
http://www.non-lethal-weapons.com/sy03index.html

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